Appendix 4-15: PSTA Research and Demonstration Project Phase 1, 2 and 3 Summary Report

CH2MHill, March 2003

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
Suite 350
Deerfield Beach, FL 33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

April 3, 2003

170626.P3.CH

Ms. Lori Wenkert
South Florida Water Management District
3301Gun Club Road
West Palm Beach, FL 33416

Subject: Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project, Final Phase 1, 2 and 3 Summary Report (C-E8624)

Dear Lori:

Enclosed are ten (10) copies of CH2M HILL's final report on Phases 1, 2 and 3 of the Periphyton-Based Stormwater Treatment Area (PSTA) research and demonstration project. In addition, one unbound "original" is provided to facilitate the District's production of additional copies if needed for wider distribution to other staff or interested parties.

As agreed through prior communications, two CDs have been inserted at the back of each copy of the report. The first CD provides the appendices for this report in PDF format. The second CD contains PDFs of all major PSTA project deliverables submitted to the District over the course of the project from 1999 to 2002.

In light of the high level of interagency interest in PSTAs as a potential advanced treatment technology that could support Everglades Restoration, copies of the final report are being sent to the following interested parties:

- Frank Nearhoof, Taufiqal Aziz, Dianne Crigger, and Inger Hansen (Florida Department of Environmental Protection)
- Nick Aumen and Mike Zimmerman (Department of the Interior, National Park Service)
- Bob Kadlec (DOI consultant)
- Bill Walker (DOI consultant)
- Kim Taplin, Bill Neimes, Ed Brown, and Peter Besrutschko (U.S. Army Corps of Engineers)
- Kevin Palmer (U.S. Fish & Wildlife Service)
- Susan Teel (U.S. Environmental Protection Agency)

These courtesy copies will be shipped regular mail for delivery by next week.

This document represents the culmination of five years of precedent-setting PSTA investigations. As detailed in the acknowledgements section of the enclosed report, the success of the project has been the result of an open, collaborative process that included multiple phases of field research, objective reporting, rigorous peer review, and subsequent refinement of the investigations. On behalf of the entire CH2M HILL team, I would like to take this opportunity to personally thank you individually, all other District participants collectively, and the many other agency representatives for the cumulative constructive comments and support during the course of these investigations.

We truly hope that the project's findings to date will serve not as the ending punctuation for the PSTA story, but merely the end of a chapter. The District and other parties will determine the future course of the South Florida PSTA research and demonstration program. As always, should any questions arise regarding the enclosures or any aspect of the project, please feel free to call Ellen Patterson or me.

Sincerely,

CH2M HILL

Steven W. Gong
Project Manager

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Enclosures
c: Jennifer Jorge/SFWMD
Jana Newman/SFWMD
Bob Knight/WSI
Jim Bays/CH2M HILL
Ellen Patterson/CH2M HILL

February 1999 to September 2002

PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report

Prepared for

South Florida Water Management District

Prepared by

CH2MHILL

March 2003

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Abbreviations and Acronyms

AM	Aquamat
AFDW	ash-free dry weight
AS	Aquashade
ATT	Advanced Treatment Technologies
BMP	Best Management Practices
$^{\circ}C$	degrees Celsius
ca	calcium
cf/d	cubic feet per day
cm	centimeter
CM	community metabolism
cm/d	centimeters per day
cm/s	centimeters per second
CompQAP	Comprehensive Quality Assurance Plan
CR	community respiration
CSTR	continuously stirred tank reactor
CU	color unit
DBEL	DB Environmental Laboratories
DMSTA	Dynamic Model for Stormwater Treatment Areas
DO	dissolved oxygen
DOP	dissolved organic phosphorus
DRP	dissolved reactive phosphorus
DW	dry weight
EAA	Everglades Agricultural Area
ECP	Everglades Conservation Project
EFA	Everglades Forever Act
ENCO	Environmental Conservation Laboratories
ENRP	Everglades Nutrient Removal Project
ET	evapotranspiration
FDEP	Florida Department of Environmental Protection
FEB	flow equalization basin
FSC	field-scale cell
ft	feet
ft^2	square feet
GPP	gross primary productivity
ha	hectare
HCI	hydrochloric acid
HLR	hydraulic loading rate
HRT	hydraulic residence time

IFAS	Institute of Food and Agricultural Sciences
in	inch
L	liter
LR	limerock
m	meter
m/d	meters per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MJ	megajoule
m^2	square meter
mt/ha	metric tonne per hectare
µg/cm	micrograms per centimeter
µg/L	micrograms per liter
µm	micrometer
NA	not available
NPP	net primary productivity
NTU	Nephelometric Turbidity Unit
O&M	operation and maintenance
OPP	Optimal Performance Period
P	phosphorus
PAR	photosynthetically active radiation
PE	peat
POR	period of record
pp	porta-PSTA
ppb	parts per billion
PPB	PPB Environmental Laboratory
PSTAs	Periphyton-based Stormwater Treatment Areas
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
SA	sand
SAV/LR	submerged aquatic vegetation/limerock
SFWMD	South Florida Water Management District
SR	shellrock
STA	stormwater treatment area
STC	South Test Cell
STRC	Supplemental Technology Research Compound
STSOC	Supplemental Technology Standards of Comparison
TDP	total dissolved phosphorus
TDS	total dissolved solids
TIP	total inorganic phosphorus
TIS	tank-in-series
TKN	total Kjeldahl nitrogen
TOC	total organic carbon

TOP	total organic phosphorus
TP	total phosphorus
TPP	total particulate phosphorus
TSS	total suspended solids
VPP	Verification Performance Period
WCA	Water Conservation Area

Acknowledgements

The South Florida Water Management District's Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration project has been a team effort in terms of study design, implementation, and review. Key individuals and organizations who have come together to complete this work are acknowledged below.

South Florida Water Management District

Lori Wenkert (Project Manager)

Marty Braun
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Jose Lopez
Richard Meeker
Jana Newman
Kathy Pietro

The CH2M HILL Team

Steve Gong - CH2M HILL(Project Manager)
Ellen Patterson - CH2M HILL (Assistant Project Manager)
Bob Knight - Wetland Solutions, Inc. (Principal Investigator)

Jim Bays - CH2M HILL
Fran Bennett - CH2M HILL
Dan Castillo - Milian Swain & Associates
Ron Clarke - Wetland Solutions, Inc.
Roger Copp - Brown & Caldwell
Alex Crane - CH2M HILL
Steve Eakin - CH2M HILL
Greg Ford - CH2M HILL
Pablo Garcia - Milian Swain & Associates
Chris Keller - CH2M HILL
Jamie Luft - CH2M HILL
Jeff Madejczyk - CH2M HILL
Jeremy McBryan - Brown & Caldwell
Emily Mott - Brown & Caldwell
Astrid Richardson - CH2M HILL
Todd Rohack - CH2M HILL
Tazmi Shaw - CH2M HILL
Mary Stone - CH2M HILL

Scientific Review Panel

Ramesh Reddy - University of Florida Soil and Water Science Department
Jan Stevenson - University of Michigan
Jan Vymazal - Czech Republic
Bob Wetzel - University of North Carolina

Analytical Laboratories

Columbia Analytical Services
- Paul Gunsaulies
- Joe Wiegel

PPB Laboratories
- Paul Berman

Sanders Laboratories
- William Dromgoole

University of Florida - Soil and Water Science Department
- Yu Wang

Water and Air Research
- Michael Hein

XENCO Laboratories
- Tom Helton

STSOC Peer Review

Alex Horne - University of California, Berkeley
Bijay Panigrahi - BPC Group
Arnold Van Der Valk - Iowa State University

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DBEL
- Tom DeBusk

Department of Interior - Everglades National Park
- Nick Aumen
- Bob Kadlec (consultant/WMS)
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- Taufiqul Aziz
- Frank Nearhoof

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Executive Summary

Introduction

From 1998 to 2003 the South Florida Water Management District (District) conducted research focused on determining the effectiveness and design criteria of potential advanced treatment technologies to support reduction of phosphorus (P) loads in surface waters entering the remaining Everglades (SFWMD, 2000). Particular focus was placed on the treatment of surface waters from the Everglades Agricultural Area (EAA) as well as Lake Okeechobee water that is diverted through the primary canal system to the Lower East Coast of Florida.

Periphyton-based stormwater treatment areas (PSTAs) were one of the Advanced Treatment Technologies (ATTs) being considered by the District for potential application downstream of the macrophyte-based stormwater treatment areas (STAs). The PSTA concept was proposed for P removal from EAA waters by Doren and Jones (1996). Evaluations remain focused on PSTAs as post-STA treatment units intended to help achieve compliance with the ultimate total phosphorus (TP) criterion of 10 parts per billion (ppb).

In concept, the periphyton complex is hypothesized as being capable of extracting available P in the water introduced into the system and incorporation of that P into the biomass of the periphyton mat. Settling of detrital matter contributes to the long-term P storage. Additionally, because of the high primary productivity of these periphyton systems, water quality conditions favor P precipitation and binding into the newly formed sediments. The result is a water outflow with much of the available P scavenged and retained in the system biomass and sediments. These concepts are depicted in Exhibit ES-1.

Prior to initiation of the District's PSTA project in July 1998, detailed research to evaluate PSTA feasibility had not been performed. The key study objectives, therefore, were to research and demonstrate (to the extent possible within the contract period) PSTA viability, effectiveness, and sustainability at several scales of application. The following specific questions were to be addressed:

- Viability: Can periphyton-dominated ecosystems for P control be established?
- Effectiveness: Can P removal and retention be achieved?

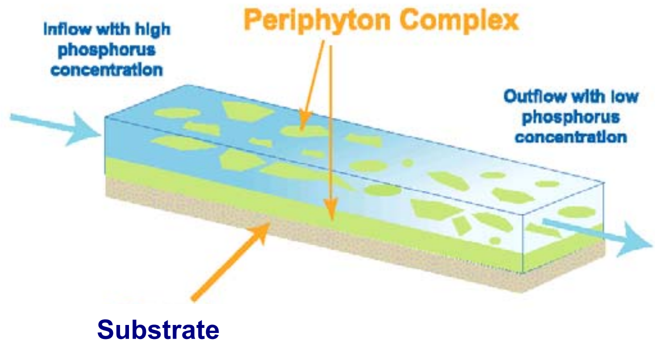


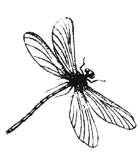
EXHIBIT ES-1
Schematic Diagram of the Periphyton Stormwater Treatment Area (PSTA) Concept

- Sustainability: Can PSTA viability and effectiveness be maintained for long-term periods?

Viability was assessed by documenting how long it took for the development of periphyton-dominated plant communities in the constructed PSTAs, and whether they could be maintained for reasonable periods of time. Effectiveness as a water quality treatment approach was evaluated based on the ability of the PSTA test systems to achieve low TP outflow concentrations. The TP removal rate constant, a metric for phosphorus removal efficiency, was quantified for the various PSTA research platforms tested during the study. Because sustainability issues would not be fully addressable within the anticipated 3-year study period, this question was evaluated through development and application of a performance forecast model based on the empirical data generated by the field studies.

A two-phased approach was originally adopted to investigate the PSTA concept: an Experimental Phase (Phase 1), and a Validation/Optimization Phase (Phase 2). The project approach was later modified to include Phase 3, which included a demonstration of PSTA viability, effectiveness, and sustainability at a larger field scale. The types of activities that were included in each project phase are described as follows:

- **Phase 1 (Experimental Phase)** included development of the work plan and experimental design, initial research in three experimental Test Cells (PSTA Test Cells) located at the southern end of the Everglades Nutrient Removal Project (ENRP) (see Exhibit ES-2 and SFWMD [2000] for location of sites), and construction and startup/monitoring of research using 24 portable experimental mesocosms (Porta-PSTAs). The Phase 1 experimental studies provided critically needed information for addressing basic issues associated with PSTA viability and treatment performance effectiveness. Development of a preliminary forecast model and preliminary model calibration were also completed in Phase 1.



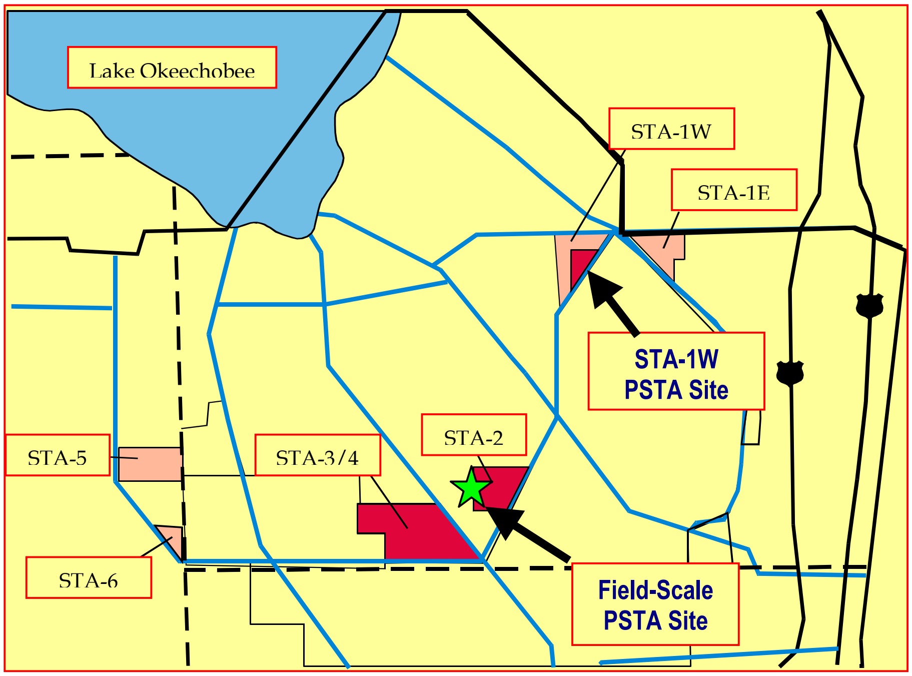


EXHIBIT ES-2
Locations of District PSTA Research Sites

- **Phase 2 (Validation/Optimization Phase)** included continuing research in the STA-1W PSTA Test Cells and in the Porta-PSTAs, and design and observations during the District's construction of the field-scale demonstration PSTAs immediately west of STA-2. During Phase 2, the expanded PSTA operational database was used to further refine and calibrate the performance forecast model, and develop design criteria for a full-scale PSTA system. The forecast model was applied to support projections of the long-term cost of implementing PSTAs to meet ultimate P reduction goals under the Everglades Forever Act (EFA).
- **Phase 3 (Demonstration Phase)** included operation and monitoring of four 5-acre Field-Scale PSTA cells located immediately west of STA-2. This demonstration was used to help develop necessary design and construction information related to various methods and efficacy of substrate preparation (limerock fill, scrape-down , and existing peat-based soils), effects of cell configuration and flow velocity, and effects of groundwater exchanges.

In the aggregate, the PSTA Research and Demonstration Project was designed to develop defensible conclusions related to specific hypotheses that are relevant to key research questions and design issues described in the *PSTA Research Plan* (CH2M HILL, 1999). This final report provides a summary of the Phase 1, 2, and 3 findings.

Research Plan and Mesocosm Overview

Exhibit ES-3 summarizes the treatments used for Phases 1, 2, and 3 of the PSTA Research and Demonstration Project. A more detailed description of the three research platforms is provided below.

Porta-PSTA Mesocosms

Twenty-four Porta-PSTA (PP) mesocosm units were fabricated of fiberglass offsite and delivered to the South STA-1W (former ENRP) Supplemental Technology Research Compound (STRC). Twenty-two of the fiberglass tanks were 6 m long by 1 m wide by 1 m deep. The remaining two tanks were 3 m wide to allow assessment of mesocosm configuration effects. Exhibit ES-4 shows the layout of typical 1- and 3-m-wide mesocosms in relation to the constant-head tank and inlet manifolds.

Porta-PSTA treatments focused on the following primary design variables:

- Substrate type: organic soils (peat) or calcareous material (shellrock)
- Water depth
- Hydraulic loading rate (HLR)

Substrate and water depth were replicated in a complete factorial design, while hydraulic loading was varied only on the shellrock substrate. All Porta-PSTA treatments were planted with an initial low density of emergent macrophytes (*Eleocharis*).

In addition to these primary treatment variables, these PSTA mesocosms were also used to test the effects of:

- Scale (1 x 6 meter vs. 3 x 6 meter)
- Macrophytes – *Eleocharis cellulosa* planted to help provide 3-dimensional structure and periphyton mat stability
- Sand substrate (relatively inert with respect to oxygen demand and TP content)
- Limerock substrate similar to material used by other researchers (for example, submerged aquatic vegetation [SAV] channel studies by DB Environmental Laboratories (DBEL) 2001b)
- Unvegetated controls with Aquashade (aquatic dye) to reduce periphyton growth
- Effects of higher flow velocities simulated by internal re-circulation

EXHIBIT ES-3
PSTA Design Criteria and Experimental Treatments

PSTA Treatment	Phase	Cells	Area (m^2)	Substrate Type	Target Wtr Depth (cm)	Target HLR (cm/d)	Target Depth:Width Ratio	Other Considerations
Porta-PSTA Mesocosms								
PP-1	1	9, 11, 18	6	Peat	60	6	0.6	macrophytes
PP-2	1	4, 7, 8	6	Shellrock	60	6	0.6	macrophytes
PP-3	1, 2	12, 14, 17	6	Peat	30	6	0.3	macrophytes
PP-4	1, 2	3, 5, 10	6	Shellrock	30	6	0.3	macrophytes
PP-5	1	2, 13, 16	6	Shellrock	60	12	0.6	macrophytes
PP-6	1	1, 6, 15	6	Shellrock	0-60	0-12	0-0.6	macrophytes
PP-7	1, 2	19	6	Sand	30	6	0.3	macrophytes
PP-8	1	20	6	Sand	60	6	0.6	macrophytes
PP-9	1	21	6	Peat	60	6	0.6	Aquashade; no macrophytes
PP-10	1	22	6	Shellrock	60	6	0.6	Aquashade; no Macrophytes
PP-11	1, 2	23	18	Shellrock	30	6	0.1	macrophytes
PP-12	1, 2	24	18	Peat	30	6	0.1	macrophytes
PP-13	2	9, 11, 18	6	peat (Ca)	30	6	0.3	macrophytes
PP-14	2	4, 7, 8	6	Limerock	30	6	0.3	macrophytes
PP-15	2	2, 13, 16	6	Shellrock	30	6	0.3	macrophytes; recirculation
PP-16	2	1, 6, 15	6	Shellrock	0-30	0-6	0-0.3	macrophytes
PP-17	2	20	6	sand (HCl)	30	6	0.3	macrophytes
PP-18	2	21	6	None	30	6	0.3	no macrophytes
PP-19	2	22	6	Aquamat	30	6	0.3	no macrophytes
Test Cell PSTAs								
STC-1	1	13	2,240	Peat	60	6	0.02	macrophytes
STC-2	1	8	2,240	Shellrock	60	6	0.02	macrophytes
STC-3	1	3	2,240	shellrock	0-60	0-12	0-0.02	macrophytes
STC-4	2	13	2,240	peat (Ca)	30	6	0.01	macrophytes
STC-5	2	8	2,240	shellrock	30	6	0.01	macrophytes
STC-6	2	13	2,240	shellrock	0-30	0-12	0-0.01	macrophytes
Field-Scale PSTAs								
FSC-1	3	1	20,790	Limerock/Peat	0-60	0-12	0.005	macrophytes
FSC-2	3	2	20,790	Limerock/Peat	0-60	0-12	0.014	macrophytes
FSC-3	3	3	20,790	Caprock	0-60	0-12	0.005	macrophytes
FSC-4	3	4	20,790	Peat	0-60	0-12	0.005	macrophytes

Notes:
PP = Porta-PSTA
STC = South Test Cell
FSC = Field-Scale Cell

EXHIBIT ES-4
Porta-PSTA Tank 23 (Treatment PP-11) After 11 Months of Colonization
This 6 x 3 meter tank has shellrock soils and was operated at a 30-cm water depth. Floating periphyton mats are visible among the sparse emergent macrophytes. Narrow tanks can be seen in the background as well as the raised constant Head Tank used to feed all mesocosms at this site.

South STA-1W Test Cells

The South STA-1W Test Cells (STCs) consisted of 15 rectangular, 0.2-hectare (ha) cells receiving flows from a single Head Cell. Water pumped into the Head Cell from STA-1W Cell 3 flowed by gravity through a distribution manifold into each of the Test Cells. The District assigned three STA-1W Test Cells to the PSTA Research and Demonstration Project. During final construction, substrate within these PSTA Test Cells was modified by the District by placing the following layers of substrate over the cell liner:

- **STC-1 (Test Cell 13)** – approximately 80 centimeters (cm) of sand surcharge plus 30 cm of locally mined shellrock plus 30 cm of peat taken from a local unflooded former agricultural lands area
- **STC-2 (Test Cell 8)** – approximately 1 meter (m) of sand surcharge plus 30 cm of locally mined shellrock
- **STC-3 (Test Cell 3**) – approximately 1 m of sand surcharge plus 30 cm of locally mined shellrock

Exhibit ES-5 shows PSTA Test Cell 8 (PSTA Treatment STC-2), with shellrock substrate after nearly 1 year of colonization. Test Cell PSTA treatments addressed the following primary design variables:

- Substrate type organic soils (peat) or calcareous material (shellrock)
- Variable depth and HLR

No replication was possible for this scale of field investigation. All three Test Cells were planted with *Eleocharis*.

EXHIBIT ES-5
PSTA Test Cell 8 (Treatment STC-2) After Approximately 12 Months of Colonization
This photo is looking upstream from the outfall standpipes toward the inflow at the far end of the cell. Monitoring walkways are located at 1/3 and 2/3 points along the flow path.

Field-Scale Cells

Four field-scale pilot PSTA cells were constructed during the end of Phase 2 at a site immediately west of STA-2, Cell 3 (see Exhibit ES-6). These four field-scale cells (FSCs) were each approximately 20,000 m^2 (5 ac). Three of the cells were rectangular at 61 m wide by 317 m long (200 by 1,040 ft); the fourth cell was sinuous and had a length of 951 m (3,120 ft) and a width of 21 m (70 ft). Cells 1 and 2 had approximately 60 cm (24 in) of compacted limerock placed over the native peat soils. The native peat soils were excavated and removed from Cell 3 to expose the underlying caprock. The floor of Cell 4 consisted of native, onsite peat soils with no amendments or other pre-treatments. The Field-Scale PSTAs were developed to provide specific information regarding construction issues as well as to demonstrate whether system viability and phosphorus removal effectiveness seen in the smaller-scale systems could be matched or improved upon. Substrate effects and the influence of surface and groundwater interaction on apparent treatment performance at this PSTA scale were assessed during Phase 3 monitoring. Additionally, water velocity effects on treatment effectiveness were partially quantified through these investigations.

EXHIBIT ES-6
Field-Scale Pilot PSTA Research Site West of STA-2
Field-Scale PSTA Demonstration Site West of STA-2 (left side of photo). The inflow canal is at the top of the photo (south side) and the outflow canal is near the bottom of the photo (north). FSC-1 is on the left side of the photo adjacent to the STA-2 seepage canal. FSC-4 is on the right (west side). FSC-2 has two internal longitudinal berms that create sinuous flow. There are separation canals between FSC-2 and FSC-3 and between FSC-3 and FSC-4.

PSTA Key Findings

Key findings regarding PSTA viability, treatment effectiveness, and apparent sustainability based on the Phase 1 through 3 results are highlighted as follows.

PSTA Viability

Some of the periphyton communities that were established within the PSTA test systems attained biomass levels and replicated normal periphyton algal species assemblages typical of low-P Everglades waters (Browder et al., 1994) within 1 year of startup. These experimental PSTA plant communities displayed community-level responses (gross primary productivity [GPP] and community respiration [CR]) in response to environmental forcing functions such as sunlight and antecedent soil conditions that are similar to natural Everglades plant communities (DWC, 1995; Browder et al., 1994).

More than 370 algal taxa were identified in periphyton samples collected from the PSTA test systems. Filamentous green algae were seen at the front end of the PSTA cells in areas of elevated dissolved reactive P (DRP), while filamentous blue-greens and diatoms dominated floating and benthic periphyton mats throughout the majority of the test systems. Initial colonization was typically by diatom species followed by gradual succession to filamentous blue-greens.

PSTA periphyton communities were similar to those found in natural Everglades areas with low to moderate TP concentrations.

Ash-free dry weight (AFDW) biomass increased to sustainable levels (typically between 100 and 1,000 grams per square meter [g/m^2] in all test systems) within 4 to 5 months of startup. Chlorophyll *a* (corrected for phaeophytin) and algal biovolume continued to increase throughout a 2-year period (with the exception of peat-based systems invaded by emergent macrophytes), indicating that a mature periphyton community is slower to establish. Average chlorophyll *a* concentrations were between 30 and 250 milligrams per square meter (mg/m^2).

Eleocharis cellulosa (spikerush) and *Utricularia* spp. (bladderwort) were purposely added to most of the PSTA mesocosms. Natural Everglades periphyton-dominated plant communities include these macrophytes, and it was decided to include them in the test mesocosms because they provide periphyton attachment sites and stability against wind-induced periphyton mobility. *Typha latifolia* (cattail), *Hydrilla verticillata* (hydrilla), and *Chara* spp. (stonewort) invaded the PSTA mesocosms, with greatest invasion rates in mesocosms with peat soils. Macrophyte biomass estimates indicated that the peat soil mesocosms were overwhelmed by macrophyte growth (see Exhibit ES-7), dominating visual plant cover estimates. By the end of nearly 2 years of colonization, macrophyte cover dominance reduced the periphyton community importance in peat-based mesocosms. PSTA mesocosms with shellrock, sand, and limerock soils maintained high periphyton biomass and relatively sparse macrophyte plant communities throughout the research program. Some form of macrophyte management will likely be required for PSTAs built on any substrate type.

EXHIBIT ES-7
Porta-PSTA Treatment PP-12 (Tank 24) Showing Dense Colonization by Spikerush
Average live stem count in this tank was approximately 322 stems/m^2 by the end of Phase 2. Periphyton biomass and algal cell counts were reduced with high macrophyte cover.

Treatment Effectiveness

Based on the conditions selected for this research, these PSTA mesocosms attained average TP outflow concentrations as low as 11 to 15 micrograms per liter (µg/L). These average concentrations were considerably lower than the long-term average outflow TP concentration from STA-1W of 22 µg/L (Walker, 1999) and were comparable to STA-1W Cell 4 averages during a 2-year period with optimal performance (13 to 15 µg/L) DBEL, 2001b).

Lower average TP concentrations have been observed in natural periphyton-dominated communities in Water Conservation Area 2A (McCormick et al., 1996), in the southern Everglades, and in outflow from experimental mesocosms built with limerock substrates (DBEL, 1999). The minimum TP values recorded during the PSTA project were clearly related to internal P loading from antecedent soils. Shellrock, limerock, and sand soils released less available P than peat soils. It is not currently known if these minimum outflow TP concentrations will continue to decline with increasing system maturity and eventual complete burial of antecedent soils.

The first-order TP removal rate constant (k_1) values recorded in this research are comparable to or higher than values recorded for emergent macrophyte and SAV-dominated treatment wetlands in South Florida. Long-term average PSTA k_1 values ranged from -3 to 27 meters per year (m/yr), depending on specific treatment variables. Walker (1999) determined that the overall STA-1W k_1 value was approximately 15.5 m/yr for the period from March 1995 through November 1998. The k_1 value for Cell 3 of the STA-1W was probably most comparable because of similar inflow water quality conditions as the PSTA research sites. This cell averaged k_1=9.5 m/yr during this operational period. Cell 4 of the STA-1W was dominated by SAV and averaged k_1=17.3 m/yr during this same period. Continuing research with the PSTAs needs to be conducted to validate and refine the TP performance estimates obtained during the project operational period.

Inflow Phosphorus Concentrations

Inlet P concentrations were variable throughout the project period. While mean TP concentrations were similar at the three research sites (23 µg/L at the Test Cells, 25 µg/L at the Porta-PSTAs, and 27 µg/L at the Field-Scale site), TP concentration ranges were variable between all sites. These differences in TP concentrations were largely attributable to complex seasonal variations in the fractions of total dissolved P (TDP) and total particulate P (TPP) in the various water supplies. On the average, TDP comprised 52 and 62 percent of TP at the Test Cells and Porta-PSTAs, respectively. On average, TDP made up only 38 percent of the TP at the Field-Scale site, and TPP was the dominant fraction at approximately 61 percent. DRP was typically between 3 and 10 µg/L, while dissolved organic P (DOP) averaged between 7 and 14 µg/L in the inflow waters.

Phosphorus Removal Performance

Exhibit ES-8 summarizes the TP concentrations and estimated model parameters (k-C* model of Kadlec and Knight [1996] where k is the estimated first-order removal rate constant and C* is the estimated lowest attainable concentration) for each treatment during the optimal (post-startup) period-of-record. Values for k_1 are also summarized in Exhibit ES-8 and offer a normalized comparison between treatments.

P removal rate constants in constantly loaded shellrock mesocosms were generally consistent throughout the 3½-year project. An initial startup period was evident in the data during the first 3 to 5 months of system operation, followed by apparent seasonal patterns (Exhibit ES-9). TP removal declined in some of the peat-based systems during the second and third years of operation.

The following general conclusions concerning P removal effectiveness were drawn from these PSTA research data:

- Estimated values for C*, the effective background TP concentration resulting from internal and external loadings and removals, ranged from 6 to 16 μg/L.
- Estimated TP k_1 values ranged from 1.6 to 27 m/yr.
- The lowest post-startup, treatment average TP outflow concentration was 11 μg/L, and lowest treatment monthly average was 7 μg/L.
- Tracer tests using inert tracers (lithium and bromide) were used to quantify PSTA hydraulics. Tanks-in-series estimates were measured between 1.1 and 25. Plug-flow conditions that typically result in higher P removal rates were enhanced by plant community development and higher cell length:width ratios.
- There were no consistent significant effects of water depth (30- vs. 60-cm steady depth) on outflow TP concentration, but TP removal rate was slightly higher at the shallower depth.
- Variable-water depths resulted in reduced TP removal performance compared to stable water depths.
- Outflow TP concentrations were lower and k_1 values higher in mesocosms with calcium-rich substrates than in comparable mesocosms with peat soils (see Exhibit ES-10).
- Higher loading rates (hydraulic and TP mass) increased k_1 and average outflow TP concentration.
- A slight effect of mesocosm scale was observed that indicated that smaller mesocosms underestimated outflow TP values and overestimated k_1 values.
- In Aquashade control mesocosms, average outflow TP concentrations were higher, but k_1 values were not consistently higher or lower than vegetated treatments indicating the complexity of macrophyte and periphyton P cycling from soils and water.

EXHIBIT ES-8

Model Parameters for the PSTA Treatments for the Optimal Performance Period

Treatment	Phase	Substrate	Depth	HLR	TP (mg/L) C1	C2	HLR (m/yr)	Wtr Temp (C)	k_1 (m/yr)	k_{20PFR} (m/yr)	k_{20TIS} (m/yr)	# TIS	C*	Theta
Porta-PSTAs														
PP-1	1	PE	D	L	0.020	0.014	34.9	22.7	10.1	61.9	99.6	***2.0***	0.015	0.87
PP-2	1	SR	D	L	0.020	0.013	33.4	22.0	12.9	46.5	67.2	***2.0***	0.011	0.98
PP-3	1, 2	PE	S	L	0.027	0.017	29.2	24.6	14.9	54.0	88.7	***2.0***	0.016	***1.00***
PP-4	1, 2	SR	S	L	0.027	0.014	30.5	24.7	19.9	43.2	62.9	***2.0***	0.011	1.02
PP-5	1	SR	D	H	0.025	0.017	62.8	21.7	26.7	68.1	90.4	***2.0***	0.011	0.90
PP-6	1	SR	V	V	0.026	0.015	16.5	21.1	8.3	39.6	76.5	***2.0***	0.013	0.95
PP-7	1, 2	SA	S	L	0.027	0.015	29.6	24.4	18.1	31.1	40.8	***2.0***	0.010	1.03
PP-8	1	SA	D	L	0.020	0.016	33.9	22.9	6.2	89.3	185.2	***2.0***	***0.015***	***1.00***
PP-9	1	PE (AS)	D	L	0.026	0.020	34.9	21.4	7.2	35.5	46.3	***2.0***	***0.016***	***1.00***
PP-10	1	SR (AS)	D	L	0.026	0.015	32.4	19.8	16.5	35.8	47.7	***2.0***	0.010	1.02
PP-11	1, 2	SR	S	L	0.027	0.017	32.3	24.4	14.4	39.6	54.6	***2.0***	0.013	0.96
PP-12	1, 2	PE	S	L	0.027	0.018	31.1	24.2	12.5	44.9	65.8	***2.0***	0.015	0.96
PP-13	2	PE (Ca)	S	L	0.022	0.015	31.8	28.1	11.3	20.4	24.1	***2.0***	***0.007***	***1.00***
PP-14	2	LR	S	L	0.022	0.014	32.0	28.3	14.5	27.6	34.6	***2.0***	***0.008***	***1.00***
PP-15	2	SR	S	R	0.022	0.014	29.4	31.0	13.4	26.4	33.3	***2.0***	***0.008***	***1.00***
PP-16	2	SR	V	V	0.022	0.016	64.1	28.7	19.6	45.0	53.9	***2.0***	0.006	0.96
PP-17	2	SA (HCl)	S	L	0.022	0.011	28.4	28.2	19.5	42.4	63.0	***2.0***	0.005	0.94
PP-18	2	None	S	L	0.023	0.013	29.5	28.0	14.5	32.8	43.9	***2.0***	***0.008***	***1.00***
PP-19	2	AM	S	L	0.022	0.013	31.6	28.1	15.9	28.6	36.2	***2.0***	***0.007***	***1.00***
South Test Cells														
STC-1	1	PE	D	L	0.027	0.016	16.2	24.6	7.4	34.9	51.1	***3.0***	0.013	0.92
STC-2	1	SR	D	L	0.025	0.013	16.3	25.2	10.4	31.7	44.6	***3.0***	0.010	0.96
STC-3	1	SR	V	V	0.025	0.018	13.2	23.8	5.2	42.5	76.2	***3.0***	0.016	0.93
STC-4	2	PE (Ca)	S	L	0.022	0.019	18.1	23.3	1.6	8.5	9.2	***3.0***	***0.013***	***1.00***
STC-5	2	SR	S	L	0.023	0.012	18.4	23.7	11.8	20.7	25.2	***3.0***	0.007	1.00
STC-6	2	SR	V	V	0.023	0.019	20.9	26.1	5.0	5.5	5.8	***3.0***	***0.010***	***1.00***
Porta-PSTA Summary														
		PE			0.025	0.016	30.9	24.9	13.1	48.0	72.6	***2.0***	0.014	0.97
		SR			0.024	0.015	40.1	24.7	17.9	56.7	82.5	***2.0***	0.013	0.97
		SA			0.025	0.015	30.6	24.1	15.6	33.0	43.8	***2.0***	0.011	1.03
		LR			0.022	0.014	32.0	28.3	14.5	27.6	34.6	***2.0***	***0.008***	***1.00***
		AS			0.026	0.018	33.7	20.6	12.8	40.6	55.8	***2.0***	0.014	***1.00***
		None			0.023	0.013	29.5	28.0	16.8	32.8	43.9	***2.0***	***0.008***	***1.00***
		AM			0.022	0.013	31.6	28.1	17.8	28.6	36.2	***2.0***	***0.007***	***1.00***
South Test Cells Summary														
		PE			0.024	0.018	17.3	23.9	5.0	58.5	108.5	***3.0***	0.018	1.03
		SR			0.024	0.015	17.2	24.6	7.9	68.6	143.2	***3.0***	0.015	***1.00***
Field-Scale Cells														
FSC-1	1	LR-PE	S	H	0.030	0.020	24.9	27.0	7.5	29.2	31.2	***9.0***	***0.012***	***0.90***
FSC-2	2	LR-PE	S	H	0.028	0.017	36.1	27.9	13.2	48.5	49.8	***25.0***	***0.010***	***0.98***
FSC-3	3	CR	S	H	0.027	0.017	34.3	27.1	11.7	62.5	69.3	***9.0***	***0.015***	***1.00***
FSC-4	4	PE	S	H	0.026	0.030	24.6	26.0	-3.4	37.5	40.8	***9.0***	***0.032***	***1.00***

Notes:

Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

TIS = tanks-in-series

bold and italics = values fixed in model

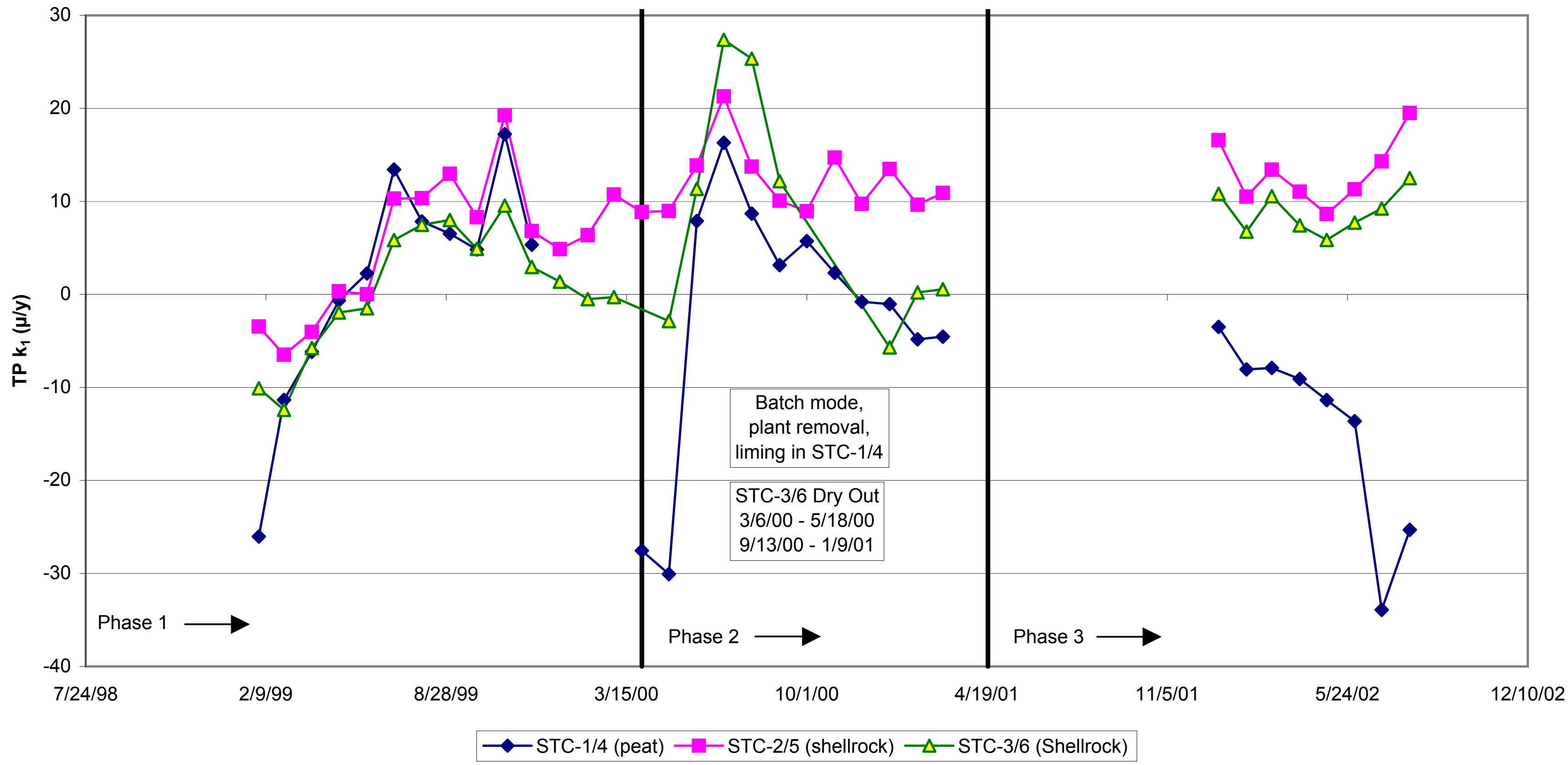


EXHIBIT ES-9

Monthly Average PSTA TP k_1 Values in South Test Cell Treatments During the 3½-Year Operational Period

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EXHIBIT ES-10
Effects of Soil Type on Average TP Outflow Concentration and k_1 During the Post-startup Optimal Performance Period

Treatment	Water Depth	Soil	TP Out (µg/L)	k_1 (m/yr)
PP-1	60 cm	Peat	14	10.6
PP-2		Shellrock	13	11.7
PP-8		Sand	16	6.4
PP-3	30 cm	Peat	17	12.7
PP-4		Shellrock	15	16.8
PP-7		Sand	15	15.3
STC-1/4	30 to 60 cm	Peat	18	5.0
STC-2/5		Shellrock	12	10.5
FSC-1	30 cm	Limerock	18	7.5
FSC-2	30 cm	Caprock	16	11.7
FSC-3	30 cm	Peat	32	-3.4

Note: Each group of treatments is nominally identical except for soil type.

Phosphorus Dynamics and Fate

The PSTA research offered a variety of “clues” to the processes that are important in P retention in periphyton-dominated treatment units. While this research focused on the overall input-output of TP, specific processes that were studied include: the fate of P in the mesocosm soils, observed non-reactive P forms, gross P accretion rates, and the effects of snail grazing on P dynamics.

Soils represented the largest single P storage in the PSTA mesocosms. The reactivity of P in antecedent soils greatly affected the startup performance of a PSTA (as well as other “natural” technologies, such as emergent macrophyte and SAV-dominated STAs). The PSTA research observed a declining concentration of TP in peat soils during the first few months of flooding. Inorganic dissolved reactive forms of P were released initially from these soils. In addition, subsequent tests indicated that P continued to be released from these soils, probably through macrophyte “pumping” of nutrients through their roots and by oxidation of soils in the relatively aerobic algal-dominated environments. P was also released from shellrock and sand soils, but at a much lower rate.

Leakage studies in the unlined Field-Scale PSTAs indicated that there is significant potential for loss of surface waters and associated TP to the shallow groundwater. Groundwater losses were found to be greatest on undisturbed peat soils and less on limerock-covered soils and when all soils are removed to expose the underlying limestone caprock. TP concentrations in groundwater were comparable to PSTA outflow concentrations, indicating water quality improvement compared to inflow TP concentrations.

PSTA Sustainability

PSTA sustainability and construction-related issues were addressed through the District's Supplemental Technology Standards of Comparison (STSOC) methodology and the simulation results of the PSTA Forecast Model. The STSOC evaluation was based on the data and modeling analyses from Phases 1 and 2 of the project. The STSOC comparison of technologies required the use of the best available data related to P removal performance, flexible engineering and operational components to attain maximum P removal levels, and development of costs associated with the conceptual engineering design. The possible environmental effects of each technology in terms of disposal of by-products and effects on downstream waters were also addressed.

Data from selected treatments (optimal design variations including Phase 1 and 2 shellrock and peat soils) were used to design and calibrate a PSTA Forecast Model. The model was developed to allow prediction of long-term behavior and performance of a PSTA, with full recognition of the substantive levels of uncertainty associated when applying the model to predict system performance at scales beyond those for which actual performance data exist. Further, use of the model to estimate design features in some cases required extrapolations beyond the range of data for which real values existed. PSTA modeling projections remain the best available way of evaluating likely design features, but are preliminary at best. It is recommended that data from the PSTA Field-Scale project eventually be used for validation of the PSTA Forecast Model developed during Phases 1 and 2.

The model results provided crucial information needed to support the STSOC analysis, which in turn was needed to allow comparison of PSTA feasibility to that of the other ATTs. The calibrated PSTA Forecast Model was used to simulate treatment performance for a 10-year period-of-record (POR), using a synthetic dataset of TP concentrations and flows from STA-2 (post-STA) provided by the District. These datasets were used in all ATT STSOC evaluations to standardize the analyses. The resultant ATT designs and planning level costs are not envisioned as leading to technology implementation scenarios, but rather to be used to compare the relative merits of the subject treatment technologies.

PSTA Footprint

PSTAs are a relatively low-management but land-intensive treatment option that depends on environmental energy inputs from the sun and the atmosphere. The primary energy input is solar radiation. Because the PSTA is a solar-powered system, it must have a large areal extent to grow enough periphyton and other plants to capture very low TP concentrations through biological uptake and to sequester that TP in the form of calcium- and carbon-bound accreted sediments. No harvesting of biomass or sediments is envisioned for this process, so TP must be effectively stored within the PSTA footprint to achieve a useful project life (e.g., in excess of 50 years). The mass action rule (first order process) indicates that the area required to accomplish this low TP outflow concentration is vastly greater than the area needed to achieve higher outflow concentrations.

Actual inflow TP concentrations to the PSTA research cells were typically well below 50 µg/L and averaged less than half that value. For this reason, PSTA performance modeling included runs with flow-weighted mean inflow concentrations between 25 and 50 µg/L.

Six specific scenarios were tested with the PSTA Forecast Model:

- Flow-weighted mean outflow TP of 12 µg/L with 0, 10, and 20 percent inflow bypass
- Flow-weighted mean outflow TP of 20 µg/L with 0, 10, and 20 percent inflow bypass

The benefits of constructing an upstream flow equalization basin (FEB) for possibly reducing the PSTA footprint were investigated by use of the PSTA Forecast Model. Water depths in the FEB were limited to 4.5 feet. Model runs determined that addition of flow equalization did not significantly reduce the overall footprint (FEB+PSTA) needed to achieve the target TP goals downstream. For this reason, the PSTA conceptual design did not include flow equalization.

Exhibit ES-11 summarizes the estimated PSTA footprint areas needed for each of the six post-STA-2 discharge scenarios. These estimated areas ranged from 2,026 to 6,198 hectares (5,006 to 15,316 acres). Assumptions related to the correct number of tanks-in-series (TIS) to assume in PSTA design may lower these estimated footprints by up to 50 percent. Model estimates of PSTA areas, flows, and water depths were used to develop the cost estimates for full-scale PSTA construction and operation.

EXHIBIT ES-11
Estimated PSTA Areas Based on Alternate Post-STA Average Inflow TP Concentrations

Area Needed In Acres				
Flow Wt Avg. TP Inflow (µg/L)	**Flow Wt Avg. TP Outflow**	**Percent Bypass**		
		0	**10**	**20**
	Range			
25		5,391	4,581	4,069
30		7,414	6,346	5,635
40		11,410	9,855	8,766
50		15,316	13,241	11,791
	20 µg/L			
25		1,109	885	790
30		2,214	1,842	1,637
40		4,423	3,741	3,321
50		6,603	5,639	5,006

Note:
Results are based on the PSTA forecast model. Parameters for the optimum performance period. Post STA-2 10-Year Simulation.

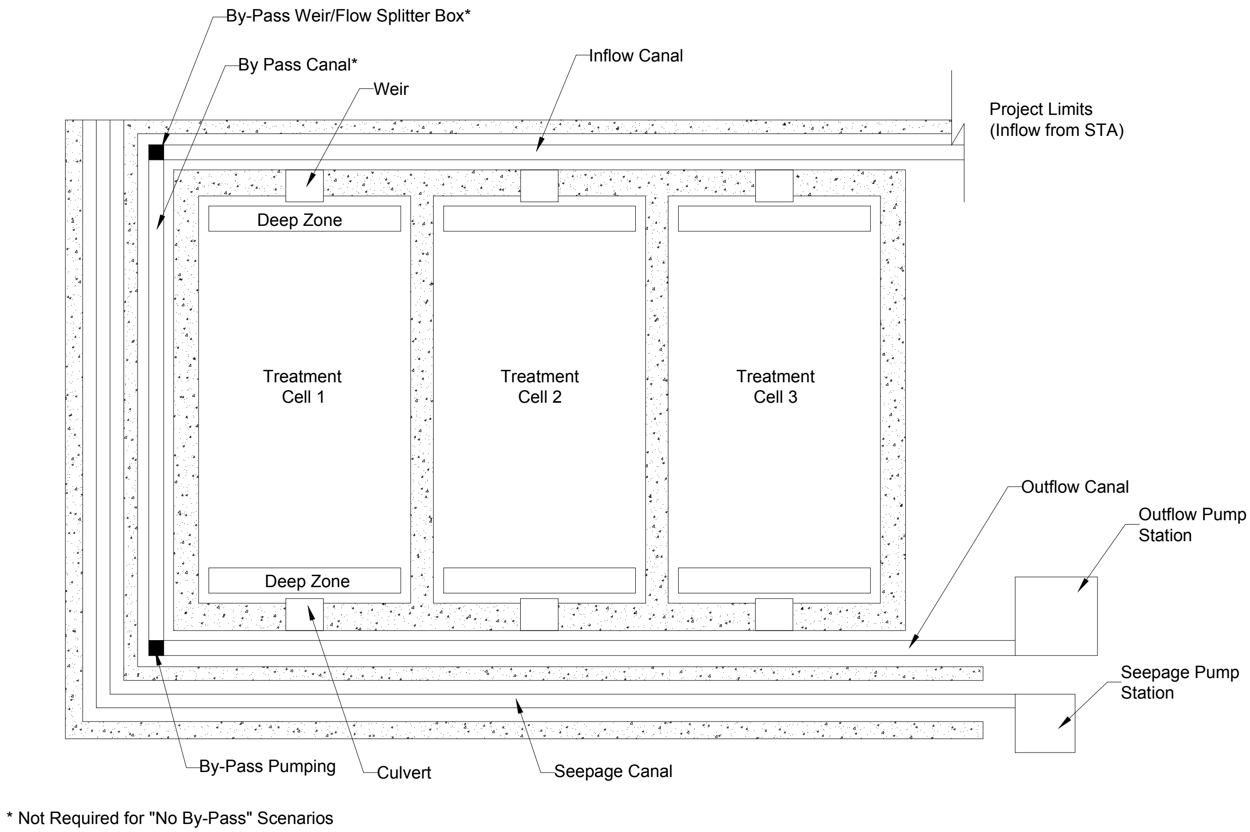
Additional modeling was conducted to evaluate the effect of reducing the assumed inflow TP concentration on the resulting estimated PSTA footprint area. Inflow concentrations were reduced in the post-STA-2 dataset, and the PSTA Forecast Model was simulated for the various target outflow TP concentrations and bypass scenarios. For example, lowering the input TP from 50 to 25 µg/L lowered the estimated PSTA area from approximately 2,670 to 450 hectares (6,600 to 1,100 acres) for an outflow goal of 20 µg/L and 0 percent bypass, and from approximately 6,200 to 2,180 hectares (15,300 to 5,400 acres) for an outflow goal of 12 µg/L and 0 percent bypass. This analysis highlights the importance of using the best possible input water quality and flow estimates and modeling techniques during final design of a PSTA.

One additional sensitivity analysis was conducted with the PSTA Forecast Model. Full-scale PSTA areas needed to achieve 20 and 12 µg/L with 0 percent bypass were estimated based on effects of deep percolation losses of water with associated TP (no recycle). The effects of average leakance between 0 (base case) and 0.6 centimeters per day (cm/d) were estimated with the PSTA Forecast Model. The estimated PSTA footprint area needed to reduce flow-weighted TP from 50 to 20 µg/L was reduced from approximately 2,670 to 2,226 hectares (6,600 to 5,500 acres) and from 6,200 to 4,371 hectares (15,300 to 10,800 acres) for a goal of 12 µg/L.

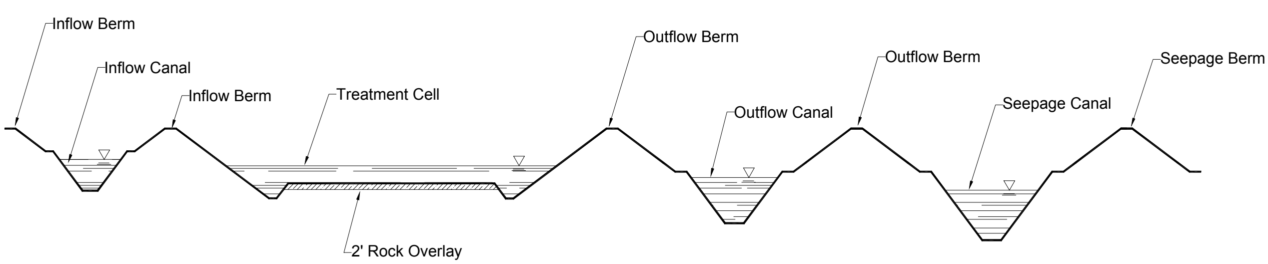
PSTA Conceptual Design

Exhibit ES-12 provides a plan and profile view of a conceptual post-STA-2 PSTA needed to meet the expectations required by the STSOC analysis. This conceptual design included:

- An inflow canal
- Multiple gated inlet weirs for each treatment cell to convey water from the inlet canal into the PSTA cells
- Three parallel PSTA treatment cells with inlet and outlet deep zones (approximately 1 m) for flow distribution and collection
- A bypass pumping station
- A bypass structure with weir
- A bypass canal to convey bypasses around the PSTA
- Double-barreled culverts with gates to convey water from the treatment cells to the outflow canal
- An outflow canal
- An outflow pump station
- A seepage control canal
- A seepage pump station



Plan View



Cross Section

EXHIBIT ES-12
Plan View and Cross Section of Conceptual Full-Scale PSTA System

No inflow pumping station was incorporated into the conceptual design based upon the assumption that the outflow pumping station from STA-2 would be utilized to provide inflow to the PSTA treatment system. No periphyton or macrophyte planting is envisioned for the full-scale PSTA cells. Development of calcareous periphyton and sparse emergent macrophyte cover will be encouraged through water depth management.

The nature of the onsite soils has a significant impact on PSTA performance. If existing soils have low available (water soluble) P levels (< 2 mg/kg), then minimal P leaching from the soil should occur and no soil amendment is necessary. However, if existing soils are higher in available P, then leaching of P is probable, and the site must be modified either by adding limerock over the surface of the entire PSTA or by removing the existing soils down to the underlying caprock. Another potential, intermediate option is the use of soil amendments to lock available P in the soils to prevent its release. A soil amendment study conducted during Phase 3 work indicated that aluminum and iron-based chemical amendments were more effective than a calcium-based amendment. However, none of the amendments tested completely controlled P release from peat soils at that site. Only removing the native peat soils and exposing the caprock or covering the peat soil with limerock were found to be effective within the design of the Field-Scale PSTA demonstration project. For the STSOC analysis, a worst-case scenario requiring application of a 2-foot-thick cap of limerock (compacted to approximately 1 foot) placed over the onsite soils was evaluated.

Cost Estimates

Cost estimates were developed using a unit cost spreadsheet provided by the District. The estimated range of total capital costs associated with achieving a TP level of 20 µg/L is approximately $321,886,000 to $408,515,000. With a target finished water TP level of 12 µg/L, this cost range increases to approximately $663,698,000 to $843,799,000 (see Exhibit ES-13).

EXHIBIT ES-13
Costs for Full-Scale PSTA Implementation Including 2 Feet of Limerock Fill

Cost Component	12 µg/L, No by-pass	12 µg/L, 10% by-pass	12 µg/L, 20% by-pass	20 µg/L, No by-pass	20 µg/L, 10% by-pass	20 µg/L, 20% by-pass
Capital Costs	$843,798,569	$737,832,446	$663,697,737	$408,514,840	$357,406,344	$321,886,004
Operating Costs	$1,581,898	$1,483,448	$1,417,593	$1,367,755	$1,292,178	$1,255,048
Demolition/ Replacement Costs	$20,691,746	$16,867,324	$15,739,170	$20,935,504	$16,971,599	$14,797,671
Salvage Costs	($73,210,339)	($63,342,812)	($56,483,392)	($32,050,978)	($27,407,667)	($24,378,828)
Lump Sum/ Contingency Items	$764,320	$814,320	$814,320	$764,320	$814,320	$814,320

The detailed analysis of operation and maintenance (O&M) costs for the PSTA is also provided. Estimated annual costs range from approximately $1,418,000 to $1,582,000 for a system with an outflow TP of 12 µg/L and from approximately $1,255,000 to $1,368,000 for a system with an outflow TP of 20 µg/L. These O&M

costs are expected to include any costs associated with management of emergent macrophytes.

Present worth costs were calculated for a 50-year period based on an interest rate of 4 percent. Exhibit ES-14 provides a summary of the 50-year present worth costs for the PSTA alternatives described above. These costs range from $361,033,000 to $888,945,000. These costs are equivalent to unit costs of $0.17 to $0.35 per thousand gallons treated and $699 to $1,096 per pound of TP removed.

EXHIBIT ES-14
Present Worth Costs for PSTA Conceptual Design Scenarios

		Without STA2 Costs			With STA2 Costs		
Target	**Bypass**	**50-Year Present Worth Cost**	**$/lb. TP removed**	**$/1,000 gallons treated**	**50-Year Present Worth Cost**	**$/LB TP removed**	**$/1,000 gallons treated**
12 ppb	0	$888,945,000	$1,076	$0.35	$1,051,748,000	$1,273	$0.41
	10	$778,477,000	$1,078	$0.34	$941,279,000	$1,303	$0.41
	20	$702,764,000	$1,096	$0.35	$865,566,000	$1,350	$0.43
20 ppb	0	$455,092,000	$699	$0.18	$617,894,000	$949	$0.24
	10	$399,099,000	$705	$0.17	$561,901,000	$992	$0.25
	20	$361,033,000	$718	$0.18	$523,835,000	$1,042	$0.26

The limerock placement comprises approximately 80 to 90 percent of the PSTA construction cost. Total present worth costs would be reduced by approximately 60 to 70 percent if PSTA performance could be assured without the limerock fill and, to a lesser extent, if the amount of limerock fill could be reduced. Based on research conducted from 1998 to 2002, it appears that the limerock would *not* be necessary if antecedent soils have low available TP concentrations or if an effective chemical soil amendment could be used to tie up existing soluble TP in the soil column. Preliminary estimates of the cost of a hydrated lime soil amendment for soils in the vicinity of STA-2 is approximately $1,300 per acre (as opposed to the $31,000 per acre assumed for 2 feet of limerock fill). An approximate cost estimate was also prepared assuming a lime soil amendment. This assumption reduces the estimated present worth costs for a full-scale PSTA to $173,000,000 for the 20 µg/L TP goal and $234,000,000 for the 12 µg/L goal. Because of the major cost impact of this limerock fill, additional work to minimize the costs associated with initial labile TP concentrations should be undertaken prior to final PSTA alternative analysis and design.

Implementation Schedule

The startup period for PSTA was assessed in a total of 31 individual research cells (3 Test Cells, 24 Porta-PSTAs, and 4 FSCs). While there was some variability between treatments, the typical time from commencement of inflows to stable performance was from 3 to 6 months. The optimal seasons for startup were spring and summer. It is likely that startup through the fall and winter months would require a longer stabilization period.

The time needed for implementation of a full-scale PSTA depends on the treatment alternative selected, the site selection and acquisition process, preliminary and final engineering and design completion, bidding and contractor selection, construction completion, and startup. The time required for each of these components was estimated based on observations from prior District projects, such as the implementation of STA-3/4, the largest of the existing STAs. Based on a hypothetical start date of January 1, 1999 (established by the District in the STSOC guidelines), the estimated time required for final completion and compliance with water quality standards is December 2004 (72 months).

Feasibility and Functionality of Full-Scale Design

In some ways, PSTA is the least developed of the supplemental technologies. Significant research on design and performance of PSTAs has only been underway for approximately 3½ years. No full-scale PSTA systems have been designed, constructed, or operated nor are any of the existing PSTA systems operated to meet specific outflow discharge permit requirements. For these reasons, the feasibility, costs, and reliability of full-scale PSTA implementation should be evaluated cautiously. On the other hand, large-scale, periphyton-dominated areas have been providing water with a low TP concentration for decades. The southern area of WCA 2A is dominated by a mixture of calcareous periphyton and sawgrass plant communities. This area has produced a long-term average TP concentration of approximately 14.3 µg/L (arithmetic average) or 10.5 µg/L (geometric mean) (Kadlec, 1999). Further downstream in WCA-2A, annual average TP concentrations range between 5 and 12 µg/L. Payne et al. (2001) reported the median annual TP geometric mean as 8.5 µg/L at the reference stations located in WCA-2A. Wet prairie and slough areas of WCA-1 had a median geometric mean TP concentration of approximately 9.1 µg/L (Payne et al., 2001). Areas of the Everglades National Park are also dominated by calcareous periphyton plant communities and have low ambient concentrations of TP. It is important to note that none of these existing full-scale systems were specifically designed to optimize TP removal and, therefore, their greater or lesser performance in relation to an engineered PSTA is not known.

Additional Research Issues Important for Final Design

There are many potential research issues that could provide additional certainty prior to full-scale PSTA design and implementation. These items have been previously summarized as part of ongoing ATT team meetings. Critical research topics related to PSTA implementation include:

- Response of the PSTA periphyton and sparse macrophyte plant communities to a range of inlet TP concentrations (especially more than 30 µg/L) and flow rates
- Management issues related to maintaining periphyton dominance over emergent and submerged aquatic macrophytes
- Investigation of additional soil pre-treatment options on P removal effectiveness and on periphyton community dynamics at a larger scale
- Effects/benefits of placing multiple PSTA cells in series

- Benefits/liabilities of high current water velocities and winds on PSTAs
- Effects of long-term soil accretion on PSTA performance and engineering design

Additional information related to some of these topics will continue to be gathered from the District's Field-Scale PSTA Demonstration Project currently underway. A plan was previously developed to use the District's STA 1-W Test Cells to quantify the effects of cells-in-series, pulsed inlet loading, and combination of PSTA with other natural wetland treatment technologies (emergent and submerged macrophytes) and could still be implemented. Use of the PSTA portable mesocosms might be the best research platform to test alternative management techniques and soil amendments.

Summary of PSTA Results

Engineered PSTAs have only been studied during a 3½-year research and demonstration period and only at relatively small scales (PSTA cells with areas ranging from 6 to 20,000 m^2). Assessment of the cost and reliability of full-scale PSTAs intended to treat very large volumes of stormwater runoff is based on this existing database, model simulations, and cost and construction assumptions described in this report. These estimates of system design and performance are subject to considerable uncertainty until additional information is gathered and analyzed. Thus, while the information generated during this study period has dramatically increased our understanding of the viability, effectiveness, and sustainability of PSTAs, and these data have supported the preliminary STSOC analysis, it is premature to conclude that sufficient information is in hand to support detailed PSTA design and technology application full scale.

Results to date for performance of PSTAs for post-STA TP load reduction are promising. TP mass reduction rates depend on TP load and are as high as or higher than removal rates of other natural wetland-based technologies. In addition, PSTAs offer the potential to achieve lower TP outflow concentrations than either emergent macrophyte STAs or wetlands dominated by SAV and have the ability to recover relatively quickly following drought. They are not subject to fire or significant impairment from hurricanes or other foreseeable natural disasters. They are not likely to create an ecological imbalance in adjacent aquatic environments.

PSTAs do have limitations for full-scale application for TP load reduction. Land area requirements estimated by the conceptual design analysis are large, requiring many thousands of acres to meet low TP concentration targets downstream from the existing STAs. Area estimates for PSTAs are subject to the uncertainty described above, and additional research on effects of pulsing, cells-in-series design, and antecedent soil conditions on TP removal performance is sorely needed.

In addition to their relatively large footprint, PSTAs will require an undetermined amount of plant management and/or alteration of pre-existing soil conditions. Placement of relatively inert soils to cover agricultural lands with high antecedent concentrations of available P may not be practical on a large scale. However, it is clear from the existing research that, at least during the early operational phase, relatively small amounts of available soil P will offset P removal potential of any of the natural wetland treatment technologies near background TP concentrations. An additional effect of these elevated soil TP levels for PSTA is their apparent stimulatory effect on colonization and growth of emergent macrophytes that may out-compete the desired calcareous periphyton plant communities. While we have not yet identified how to optimize PSTA design and operations on peat substrates, the reality is that this is the system that prevails in the natural Everglades. Further research on peat-based PSTAs is strongly recommended in spite of the early results obtained to date.

Because there are few potential tools available to the regulator who wishes to achieve very low TP standards and Everglades protection, it is prudent to continue to refine knowledge of PSTA design and the potential of PSTAs for TP control. Their best use might be in conjunction with other "pre-treatment" technologies, such as emergent macrophyte STAs or SAV wetlands. Whether as stand-alone or integrated treatment units, PSTAs offer the potential to help achieve the environmental goals in the Everglades of South Florida.

Issues for Further Investigation

While the results of this 5-year study have addressed many of the questions initially posed about PSTA viability, effectiveness, and sustainability, much remains to be learned regarding operational optimization and potential full-scale applications. Some of the key issues that warrant further investigation include the following:

- Factors that affect plant community establishment and management
- Available options and effects of soil amendments and effects of antecedent soil P on C^*_{TP}
- Benefits of placing PSTA cells in series
- PSTA performance as a function of high inlet TP concentrations and loads
- PSTA performance under highly variable hydraulic loads

Continued operation of the PSTA Test Cells and the FSCs is planned by the District, and the opportunity exists to address some of these issues during the study continuation. Study of these issues, further detailed in Section 5, would increase the current ability to address sustainability concerns, and refine how to apply the cumulative PSTA knowledgebase toward future system design and operations.

SECTION 1

Project Background

1.1 Introduction

In support of the overall Everglades restoration program, the South Florida Water Management District (District) conducted research focused on potential advanced treatment technologies to support reduction of phosphorus (P) loads in surface waters entering the remaining Everglades. Periphyton-based stormwater treatment areas (PSTAs) were one of the advanced treatment technologies investigated by the District for potential application downstream of the macrophyte-based stormwater-treatment areas (STAs).

The PSTA concept was proposed for P removal from Everglades Agricultural Area (EAA) waters by Doren and Jones (1996) and further described and evaluated by Kadlec (1996a,b) and Kadlec and Walker (1996). Evaluations focused on PSTAs as post-STA treatment units intended to help achieve compliance with a target total phosphorus (TP) concentration that may be as low as 10 parts per billion (ppb). PSTAs are intended to emulate the nutrient uptake functions observed in oligotrophic Everglades periphyton-dominated marsh habitats. Prior to initiation of the District's PSTA project in July 1998, research to evaluate treatment performance issues and the long-term viability of the PSTA approach to P reduction in EAA surface waters had not been performed.

In concept, the periphyton complex is hypothesized to be capable of extracting available P in the water introduced into the system, followed by incorporation of that P into periphyton biomass and accreted organic soils. Additionally, because of the relatively high primary productivity of these periphyton systems, water quality conditions favor chemical P precipitation and additional accretion into the newly formed sediments. The desired result of the PSTA technology is a water outflow with much of the available P scavenged and retained in the system. These concepts are depicted in Exhibit 1-1.

With the guidance of internal and external experts (van der Valk and Crumpton, 1997; Goforth, 1997a and 1997b; Nearhoof and Aziz, 1997; SFWMD, 1997), the District developed a scope of services for the PSTA project in 1998.

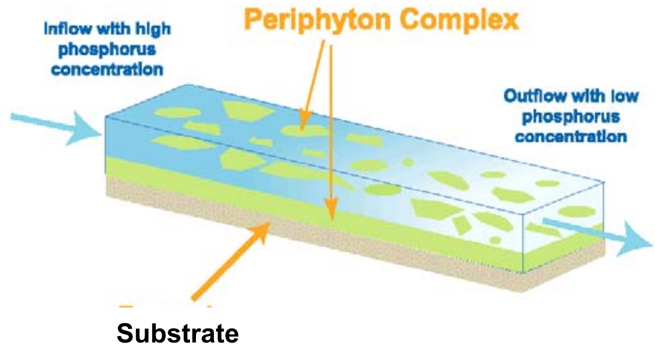


EXHIBIT 1-1
Schematic Diagram of the Periphyton Stormwater Treatment Area (PSTA) Concept

Originally, a two-phased approach was adopted. The two phases included the following activities:

- **Phase 1 (Experimental Phase)** included development of the work plan and experimental design, initial research in three experimental test cells (PSTA Test Cells) located at the southern end of the Everglades Nutrient Removal Project (ENRP) (see SFWMD, 2000 for location of sites), and construction and startup/monitoring of research using 24 portable experimental mesocosms (Porta-PSTAs). The Phase 1 experimental studies yielded critical information needed to plan for field-scale mesocosm (PSTA Field-Scale Cells [FSCs]) design and construction in Phase 2. Development of a forecast model and associated predictive tools was initiated in Phase 1, along with preliminary model calibration with the Phase 1 experimental data.

- **Phase 2 (Validation/Optimization Phase)** included continued research in the ENRP PSTA Test Cells and in the Porta-PSTAs, and design/construction of the PSTA FSCs. During Phase 2, the expanded database was used to validate the performance forecast model, and to develop the design criteria for a full-scale PSTA system through the District-mandated Standards of Comparison (PEER Consultants/Brown and Caldwell, 1996; 1999). The PSTA Forecast Model has been applied to provide projections of the long-term cost of implementing PSTAs to meet ultimate P reduction goals under the Everglades Forever Act (EFA).

As a slight revision to this original plan and because of the prolonged construction schedule for the PSTA FSCs, a third phase of the PSTA Research and Demonstration Project was initiated to test the PSTA concept at a larger scale:

- **Phase 3 (Demonstration Phase)** included operation of four PSTA FSCs located to the west of STA-2. This phase developed information related to larger-scale construction costs, operational issues related to unlined cells and groundwater exchanges, and effects of higher water velocities and wind on PSTA development and performance. Phase 3 operation was scheduled to continue through December 2002. However, because of contractual schedules, this final report provides a synthesis of operational data for the study period ending September 30, 2002.

This document is the final summary report of PSTA Research and Demonstration Project Phases 1, 2, and 3 (February 1999–September 2002). In that it represents the culmination of the District's PSTA studies to date, this document includes information previously summarized in the Phase 1 and 2 final report (CH2M HILL, 2002), as well as the data generated during Phase 3. This section provides background information on periphyton ecology and relevant phosphorus treatment performance data generated by other studies and provides an overview of the program's experimental design. Additionally, data regarding some of the key physical measures recorded during the study period are summarized for reference.

The Phase 3 information was integrated into the report sections presented at the end of Phase 2, including the following:

- Section 2 – Community Development and Viability
- Section 3 – Phosphorus Removal Performance and Effectiveness
- Section 4 – Forecast Model, Conceptual Design, and Sustainability
- Section 5 – Remaining PSTA Research Issues
- Section 6 – Works Cited

The following appendices are provided on the enclosed CD:

- Appendix A – Field Methods and Operational Summary: Methods Summary/Standard Operating Procedures/Key Date Summary/Quality Assurance Data
- Appendix B – Detailed Meteorological Data
- Appendix C – Test Cell Detailed Data: Data Summary, Trend Charts, and Diel Study
- Appendix D – Porta-PSTA Detailed Data: Data Summary, Trend Charts, Diel Study, and Batch-Mode Study
- Appendix E – Field-Scale Detailed Data: Data Summary and Trend Charts
- Appendix F – Periphyton Taxonomic and Abundance Data Analysis
- Appendix G – Hydraulic Tracer Test Data
- Appendix H – Statistical Analyses
- Appendix I – Field-Scale Soil Amendment Study: Literature Review and Study Plan, and Detailed Data Summaries
- Appendix J – Post STA-2 Cost Estimates
- Appendix K – Reviewer Comments

1.2 Overview of Periphyton Ecology and Other Studies of TP Removal by Periphyton

1.2.1 Periphyton Ecology

Periphyton (also referred to as aufwuchs and including benthic algae) are a complex assemblage of attached-growth algae, fungi, bacteria, and invertebrates that grow in response to sunlight in shallow aquatic environments (Vymazal, 1995). Everglades periphyton can be operationally sub-divided into the following groups (McCormick et al., 1998): floating mats, epiphyton (growing on plant surfaces), metaphyton (growing in the water column and not attached to surfaces), and benthic mats or epipelon (growing in contact with the sediments) (see Exhibit 1-2). Tychoplankton are free-floating algae derived from the periphyton. These tychoplanktonic algae as well as some filamentous metaphyton forms are most likely to be exported in outflows from the PSTA to downstream waters.

Everglades periphyton have also been classified according to environmental conditions (Browder et al., 1994). Water chemistry and hydroperiod are important factors that affect the taxonomic composition and biomass of these periphyton. Short hydroperiod, low TP concentrations (<20 micrograms per liter [μg/L]), high calcium saturation (hard water, calcium >50 milligrams per liter [mg/L]), and high pH (6.9 to 7.5) lead to calcareous periphyton dominance. Long hydroperiod and low calcium saturation (soft water, calcium <5 mg/L) and low pH [5 to 7]) result in desmid-rich periphyton assemblages. P concentration is another important environmental variable that affects periphyton species occurrence. Low P results in dominance by blue-green algae while higher P results in dominance by filamentous green species. Intermediate periphyton communities with mixtures of species characteristic of both extremes are found along all of these environmental gradients.

In addition to their influence on P concentrations, algal-dominated systems are known to alter other chemical aspects of water quality. Of particular relevance is the effect of primary productivity on pH and dissolved oxygen (DO) conditions. Relatively wide variations of these parameters are typical of Everglades slough environments (Duke Wetland Center, 1995; Vymazal and Richardson, 1995; McCormick et al., 1997).

Periphyton initially colonize surfaces of submerged macrophytes and other natural debris, such as woody vegetation, organic and mineral soils, rocks, and plant litter. Some of the periphyton may float or drift from their initial attachment sites and become free-living masses (metaphyton) and floating mats.

1.2.1.1 Periphyton/Macrophyte Interactions

In natural Everglades ecosystems and in other aquatic environments, periphyton and wetland macrophytes are intimately connected. Periphyton typically

Benthic Mat

Epiphyton"Sweaters"

Floating Mat

EXHIBIT 1-2
Representative Examples of PSTA Periphyton

grows on the surfaces of macrophytes that serve as increased attachment resources in otherwise two-dimensional environments (Browder et al., 1994; Duke Wetland Center, 1995; Vymazal and Richardson, 1995; McCormick et al., 1998). Macrophytes are also known to release cell fluids or exudates, which contain nutrients that stimulate periphyton growth (Wetzel, 1983; Burkholder, 1996). In many macrophyte-dominated wetland and aquatic environments, periphyton contribute a significant portion (up to 50 percent or more) of the total primary productivity. This contribution to the autotrophic food chain is especially important in Everglades slough ecosystems (Browder et al., 1994).

It is hypothesized that sparsely vegetated macrophyte beds support significantly higher periphyton productivity on an areal basis compared to open water because of increased surface area for colonization. However, at higher macrophyte densities, light attenuation from shading results in reduced periphyton productivity (Grimshaw et al., 1997; McCormick et al., 1998). Determination of the optimal macrophyte density is an important design variable for maximizing PSTA removal of P. The importance of this relationship for the periphyton-dominated ecosystems of the Everglades is highly relevant to the PSTA concept.

The PSTA Research and Demonstration Project addressed the overall effect of this interaction through the incorporation of low-density macrophyte planting in experimental units. Plant species that were tested were *Eleocharis cellulosa* (spikerush), an emergent macrophyte, and various submerged aquatic plants, including *Utricularia* spp. (bladderwort) and the macroalga chara (*Chara* sp.). These wetland plant species are known to support significant periphyton populations (Vymazal and Richardson, 1995; Havens et al., 1996; McCormick et al., 1998). Volunteer plant species (primarily cattails [*Typha latifolia*] and hydrilla [*Hydrilla verticillata*]) also colonized some of the PSTA mesocosms, resulting in additional new information about the interaction of these species with periphyton community development.

1.2.1.2 Importance of Soil Type on Periphyton/Macrophyte Community Development and Competition

As originally envisioned (Doren and Jones, 1996), PSTA systems would be constructed with calcium-rich substrates (shellrock, limerock, or weathered limestone) to increase the opportunity for P mineralization, and to decrease the rate of macrophyte invasion (Kadlec and Walker, 1996; van der Valk and Crumpton, 1997). Macrophyte colonization of full-scale PSTAs may be inevitable on soils with high antecedent available P concentrations. If high macrophyte density occurs, it is likely to lead to replacement of an algal-dominated treatment unit by a treatment wetland similar to the existing STAs and ultimately limiting P removal rates and minimum achievable P concentrations.

It is notable that organic soils are typical of periphyton-rich areas in Water Conservation Area (WCA) 2A and WCA-3. David (1996) found that average peat substrate depth in WCA 3A in macrophyte stands, including *E. cellulosa*, *Rhyncospora tracyi*, and *Utricularia* spp., was between 43 and 48 centimeters (cm). It has also been widely observed that periphyton-dominated communities occur extensively in WCA-2A and elsewhere over organic soils (Browder et al., 1994).

Thus, it is clear that peat-based PSTAs should be feasible. For this reason, macrophyte colonization rate and growth rate, as well as dominant species, were investigated in the experimental PSTAs on peat soils. This work was pursued to determine the nature and speed of macrophyte colonization, and to identify practical methods to manage macrophytes and to promote a periphyton-dominated environment.

1.2.1.3 Net P Accretion Rate

Numerous research projects have determined that periphyton can rapidly assimilate available P (Vymazal, 1988; Havens et al., 1996; Borchardt, 1996; Wetzel, 1996; Drenner et al., 1997). This P uptake is accelerated by the relatively small scale and diffusional gradients associated with these microscopic organisms and by phosphatase enzymes and other metabolic adaptations. While P uptake is extremely rapid during short-term laboratory and mesocosm studies, other research has indicated that periphyton net production and accrual are maximum during successional community development and lower under mature conditions (Knight, 1980). The effect of this ecosystem-level response on TP removal may result in the need for periodic disturbance of PSTA periphyton communities to maintain high accretion rates. Assessment of long-term P uptake in periphyton-dominated plant communities was one of the key objectives of the District's PSTA Research and Demonstration Project.

1.2.1.4 Effects of Flow Velocity

Flow velocity is known to affect periphyton growth with respect to community thickness, species composition, and primary productivity (Stevenson and Glover, 1993; Stevenson, 1996; Ghosh and Gaur, 1998). Flow velocity is known to affect periphyton in two ways: replenishment of growth nutrients and removal of waste products, and creation of sloughing and downstream export (Stevenson, 1996).

Current velocity has been shown to increase periphyton productivity at low levels and to reduce productivity at higher levels. Simmons (2001) studied the effects of flow velocity on periphyton in bench-scale mesocosms located at the south ENRP advanced treatment technology research site. His 0.5 m^2 and 6-cm-deep mesocosms had baffles that allowed side-by-side comparison of periphyton biomass growth, biomass export, and TP reduction rates at hydraulic loading rates (HLRs) of 7.7 meters per day (m/d), and nominal velocities of 0.11 centimeters per second (cm/s) (slow treatment) and 1.0 cm/s (fast treatment). Based on physical observations, the periphyton community structure was dominated by filamentous green algal species. Biomass accrual was 27 percent greater in the fast treatment during the 22-day, flow-through study period. The respective net rates of dry weight (dw) accumulation were approximately 7.5 and 6.0 g $dw/m^2/d$. Biomass export was also approximately 25 percent higher in the fast treatment compared to the control (1.3 vs. 1.0 g $dw/m^2/d$). During an 8-day recirculation period, there was no additional net increase in the periphyton biomass values. TP concentration was reduced from approximately 23 to 18 μg/L in both treatments during the first 15 hours of recirculation. TP concentrations did not decline further during the next 5 days of recirculation and then increased to near starting levels during the last 2 days of the recirculation phase of the study. TP in the periphyton was estimated as approximately 650 milligrams per kilogram (mg/kg) and 648 mg/kg in the fast and slow treatments, respectively.

1.2.1.5 Effects of Temperature

Natural Everglades slough communities undergo significant temperature variation in response to insolation, water depth, and color (related to light attenuation). Diel temperature measurements at the Duke University dosing site in WCA-2A indicated daily ranges of 4 to 5 degrees Celsius (°C) during July and August 1995, with maximum and minimum temperatures of approximately 32.0°C and 26.5°C, respectively (Duke Wetland Center, 1995). Diel water temperatures varied by approximately 6°C to 14°C during October 1980 at a reference slough site in WCA-1, with a median water depth of approximately 30 cm to 50 cm and maximum and minimum temperature readings of 28°C and 14°C, respectively, during a 5-day period (McCormick et al., 1998). During the same week at this site, the diel temperature range was approximately 2°C to 4°C, and the minimum and maximum values were 21°C and 26°C, respectively. The authors reported a diel temperature range from approximately 26°C to 28°C at an enriched slough site in WCA-2A during August 1985. In a comprehensive study of the three WCA-periphyton communities in 1978–1979, Swift (1981) reported that the mean water temperature was 23.8ºC, with an annual variation from 13.4°C to 35.7°C. In the Lake Okeechobee littoral zone slough communities, Havens et al. (1996) reported water temperatures from 25°C to 30°C, with a maximum of 40°C recorded under a periphyton mat. Littoral mesocosms had temperatures typically between 28.2°C and 30.9°C, with peaks up to 37°C and a diel change of 3°C to 7°C (Havens et al., 1996).

This review indicates that Everglades periphyton-dominated ecosystems typically experience temperature extremes ranging between 13°C to 37°C, with typical diel variation between 2°C to 7°C.

1.2.1.6 Effects of Water Regime

Maximum water depths in natural Everglades periphyton-dominated sloughs are generally less than 1.5 meters (m), and average water depths are typically approximately 0.6 m (Browder et al., 1994; Vymazal and Richardson, 1995).

Everglades macrophytes are known to be distributed in response to water regime and water column TP concentrations. David (1996) found typical Everglades slough macrophyte stands at average water depths ranging from 33 to 37 cm in WCA 3A, and 25 to 28 cm in the Dupuis Reserve (David, unpublished). Average inundation frequencies at these sites were approximately 45 to 100 percent in WCA 3A, and 71 to 85 percent in the Dupuis Reserve.

Everglades periphyton communities typically experience complete drydown and dessication on a relatively frequent basis (Browder et al., 1994). Thick periphyton mats trap water and often only the surface of the mat is fully desiccated. Reflooding leads to fairly rapid revitalization of the algae, bacteria, fungi, and microinvertebrates that make up the mats. Even fully dessicated periphyton mats recover rapidly following rewetting, apparently because of the presence of numerous forms of spores and resting stages for nearly all species present. Other species rapidly recolonize these areas through wind- or water-borne propagules. It has been hypothesized that periphyton communities can regain their phosphorus-trapping properties within hours of reflooding (Thomas, et al., 2002).

1.2.1.7 Effects of Ambient TP Concentrations

Ambient TP in Everglades areas colonized by periphyton-dominated plant communities are in the range of 5 to 15 micrograms TP per liter (µg TP/L) (McCormick et al., 1996; McCormick and O'Dell, 1996). As mentioned previously, periphyton species dominance appears to be tied closely to P concentrations. The availability of a large pool of potential algal species provides adaptability to a broad range of P concentrations. Macroscopically, periphyton in South Florida freshwater environments shifts from filamentous green dominance at higher P concentrations (>20 µg/L) to a more cohesive mat dominated by blue-greens and diatoms at lower P concentrations. Dominance of green filamentous species appears to be most closely tied to the presence of dissolved reactive P (DRP).

Populations of *Utricularia* spp. and *E. cellulosa* were found to be limited to TP water concentrations of less than 30 µg/L, while another common slough macrophyte, *Nymphea odorata,* had maximum plant cover at 50 µg TP/L (Duke Wetland Center, 1997). These results indicate that it may be challenging to obtain growth, propagation, and macrophyte dominance of these species at higher influent TP concentrations anticipated in a PSTA (>50 µg/L).

Macrophytes are generally more dependent on sediments than on the water column for growth nutrients, such as P. If PSTAs tend to accumulate P in their sediments, macrophyte growth may be more rapid than in oligotrophic Everglades slough plant communities. There is considerable concern that undesirable colonization by macrophytes, such as cattails (*Typha* spp.), may result in a need for plant eradication or periodic management (Kadlec and Walker, 1996; van der Valk and Crumpton, 1997) within a PSTA system.

1.2.2 Periphyton P Removal Performance in Shallow Raceways

Complementary research has been conducted on periphyton-dominated mesocosms by DB Environmental Laboratories, Inc. (DBEL) as part of the District's submerged aquatic vegetation/limerock (SAV/LR) advanced treatment technology project since July 1998 (DBEL, 1999; 2000a,b,c; 2001a,b). The SAV/LR project has tested post-STA water P removal in several long and narrow raceways at the South ENRP Supplemental Technology Research Compound (STRC), the same site used for the PSTA mesocosm testing described in this report. Three parallel replicate periphyton-dominated troughs (44 m in length and 30 cm wide) were designed to convey water at two depths: 2 and 9 cm (high and low velocity), at widely different HLRs (low=11 cm/d and high=220 to 440 cm/d). All of these troughs were filled with a layer of crushed limerock. The low-velocity periphyton mesocosms (9 cm deep) were able to provide a mean TP outflow concentration of 10 µg/L at an average inflow concentration of

17 µg/L (DBEL, 1999). The TP settling rate (k_1) was 21 m/yr, and the average mass removal rate was 0.29 g $P/m^2/yr$. Periphyton biomass in the 9-cm raceways was 867 g dw/m^2 at the end of the 8-month study. Approximately 166 mg P/m^2 was stored in this periphyton, or approximately 97 percent of the observed TP removal. TP concentrations in this periphyton varied from approximately 1,095 mg/kg in the front end of the mesocosms to approximately 190 mg/kg in the downstream end.

The high-velocity raceways reduced TP from 17 to 14 µg/L at a nominal hydraulic residence time (HRT) of 6.5 to 13 minutes. High algal sloughing was observed in these high velocity mesocosms. Dry matter net production averaged 5.9 g $dw/m^2/d$ in the front end of the mesocosms and 2.4 g $dw/m^2/d$ in the outlet region. TP in the periphyton was 1,201 mg/kg in the front end to 764 mg/kg in the downstream area.

Follow-on studies have been conducted in these raceways, beginning in February 2000. The HLR to the 9-cm raceways (slow) was doubled and inflow TP concentration increased at the same time, resulting in an approximate four-fold increased TP loading. Effluent TP concentrations from these periphyton-dominated raceways increased to approximately 20 µg/L in response to these operational changes. Two months later, inflow rates were reduced to 11 cm/d, yet high outflow TP concentrations continued for several weeks before declining to approximately 15 µg/L. HLR was doubled again in May 2000 and outflow TP concentrations continued to range between approximately 10 and 20 µg/L until the end of the 29-month experiment in November 2000. The long-term average inflow and outflow TP concentrations for these raceways at 11 cm/d were 20 and 11 µg/L, respectively. During the period of higher loading (22 cm/d), the average inflow and outflow concentrations were 23 and 15 µg/L. The overall performance for all loading rates was a reduction of TP from 21 to 12 µg/L and a net TP removal rate of 0.43 g $P/m^2/yr$ (DBEL, 2002)

One-parameter TP removal rate constants for these two periods were estimated as 24 and 34 m/yr, respectively. Calibration of the two-parameter k-C* model (Kadlec and Knight, 1996) with the raceway data returned a k_{PFR} (plug flow k value) of 60 m/yr at a background TP concentration (C*) of 8 µg/L. Calibration with the two-parameter tanks-in-series model returned a k_{TIS} (tanks-in-series k value) of 61 m/yr with an estimated 2.8 tanks-in-series and C* equal to 7 µg/L. Long-term trend analysis indicated a slight decreasing trend in k_1 values for these raceways. No seasonal trend in k_1 values was evident.

In November 2000, the three raceways were joined in series to provide a 132-m flowpath. The inflow HLR was also tripled to 66 cm/d, resulting in a nominal velocity of 0.36 cm/s. During the first few weeks of operation, *Chara* established dominance in the inflow region of the raceway, and calcareous periphyton dominated the remaining raceway length (DBEL, 2002). During the 6-month study, average inflow and outflow TP concentrations were 23 and 17 µg/L. DBEL (2002) concluded from this work that higher flow velocities did not appear to have a beneficial effect on P removal in this shallow PSTA mesocosm.

1.2.3 PSTA Performance at the Village of Wellington Aquatics Pilot Program

The Village of Wellington in Palm Beach County, Florida, conducted a demonstration project to evaluate the possible use of natural treatment systems for stormwater P removal (CH2M HILL Constructors Inc., 2003). Natural technologies evaluated included floating aquatic vegetation (FAV), emergent aquatic vegetation (EAV), SAV, and PSTA. The pilot test cells were constructed from July to August 2001. Plantings were conducted in September 2001, and grow-in occurred from September through early 2002. Start-up period water quality monitoring was performed from November 2001 to February 2002. Post-startup monitoring began in April 2002 and continued through February 2003. The period-of-record presented in the referenced report was April 2002 to November 2002.

Two aquatic "treatment trains" were evaluated: the West Flow Path (FAV-EAV-PSTA in series) and the East Flow-Path (EAV-SAV-PSTA in series). Each PSTA cell had a total wetted area of 493 m^2. Wetted areas of the other cells were FAV 463 m^2, EAV 552 m^2, and SAV 437 m^2. The FAV, EAV, and SAV cells were rectangular with an aspect (length:width) ratio of 2 with no internal berms. The two PSTA cells were configured with a sinuous flow-path around three internal berms for an aspect ratio of 8.

The PSTA cells were filled with 15 cm of limerock. The original limerock substrate consisted of a No. 57-stone limerock gravel. A 2.5-cm-deep layer of crushed limerock was installed in March 2002 on top of this layer. Design water depth for the PSTA cells was 15 cm, and the design HLR was 11 cm/d. Inflow TP concentrations and resulting TP loads varied across the two PSTA cells in response to upstream cell performance and inlet TP concentration.

Operational data for the period from April 2002 through November 2002 are summarized in Exhibit 1-3.

EXHIBIT 1-3
Village of Wellington PSTA Performance for the Period from April 2002 through November 2002

	East PSTA	West PSTA
Wetted Area (m^2)	493	493
Average Flow (m^3/d)	109	59
Average HLR (cm/d)	22.1	11.9
Average TP In (µg/L)	118	25
Average TP Out (µg/L)	46	21
Average TP Load (g/m^2/yr)	10.8	1.1
Average TP Removed (g/m^2/yr)	7.7	0.7
Average TP Mass Removal Percentage	71%	59%
Average k_1 (m/yr)	75.7	7.8

The overall TP removals in the two treatment trains (including the FAV, EAV, and SAV cells) were very good. On the west side, average TP was reduced from an inflow average of 25 µg/L to an average of approximately 21 µg/L at the outflow from the PSTA cell. On the east side, system performance was variable because of the cumulative effects of extremely high phosphorus loading. During the period of best "stable" performance, outflow TP concentrations from the PSTA cell of 46 µg/L were achieved.

1.2.4 Periphyton P Removal Performance in the Vicinity of C-111

Limited data have been collected in the vicinity of C-111, a large water control canal constructed in the eastern Everglades in Miami-Dade County. This area is reported to be dominated by a calcareous periphyton plant community. Inflow and outflow TP data and estimated HLRs are available for the period from August 1998 through December 2000. These data have been analyzed to determine the possible effectiveness of a large-scale periphyton-dominated wetland for TP reduction (Walker, 2001). The average inflow TP during this period was 7 µg/L, and the average outflow concentration was 6 µg/L. Based on an average HLR of 22.3 m/yr, the estimated k-C* parameters for the plug-flow model are 29 m/yr and 5 µg/L. The estimated value for k_{TIS} is 31 m/yr with five tanks-in-series (Walker, 2001).

1.3 Experimental Hypotheses

The PSTA research program was established to address the following three critical issues:

- **Viability** refers to establishment and maintenance of the desired periphyton-dominated ecological community. Although the location of periphyton-dominated ecosystems in the Everglades is known, there was a need to refine the basic understanding of how to create this ecosystem, how long it takes to establish mature periphyton communities, and how to maintain these systems against shifting dominance by macrophytes (floating, submerged, or emergent) and phytoplankton (free-floating algae).

- **Effectiveness** refers to the ability of a PSTA to consistently and predictably remove P. Net P removal is dependent upon sustainable gross P removal rates, chemical and biological transformations of the P into non-reactive forms, and ultimate burial of P in newly accreted sediments or biomass. A number of design considerations are likely to determine the effectiveness of a full-scale PSTA. These include such factors such as flow velocity, water depth, presence/absence of macrophytes at low densities, and the nature of underlying antecedent soils.

- **Sustainability** refers to the long-term maintenance and operational cost of a periphyton-dominated treatment system. The most important sustainability issue is the expected useful life of a PSTA-dominated treatment system. The PSTA Forecast Model was developed to provide a basis for extrapolation from the relatively short operational period covered by this research. Other sustainability questions included: Will these systems require intervention for removal of accreted P? Will they restart and operate smoothly after a dry-down or flood event? Will they create water quality problems downstream in receiving waters from release of chronically or acutely toxic environmental pollutants?

The following research hypotheses—detailed in the *PSTA Research Plan* (CH2M HILL, April 2001)—are related to the three critical issues described above, and were tested by one or more of the research components:

- Hypothesis #1: PSTAs can be colonized and operational in less than 1 year following basin construction (**viability**).
- Hypothesis #2: The presence of low-density stands of emergent macrophytes and submerged aquatics will increase the PSTA sustainable TP settling rate (**viability** and **effectiveness**).
- Hypothesis #3: Substrate type significantly affects the PSTA sustainable TP settling rate (**effectiveness**).
- Hypothesis #4: The sustainable TP settling rate for PSTAs is >35 m/yr (**effectiveness**).
- Hypothesis #5: PSTA annual average TP export concentration can be sustained below 10 μg/L (**effectiveness**).
- Hypothesis #6: PSTA maximum monthly average export TP can be sustained at less than two times the annual average TP export (**effectiveness**).
- Hypothesis #7: PSTA TP export concentration is highly correlated with HLR for a given TP inflow concentration (**effectiveness**).
- Hypothesis #8: PSTA sediment and macrophyte biomass accretion rates will dictate major operation and maintenance (O&M) requirements in less than 10 years (**sustainability**).
- Hypothesis #9: Flow velocity exhibits a subsidy-stress effect on PSTA sustainable TP settling rate (**effectiveness**).
- Hypothesis #10: Water depth in the range between 30 and 60 cm does not significantly affect PSTA sustainable TP settling rates (**viability** and **effectiveness**).
- Hypothesis #11: Outflow water from full-scale PSTAs will not be chronically toxic to indigenous Everglades flora or fauna and will not include unacceptably high concentrations of methyl-mercury (**sustainability**).

The PSTA Research and Demonstration project has provided evidence for acceptance or rejection of the 11 hypotheses as summarized in Sections 2 through 4. Detailed data supporting the conclusions in this report are included in the appendices.

1.4 Summary of PSTA Experimental Design and Treatments

This section provides key information related to the experimental design used in Phases 1, 2, and 3 of the PSTA Research and Demonstration Project. Exhibit 1-4 summarizes the PSTA design criteria and treatments tested at all three research scales. The details of the three PSTA research scales (Porta-PSTAs [PP], South ENRP PSTA Test Cells [STCs], and FSCs are described below. The locations of the three PSTA research sites are shown in Exhibit 1-5. Key dates for PSTA construction and operation are summarized in Appendix A.

1.4.1 Porta-PSTA Mesocosms

Twenty-four fiberglass Porta-PSTA mesocosms were constructed offsite and delivered to the South ENRP Test Cells. Twenty-two of the fiberglass tanks were 6 m long by 1 m wide and 1 m deep. The remaining two tanks were the same length and depth as the other tanks, but were 3 m wide to allow assessment of mesocosm configuration effects.

Exhibit 1-6 provides a schematic view of the Porta-PSTA experimental setup showing the layout of typical 1- and 3-m-wide mesocosms in relation to the constant-head tank and inlet manifolds. Exhibit 1-7 provides a photograph of Porta-PSTA Tank 23 following periphyton colonization.

Twelve treatments were tested in the Porta-PSTAs during Phase 1. These included variations in water depth, soil type, HLR, mesocosm width, and presence of periphyton. During Phase 2, five treatments continued unaltered and 7 new treatments replaced Phase 1 treatments. This resulted in a total of 19 numbered treatments in the 18-month Porta-PSTA study. Detailed design and operational criteria for the Porta-PSTAs are summarized in Exhibit 1-8. Monthly average HLRs applied to the Porta-PSTAs are summarized in Exhibit 1-9. Average monthly water depths in all Porta-PSTA treatments are provided in Exhibit 1-10. Detailed operational data for the Porta-PSTA test systems are summarized in Appendix C.

1.4.2 South ENRP PSTA Test Cells

The District assigned three South ENRP Test Cells (STCs) to the PSTA Research and Demonstration Project. During final construction, substrate in these PSTA

Test Cells was modified by the District by placing the following layers of substrate over the cell liner:

- **Test Cell 13:** 2.5 feet (ft) of sand fill plus 1.0 ft of shellrock (locally mined) plus 1.0 ft of peat (taken from area of STA 1W, Cell 5 – unflooded, former agriculturally worked lands)

EXHIBIT 1-4
PSTA Design Criteria and Experimental Treatments (Phases 1, 2, and 3)

PSTA Treatment	Phase	Cells	Area (m2)	Substrate Type	Target Wtr Depth (cm)	Target HLR (cm/d)	Target Depth:Width Ratio	Other Considerations
PP-1	1	9, 11, 18	6	peat	60	6	0.6	sparse macrophytes
PP-2	1	4, 7, 8	6	shellrock	60	6	0.6	sparse macrophytes
PP-3	1, 2	12, 14, 17	6	peat	30	6	0.3	sparse macrophytes
PP-4	1, 2	3, 5, 10	6	shellrock	30	6	0.3	sparse macrophytes
PP-5	1	2, 13, 16	6	shellrock	60	12	0.6	sparse macrophytes
PP-6	1	1, 6, 15	6	shellrock	0-60	0-12	0-0.6	sparse macrophytes
PP-7	1, 2	19	6	sand	30	6	0.3	sparse macrophytes
PP-8	1	20	6	sand	60	6	0.6	sparse macrophytes
PP-9	1	21	6	peat	60	6	0.6	Aquashade; no macrophytes
PP-10	1	22	6	shellrock	60	6	0.6	Aquashade; no macrophytes
PP-11	1, 2	23	18	shellrock	30	6	0.1	sparse macrophytes
PP-12	1, 2	24	18	peat	30	6	0.1	sparse macrophytes
PP-13	2	9, 11, 18	6	peat (Ca)	30	6	0.3	sparse macrophytes
PP-14	2	4, 7, 8	6	limerock	30	6	0.3	sparse macrophytes
PP-15	2	2, 13, 16	6	shellrock	30	6	0.3	sparse macrophytes; recirculation
PP-16	2	1, 6, 15	6	shellrock	0-30	0-6	0-0.3	sparse macrophytes
PP-17	2	20	6	sand (HCl)	30	6	0.3	sparse macrophytes
PP-18	2	21	6	none	30	6	0.3	no macrophytes
PP-19	2	22	6	Aquamat	30	6	0.3	no macrophytes
STC-1	1	13	2,240	peat	60	6	0.021	sparse macrophytes
STC-2	1	8	2,240	shellrock	60	6	0.021	sparse macrophytes
STC-3	1	3	2,240	shellrock	0-60	0-12	0-0.02	sparse macrophytes
STC-4	2	13	2,240	peat (Ca)	30	6	0.010	sparse macrophytes
STC-5	2	8	2,240	shellrock	30	6	0.010	sparse macrophytes
STC-6	2	13	2,240	shellrock	0-30	0-12	0-0.01	sparse macrophytes
FSC-1	3	1	19,350	limerock/peat	0-60	0-12	0.005	sparse macrophytes
FSC-2	3	2	19,970	limerock/peat	0-60	0-12	0.014	sparse macrophytes
FSC-3	3	3	19,350	caprock	0-60	0-12	0.005	sparse macrophytes
FSC-4	3	4	19,350	native peat	0-60	0-12	0.005	sparse macrophytes

Notes:
PP = Porta-PSTA
STC = South Test Cell
FS = Field-Scale
FSC = Field-Scale Cell

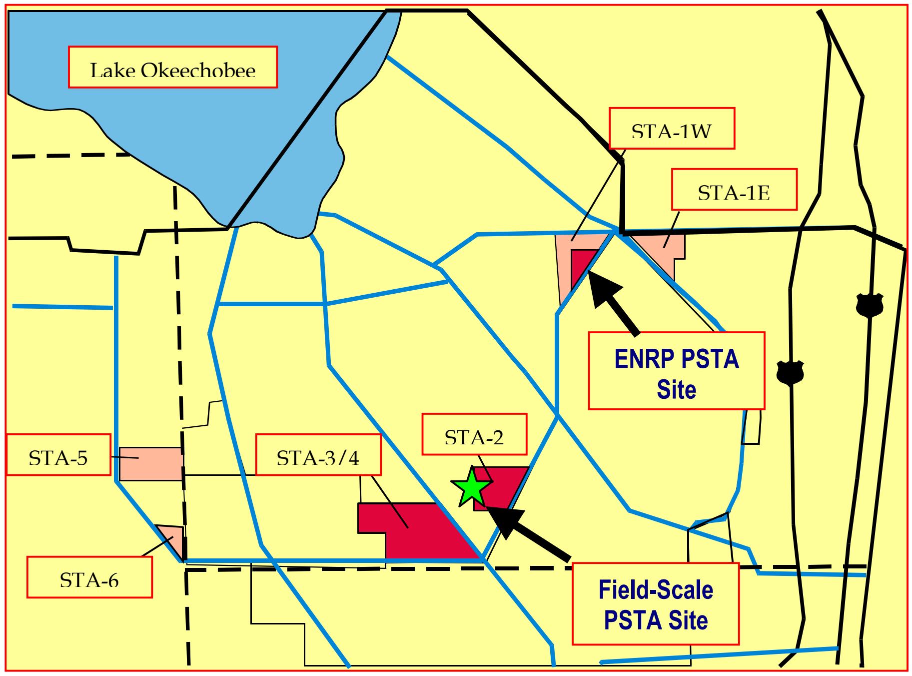


EXHIBIT 1-5
Locations of District PSTA Research Sites

- **Test Cells 3 and 8:** 3.5 ft of sand fill plus 1.0 ft of shellrock (locally mined)

Exhibit 1-11 provides a plan view of a typical PSTA Test Cell showing sampling locations and walkways. Exhibit 1-12 summarizes detailed design criteria and treatments for the PSTA Test Cells during the first two project phases. Exhibit 1-13 provides a photograph of a typical PSTA Test Cell at the South ENRP Test Cell site.

The effects of three replicated treatments (substrate, water depth, and HLR) were tested in the Test Cells during Phase 1 (February 1999 to March 2000). The treatments were renumbered for Phase 2 with monitoring beginning in April 2000 and continuing through early April 2001.

For Phase 2, the Test Cells underwent changes, including peat soil amendment, water regime, and water depth. Treatment STC-4 (Test Cell 13) was amended with calcium to attempt to decrease the amount of soluble P being released from the peat soils after reflooding. Average water depth was reduced from 60 to 30 cm, and the target HLR remained at 6 cm/d. Water depth in Treatment STC-5 (South Test Cell 8) was reduced from 60 to 30 cm.

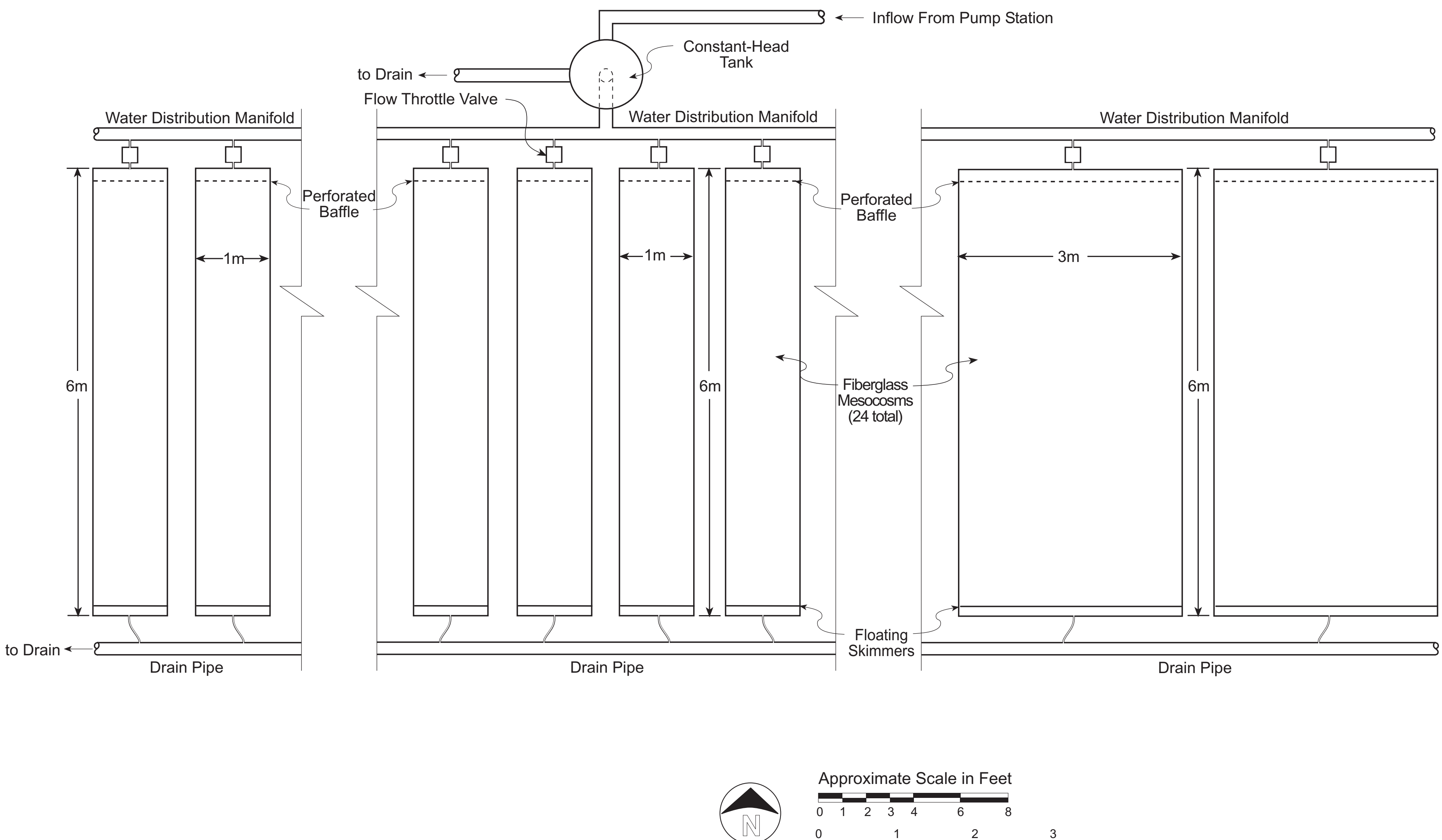


Exhibit 1-6. Porta-PSTA Experimental Mesocosm Site Plan

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EXHIBIT 1-7
Porta-PSTA Tank 23 (Treatment PP-11) After 11 Months of Colonization
This 6 x 3 meter tank has shellrock soils and was operated at a 30-cm water depth. Floating periphyton mats are visible among the sparse emergent macrophytes. Narrow tanks can be seen in the background as well as the raised constant Head Tank used to feed all mesocosms at this site.

The operation schedule for Treatment STC-6 (South Test Cell 3) was revised during Phase 2 to include two prolonged dry-outs, a maximum HLR of 11.4 cm/d, a maximum operational water depth of 60 cm, and an average depth of approximately 30 cm. Monthly average HLRs actually achieved in the PSTA Test Cells during Phase 1 and 2 research are summarized in Exhibit 1-14. Average monthly water depths in the PSTA Test Cells are provided in Exhibit 1-15. Detailed operational data for the PSTA Test Cells are summarized in Appendix C.

1.4.3 PSTA Field-Scale Cells

Exhibit 1-16 provides a summary of the Field-Scale PSTA design criteria and Exhibit 1-17 schematically illustrates the PSTA Field-Scale Demonstration Facility layout. Four PSTA Cells were constructed between April 2000 and early 2001 from onsite materials (see Exhibit 1-18). These four cells were each approximately 20,000 square meters (m^2) (5 acres). Three of the cells were rectangular at 61 m wide by 317 m long (200 by 1,040 feet [ft]), and one cell was sinuous with a length of 951 m (3,120 ft) and a width of 21 m (70 ft). FSC-1 and FSC-2 had approximately 60 centimeters (cm) or 24 inches of limerock placed over the native peat soils. The relatively shallow peat soils were excavated and removed from FSC-3 to expose the underlying caprock. Native (onsite) peat soils, without amendments or other pretreatments, comprised the floor of FSC-4.

EXHIBIT 1-8

Comparison of Porta-PSTA Mesocosm Phase 1 and Phase 2 Treatments

	Phase 1 (April 1999 - March 2000)	Phase 1 to Phase 2 Alterations (March - April 2000)	Phase 2 (April 2000 - October 2001)
Porta-PSTAs 9, 11, 18	**PP-1** Substrate: Peat Depth: 60 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Tanks drained and vegetation removed • Sediment wetted and peat soil amended with lime (7mt/ha) • Vegetation replanted • Tank reflooded, but operated at 30 cm • Tank inoculated with periphyton	**PP-13** Substrate: Peat + Ca Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis* *Utricularia*
Porta-PSTAs 7, 4, 8	**PP-2** Substrate: Shellrock Depth: 60 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Tanks drained and vegetation removed • Shellrock removed and tank rinsed with dilute HCl • 20 cm of washed limerock added to tank • Tank replanted with spikerush • Tank reflooded, but operated at 30 cm • Tank inoculated with periphyton	**PP-14** Substrate: Limerock Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTAs 12, 14, 17	**PP-3** Substrate: Peat Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Continue routine monitoring with no changes	**PP-3** Substrate: Peat Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTAs 3, 5, 10	**PP-4** Substrate: Shellrock Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Continue routine monitoring with no changes	**PP-4** Substrate: Shellrock Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTAs 2, 13, 16	**PP-5** Substrate: Shellrock Depth: 60 HLR (cm/d): 12 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• HLR reduced to 6 cm/d • Water depth reduced to 30 cm • Recirculation pumps installed to increase velocity to 0.5 cm/s	**PP-15** Substrate: Shellrock Depth: 30 cm HLR (cm/d): (recirc) Average Velocity (cm/s): 0.5 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTAs 1, 6, 15	**PP-6** Substrate: Shellrock Depth: 0- 60cm HLR (cm/d): 0- 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0- 0.6 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• One complete dry out scheduled with subsequent reflooding • Variation in water regime scheduled • Maximum water depth reduced to 30 cm	**PP-16** Substrate: Shellrock Depth: 0- 30 cm HLR (cm/d): 0- 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0- 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTA 19	**PP-7** Substrate: Sand Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Continue routine monitoring with no changes	**PP-7** Substrate: Sand Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTA 20	**PP-8** Substrate: Sand Depth: 60 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Tank drained and vegetation removed • Sand thoroughly washed with dilute HCl to remove available P • Tank rinsed • Tank replanted with spikerush • Tank reflooded, but operated at 30 cm • Tank inoculated with periphyton	**PP-17** Substrate: Sand- HCl Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Eleocharis, Utricularia*
Porta-PSTA 21	**PP-9** Substrate: Peat- Aquashade Depth: 60 HLR (cm/d): 6 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: None	• Tank drained and substrate removed • Tank thoroughly rinsed with dilute HCl • Tank rinsed • Tank reflooded, but operated at 30 cm • Tank inoculated with periphyton	**PP-18** Substrate: None Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Utricularia*
Porta-PSTA 22	**PP-10** Substrate: Shellrock- Aquashade Depth: 60 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0007 Depth:Width Ratio: 0.6 Vegetation: None	• Tank drained and substrate removed • Tank thoroughly rinsed with dilute HCl • Tank rinsed • Tank reflooded, but operated at 30 cm • Synthetic substrate (Aquamat) added • Tank inoculated with periphyton	**PP-19** Substrate: None- Aquamat Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.3 Vegetation: Periphyton, *Utricularia*
Porta-PSTA 23	**PP-11** Substrate: Shellrock Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.1 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Continue routine monitoring with no changes	**PP-11** Substrate: Shellrock Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.1 Vegetation: Periphyton, *Eleocharis* , *Utricularia*
Porta-PSTA 24	**PP-12** Substrate: Peat Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.1 Vegetation: Periphyton, *Eleocharis* , *Utricularia*	• Continue routine monitoring with no changes	**PP-12** Substrate: Peat Depth: 30 cm HLR (cm/d): 6 Average Velocity (cm/s): 0.0014 Depth:Width Ratio: 0.1 Vegetation: Periphyton, *Eleocharis* , *Utricularia*

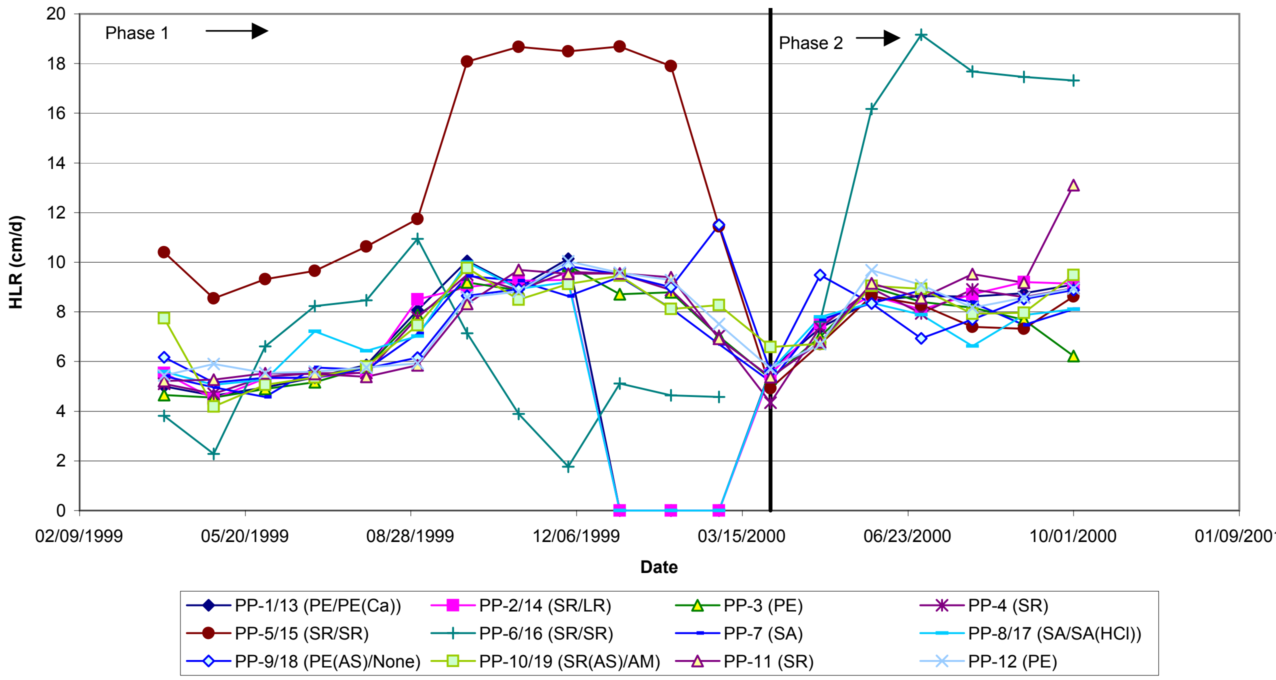

EXHIBIT 1-9

Average Monthly Inlet Hydraulic Loading Rates in the Porta-PSTAs during Phases 1 and 2

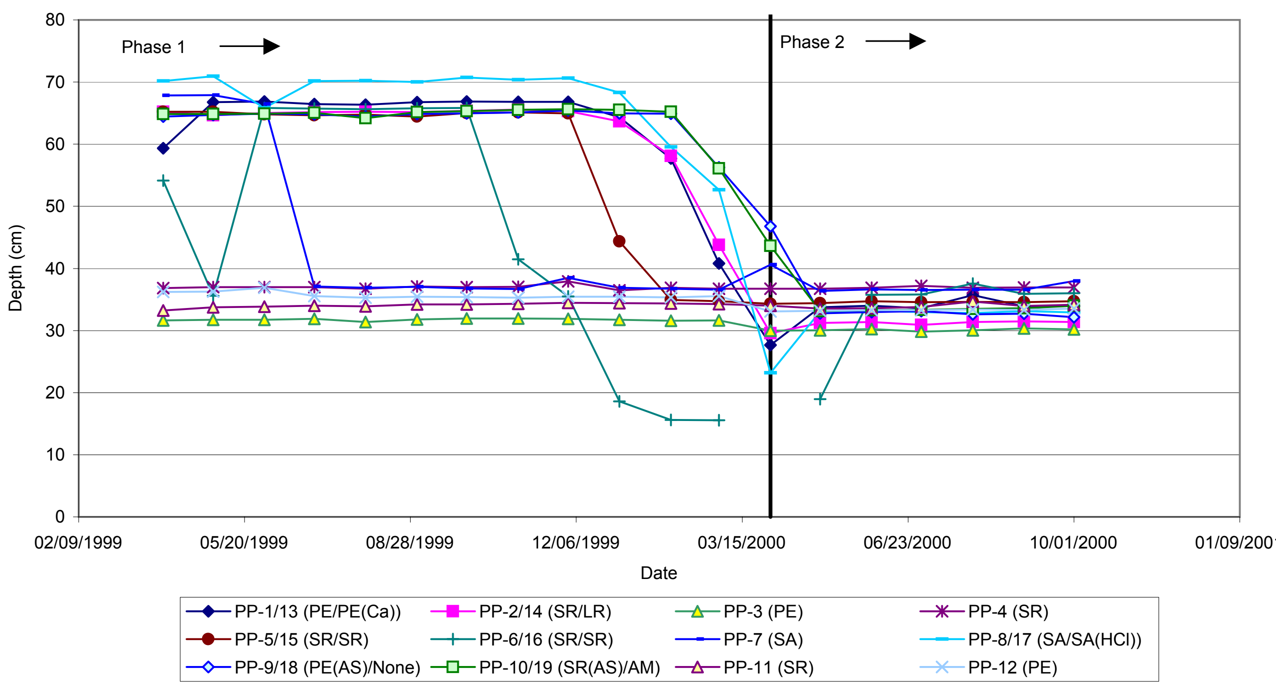

EXHIBIT 1-10

Average Monthly Water Depth in the Porta-PSTAs during Phases 1 and 2

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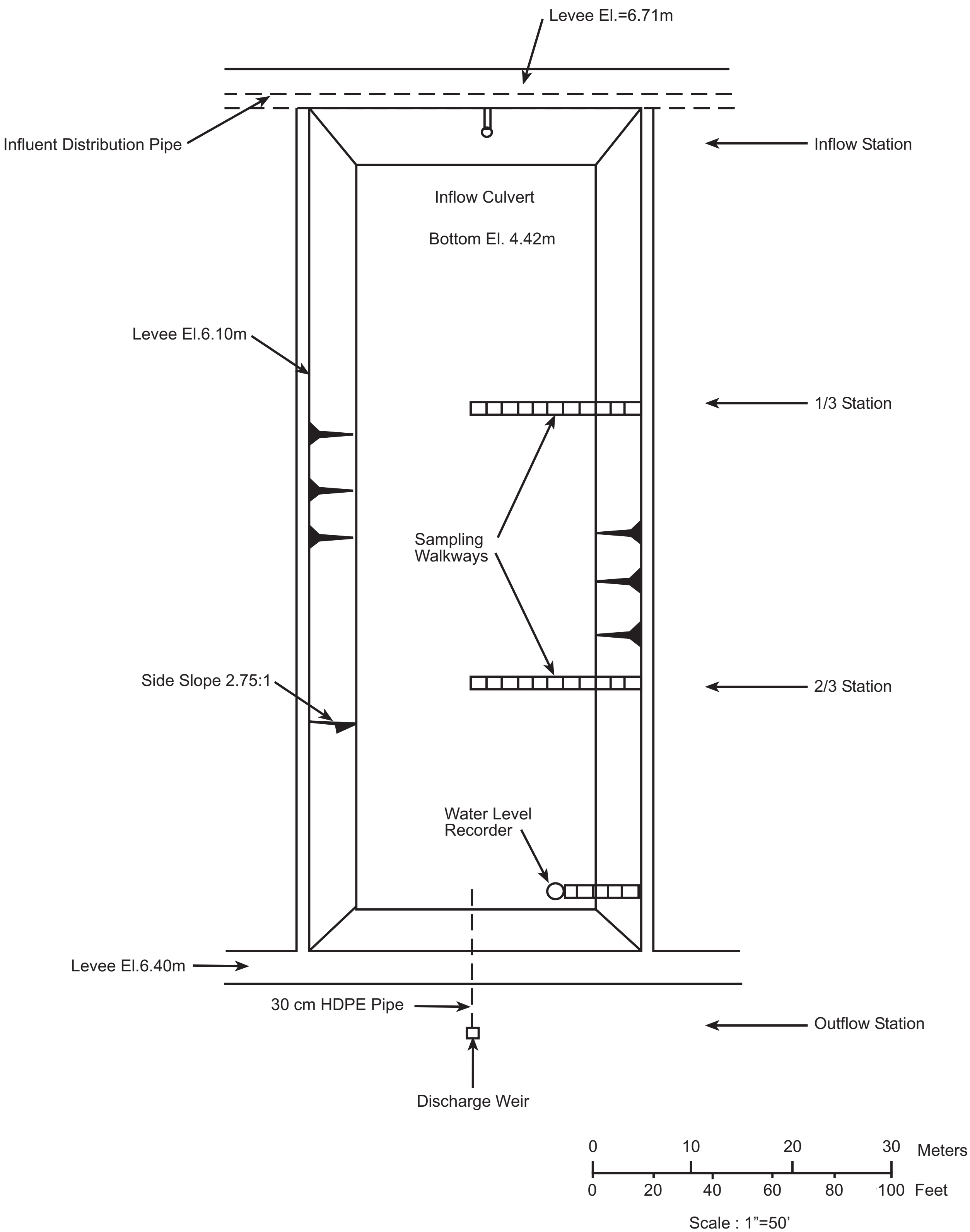

Exhibit 1-11. Plan View of Typical ENR PSTA Test Cell Showing Sampling Locations

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EXHIBIT 1-12
Comparison of PSTA ENRP South Test Cell Phase 1 and Phase 2 Treatments

TC #	Phase 1 (February 1999 - March 2000)		Phase 1 to Phase 2 Alterations (March - April 2000)	Phase 2 (April 2000 - April 2001)	
TC 13	**STC-1**			**STC-4**	
	Substrate:	Peat	• Vegetation herbicided and removed	Substrate:	Peat + Ca
	Depth:	60 cm	• Cell floor wetted and peat soil amended with lime (7mt/ha)	Depth:	30 cm
	HLR (cm/d):	6		HLR (cm/d):	6
	Average Velocity (cm/s):	0.0093	• Cell reflooded, but operated at 30 cm	Average Velocity (cm/s):	0.0185
	Depth:Width Ratio:	0.02	• Vegetation replanted	Depth:Width Ratio:	0.01
	Vegetation:	Periphyton, *Eleocharis, Utricularia*	• Cell inoculated with periphyton	Vegetation:	Periphyton, *Eleocharis, Utricularia*
TC 8	**STC-2**			**STC-5**	
	Substrate:	Shellrock	• Water depth reduced to 30 cm	Substrate:	Shellrock
	Depth:	60 cm	• No other changes made	Depth:	30 cm
	HLR (cm/d):	6		HLR (cm/d):	6
	Average Velocity (cm/s):	0.0093		Average Velocity (cm/s):	0.0185
	Depth:Width Ratio:	0.02		Depth:Width Ratio:	0.01
	Vegetation:	Periphyton, *Eleocharis, Utricularia*		Vegetation:	Periphyton, *Eleocharis, Utricularia*
TC 3	**STC-3**			**STC-6**	
	Substrate:	Shellrock	• Two complete dry-outs scheduled for the cell with subsequent reflooding	Substrate:	Shellrock
	Depth:	0- 60 cm	• Maximum water depth of 30 cm	Depth:	0- 30 cm
	HLR (cm/d):	0- 12		HLR (cm/d):	0- 12
	Average Velocity (cm/s):	0.0093		Average Velocity (cm/s):	0.0185
	Depth:Width Ratio:	0.02		Depth:Width Ratio:	0.01
	Vegetation:	Periphyton, *Eleocharis, Utricularia*		Vegetation:	Periphyton, *Eleocharis, Utricularia*

Note:
mt/ha = metric tonnes per hectare

EXHIBIT 1-13
PSTA Test Cell 8 (Treatment STC-2) After Approximately 12 Months of Colonization
This photo is looking upstream from the outfall standpipes toward the inflow at the far end of the cell. Monitoring walkways are located at 1/3 and 2/3 points along the flow path.

Influent water to this facility can be conveyed from two sources: the western STA-2 seepage control canal or Cell 3 of STA-2. These water sources can be used independently or by blending. Influent canal water is pumped through inlet manifolds into the four FSCs using diesel pumps. The inlet flow rate is measured with an in-line magnetic meter in each inlet manifold. Water flows by gravity from the inlet deep zones to the outlet deep zones, which distribute and collect these flows. Water flows out of each cell through a single outlet weir box equipped with an Agridrain water level control structure, which contains 60-cm-wide removable stoplogs. The top stoplog acts as a horizontal overflow weir and controls the water level in the cell as well as being used in conjunction with a water level recorder for outflow quantification.

Scaffold-type "boardwalks" were installed across the width of each cell at the center point to allow access for internal sampling. A series of groundwater sampling wells were arranged within and around the FSCs to allow monitoring of groundwater TP gains and losses. Low densities of spikerush were planted in bands across the width of each cell to help prevent the periphyton mat from washing out toward the outflow structures. Periphyton colonization was by natural recruitment. Construction of the PSTA Field-Scale demonstration facility was completed during the first quarter of 2001, and routine operation and monitoring began in July 2001.

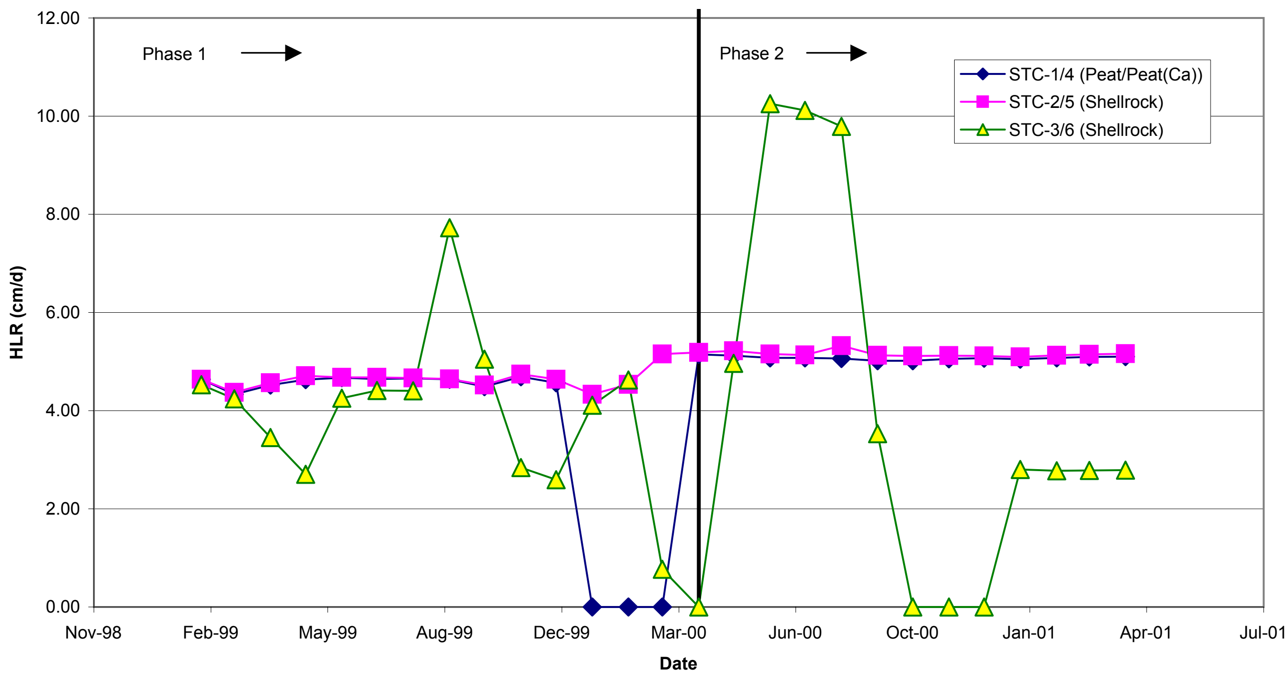


EXHIBIT 1-14
Average Monthly Inlet Hydraulic Loading Rates in the PSTA Test Cells during Phases 1 and 2

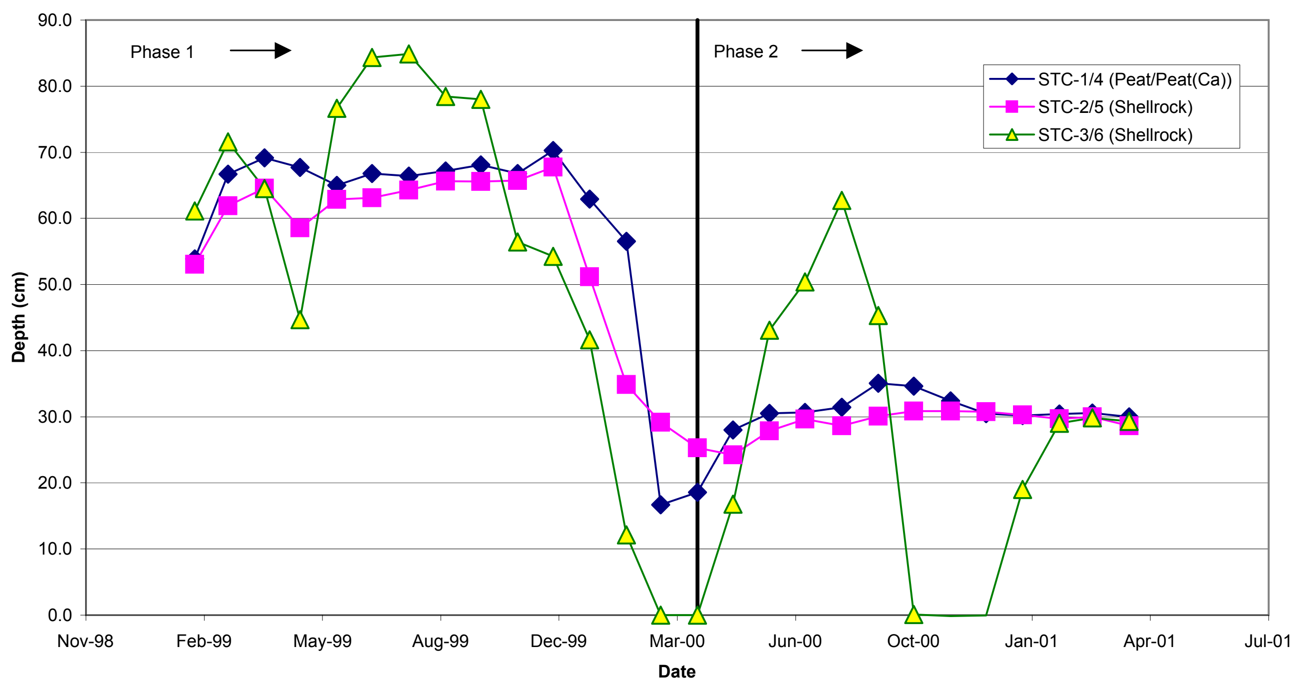


EXHIBIT 1-15
Average Monthly Water Depth in the PSTA Test Cells during Phases 1 and 2

EXHIBIT 1-16

Experimental Treatments and Design Criteria for PSTA Field-Scale Demonstration Cells

Design Parameter	PSTA Treatment FSC-1	FSC-2	FSC-3	FSC-4
No. Cells	1	1	1	1
Flow (m^3/d)				
Average	1250	1250	1250	1250
Maximum	2500	2500	2500	2500
Minimum	0	0	0	0
Cell Length (m)	315	945	315	315
Cell Width (m)	66	22	66	66
Aspect Ratio	5	43	5	5
Horizontal Cell Area (m^2)	20790	20790	20790	20790
Operational Water Depth (m)				
Average	0.30	0.30	0.30	0.30
Maximum	0.60	0.60	0.60	0.60
Minimum	0.00	0.00	0.00	0.00
Operational Water Volume (m^3)				
Average	6237	6237	6237	6237
Maximum	12474	12474	12474	12474
Minimum	0	0	0	0
Nominal Hydraulic Residence Time (d)				
@ average flow and depth	5.0	5.0	5.0	5.0
@ maximum flow and minimum depth	0.0	0.0	0.0	0.0
@minimum flow and maximum depth	INF	INF	INF	INF
Hydraulic Loading Rate (cm/d)				
@ average flow and depth	6.0	6.0	6.0	6.0
@ maximum flow	12.0	12.0	12.0	12.0
@minimum flow	0.0	0.0	0.0	0.0
Nominal Linear Velocity (m/d)				
@ average flow and depth	63	189	63	63
Substrate	LR-PE	LR-PE	CR	PE
Liner (Yes/No)	No	No	No	No
Deep Zones				
Number per Cell	2	4	2	2
Depth Below Floor Elevation (m)	1	1	1	1
Plant Species (Yes/No)				
Periphyton	Yes	Yes	Yes	Yes
Macrophytes	Yes	Yes	Yes	Yes
Design TP Influent Quality (µg/L)				
Average	25	25	25	25
Maximum	40	40	40	40
Minimum	15	15	15	15
Design TP Mass Loading ($g/m^2/y$)				
Average	0.55	0.55	0.55	0.55
Maximum	0.88	0.88	0.88	0.88
Minimum	0.33	0.33	0.33	0.33

Notes:
PE = peat
LR-PE = limerock fill over peat
CR = limestone caprock
INF = infinite

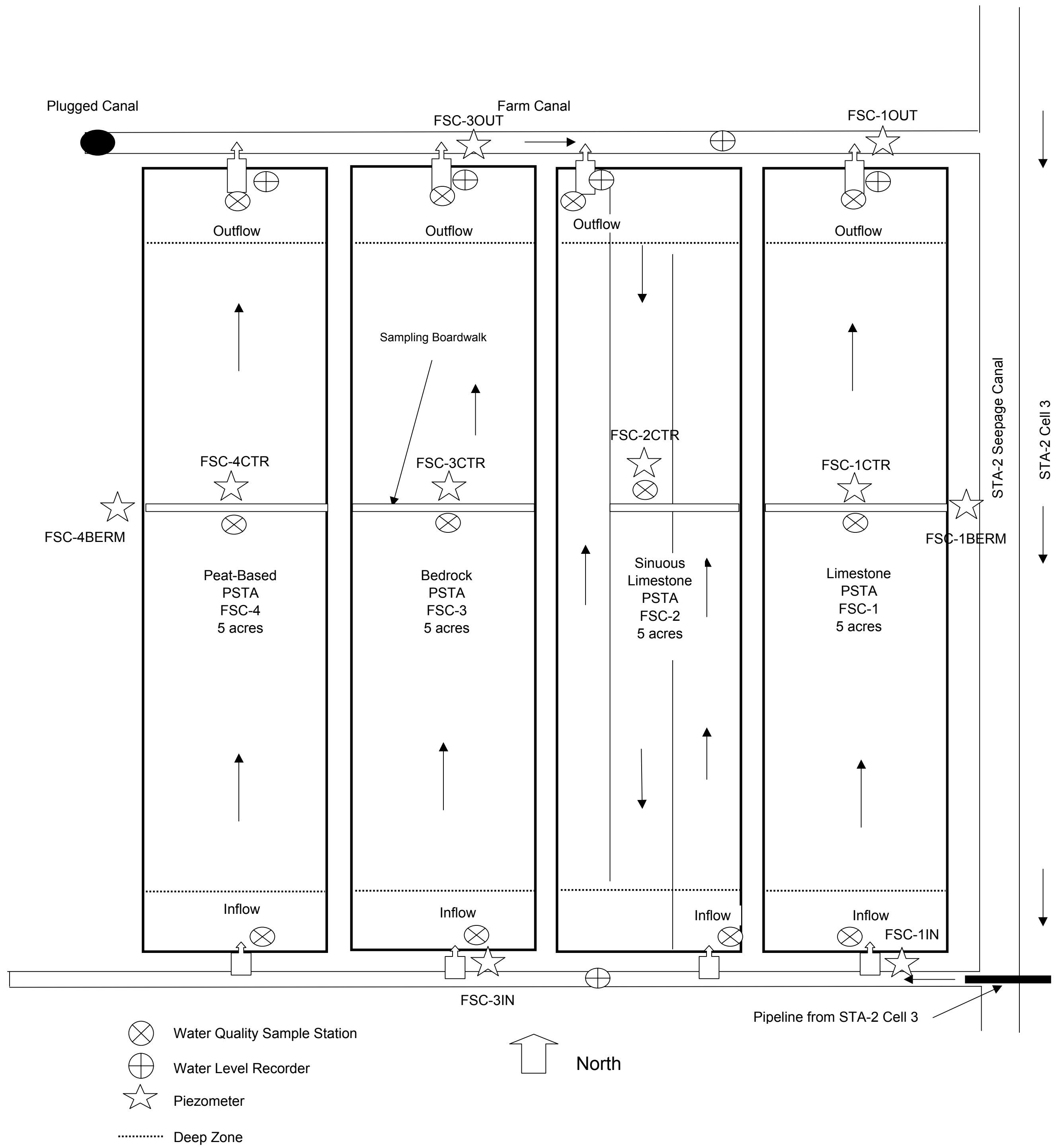
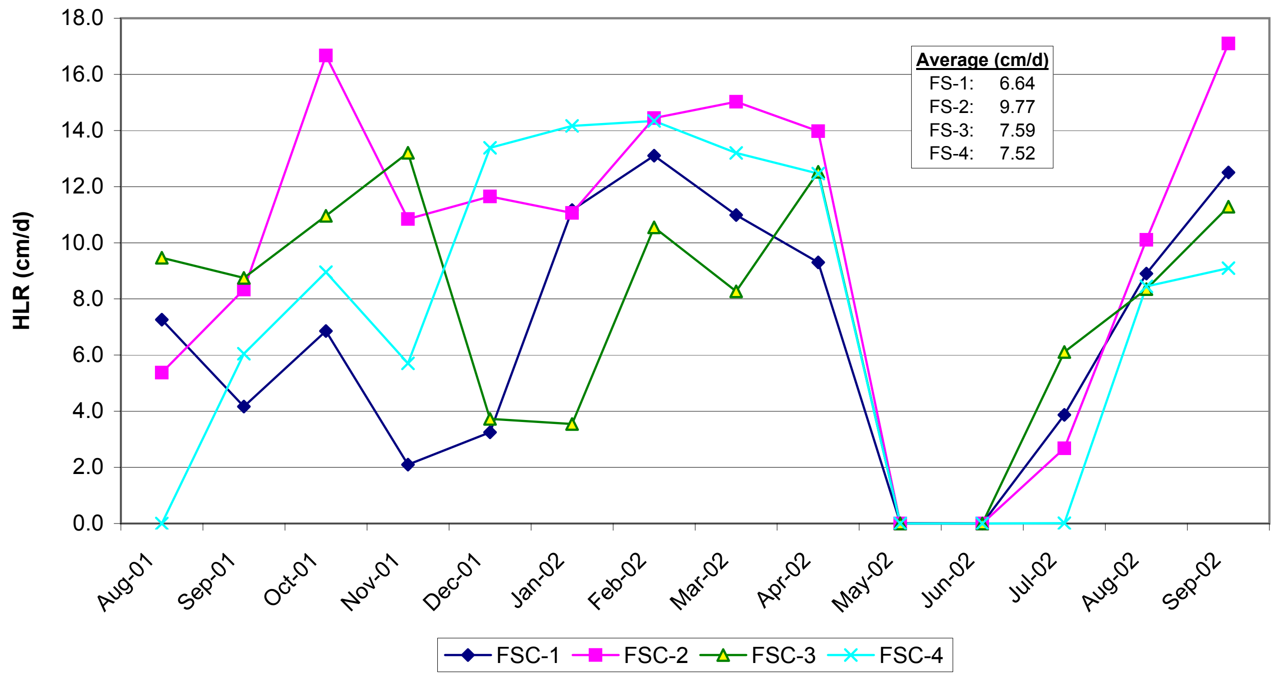


EXHIBIT 1-17
Schematic of Field-Scale Cells Showing Sampling Locations

EXHIBIT 1-18
Field-Scale Pilot PSTA Research Site West of STA-2
This photo is looking south. STA-2 Cell 3 is to the left (east) and the Field-Scale Cells are numbered 1 through 4 with FSC-1 on the left. Dividing channels are placed between FSC-2 and FSC-3 and between FSC-3 and FSC-4 to help isolate the cells from groundwater interactions.

Monthly average HLRs and water depths actually achieved in the Field-Scale PSTA cells during Phase 3 are summarized in Exhibit 1-19. Difficulties were encountered in maintaining consistent water deliveries and depths in the FSCs because of mechanical problems with the diesel-powered pumps, and drought conditions resulting in inadequate water supply to meet the needs of the research and demonstration project at all times. Operational success was measurably improved following the spring 2002 drydown of the system and the improved water availability with the onset of the 2002 wet season. Detailed operational data for the Field-Scale PSTA test systems are summarized in Appendix E.



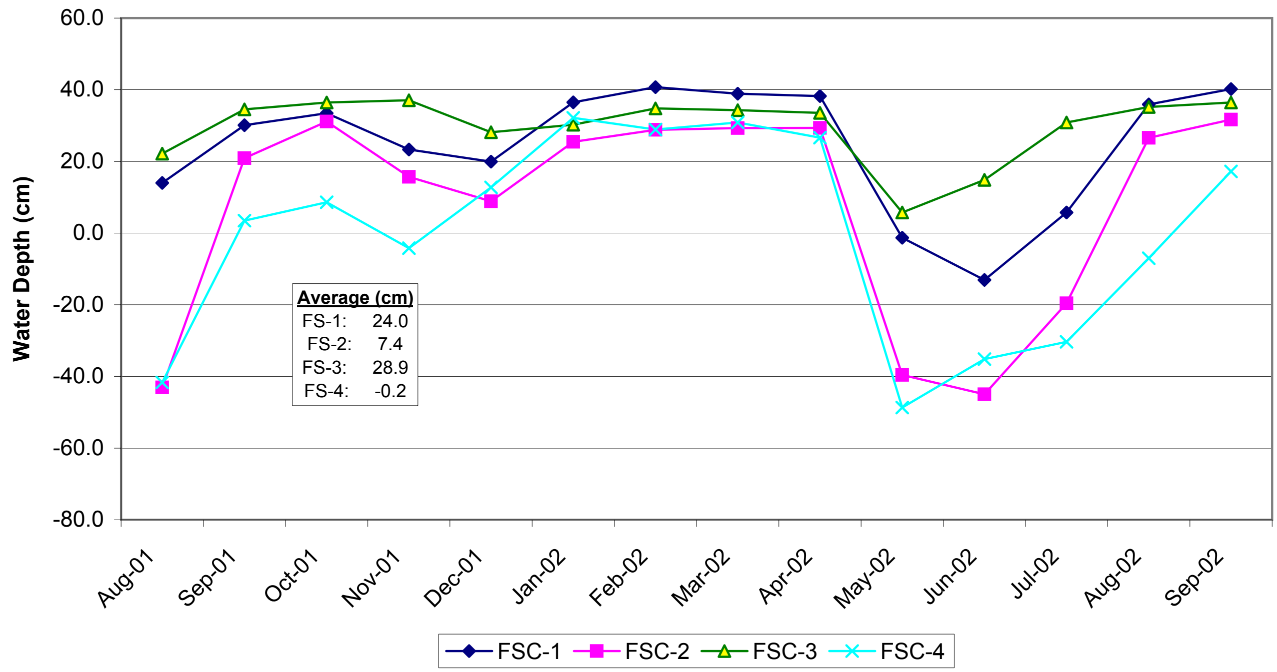


EXHIBIT 1-19

Monthly Average Hydraulic Loading Rate and Water Depths in the Field-Scale PSTA Cells

1.5 Summary of Environmental Forcing Functions

External environmental forcing functions that affected the growth and performance of the PSTA mesocosms include:

- Sunlight (measured as total insolation and photosynthetically active radiation [PAR])
- Rain inputs
- ET outputs

The general history of each of the environmental forcing functions for the Phase 1, 2, and 3 periods-of-record (POR) is presented in Exhibits 1-20 and 1-21. Appendix B includes detailed meteorological data for the three project phases. Inflow hydraulic loads, P concentrations, and water temperatures are also external forcing functions and are described elsewhere in this report.

1.5.1 Solar Inputs

Exhibit 1-20 summarizes the total insolation and PAR received at the three project sites during the project period. Total insolation averaged 18.1 megajoules (MJ) per m^2/d, and PAR averaged 28.9 mols per m^2/d. Sunlight inputs are clearly seasonal with short-term effects attributable to the presence of cloud cover.

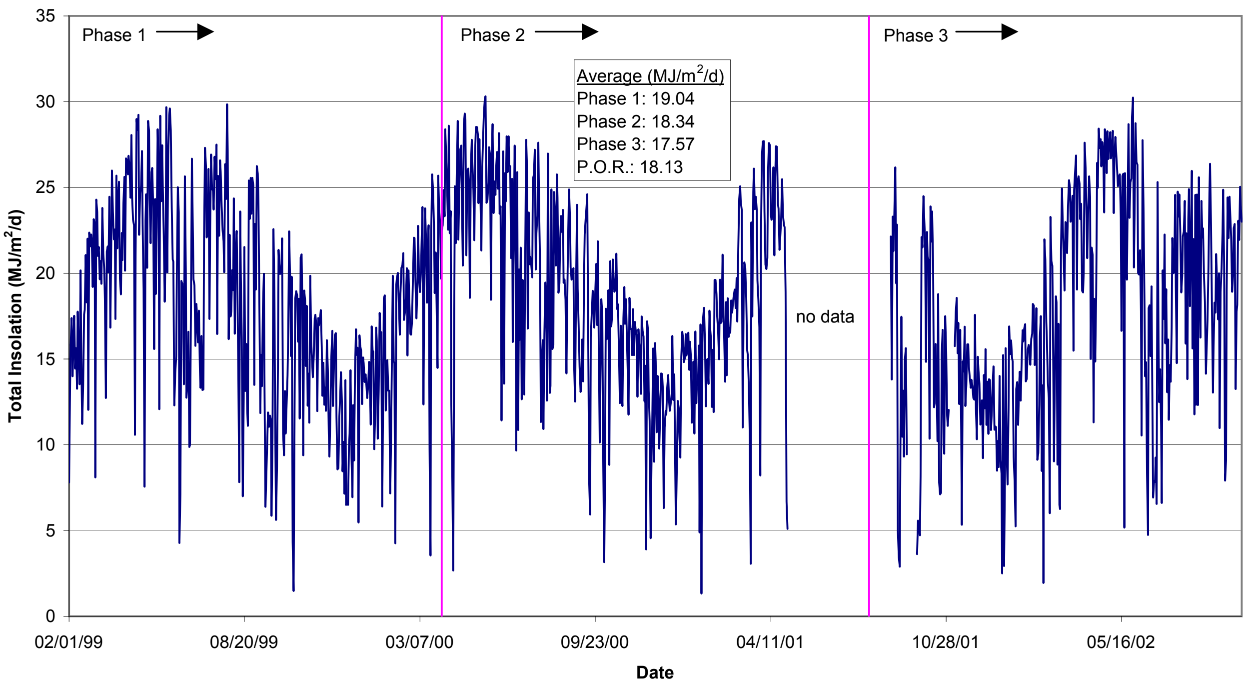
1.5.2 Precipitation and Evapotranspiration

Exhibit 1-21 compares the measured rainfall and estimated evapotranspiration (ET) and their net difference. ET data were provided by the District and are from their STA-1W station. The total rainfall for the 1,213-day POR was 425 cm (167 inches [in]), which is equal to approximately 0.35 cm/d (0.14 in/d), while ET was 461 cm (181 in), or 0.38 cm/d (0.15 in/d). These data indicate that there was a slight net ET water loss to the atmosphere (0.03 cm/d) [0.01 in/d] from the PSTA test systems during the POR.

1.6 PSTA Test System Water Balances and Hydraulics

PSTA test systems were aquatic ecosystems, and detailed knowledge of their hydrology and hydraulics was important for interpretation of their ecology and P removal performance. This section briefly summarizes the water balances for all 29 of the PSTA experimental treatments as well as hydraulic properties for a selected subset of those systems. Detailed water balances are provided for all PSTA test systems in Appendices C, D, and E. Tracer testing results for selected PSTAs are provided in Appendix G.

EXHIBIT 1-20
Solar Energy Inputs to the PSTA Mesocosms During Phases 1, 2, and 3



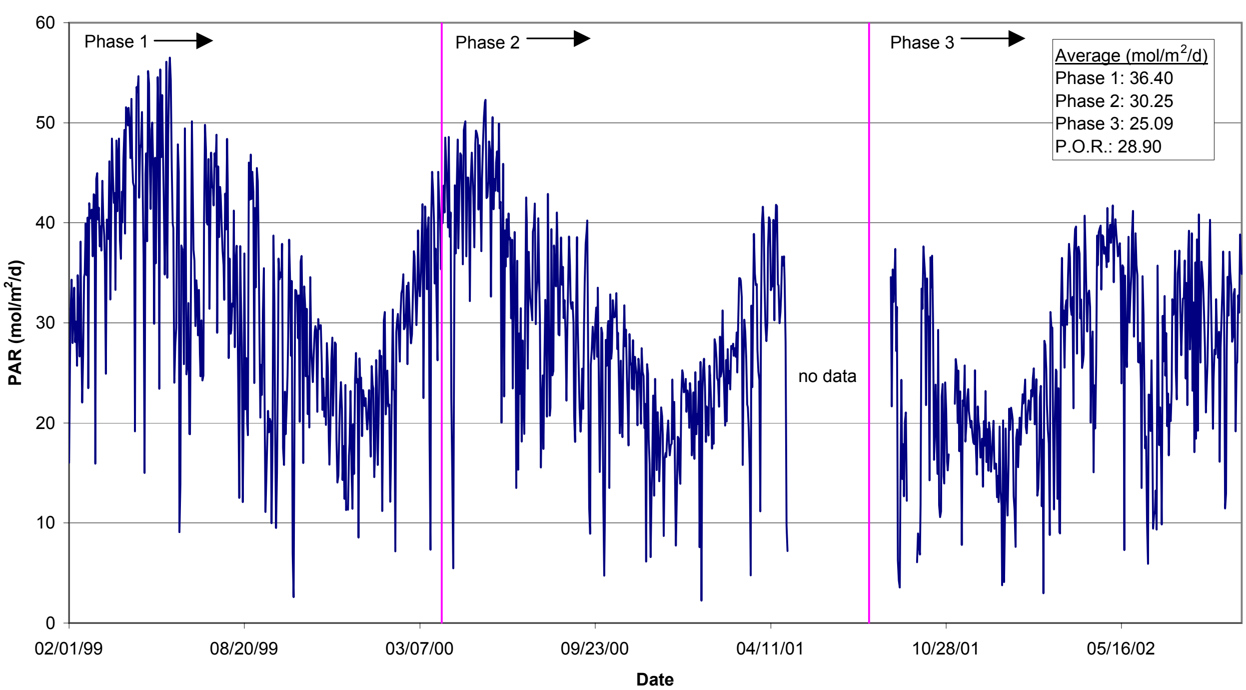
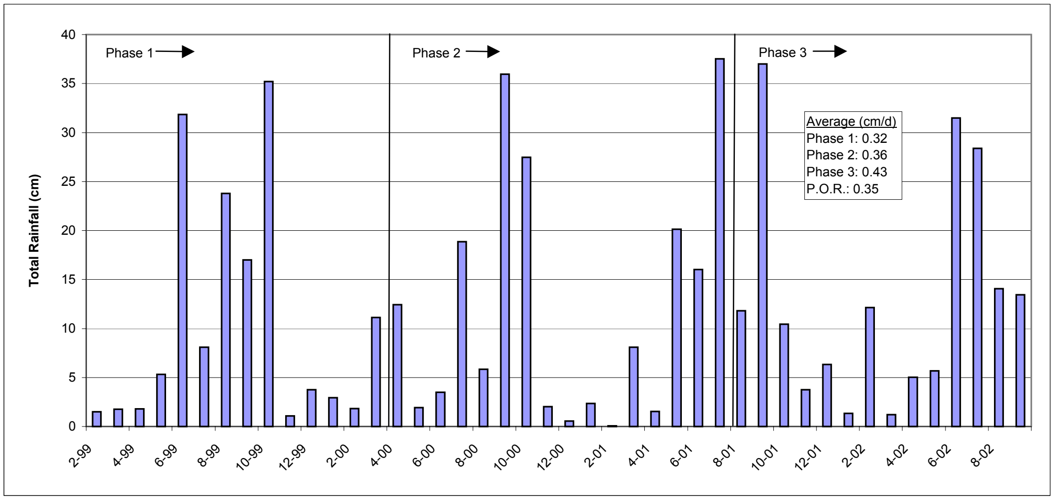
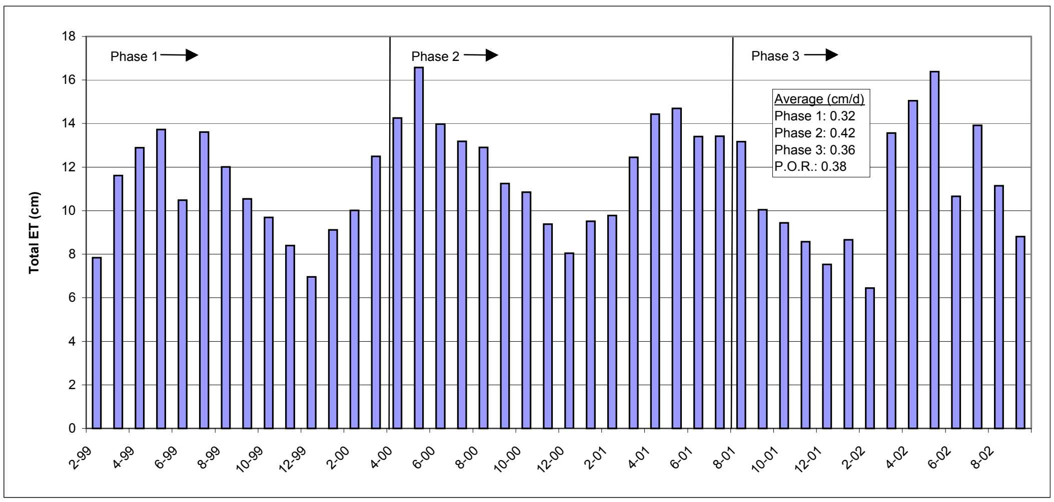
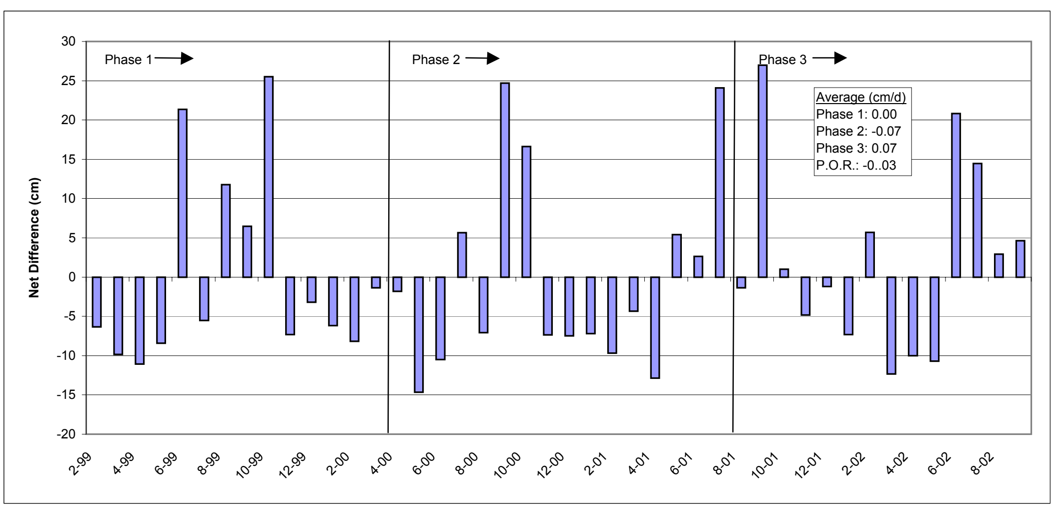


EXHIBIT 1-21
Rainfall and Evapotranspiration at the PSTA Mesocosms During Phases 1, 2, and 3







Notes:
Phase 1: 424 days, Phase 2: 364 days, Phase 3: 425 days
Feb99-Mar01: Rainfall (Stn ENR301) ; ET (Stn ENRP)
Apr01-Sept02: Rainfall (GG630 Stn S7) ; ET (KN810 Stn STA-1W)
ET estimated from July - September 2002 (ET station updated quarterly in DBHYDRO)

1.6.1 Water Balances

Exhibit 1-22 summarizes the period-of-record water balances for each of the PSTA treatments. The residual for each water balance provides an estimate of the total unaccounted water gains and losses. For the lined Porta-PSTAs and Test Cells, groundwater exchanges were not considered to be likely. In those cases, the estimated residuals are an indication of the cumulative errors in measuring surface inflows and outflows (including rainfall and ET). For the unlined FSCs, these residuals also include the observed groundwater exchanges.

Residuals for the Porta-PSTA treatments ranged from approximately 0.2 to 19.3 percent of the measured inflow. These numbers indicate that most of these water mass balances were fairly reasonable.

Residuals for the PSTA Test Cell treatments ranged from 0.1 to 48 percent of the measured inflows. Residuals were generally small (less than approximately 11 percent of inflows), except in the Phase 1 variable water regime cell. The largest contribution to this water balance error occurred during a month of rapid water level changes.

Measured residuals for the FSCs ranged from approximately 10 to 78 percent of inflows. FSC-1, FSC-2, and FSC-4 lost a significant quantity of water by leakage to the surficial groundwater and to surrounding surface waters, both in the inflow canal and to adjacent cells. Exhibit 1-23 illustrates the time-series data for water levels in the four FSCs and in the adjacent shallow groundwater wells. There was a clear gradient from surface water to groundwater during most operational periods in all of these PSTA cells.

Average estimated daily leakage losses for these cells were approximately 5.0, 6.8, and 7.2 cm/d for FSC-1, FSC-2, and FSC-4, respectively. FSC-3 was excavated through the surficial soils and had a resulting lower ambient water level than the other three FSCs. For this reason, FSC-3 leaked some of the time and at other times of lower water stages received some inputs from the shallow groundwater and from adjacent surface waters in the inflow canal, the outflow canal, and the dividing seepage canals. The net effect of these exchanges was a much lower residual (10 percent of inflows) and estimated leakage (1.0 cm/d) than for the other FSCs.

1.6.2 System Hydraulics

Exhibit 1-24 summarizes the results of 14 lithium-based tracer tests conducted on the PSTA test systems within the time-frame of this report. There were four tracer tests in Porta-PSTAs, six tests in the Test Cells, and one each in the four Field-Scale PSTA cells.

In the Porta-PSTAs, the tracer mass recovery varied from 62 to 98 percent, and volumetric efficiencies ranged from 86 to 228 percent. The estimated tanks-in-series (TIS) for three shellrock-based tanks ranged from 1.5 to 2.2. In the recirculation shellrock Porta-PSTA tank, the TIS estimate fell to 1.1.

EXHIBIT 1-22

Porta-PSTA, Test Cell, and Field-Scale Cell Period-of-Record Estimated Water Balances

Platform	Treatment	Phase	Cell	Substrate	Depth	HLR	Area (m^2)	# DAYS	Depth (m)	HLR (cm/d)	Inflow (m^3/d)	Inflow (m^3)	Outflow (m^3/d)	Outflow (m^3)	Rainfall (in)	Rainfall (m^3)	ET (mm)	ET (m^3)	ΔSTORAGE (m^3)	Residual (m^3)	Residual (% of inflow)
Porta-PSTA's	PP-1	1	9,11,18	PE	D	L	6	335	0.660	7.17	0.430	144.15	0.389	130.38	51.5	7.85	983.1	5.90	0.443	15.3	10.0
	PP-2	1	4,7,8	SR	D	L	6	335	0.652	7.03	0.422	141.23	0.390	130.64	51.5	7.85	983.1	5.90	0.008	12.5	8.4
	PP-3	1, 2	12,14,17	PE	S	L	6	671	0.311	7.21	0.431	289.02	0.404	270.91	91.2	13.90	1804.5	10.83	-0.088	21.3	7.0
	PP-4	1, 2	3,5,10	SR	S	L	6	671	0.369	7.50	0.449	301.49	0.453	303.97	91.2	13.90	1804.5	10.83	0.006	0.6	0.2
	PP-5	1	2,13,16	SR	D	H	6	349	0.582	13.84	0.830	289.80	0.774	270.20	56.6	8.62	983.1	5.90	-1.831	24.2	8.1
	PP-6	1	1,6,15	SR	V	V	6	335	0.454	5.54	0.333	111.45	0.315	105.56	56.6	8.62	983.1	5.90	-2.316	10.9	9.1
	PP-7	1, 2	19	SA	D/S	L	6	671	0.419	7.36	0.442	296.45	0.415	278.37	91.2	13.90	1804.5	10.83	-1.792	22.9	7.4
	PP-8	1	20	SA	S	L	6	335	0.699	7.32	0.439	147.22	0.356	119.25	51.5	7.85	983.1	5.90	0.014	29.9	19.3
	PP-9	1	21	PE (AS)	D	L	6	335	0.641	7.32	0.439	147.14	0.421	141.04	56.6	8.62	983.1	5.90	-0.494	9.3	6.0
	PP-10	1	22	SR (AS)	D	L	6	335	0.644	7.14	0.428	143.46	0.372	124.62	56.6	8.62	983.1	5.90	-0.524	22.1	14.5
	PP-11	1, 2	23	SR	S	L	18	671	0.340	7.82	1.400	939.71	1.387	930.44	91.2	41.71	1804.5	32.48	0.165	18.3	1.9
	PP-12	1, 2	24	PE	S	L	18	671	0.348	7.64	1.374	921.83	1.365	915.89	91.2	41.71	1804.5	32.48	-0.480	15.7	1.6
	PP-13	2	9,11,18	PE (Ca)	S	L	6	301	0.332	8.08	0.488	146.97	0.481	144.65	34.7	5.28	821.5	4.93	0.376	2.3	1.5
	PP-14	2	4,7,8	LR	S	L	6	301	0.310	8.12	0.482	145.09	0.523	157.42	34.7	5.28	821.5	4.93	0.110	-12.1	-8.0
	PP-15	2	2,13,16	SR	S	R	6	315	0.346	7.41	0.444	139.77	0.412	129.90	34.7	5.28	821.5	4.93	0.022	10.2	7.0
	PP-16	2	1,6,15	SR	V	V	6	287	0.295	15.90	0.836	239.93	0.826	237.07	34.7	5.28	821.5	4.93	1.782	1.4	0.6
	PP-17	2	20	SA (HCl)	S	L	6	301	0.316	7.47	0.449	135.26	0.464	139.73	34.7	5.28	821.5	4.93	0.583	-4.7	-3.3
	PP-18	2	21	None	S	L	6	301	0.347	7.92	0.486	146.39	0.530	159.58	34.7	5.28	821.5	4.93	-0.877	-12.0	-7.9
	PP-19	2	22	AM	S	L	6	301	0.349	8.09	0.470	141.57	0.520	156.42	34.7	5.28	821.5	4.93	0.071	-14.6	-9.9
Test Cells	STC-1	1	13	PE	D	L	2240	377	0.636	4.80	122	45974	122	45844	51.6	2938	1178	2638	366	64	0.1
	STC-2	1	8	SR	D	L	2240	398	0.588	4.57	120	47902	137	54421	57.9	3293	1178	2638	-551	-5313	-10.4
	STC-3	1	3	SR	V	V	2240	377	0.552	4.40	114	42977	177	66877	57.9	3293	1178	2638	-1074	-22172	-47.9
	STC-4	2	13	PE (Ca)	D	L	2240	344	0.278	4.96	122	41921	117	40152	46.9	2668	1534	3437	303	697	1.6
	STC-5	2	8	SR	D	L	2240	365	0.296	5.05	123	44940	119	43388	46.9	2668	1534	3437	94.7	688	1.4
	STC-6	2	3	SR	V	V	2240	316	0.206	5.72	89.7	28340	87.4	27605	46.9	2668	1534	3437	546	-579	-1.9
Field-Scale Cells	FSC-1	3	1	LR-PE	S	H	20234	462	0.256	7.49	1516	745940	585	287673	72.8	37405	1645	33288	-1269	463654	59.2
	FSC-2	3	2	LR-PE	S	H	20234	462	0.088	10.60	2145	1055455	864	425260	72.8	37405	1645	33288	3037	631275	57.8
	FSC-3	3	3	CR	S	H	20234	462	0.302	8.53	1727	849534	1554	764796	72.8	37405	1645	33288	-946	89801	10.1
	FSC-4	3	4	PE	S	H	20234	462	0.013	8.19	1657	815315	299	146986	72.8	37405	1645	33288	4346	668100	78.3

Notes:

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

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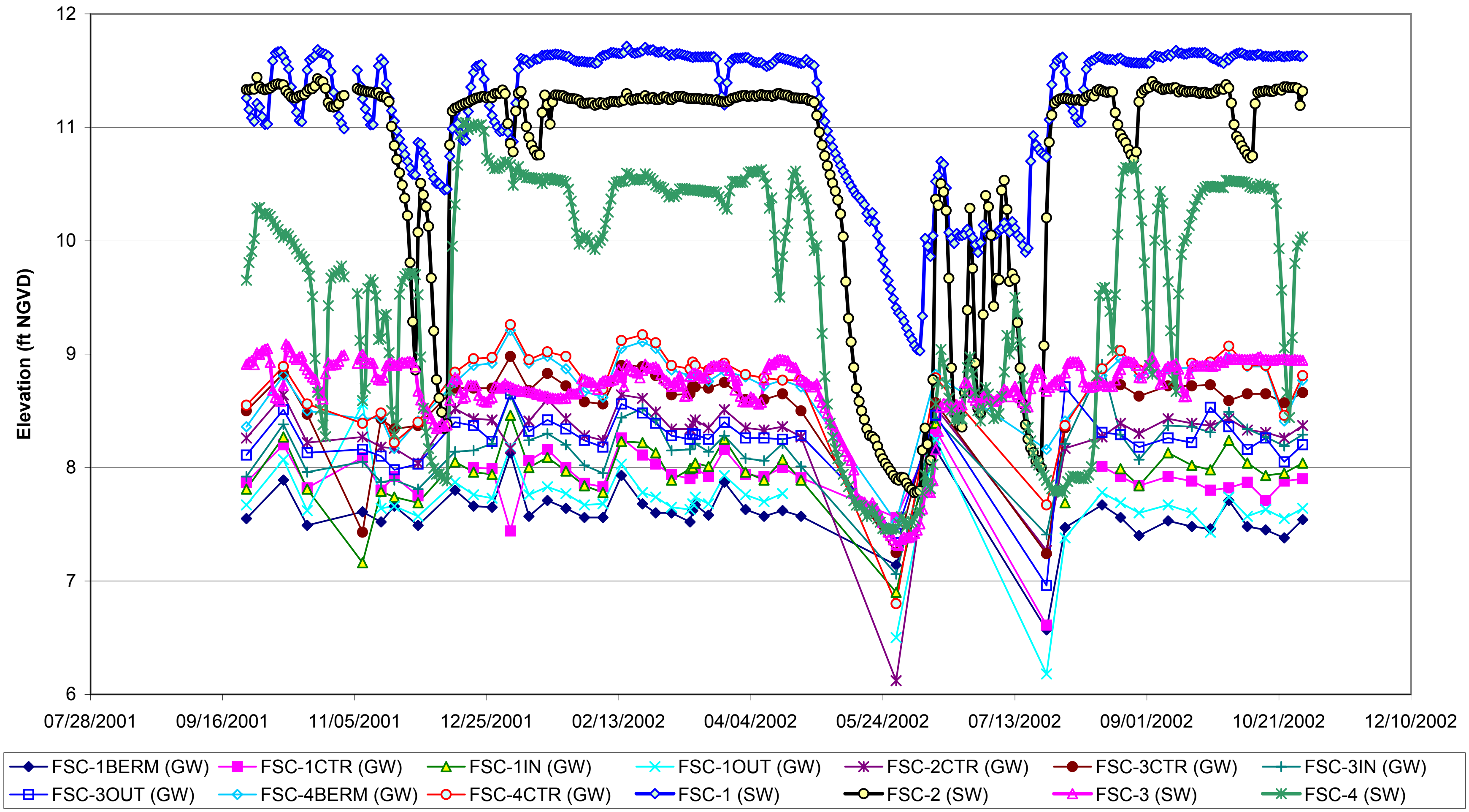

EXHIBIT 1-23

Timeseries of Surface Water (SW) and Groundwater (GW) Data from the Field-Scale PSTA Cells

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EXHIBIT 1-24

PSTA Lithium Tracer Study Results for Phases 1, 2, and 3

Project Phase and Date	Treatment	Cell	(m^2)	Substrate Type	Average Depth (m)	Average Volume (m^3)	Average Flow (m^3/d)	Nominal HRT (d)	Actual HRT (d)	TIS	Volumetric Efficiency (%)	Mass Recovery (%)
Phase 1	PP-2	7	6	shellrock	0.65	3.9	0.28	14.0	18.5	2.2	130	83
April-June 1999	PP-4	10	6	shellrock	0.36	2.2	0.27	8.2	14.6	1.5	178	98
	PP-11	23	18	shellrock	0.34	6.1	0.96	6.4	14.8	1.5	228	75
July - September 1999	STC-1	13	2,240	peat	0.66	1612	114	14.2	22.4	2.7	155	61
	STC-2	8	2,240	shellrock	0.66	1612	125	12.9	10.7	1.2	83	75
	STC-3	3	2,240	shellrock	0.77	1908	127	15.1	15.5	1.9	103	118
Phase 2	PP-15	16	6	shellrock	0.30	2	0.23	7.8	6.7	1.1	86	62
January - February 2001	STC-1	13	2,240	peat	0.26	587	115	5.1	4.7	3.8	91	95
	STC-2	8	2,240	shellrock	0.29	649	116	5.6	5.6	4.0	101	81
	STC-3	3	2,240	shellrock	0.23	512	114	4.5	14.0	4.1	311	135
Phase 3	FSC-2	2	19,350	limerock/peat	0.29	5868	2084	2.8	2.5	25	89	45
March - April 2002	FSC-4	4	19,350	native peat	0.31	6273	1445	4.3	4.2	9.3	97	6
October - November 2002	FSC-1	1	19350	limerock/peat	0.41	8337	2875	2.9	5.1	9.0	177	46
	FSC-3	3	19,350	caprock	0.38	7753	3160	2.5	3.0	4.5	124	101

Notes:
PP = Porta-PSTA
STC = South Test Cell
FSC = Field-Scale Cell
HRT = hydraulic residence time
TIS = tanks-in-series

The Phase 1 Test Cell PSTAs had estimated tracer mass recoveries between 61 and 118 percent, and volumetric efficiency estimates between 83 and 155 percent.

TIS estimates in the Phase 1 Test Cells were between 1.2 and 2.7. During Phase 2, after considerable time for plant community development, these PSTA Test Cell TIS estimates increased to 3.8 to 4.1.

The four Field-Scale cells were tested with lithium and rhodamine (visual) tracers during Phase 3. FSC-2 and FSC-4 were tested in the spring of 2002, and FSC-1 and FSC-3 were tested in the fall of 2002. The rhodamine visual tracer indicated that there was some significant “cross talk” between the PSTA cells and the surrounding canals. For example, leaks were detected from FSC-1 to FSC-2, increasing the water and P load to FSC-2. Both FSC-1 and FSC-2 had leaks back to the inlet canal. Analysis of groundwater samples indicated that tracers were not showing up in the wells, indicating that most of the cell leaks were via surface outflows to adjacent ditches and neighboring cells.

Tracer mass recoveries were relatively low in three of the FSCs. FSC-1 and FSC-2 had mass recoveries of 46 and 45 percent, respectively. FSC-3 had complete mass recovery (101 percent) while FSC-4 (undisturbed peat soils) had the lowest mass recovery at 6 percent. These data indicate that covering the peat reduced overall leakage in the cells and that leakage is near zero when the cell water surface is near the surrounding groundwater level (FSC-3). Estimated volumetric efficiencies in the FSCs varied from a high of 177 percent in FSC-1 to a low of 89 percent in FSC-2.

TIS estimates for the FSCs were relatively high compared to the other PSTA test platforms. FSC-2, the “sinuous” PSTA cell (length:width ratio of approximately 45:1), had approximately 25 TIS. FSC-1 and FSC-4 each had approximately 9 TIS. FSC-3, which typically had the most open water, had an estimated TIS value of approximately 4.5.

These tracer results provide an expanding perspective on the hydraulics of small and large-scale PSTAs. It appears that “vegetated” PSTA cells containing periphyton mat and sparse macrophytes are fairly close to “plug flow”, which will theoretically provide more effective treatment performance within a given PSTA footprint. Unvegetated or recirculated cells are subject to greater mixing and more nearly approximate a continuous stirred tank reactor, a less efficient treatment vessel per unit area. Smaller test units, such as the Porta-PSTAs, appear to underestimate the TIS values from larger cells. These tracer test results are tied into performance estimates in Section 3 and in PSTA conceptual designs in Section 4.

SECTION 2

Community Development and Viability

2.1 Introduction

PSTA technology development depends on being able to create and maintain a periphyton-dominated ecosystem that has some characteristics of a typical Everglades periphyton assemblage. It is hypothesized that PSTAs must have the following general characteristics to be considered viable:

- Biomass and primary productivity levels that approximate those of natural, low nutrient adapted periphyton assemblages
- Algal species dominance and diversity similar to natural periphyton assemblages that have the ability to capture and sequester P at low surface water concentrations and in stable forms
- Able to recover from dry-down periods relatively quickly and reestablish high productivity rates and P sequestration
- Resistant to wash-out and wind transport under varying climatic regimes
- Relatively immune to biological upsets caused by population explosions of consumers

PSTA research has provided information that addresses most of these questions related to PSTA viability. This section reports specific findings related to periphyton ecology, macrophyte growth in the PSTA mesocosms, and overall ecological processes in these systems.

2.2 Periphyton Ecology

2.2.1 Background

A typical adapted periphyton community is as complex as any other ecosystem and includes a high diversity of primary producers, various levels of grazers and consumers, and a detrital food web (Lowe, 1996; Bott, 1996). As with other eco-systems, the periphyton can be studied as an assemblage of mutually dependent organisms (population approach) and/or based on overall ecological form and function (systems-level or "green-box" approach). Studies focused solely on the algal component of the periphyton are too narrow to assess the function of the entire ecosystem of producers and consumers. Population studies are time-consuming and costly, and may not be able alone to provide answers to the questions most relevant to PSTA design. The PSTA Research and Demonstration Project utilized an experimental and engineering approach that includes measurements of both population and system-level properties of the periphyton.

2.2.2 Periphyton Sampling Methods

Detailed sampling and research methods are provided in the *PSTA Research Plan* (CH2M HILL, April 2001) and are briefly described in this section as well as in Appendix A. Periphyton species dominance and succession were documented through routine algal species identification, cell counts, and cell volume estimates throughout the PSTA project period. These cell counts encompassed algal population conditions during typical successional periods and during a range of seasonal conditions. Identification, cell counts, and algal biovolume estimates were made using mixed periphyton samples collected by coring the entire mesocosm water column. Periphyton populations were not studied on artificial substrates, such as glass slides, because these devices commonly underestimate natural periphyton biomass and diversity (Swift, 1981). However, mesocosm walls were periodically sampled to quantify the effect of this excess surface area on overall mesocosm ecological function. System-level measurements of periphyton community structure also included routine sampling for chlorophyll *a*, *b*, and *c*, phaeophytin, dry weight biomass and ash-free dry weight (AFDW).

Sloughing and downstream export of periphyton were measured by filtration of water exiting experimental PSTAs. Grab samples were filtered on a routine basis (monthly) to measure particulate matter and particulate P export. One diel study was conducted in the Porta-PSTAs and Test Cells to provide samples for export dry weight, AFDW, species composition, cell numbers, and cell volume.

2.2.3 Algal Taxonomic Composition

A total of 371 algal taxa were identified in PSTA periphyton samples collected in the Porta-PSTAs and in the PSTA Test Cells (see Exhibit 2-1). A total of 106 species were identified in the FSC periphyton samples (Exhibit 2-2). These species numbers reflected the much larger number of samples analyzed in each of these test systems rather than an actual difference in diversity. Detailed lists of the algal cell counts and monthly totals by individual taxa for the three PSTA research platforms are provided in Appendices C through E. A detailed analysis of periphyton taxonomy and abundance in the Porta-PSTAs and Test Cells is provided in Appendix F.

Periphyton community composition was relatively similar at all three research scales. Based on cell counts, taxa were fairly evenly distributed between diatoms

EXHIBIT 2-1

Periphyton Algal Species Diversity in PSTA Mesocosms During Phases 1 and 2

Phylum	No. Species Observed									Combined Total
	Test Cells			Porta-PSTAs						
	Shellrock	Peat	Total	Shellrock	Peat	Sand	Limerock	None	Total	
Cyanobacteria (blue-greens)	68	54	77	98	74	60	39	32	106	108
Chlorophyta (greens)	59	55	73	84	65	39	29	13	98	110
Bacillariophyceae (diatoms)	80	60	91	87	101	47	25	15	116	135
Chrysomonodales (dinobroyon)	0	0	0	2	0	0	0	0	2	2
Xanthophyceae (yellow greens)	2	0	2	0	1	0	0	0	1	3
Euglenophyta (euglenoids)	3	1	3	2	2	0	1	0	2	3
Cryptophyta (cryptomonads)	5	4	5	5	4	2	0	0	5	5
Pyrrhophyta (dinoflagellates)	3	0	3	3	2	1	2	1	5	5
Total No. Spp.	**220**	**174**	**254**	**281**	**249**	**149**	**96**	**61**	**335**	**371**

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(35 to 37 percent), blue-greens (30 to 41 percent), and greens (21 to 29 percent). This relatively even distribution of taxa was generally consistent in all of the shellrock and peat-based PSTA mesocosms. A total of 220 algal taxa were recorded in the shellrock Test Cell treatments, and 174 taxa were recorded in the peat-based Test Cell.

A total of 281 algal species were reported in the shellrock Porta-PSTAs, 249 species in the peat Porta-PSTAs, and lower numbers in the other soil treatments (see Exhibit 2-1 and Appendix C). Part of these differences is attributable to the number of replicates and the longer POR in the shellrock and peat-based systems. Only 61 algal taxa were observed in the non-substrate control Porta-PSTAs. Blue-greens were dominant in terms of number of taxa only in the sand and non-substrate control mesocosms.

In the Field-Scale PSTAs, a greater number of algal species were identified in the limerock systems over peat than in the scrape-down cell, and fewest in the peat cell. However, the distribution of taxa between taxonomic groups was similar for all cells, with blue-greens and diatoms nearly equal, followed by a lower number of green alga (Exhibit 2-2). The peat cell was sampled for periphyton only once during the POR because of pump issues resulting in inadequate water supply. Thus, the periphyton community in FSC-4 was probably not representative of what might have developed with a more continuous hydroperiod.

EXHIBIT 2-2
Periphyton Algal Species Diversity in PSTA Field Scale Cells During Phase 3

	Number Species Observed					
Phylum	**FSC-1 (LR-PE)**	**FSC-2 (LR-PE)**	**Total (LR-PE)**	**FSC-3 (CR)**	**FSC-4 (PE)**	**Total**
Cyanobacteria (Bluegreens)	34	31	40	28	16	44
Chlorophyta (Greens)	12	15	19	8	5	22
Bacillariophyceae (Diatoms)	22	28	33	21	15	39
Euglenophyta (Euglenoids)	1	0	1	0	0	1
Total Number Species	69	74	93	57	36	106

LR-PE = limerock fill over peat
CR = limestone caprock
PE = peat

Exhibit 2-3 summarizes the PSTA average algal cell densities and biovolumes by major taxa and by treatment for the entire POR. In terms of cell counts, the blue-green (Cyanophyceae) algal taxa dominated in all treatments. Biovolumes provide an index of algal biomass. This parameter indicated that populations of diatoms (Bacillariophyceae) or blue-greens were typically dominant in these periphyton communities, followed by green (Chlorophyta) algae species. These relationships were highly variable for different treatments and over time.

Time series trends for algal biovolume are shown on Exhibits 2-4 to 2-7 for the various substrate treatments. As shown on Exhibit 2-4, algal biovolumes for the shellrock treatments were variable because of the patchiness of periphyton mats intersected by core samples and the variability within mats. Algal biovolumes for these treatments were typically less than 60 cm^3/m^2. Mean

EXHIBIT 2-3

Average PSTA Mesocosm Periphyton Community Data - Algal Populations

				Blue-Green Algae			Diatoms			Green Algae			Other Taxa			Total Taxa				
Treatment	Substrate	Depth	HLR	cells/ $m^2 * 10^9$	# taxa	Biovolume cm^3/m^2	cells/ $m^2 * 10^9$	# taxa	Biovolume cm^3/m^2	cells/ $m^2 * 10^9$	# taxa	Biovolume cm^3/m^2	cells/ $m^2 * 10^9$	# taxa	Biovolume cm^3/m^2	cells/ $m^2 * 10^9$	# taxa	Biovolume cm^3/m^2	Evenness	SWDI
PP-1	PE	D	L	20.4	11	0.65	2.23	15	3.18	1.06	4	2.94	0.01	<1	0.07	23.7	30	6.84	0.73	3.56
PP-2	SR	D	L	96.5	15	4.46	4.72	10	8.36	1.28	4	0.34	0.02	1	0.07	103	30	13.24	0.71	3.48
PP-3	PE	S	L	64.5	13	4.33	2.04	12	5.25	1.33	5	1.48	0.03	1	0.05	67.8	31	11.11	0.72	3.53
PP-4	SR	S	L	156	14	12.41	5.12	9	16.08	14.7	3	0.31	0.01	<1	0.07	173	27	28.87	0.68	3.20
PP-5	SR	D	H	157	14	5.00	5.41	9	10.22	16.5	4	1.30	0.01	1	0.03	179	27	16.56	0.75	3.53
PP-6	SR	V	V	183	15	3.42	3.61	10	5.78	5.16	4	0.61	0.05	<1	0.49	189	29	10.30	0.72	3.49
PP-7	SA	D/S	L	362	16	11.10	8.12	10	18.95	2.97	4	1.23	0.01	<1	0.01	373	30	31.28	0.72	3.52
PP-8	SA	S	L	298	17	8.31	3.45	8	8.10	5.56	5	1.42	0.06	<1	0.07	307	31	17.91	0.70	3.44
PP-9	PE (AS)	D	L	5.57	2	0.15	1.09	15	2.20	0.26	2	3.48	0.05	1	0.50	6.96	20	6.34	0.62	2.73
PP-10	SR (AS)	D	L	10.3	8	0.20	4.55	17	5.12	1.10	4	1.82	0.04	1	0.05	16.0	29	7.19	0.76	3.68
PP-11	SR	S	L	222	14	6.41	6.04	8	7.18	1.96	5	0.78	0.01	<1	0.04	200	27	14.41	0.69	3.28
PP-12	PE	S	L	19.4	10	0.61	1.34	12	2.19	0.57	4	0.07	0.01	1	0.09	21.3	27	2.96	0.64	3.01
PP-13	PE (Ca)	S	L	38.7	10	1.12	2.77	9	2.39	1.91	5	4.31	0.08	1	0.05	43.4	24	7.87	0.70	3.19
PP-14	LR	S	L	306	16	10.52	6.66	6	10.65	3.28	5	4.00	0.01	1	0.01	316	27	25.17	0.69	3.39
PP-15	SR	S	R	203	14	5.72	4.67	7	5.91	3.15	5	12.92	0.03	<1	0.19	211	26	24.73	0.71	3.30
PP-16	SR	V	V	400	17	15.83	5.65	5	5.87	4.47	3	7.36	0.06	<1	0.00	406	25	29.06	0.72	3.31
PP-17	SA (HCl)	S	L	533	16	10.04	4.17	5	4.91	6.26	3	18.84	0.00	<1	0.01	544	25	33.79	0.73	3.38
PP-18	None	S	L	815	13	30.87	12.59	5	24.92	13.3	3	47.71	0.06	1	0.03	841	22	103.54	0.65	2.86
PP-19	AM	S	L	477	14	15.47	3.42	5	5.96	1.75	3	3.84	0.00	<1	0.00	482	21	25.27	0.65	2.86
STC-1	PE	D	L	54.7	9	17.09	2.03	10	6.58	5.55	9	1.50	0.10	1	0.42	62.3	28	25.59	0.70	3.27
STC-2	SR	D	L	112	13	2.60	3.86	10	6.93	1.63	6	1.46	0.12	2	0.06	118	30	11.05	0.72	3.48
STC-3	SR	V	V	36.5	12	0.67	1.48	11	1.56	1.77	7	0.69	0.13	3	0.16	39.5	31	3.08	0.74	3.63
STC-4	PE (Ca)	D	L	162	11	31.26	9.51	8	5.04	2.59	5	2.25	0.33	1	0.27	168	21	38.82	0.66	2.87
STC-5	SR	D	L	254	15	19.96	7.91	8	8.29	1.48	3	2.13	0.00	<1	0.00	264	26	30.37	0.70	3.27
STC-6	SR	V	V	222	13	6.08	22.0	7	3.20	3.40	3	0.70	0.00	<1	0.00	227	22	9.98	0.69	3.04
FSC-1	LR-PE	S	H	86	18	4.02	1.10	8	0.71	0.90	5	0.35	0.01	1	0.08	88	29	6.21	0.71	3.57
FSC-2	LR-PE	S	H	98	16	1.83	5.00	13	3.70	2.20	6	18.88	0.00	0	0.00	105	35	24.73	0.67	3.56
FSC-3	CR	S	H	86	16	1.32	2.20	11	1.53	1.1	4	0.08	0.00	0	0.00	90	31	3.28	0.66	3.36
FSC-4	PE	S	H	2	16	0.02	0.30	15	0.14	0.10	5	0.02	0.00	0	0.00	2	36	0.18	0.76	4.07

Notes:

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

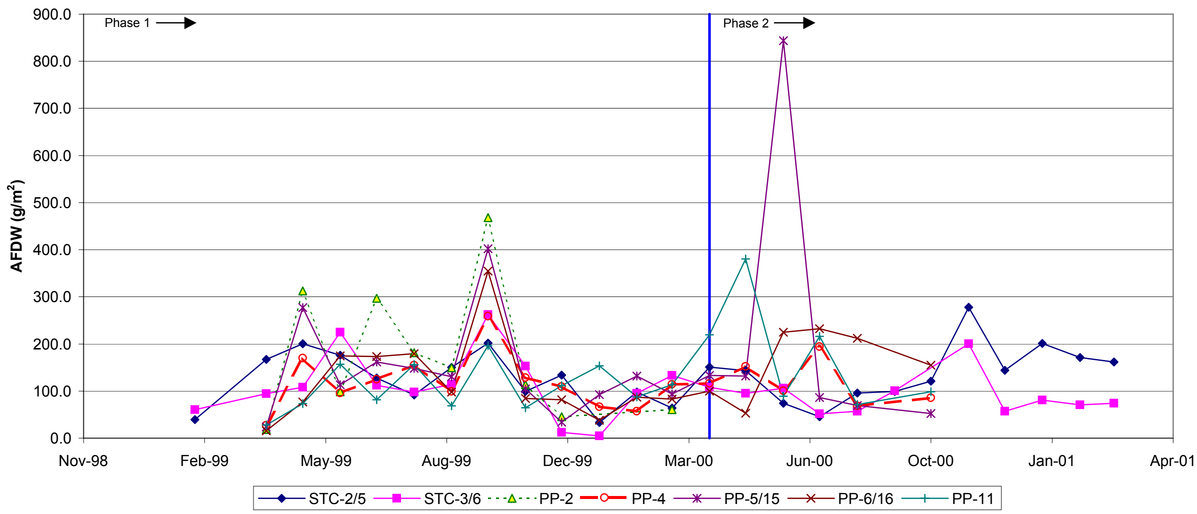
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

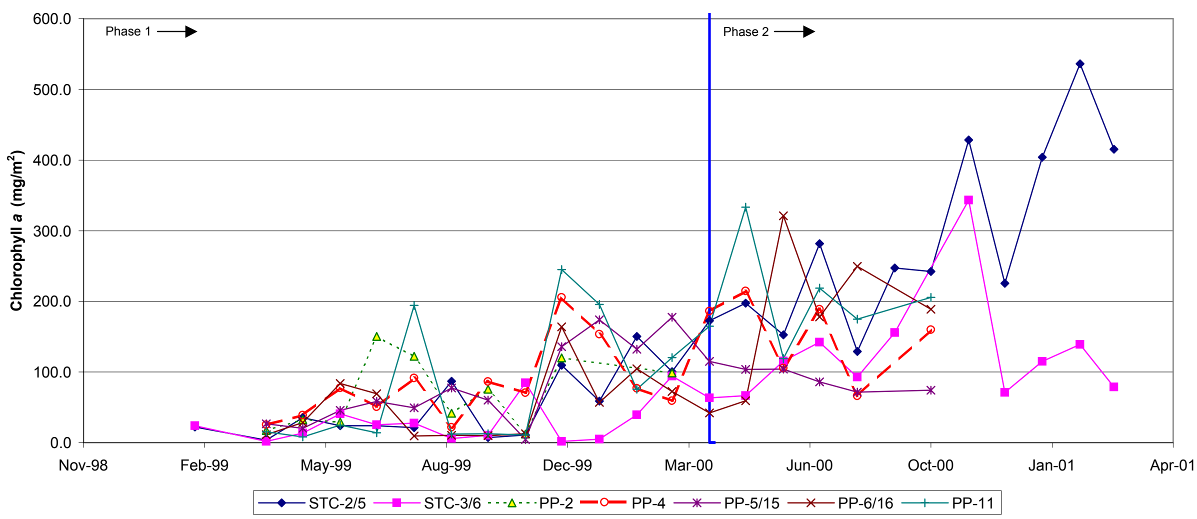
SWDI = Shannon-Weaver Diversity Index

Periphyton taxonomy conducted on a quarterly basis for PP-3, 4, 11, and 12 and STC-5 beginning in July 2000 and in the FSCs over the study period.

EXHIBIT 2-4

Periphyton Ash-Free Dry Weight Biomass, Chlorophyll *a*, and Algal Biovolumes for the Phase 1 and 2 Shellrock-Based PSTA Treatments





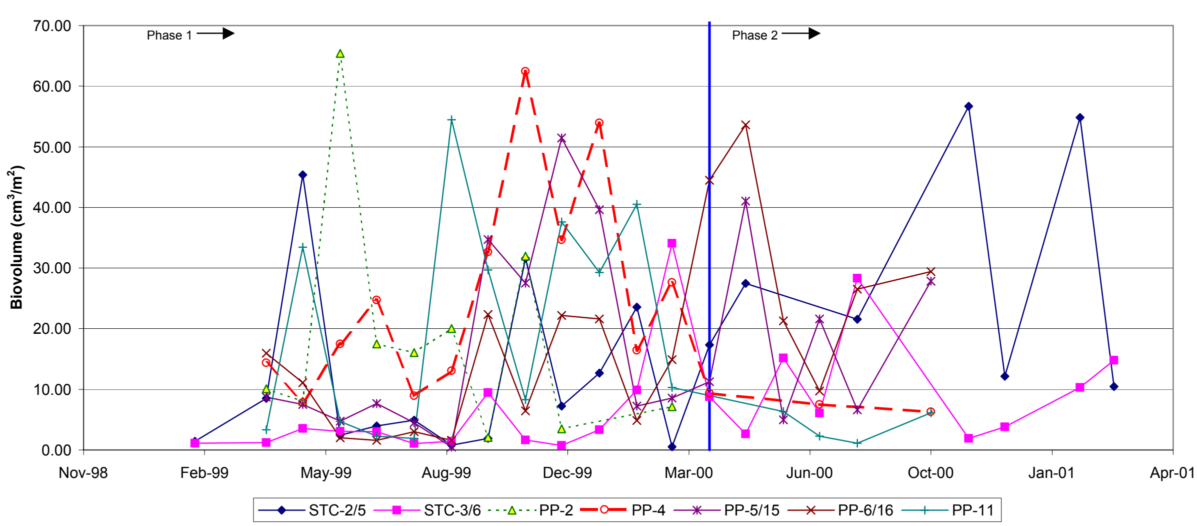
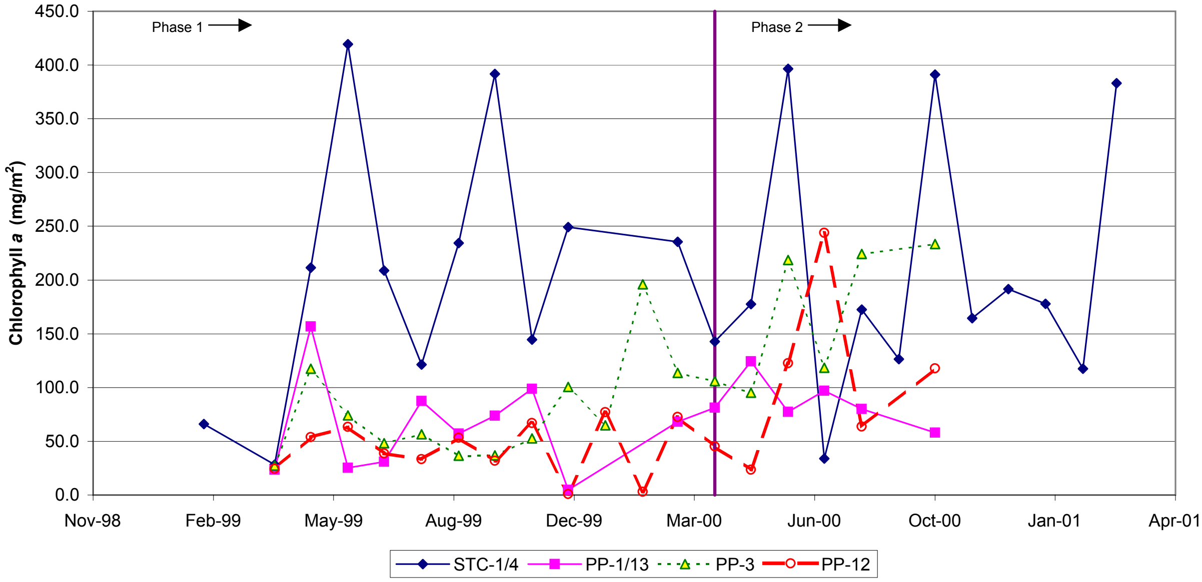
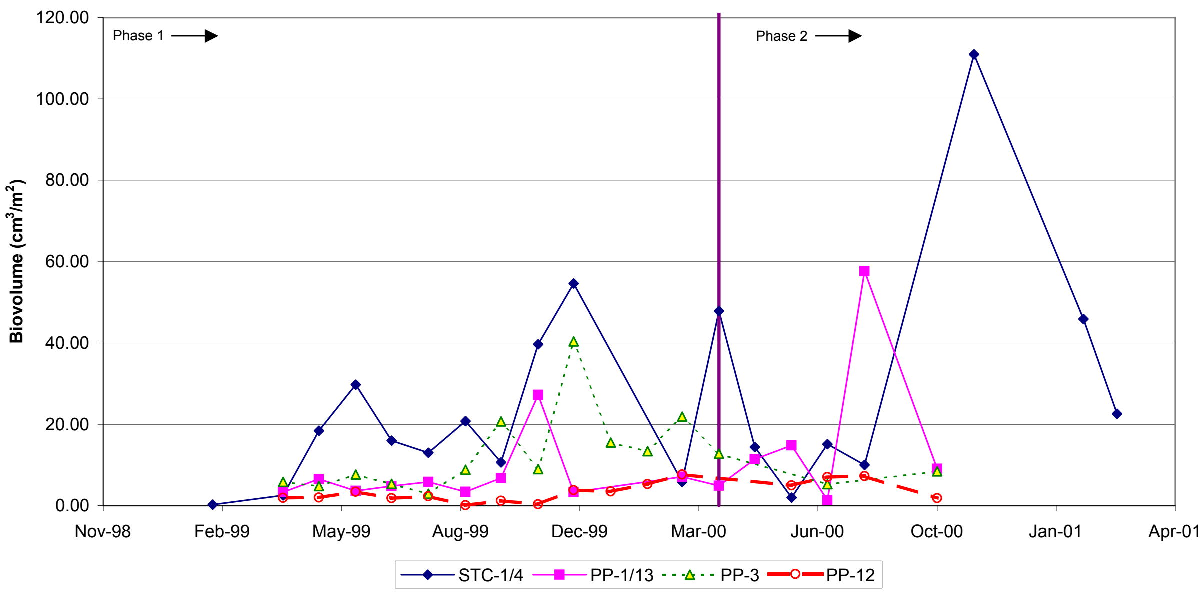


EXHIBIT 2-5

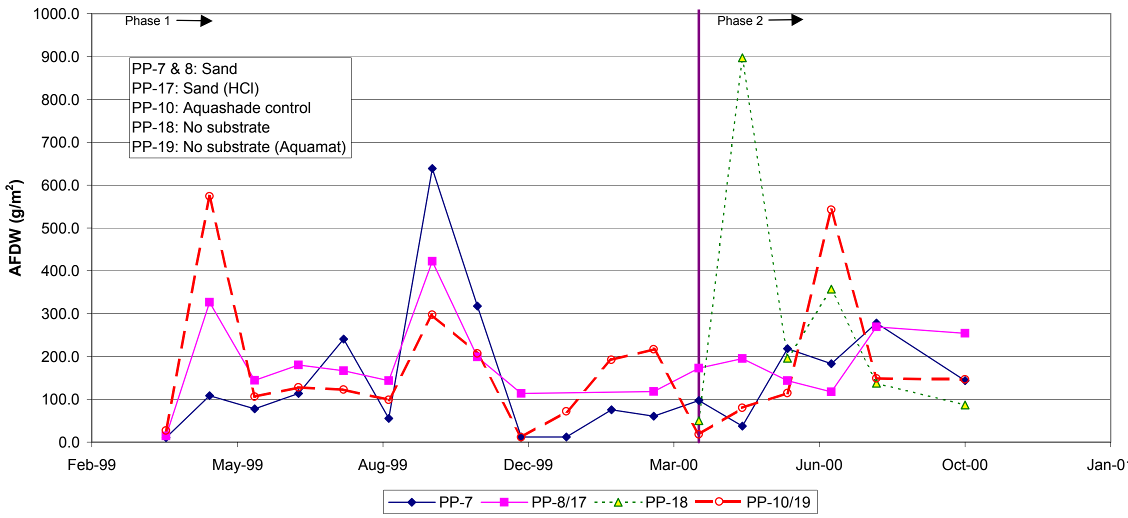
Periphyton Chlorophyll *a* and Algal Biovolumes for the Phase 1 and 2 Peat-Based PSTA Treatments

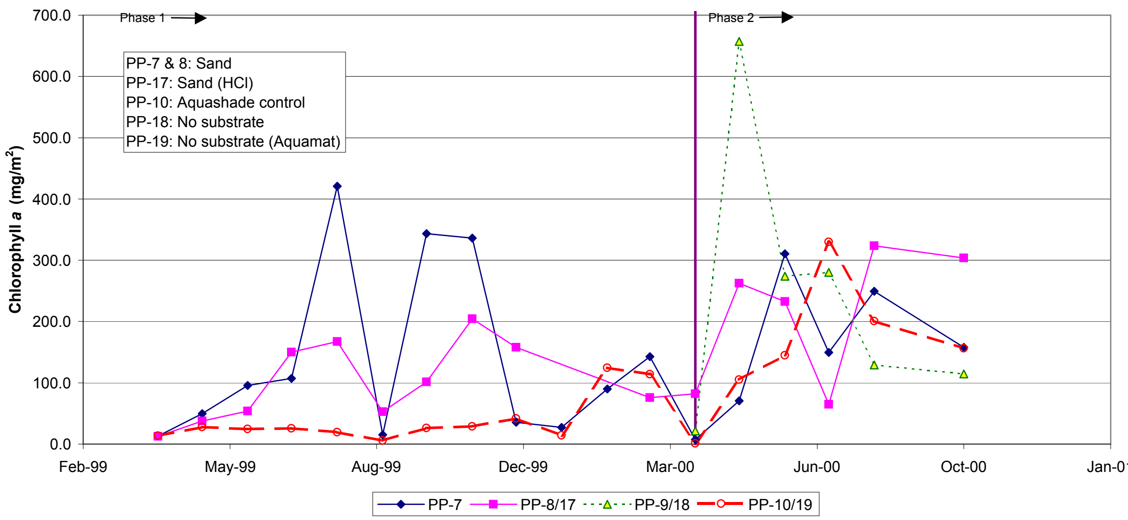




DFB31003696165.XLS/030070007
W022003001DFB

EXHIBIT 2-6
Periphyton Ash-Free Dry Weight Biomass, Chlorophyll *a*, and Algal Biovolumes for the Phase 1 and 2 Sand-Based, Aquashade, and No Substrate Control PSTA Treatments





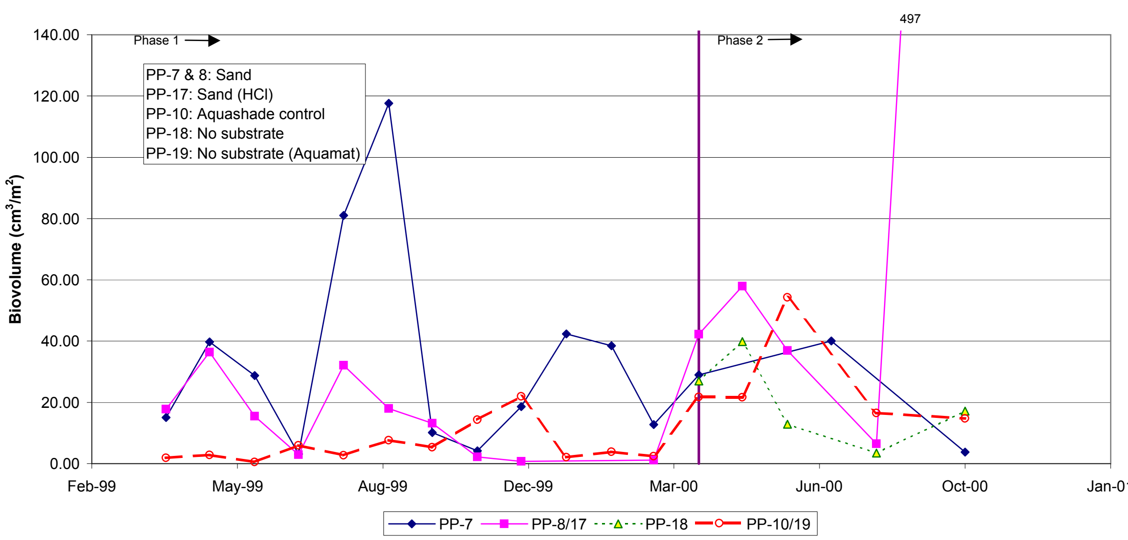


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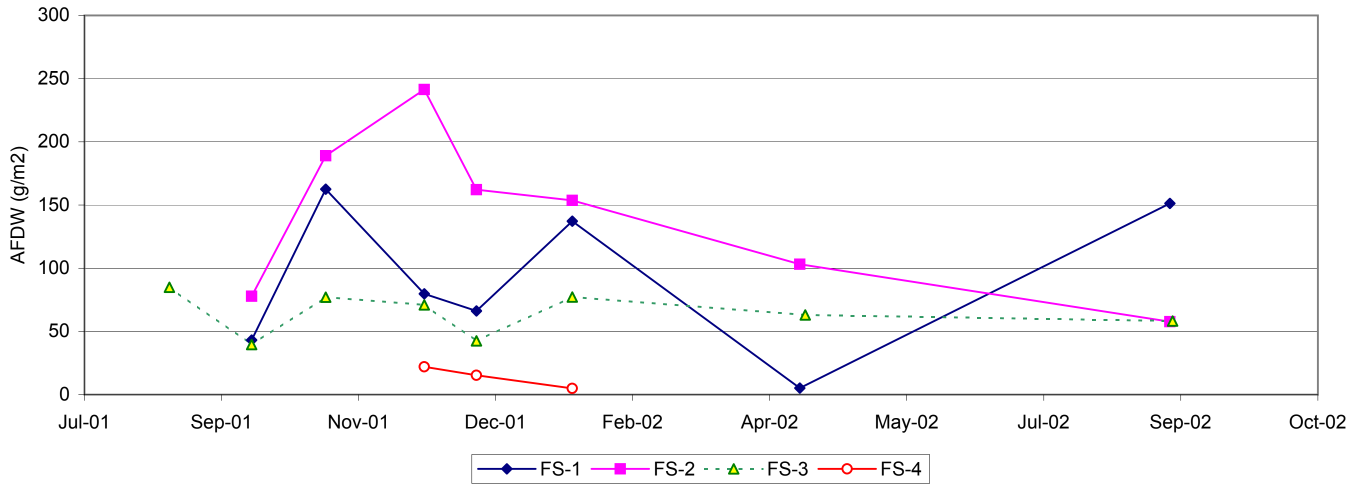
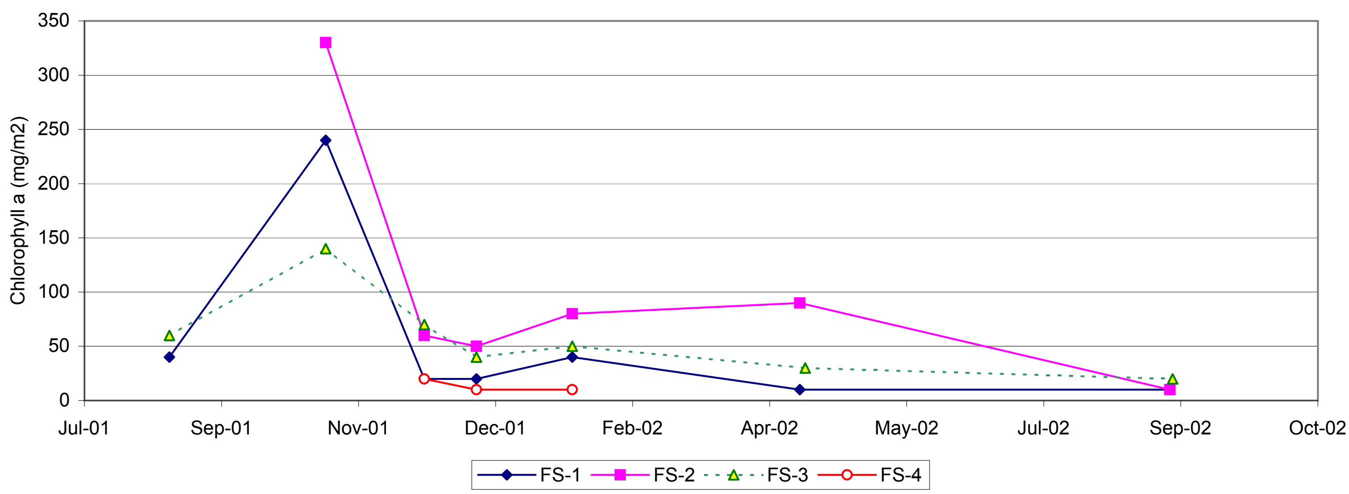
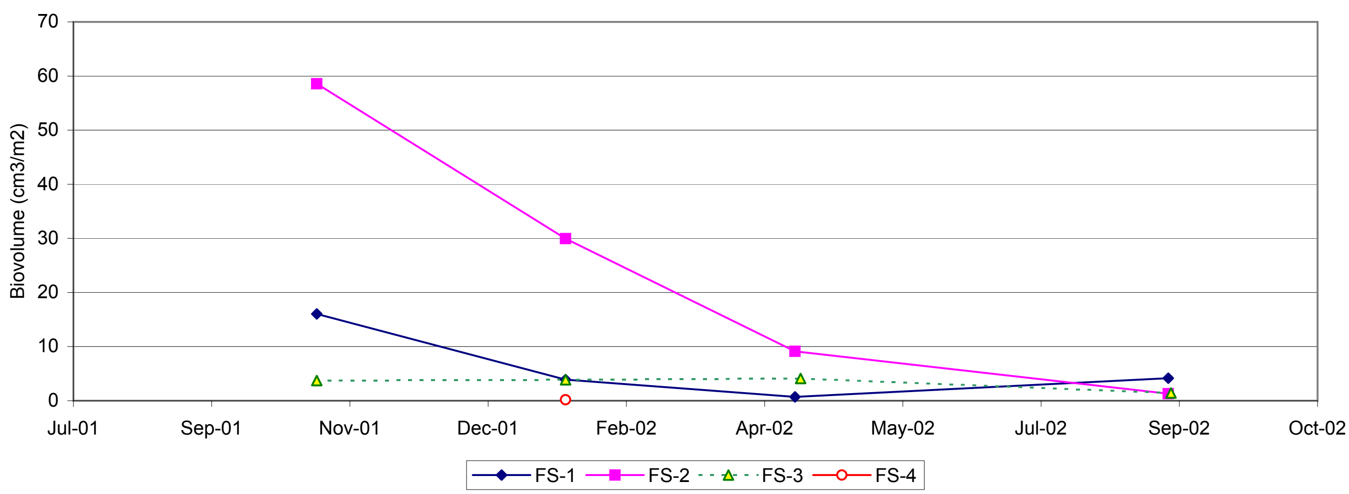
EXHIBIT 2-7
Periphyton Ash-Free Dry Weight, Chlorophyll *a*, and Algal Biovolumes for the PSTA Field Scale Cells







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values varied from approximately 3 to 30 cm^3/m^2. No apparent trend in these biovolumes was observed during the 3-year research period.

Algal biovolumes for the peat-based mesocosms showed an increasing trend over time (see Exhibit 2-5). Biovolume decreased markedly in the peat Test Cell when it was restarted in May 2000 and then rapidly recovered to higher monthly averages. Mean algal biovolumes for the peat-based cells ranged from approximately 7 to 39 cm^3/m^2.

No clear temporal trends in algal biovolume were apparent for the sand treatments. Long-term average values for these treatments were between 18 and 34 cm^3/m^2. Average algal biovolumes for the shellrock treatments were relatively low in the Aquashade treatments during Phase 1 (PP-9, 6.3 cm^3/m^2 and PP-10, 7.2 cm^3/m^2). Average algal biovolumes in the non-soil treatments during Phase 2 were higher, at 104 cm^3/m^2 for the tank with no substrate and 25 cm^3/m^2 for the tank with Aquamat (see Exhibit 2-6).

Field-scale algal biovolumes were highest during the fall of 2001 when the cells had been flooded continuously for approximately 5 months (Exhibit 2-7). These biovolumes declined through the winter and spring and had not yet recovered completely in the September 2002 samples, approximately 2 months following a complete dryout period from May through mid-July 2002.

Jan Vymazal (Ecology and Use of Wetlands) examined the PSTA Test Cell and Porta PSTA periphyton data for similarities and differences with respect to other Everglades periphyton communities (see Appendix F). Vymazal concluded that the periphyton communities colonizing the PSTA mesocosms were similar to those found in unimpacted areas of WCA-2A. The dominant species were those typically reported from oligotrophic (low P) to slightly eutrophic areas of the conservation area (McCormick and Stevenson, 1998). These species were characterized by a normal succession of dominants, beginning with *Mastogloia smithii* and other diatoms, followed by replacement by blue-green algal species, including *Scytonema*. The time needed for replacement of diatom dominance by blue-greens may be as long as 1 year under the low P concentrations tested in this research. Faster succession is observed under higher nutrient loads. Vymazal noted little effect of peat vs. shellrock substrate on the algal species composition. In sand treatments, the proportion of blue-green algae was higher. Aquashade reduced the populations and dominance of blue-greens and decreased periphyton calcification. Diatom dominance was maintained longer in shallow water compared to deeper water systems.

2.2.4 Periphyton Biomass and Chlorophyll Content

Periphyton core samples were also analyzed for dry and AFDW biomass, chlorophyll *a*, and phaeophytin. Exhibit 2-8 summarizes the monthly average data for these parameters by treatment.

Average periphyton dry weight biomass varied from a low of 30 grams dry weight per square meter (g DW/m^2) in the peat-based Field-Scale cell (FSC-4)

EXHIBIT 2-8

Average PSTA Periphyton Community Biomass, Chlorophyll, and Chemistry Data

Treatment	Substrate	Depth	HLR	Periphyton Biomass (g/m^2)			Ca		Chl_a (corr)		TP		TIP		TKN	
				Ash Wt	Dry Wt	AFDW	(g/m^2)	(g/kg)	(mg/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)
PP-1	PE	D	L	565	1101	535	93	84	67	61	0.298	271	0.087	79	10.59	9617
PP-2	SR	D	L	555	741	189	110	148	70	95	0.313	423	0.130	175	1.23	1664
PP-3	PE	S	L	327	733	406	66	89	107	146	0.322	439	0.084	115	6.96	9492
PP-4	SR	S	L	536	641	118	155	242	104	163	0.674	1051	0.162	252	1.24	1930
PP-5	SR	D	H	517	660	143	122	185	80	122	0.430	652	0.116	176	1.60	2430
PP-6	SR	V	V	468	588	120	114	194	52	88	0.346	589	0.136	231	0.66	1118
PP-7	SA	D/S	L	514	663	149	95	143	146	220	0.152	229	0.019	29	0.99	1495
PP-8	SA	S	L	475	665	190	70	106	104	157	0.135	204	0.014	21	1.63	2447
PP-9	PE (AS)	D	L	1035	1641	918	180	110	96	59	0.555	338	0.165	101	16.07	9797
PP-10	SR (AS)	D	L	542	713	171	124	173	39	55	0.395	554	0.242	340	0.68	947
PP-11	SR	S	L	661	792	131	166	210	119	150	1.055	1332	0.413	521	1.94	2455
PP-12	PE	S	L	321	657	363	58	88	63	96	0.259	394	0.084	128	5.23	7965
PP-13	PE (Ca)	S	L	912	1990	1041	259	130	86	43	0.759	382	0.458	230	5.04	2531
PP-14	LR	S	L	301	416	115	98	235	120	289	0.093	223	0.031	75	2.20	5286
PP-15	SR	S	R	321	415	219	89	213	92	223	0.256	617	0.100	240	1.72	4132
PP-16	SR	V	V	785	947	163	225	237	173	183	0.640	675	0.361	381	3.89	4109
PP-17	SA (HCl)	S	L	684	877	192	154	176	212	241	0.153	175	0.046	52	5.21	5943
PP-18	None	S	L	637	924	287	198	214	246	266	0.187	202	0.102	111	3.01	3261
PP-19	AM	S	L	488	663	175	118	178	156	236	0.216	326	0.137	207	1.52	2289
STC-1	PE	D	L	1348	2066	711	300	145	208	100	0.838	406	0.199	97	7.59	3672
STC-2	SR	D	L	417	535	118	97	181	51	95	0.286	534	0.097	182	3.98	7446
STC-3	SR	V	V	344	461	117	67	145	30	65	0.175	379	0.043	94	0.99	2139
STC-4	PE (Ca)	D	L	716	1046	330	214	205	206	197	0.700	669	0.283	270	7.98	7625
STC-5	SR	D	L	282	409	127	107	262	256	625	0.263	643	0.048	118	4.25	10390
STC-6	SR	V	H	204	303	101	91	300	138	457	0.332	1096	0.084	278	3.42	11284
FSC-1	LR-PE	S	H	249	345	87	57	284	40	132	0.100	388	0.010	63	2.10	4629
FSC-2	LR-PE	S	H	496	622	120	143	288	80	128	0.250	304	0.050	58	2.00	4715
FSC-3	CR	S	H	302	362	63	74	214	50	131	0.110	302	0.020	51	1.30	4359
FSC-4	PE	S	H	21	35	14	10	335	10	354	0.030	1219	0.000	67	---	---

Notes:

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

after numerous dryouts, to 303 g DW/m^2 in the dry-down PSTA Test Cell (STC-6), to a high of 2,066 g DW/m^2 in the calcium-amended peat Test Cell (STC-4). Periphyton dry weight biomass varied between 303 and 947 g DW/m^2 in the shellrock treatments, 30 to 2,066 g DW/m^2 in the peat treatments, 345 to 622 g DW/m^2 in the limerock treatments, 663 to 877 g DW/m^2 in the sand treatments, 362 g DW/m^2 in the scrape-down caprock treatment, and 663 to 924 g DW/m^2 in the non-sediment control treatments. The Phase 1 Aquashade treatments (PP-9 and PP-10) averaged between 713 and 1,641 g DW/m^2. This indicated that the Aquashade treatments were not effective at reducing the estimated biomass in the Porta-PSTA mesocosms, even though algal cell counts and biovolume were typically much lower in these cells (see Exhibit 2-6).

Final periphyton dry weight biomass was determined in the final destructive sampling of six Porta-PSTA treatments (CH2M HILL, August 2001). These data are summarized in Exhibit 2-9. Total final average periphyton dry weight ranged from 135 g/DW/m^2 in the peat-based treatment (PP-3) to 2,170 g DW/m^2 in one of the sand-based treatments (PP-7). The benthic periphyton was the main contributor to this biomass in all but one treatment (Aquamat control). In the non-substrate control (PP-18), there were approximately equal portions of floating and benthic periphyton mats. These data verified that the routine periphyton biomass results for the peat-based mesocosms (average DW biomass of 657 to 2,066 g/m^2 in routine samples compared to 135 g/m^2 in the final destructive sampling) probably overestimated the overall community biomass in those treatments.

AFDW biomass varied from a low of 14 g AFDW/m^2 in the peat-based Field-Scale cell (FSC-4) with numerous dryouts, to 101 g AFDW/m^2 in the shellrock dryout treatment (STC-6), to a high of 1,041 g AFDW/m^2 in the Porta-PSTA calcium-amended peat treatment (PP-13). AFDW biomass in shellrock treatments ranged from 101 to 219 g AFDW/m^2, while peat-based systems had average values between 330 and 1,041 g AFDW/m^2. AFDW biomass for the sand treatments was between 149 and 192 g AFDW/m^2, for the limerock treatment 115 g AFDW/m^2, from 171 to 918 g AFDW/m^2 in the Aquashade controls, and 175 to 287 g AFDW/m^2 in the non-substrate controls. The three limerock or caprock Field-Scale treatments had average AFDW biomasses of 63 to 120 g AFDW/m^2. These low AFDW biomasses values were apparently the result of the effects of cell maintenance activities (herbicide additions and dryouts) during the POR for these treatments.

Final periphyton AFDW biomass, also measured in the final Porta-PSTA destructive sampling, was much lower in the peat-based treatment (PP-3) than in the other treatments and also much lower than that measured in the routine monthly cores (see Exhibit 2-9). As noted in the *Phase 1 Summary Report* (CH2M HILL, August 2000), the routine peat biomass estimates were high because of the unavoidable inclusion of some peat sediment in the samples.

Chlorophyll *a* values provide an estimate of the amount of photosynthetic matter present in the periphyton samples and avoid the sampling artifact for biomass estimation in the peat mesocosms (see Exhibits 2-4 to 2-8). Average chlorophyll *a* densities ranged from 30 to 256 mg/m^2 in the shellrock treatments.

EXHIBIT 2-9
Porta-PSTA Periphyton Final Mass Balance Sampling, February 2001

Treatment No.	PP-3	PP-4	PP-7	PP-17	PP-18	PP-19
Soil Type	Peat	Shellrock	Sand	Sand	None	AquaMat
Tank Bottom Area (m^2)	6	6	6	6	6	6
Dry Weight (g/m^2)						
Floating Mat/Metaphyton	25.2	158.2	238.8	229.9	386.0	482.5
Benthic Mat	92.4	552.4	1814.3	810.2	622.0	534.6
Wall Mat	17.2	185.4	116.4	3.3	137.4	203.0
Total	134.8	896.0	2169.5	1043.4	1145.5	1220.0
Ash-Free Dry Weight (g/m^2)						
Floating Mat/Metaphyton	13.0	40.0	58.8	54.6	99.4	126.8
Benthic Mat	58.3	121.7	167.5	121.2	160.7	129.4
Wall Mat	6.7	52.9	23.1	1.2	35.6	52.6
Total	78.0	214.7	249.4	177.0	295.7	308.7
Ash Weight (g/m^2)						
Floating Mat/Metaphyton	12.2	118.2	180.1	175.3	286.7	355.7
Benthic Mat	34.1	430.6	1645.5	688.4	461.3	383.4
Wall Mat	10.5	132.5	93.2	19.0	101.9	150.4
Total	56.7	681.3	1918.9	882.8	849.8	889.4
Total Phosphorus (mg/m^2)						
Floating Mat/Metaphyton	17.5	48.8	53.4	65.0	66.8	86.1
Benthic Mat	68.7	307.4	554.7	152.3	96.0	151.5
Wall Mat	8.8	35.3	18.3	2.3	21.0	35.1
Total	95.0	391.5	626.5	219.6	183.7	272.6
TIP (mg/m^2)						
Floating Mat/Metaphyton	0.07	0.76	0.28	0.50	0.73	1.21
Benthic Mat	0.60	8.09	3.84	1.78	0.71	1.67
Wall Mat	0.06	0.67	0.21	0.00	0.11	0.19
Total	0.73	9.52	4.33	2.29	1.55	3.07
Calcium (g/m^2)						
Floating Mat/Metaphyton	4.2	40.4	44.7	43.6	89.7	108.3
Benthic Mat	7.3	99.7	167.7	72.5	145.7	136.5
Wall Mat	3.6	62.7	23.3	0.6	33.2	50.6
Total	15.1	202.9	235.8	116.8	268.5	295.4

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Average chlorophyll *a* production ranged from 63 to 206 mg/m^2 in the peat-based mesocosms, from 104 to 212 mg/m^2 in the sand treatments, from 39 to 96 mg/m^2 in the Aquashade controls, 120 mg/m^2 in the Porta-PSTA limerock treatment, and 156 to 246 mg/m^2 in the non-substrate controls. Chlorophyll *a* density was typically lower in the four FSCs (10 to 80 mg/m^2) than in the other treatments. In an earlier analysis, chlorophyll *a* was found to strongly correlate with algal cell biovolume (CH2M HILL, August 2000).

A limited number of periphyton samples were collected from the Porta-PSTA walls during Phase 1 and in February 2001, during the final destructive sampling. Visual differences were apparent between mesocosms with and without high snail densities, with different water depths, and with different emergent macrophyte densities. The overall Phase 1 average AFDW biomass of wall periphyton was approximately 36 g AFDW/m^2 of wall. Biomass values were typically greater than 50 g AFDW/m^2 in the shellrock treatments, the sand treatments, and the Aquashade controls. Lower wall periphyton biomass amounts were obtained from Tank 1 (high snail density), Tank 15 (variable water depth), and Tank 14 (high macrophyte density). This observed wall periphyton biomass had a high algal component with an average chlorophyll *a* of approximately 56 mg/m^2, an algal biovolume of 125 cm^3/m^2, and cell count of approximately 79 billion cells/m^2. Final wall sampling in six Porta-PSTA treatments indicated that from 0.3 to 21.0 percent of the entire periphyton DW biomass and from 0.7 to 25.0 percent of the AFDW biomass was associated with wall periphyton (Exhibit 2-9).

Ash weight was a significant portion of the total dry weight in most periphyton samples, typically accounting for 40 to nearly 90 percent of the total dry biomass. As a result, PSTA periphyton are placed in the highly calcareous category according to the classification proposed by Browder et al. (1994) for Everglades periphyton.

Time series trends for AFDW biomass and chlorophyll *a* are illustrated in Exhibits 2-4 to 2-6 for the Test Cell and Porta-PSTA shellrock, peat, and other treatments, respectively. Shellrock mesocosms were at relatively constant AFDW biomass levels within 3 months of startup (see Exhibit 2-4). Except in the dry-out treatments, little seasonal variation in periphyton biomass was observed. Unlike AFDW biomass, chlorophyll *a* density continued to increase throughout the POR, except in the dry-out Test Cell treatment (STC-6). As described above, algal biovolume was highly variable in all of the shellrock treatments and did not display the clear increasing trend observed in the chlorophyll *a* results.

AFDW biomass for peat-based treatments is not displayed in Exhibit 2-5 because of the sampling problems described above. Chlorophyll *a* was higher in the peatbased Test Cell treatments than in the Porta-PSTAs. No apparent trend in these data was observed after a preliminary grow-in phase. Chlorophyll *a* estimates showed an apparent increasing trend in the other peat-based treatments.

No apparent trend in the AFDW estimates was observed in the sand and non-substrate treatments, but chlorophyll *a* displayed an apparent increasing trend (see Exhibit 2-6).

Exhibit 2-7 illustrates the time-series AFDW and chlorophyll *a* data for the four FSCs. The greatest AFDW, chlorophyll *a*, and algal biovolume numbers have been observed in FSC-2, the sinuous limerock fill cell. Lowest numbers for all parameters were observed in the peat cell (FSC-4). Elevated AFDW in FSC-1 (limerock over peat) did not correspond with low values for chlorophyll *a* and algal biovolume in September 2002.

In addition to the quantitative periphyton biomass and cell count samples, semi-quantitative estimates of percent algal mat cover were made. These estimates were made for floating algal mats and did not include submerged metaphyton or benthic algal mats. Therefore, these algal mat percent cover estimates were only an indicator of the prevalence of floating periphyton in these systems. Floating mats were visually recorded by blue-green (grayish to bluish-green) and green (bright green) algal dominance.

Exhibit 2-10 illustrates the algal mat percent cover monthly estimates for the three PSTA Test Cell treatments. Algal mat percent cover was typically dominated by blue-greens rather than greens. Algal mat percent cover increased more rapidly in the peat treatment than in the two shellrock treatments and then was restarted during the second project phase. Algal mat percent cover was higher in the shellrock treatment during the second year than during the first year. In the dry-out shellrock treatment the algal mat percent cover was clearly reduced by each of the two dry outs.

Exhibit 2-11 illustrates the algal mat cover estimates for the FSCs. Algal mat percent cover reached a maximum in January 2002 in the limerock over peat cells at approximately 9 percent and then declined through the spring and as a result of the dryout in May through mid-July. The visible floating algal mat rebounded in FSC-3 (scrape-down caprock) in September 2002, but not in the other treatments.

2.2.5 Periphyton Chemical Storages and Composition

Concentrations of calcium, P, and N were routinely measured in the periphyton samples. Exhibit 2-8 summarizes data for calcium, P (total and total inorganic), and total Kjeldahl nitrogen (TKN) content of the periphyton. Average periphyton calcium content ranged from 10 to 300 g/m^2, which was confirmed by the final destructive sampling in selected Porta-PSTA treatments (range of final average values from 15 to 295 g/m^2) (see Exhibit 2-9). The unamended peat-based PSTAs typically had the lowest calcium density in their periphyton.

Average periphyton TP ranged from 30 to 1,055 mg/m^2, and total inorganic phosphorus (TIP) ranged from below detection to 458 mg/m^2. Final destructive sampling generally confirmed this range of TP values (95 to 626 mg/m^2);

EXHIBIT 2-10
Monthly Algal Mat Percent Cover Estimates in the PSTA Test Cells

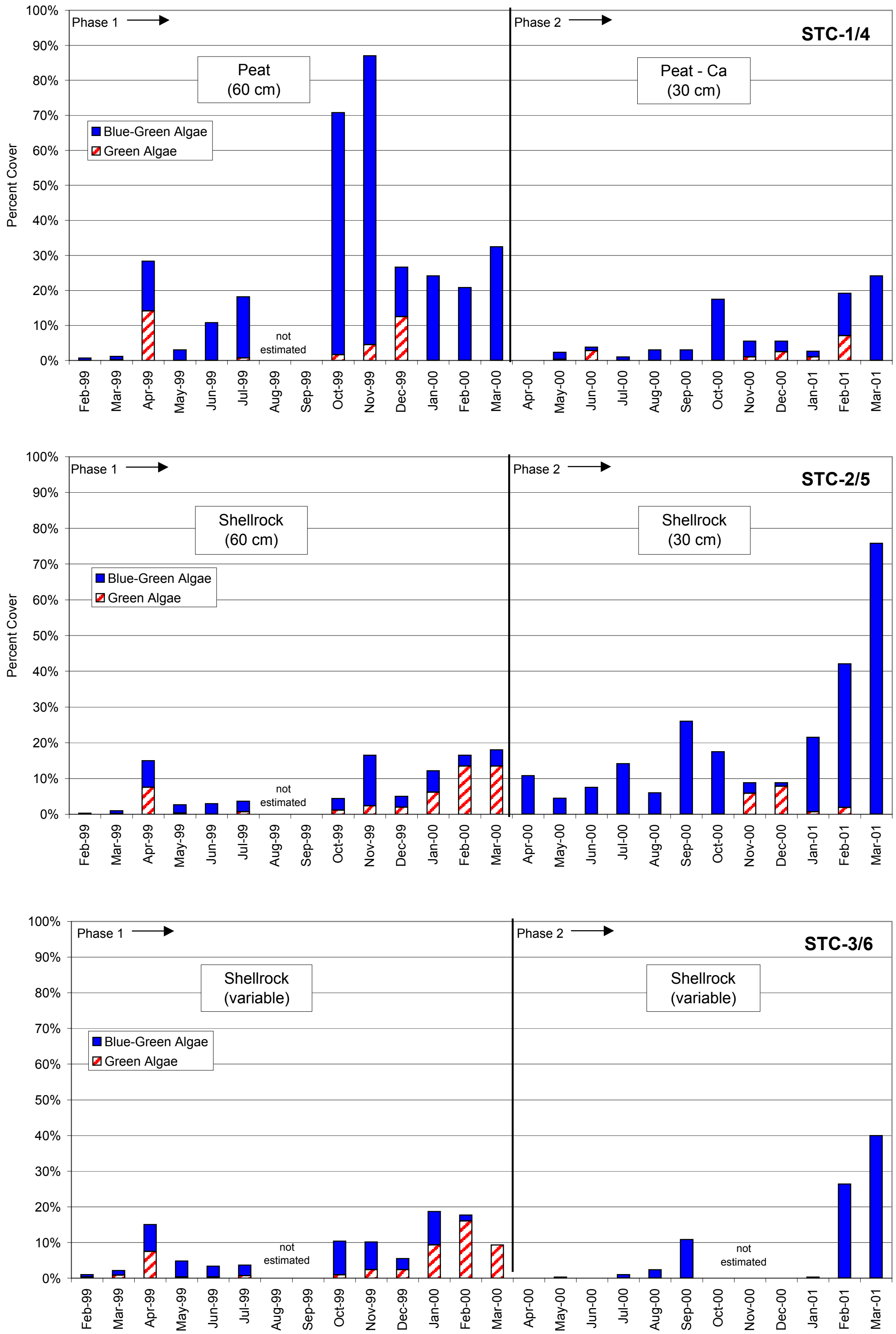

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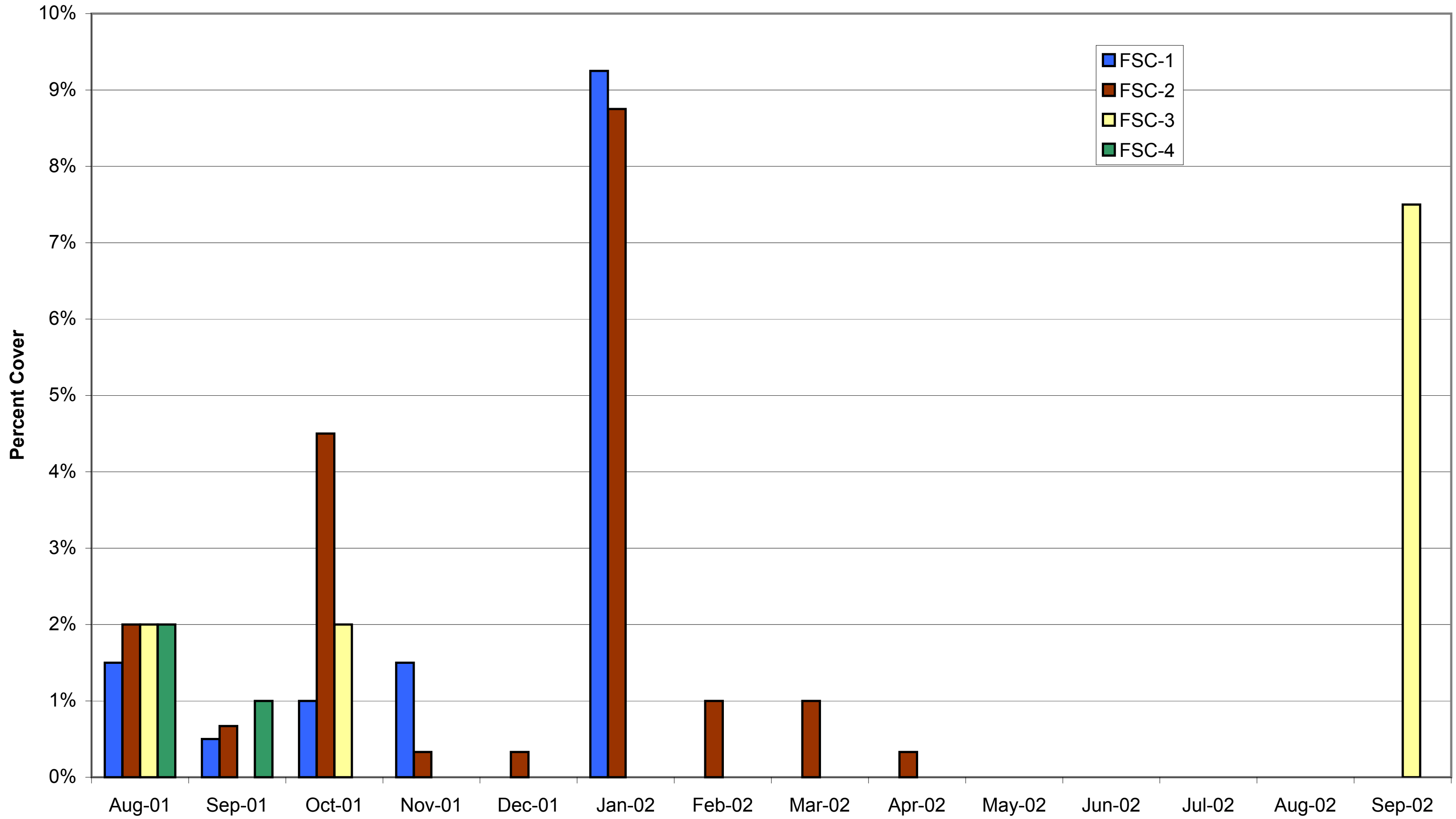
EXHIBIT 2-11
Monthly Algal Mat Percent Cover Estimates in the PSTA Field-Scale Cells



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however, TIP had a much lower range (0.73 to 9.5 mg/m^2). Average periphyton TKN mass ranged from approximately 0.66 to 16.1 g/m^2.

Exhibits 2-12 and 2-13 present time-series plots of the concentrations of these elements in the periphyton core samples from selected treatments during the POR. Periphyton calcium concentrations were relatively consistent between approximately 100 and 400 g/kg (10 to 40 percent).

Calcium was relatively abundant in the EAA runoff, with average inflow concentrations of 69 mg/L at the South ENRP Test Cells, 60 mg/L at the Porta-PSTA mesocosm site, and 73 mg/L at the Field-Scale site. Calcium is important in P dynamics because of its potential for co-precipitation with P as a result of periphyton metabolism (Browder et al., 1994). Calcium concentrations were generally slightly greater in periphyton in shellrock treatments than in organic soil and sand treatments. Average calcium content on a DW basis increased from approximately 20 percent during Phase 1 to 30 percent during Phase 2 in the shellrock PSTA Test Cell (STC-2/5); in the peat Test Cell (STC-1/4), average calcium content increased from 16 to 20 percent. Average periphyton calcium concentration was approximately 10 to 14 percent in the Porta-PSTA peat treatments, 22 to 28 percent in the shellrock treatments, 17 to 20 percent in the sand treatments, and 22 percent in the limerock treatment. Calcium content of periphyton in the non-soil controls was 21 percent. Periphyton calcium content in the PSTA FSCs ranged from approximately 21 percent to 34 percent, with the highest value recorded in the peat-based cell. Calcium in the periphyton of selected Porta-PSTAs was inventoried in February 2001 as part of the destructive sampling (CH2M HILL, August 2001). Average calcium content was 15 percent in the peat treatment, 22 percent in the shellrock treatment, 11 percent in the sand treatment, and 23 to 24 percent in the treatments without soils. The wall and floating mat periphyton typically had two to three times as much calcium as the benthic periphyton in these systems, except for the non-soil controls where the concentrations were approximately equal.

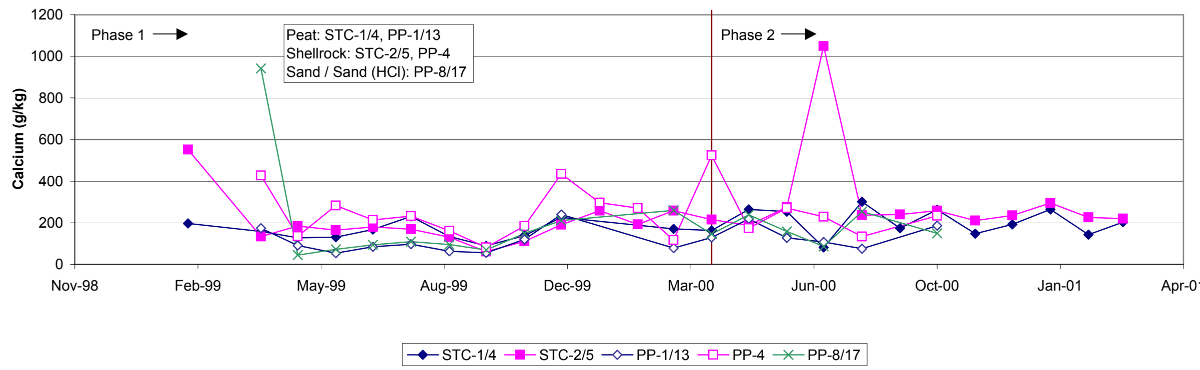
Periphyton TP and TIP time series data are also presented in Exhibits 2-12 and 2-13 for representative Test Cells and Porta-PSTA treatments. In the Test Cells and Porta-PSTAs, monthly periphyton TP estimates were typically lowest in the peat and sand treatments and highest in the shellrock treatments. The opposite trend was observed in the FSCs, where higher TP concentration was observed in the peat-based cell than in the limerock cells (see Exhibit 2-13).

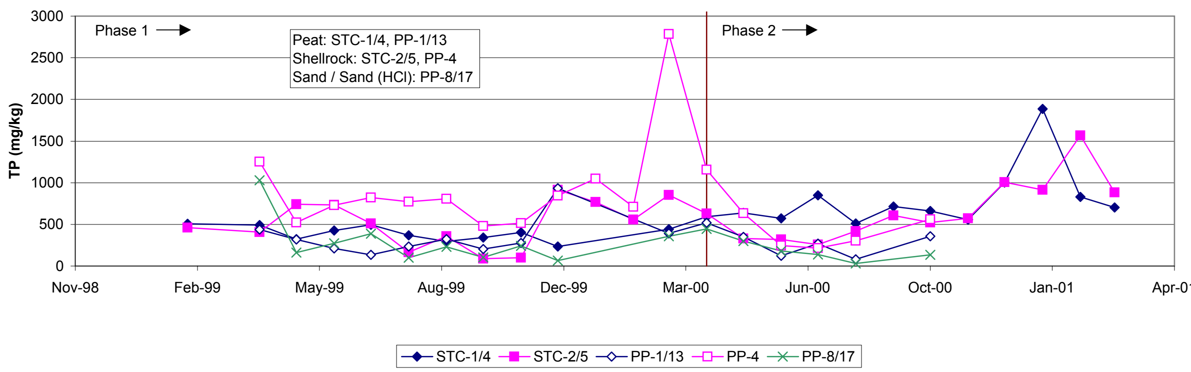
No consistent trend in periphyton P concentrations was observed; however, an increasing trend was apparent for some treatments. Average TP concentrations for shellrock treatments were between 554 and 1,440 mg/kg, and average TIP ranged from 212 to 479 mg/kg. In the peat treatments, the average TP in the periphyton ranged from 346 to 793 mg/kg, and TIP ranged from 88 to 220 mg/kg. TP in the sand treatment ranged from 205 to 385 mg/kg, and TIP averaged 36 to 65 mg/kg. Periphyton TP leveled off in the limerock Field-Scale treatment at approximately 300 mg/kg, while the peat treatment increased from approximately 650 to nearly 2,000 mg/kg during the POR. TIP for all of the Field-Scale treatments were more similar and steady between approximately 40 and 90 mg/kg.

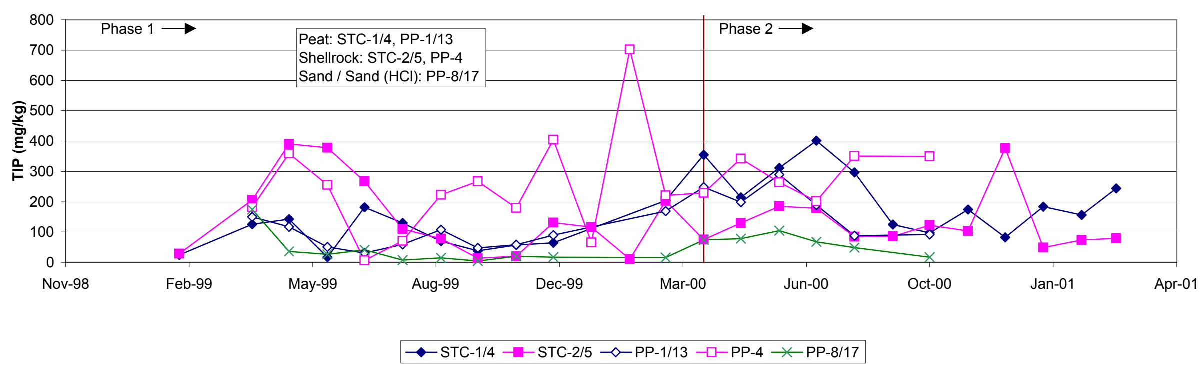
EXHIBIT 2-12

Trends for Calcium, TP, TIP, and TKN in Periphyton Samples from Selected PSTA Phase 1 and 2 Mesocosms

(STC-1/4 and PP-1/13: Peat/Peat (Ca); STC-2/5 and PP-2: Shellrock; PP-14: Limerock; PP-8/17: Sand/Sand (HCl







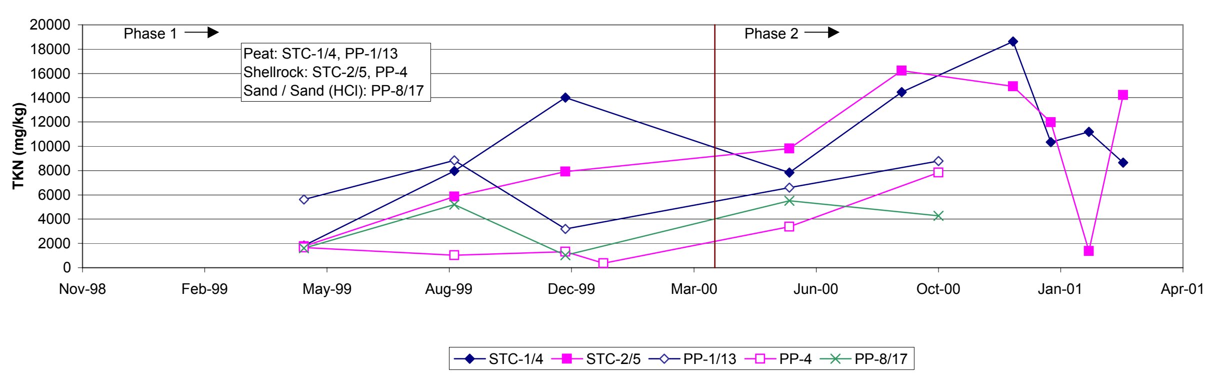
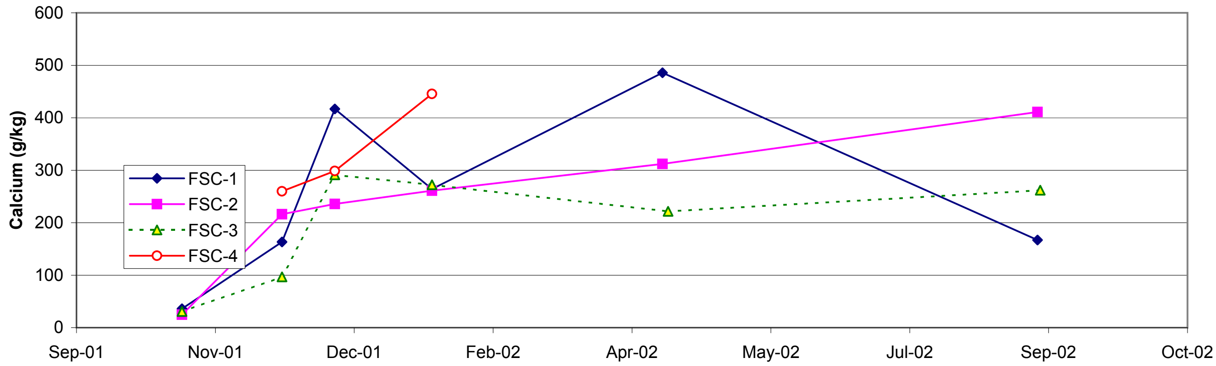
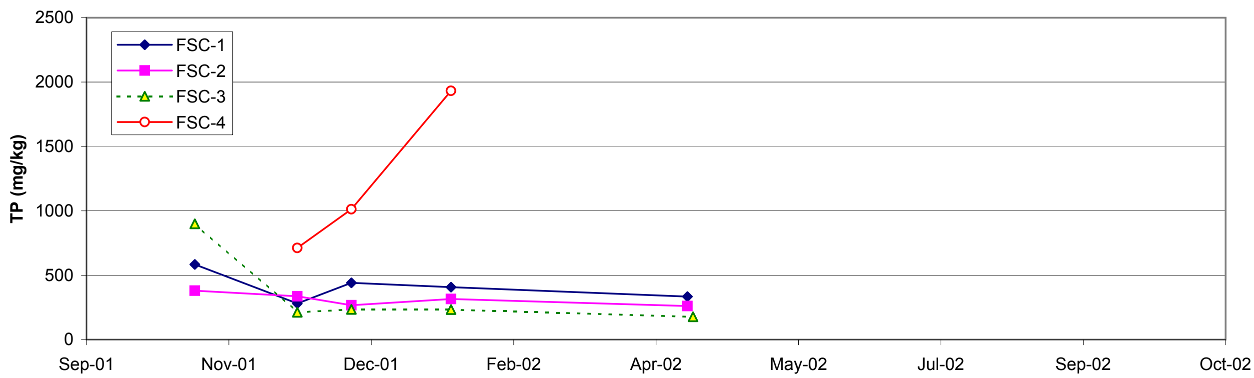
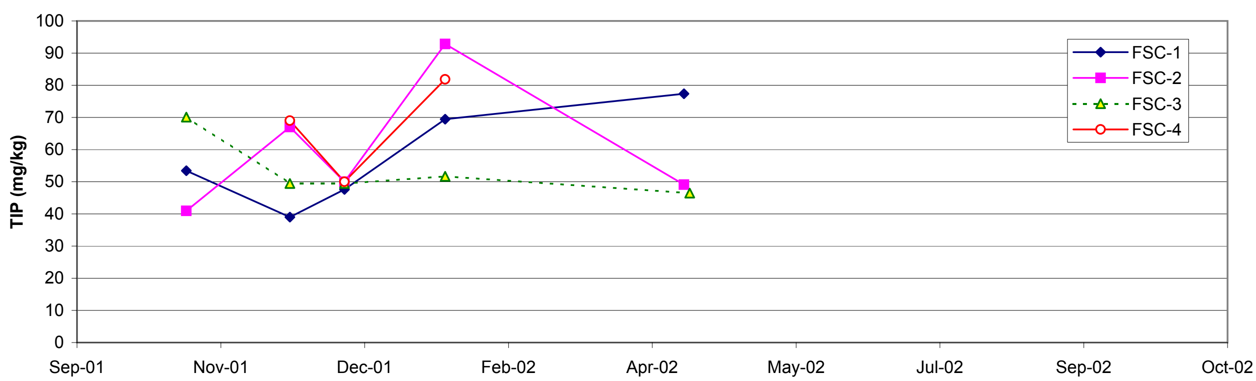
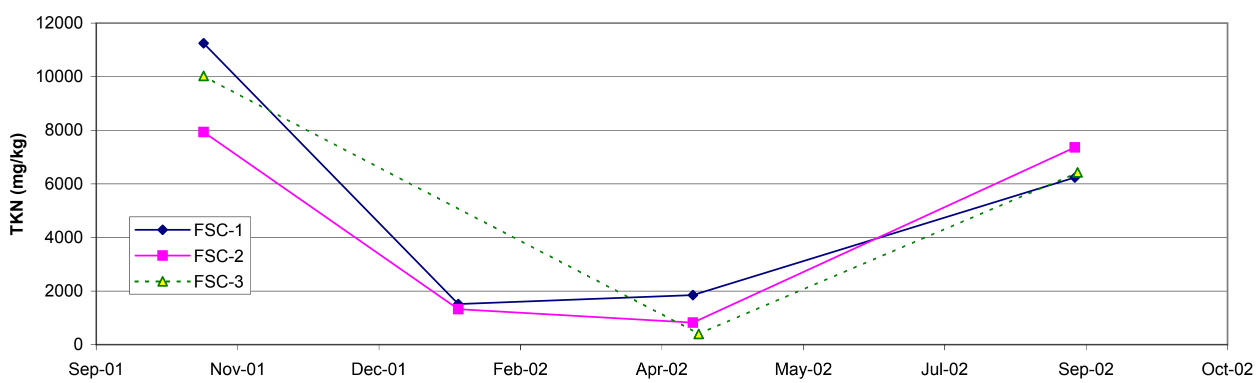


EXHIBIT 2-13
Trends for Calcium, TP, TIP, and TKN in Periphyton Samples from the PSTA Field Scale Cells









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Final destructive sampling in selected Porta-PSTAs in February 2001 found an average of 561 mg/kg TP in the peat treatment, 435 mg/kg in the shellrock treatment, 289 mg/kg in the sand treatment, and 223 to 230 mg/kg in the non-soil treatments. Final TIP concentration was 94 mg/kg in the peat treatment, 180 mg/kg in the shellrock treatment, 21 to 41 mg/kg in the sand treatments, and 43 to 72 mg/kg in the non-soil treatments. The benthic periphyton typically had higher TP and TIP concentrations than the wall and floating periphyton in these treatments, with the exception of the acid-rinsed sand treatment.

Time series data for periphyton TKN from selected PSTA treatments are also presented in Exhibits 2-12 and 2-13. TKN concentrations in the periphyton generally increased over time. Average TKN concentrations ranged from 5,889 to 21,242 mg/kg in the peat treatments, 1,462 to 11,425 mg/kg in the shellrock treatments, 2,614 to 4,897 mg/kg in the sand treatments, and 3,320 to 6,925 mg/kg in the non-soil treatments. The TKN content of the Field-Scale periphyton fell from a range of 8,000 to 11,000 mg/kg in November 2001 to less than 2,000 mg/kg in January and April 2002 and then climbed back to approximately 6,000 to 7,000 mg/kg in September 2002. No periphyton TKN data were available from the peat FSC.

These periphyton TKN averages were low for algae (typically greater than 1 to 3 percent or 10,000 to 30,000 mg/kg [Vymazal, 1995]) and provided an indication that a general lack of N availability may have been contributing to low algal growth rates in these mesocosms (discussed in Section 2.5).

2.2.6 Algal and Suspended Solids Export

Algal export was estimated from measurements of total suspended solids (TSS) in the outflow from the PSTA mesocosms. Exhibit 2-14 summarizes the treatment means for inflow and outflow TSS during the operational period. Long-term average outflow TSS concentrations typically ranged from 2.0 to 6.3 mg/L. The average outflow TSS concentration was greater than the average inflow level for several treatments. The results of the diel sampling study conducted in selected Porta-PSTAs on October 5 and 6, 1999 (CH2M HILL, August 2000), indicated a living algal cell component in these exported solids. Based on this single diel study, no clear pattern of algal export as a function of the day-night cycle was observed.

2.3 Macrophyte Communities

Macrophyte invasion in PSTAs is likely to be greatest under antecedent conditions of relatively high available soil P (>5 to 10 mg/kg total labile P) and whenever inflow P concentrations are high (>30 to 50 μg/L). Under those conditions, larger-scale PSTA systems are not likely to remain free of macrophytes without significant intervention. It is less likely that macrophyte invasion and dominance will be a significant issue for PSTA operation and management under low soil P conditions and near the downstream end of a treatment train, where P concentrations have already been reduced to less than 15 to 20 μg/L.

EXHIBIT 2-14
Average Inflow and Outflow TSS Concentrations in the PSTA Test Systems

Treatment	Phase	Substrate	Depth	HLR	Total Suspended Solids (mg/L) In	Out	Net Change
PP-1	1	PE	D	L	2.0	3.7	-1.7
PP-2	1	SR	D	L	2.1	4.5	-2.4
PP-3	1, 2	PE	S	L	2.5	2.9	-0.4
PP-4	1, 2	SR	S	L	2.7	3.5	-0.8
PP-5	1	SR	D	H	2.0	3.2	-1.2
PP-6	1	SR	V	V	1.9	3.6	-1.6
PP-7	1, 2	SA	D/S	L	2.8	2.3	0.5
PP-8	1	SA	S	L	2.0	3.8	-1.8
PP-9	1	PE (AS)	D	L	1.7	4.1	-2.4
PP-10	1	SR (AS)	D	L	3.0	5.1	-2.1
PP-11	1, 2	SR	S	L	2.5	4.8	-2.3
PP-12	1, 2	PE	S	L	2.6	4.7	-2.1
PP-13	2	PE (Ca)	S	L	4.9	4.4	0.5
PP-14	2	LR	S	L	5.5	2.6	2.9
PP-15	2	SR	S	R	4.7	3.3	1.3
PP-16	2	SR	V	V	2.7	2.5	0.2
PP-17	2	SA (HCl)	S	L	4.0	3.1	0.9
PP-18	2	None	S	L	4.0	2.6	1.4
PP-19	2	AM	S	L	3.8	4.2	-0.4
STC-1	1	PE	D	L	3.0	2.7	0.3
STC-2	1	SR	D	L	3.1	4.0	-1.0
STC-3	1	SR	V	V	2.9	6.3	-3.5
STC-4	2	PE (Ca)	D	L	3.7	4.7	-1.0
STC-5	2	SR	D	L	3.4	3.8	-0.4
STC-6	2	SR	V	V	3.4	2.7	0.7
FSC-1	3	LR-PE	S	H	9.3	2.0	7.3
FSC-2	3	LR-PE	S	H	12.7	3.1	9.6
FSC-3	3	CR	S	H	5.3	3.3	2.0
FSC-4	3	PE	S	H	3.6	3.4	0.2

Notes:
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

Sparse macrophyte communities are likely to help maintain higher periphyton populations by providing attachment sites and anchoring against wind-induced periphyton movement. Existing periphyton-dominated plant communities in the Everglades invariably have associated macrophytes, typically spikerush (*E. cellulosa*) and bladderwort (*Utricularia* spp.). For these reasons, the PSTA Test Cell treatments were intentionally planted with spikerush and bladderwort. One goal of the PSTA project was to document the growth rate and density of these macrophytes, as well as other volunteer plant species, and to attempt to identify a macrophyte density and control strategy that optimizes periphyton development and overall system P removal performance.

Exhibit 2-15 summarizes the PSTA POR average macrophyte percent cover and biomass results. Detailed monthly data are provided in Appendices C through E. Cover numbers are visual estimates for comparison purposes and do not provide an exact assessment of total leaf cover. Plant cover is estimated for more than one plant stratum, if present, and estimated total plant cover values may be greater than 100 percent. The routine biomass values summarized in Exhibit 2-15 are from plants collected in periphyton core samples. Live stems were visually estimated in the smaller mesocosms.

Average total macrophyte plant cover varied from as little as 0 to 2 percent in the non-soil and Aquashade treatments, to 124 percent in the shellrock Test Cell Treatment (STC-5). Macrophyte cover was typically highest in the peat-based Porta-PSTAs compared to the other soil treatments. Cover was dominated by spikerush because cattail seedlings were routinely pulled from the tank-based mesocosms. Submerged aquatic plants (Chara and bladderwort) were typically less than 15 percent cover in the Porta-PSTAs, but were more prevalent in the PSTA Test Cells with average cover values ranging from 18 to 83 percent. Emergent macrophyte cover in the PSTA Test Cells and FSCs was controlled to some extent by herbicide additions. These efforts were focused on removing invasive cattails and upland plants that colonized some of the FSCs during dryout. Macrophyte management activities in the PSTA systems can be reviewed in the Key Date Summary (Appendix A).

In the PSTA test systems with macrophytes, average biomass varied from 3 to 582 g DW/m^2. Average macrophyte biomass in the FSCs ranged from 27 to 271 g DW/m^2. Test Cell emergent macrophyte cover averaged between 15 and 41 percent. While spikerush accounted for most of this cover, volunteer cattails were a significant fraction of the total cover. Cattails were not controlled in any of the PSTA Test Cells during Phase 1. Cattails were pulled from the peat-based PSTA Test Cell between Phase 1 and Phase 2. Some herbicide control of cattails was conducted in all of the PSTA Test Cells during Phase 2.

Final destructive sampling in selected Porta-PSTAs indicated macrophyte biomass values of 688 g DW/m^2 for the peat treatment (PP-3), 381 g DW/m^2 for the shellrock treatment (PP-4), and from 225 to 253 g DW/m^2 for the sand treatments (PP-7 and PP-17) (CH2M HILL, August 2001). Above- and belowground macrophyte biomass was estimated in those treatments, with typically 23 to 32 percent of the DW biomass belowground.

EXHIBIT 2-15

PSTA Macrophyte Average Cover and Biomass Data for Period-of-Record

Treatment	Phase	Substrate	Depth	HLR	Emergent Macrophytes	Submerged Aquatic Plants	Total Macrophyte % Cover	Macrophyte Biomass (gDW/m^2)	No. Stems/m^2
PP-1	1	PE	D	L	13%	15%	27%	75	79
PP-2	1	SR	D	L	2%	11%	13%	19	7
PP-3	1, 2	PE	S	L	52%	2%	54%	294	299
PP-4	1, 2	SR	S	L	6%	2%	8%	53	55
PP-5	1	SR	D	H	7%	0%	7%	26	27
PP-6	1	SR	V	V	3%	5%	9%	15	18
PP-7	1, 2	SA	D/S	L	2%	0%	3%	130	26
PP-8	1	SA	S	L	1%	1%	2%	3	3
PP-9	1	PE (AS)	D	L	0%	0%	1%	--	0
PP-10	1	SR (AS)	D	L	0%	2%	2%	--	0
PP-11	1, 2	SR	S	L	14%	0%	14%	116	138
PP-12	1, 2	PE	S	L	60%	1%	62%	284	322
PP-13	2	PE (Ca)	S	L	4%	13%	17%	128	48
PP-14	2	LR	S	L	3%	0%	3%	37	19
PP-15	2	SR	S	R	30%	6%	36%	218	243
PP-16	2	SR	V	V	8%	0%	8%	82	142
PP-17	2	SA (HCl)	S	L	3%	0%	3%	30	37
PP-18	2	None	S	L	0%	0%	0%	--	0
PP-19	2	AM	S	L	0%	0%	0%	--	0
STC-1	1	PE	D	L	28%	76%	103%	582	--
STC-2	1	SR	D	L	15%	29%	44%	61	--
STC-3	1	SR	V	V	18%	18%	36%	55	--
STC-4	2	PE (Ca)	D	L	22%	78%	99%	283	--
STC-5	2	SR	D	L	41%	83%	124%	339	--
STC-6	2	SR	V	V	32%	28%	49%	121	--
FSC-1	3	LR-PE	S	H	19%	29%	48%	271	--
FSC-2	3	LR-PE	S	H	24%	18%	42%	59	--
FSC-3	3	CR	S	H	5%	8%	12%	27	--
FSC-4	3	PE	S	H	5%	1%	5%	31	--

Notes:

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

Macrophyte percent cover is visually estimated using semi-quantitative method.

Macrophyte biomass is estimated from periphyton core samples.

Stem counts are for live stems only.

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Submerged aquatic plant cover in the PSTA Test Cells ranged from 18 to 83 percent. This volunteer SAV cover was dominated by Hydrilla (*Hydrilla verticillata*), and the macro-algae *Chara* [*Chara* sp.]. Some bladderwort was present in the PSTA Test Cells.

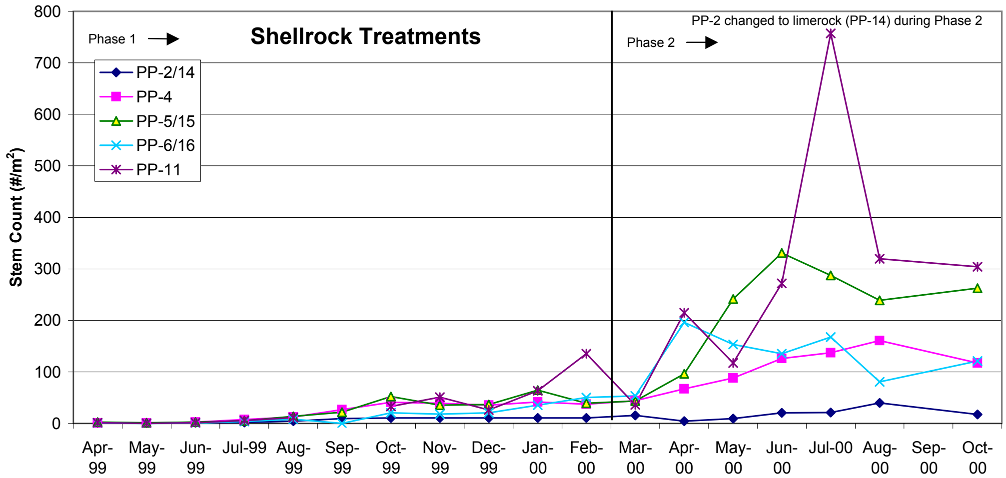
Macrophyte live and dead stem densities were also monitored in the Porta-PSTA treatments throughout the project. In the mesocosms with macrophytes, the number of live spikerush stems averaged from 3 to 322 stems/m^2. Peat-based mesocosms had average stem counts between 48 and 322 stems/m^2. Shellrock tanks had averages between 7 and 243 stems/m^2, and sand tanks had between 3 and 37 stems/m^2. Final stem counts in the peat and shellrock treatments (PP-3 and PP-4, respectively) in February 2001 found 158 live stems/m^2 in the peat and 89 stems/m^2 in the shellrock. Standing dead stems were also counted and included 364 stems/m^2 in the peat and 119 stems/m^2 in the shellrock.

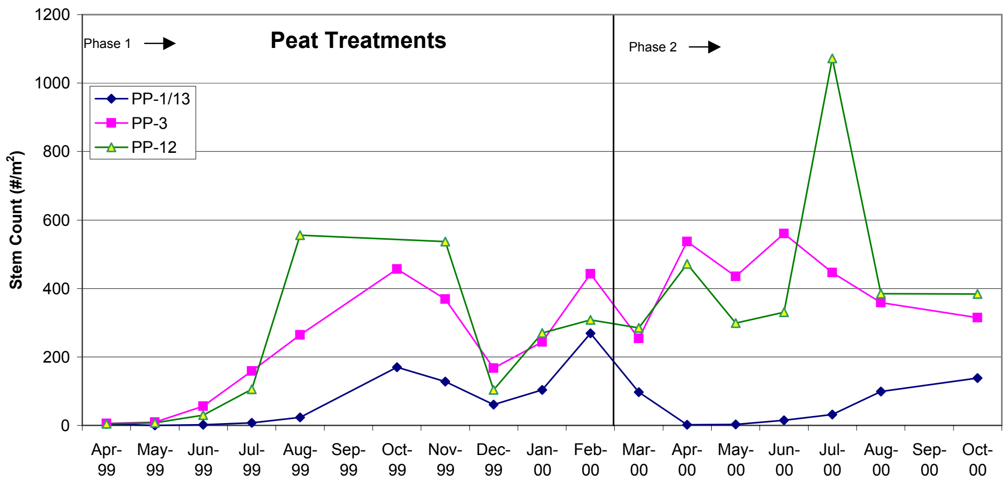
Time series plots of live stem densities in the Porta-PSTAs are provided in Exhibit 2-16. It is important to note the differences in the vertical scales on these three exhibits. In shellrock treatments, stem densities typically remained less than 100 stems/m^2 during the first year but then continued to increase during Phase 2. The highest stem densities were approximately 100 to 300 stems/m^2 in the consistent 30-cm treatments, including the recirculation treatment. Stem densities increased more rapidly in the peat treatments with the consistent 30-cm water depths, leveling off at approximately 400 live stems/m^2 within approximately 6 months after startup and continuing through the end of the 18-month operational period. Macrophyte stem densities were not estimated in the PSTA Test Cells.

Exhibit 2-17 illustrates the time series trends in macrophyte cover for the peat and shellrock PSTA Test Cell treatments with stable water depths. Emergent macrophyte cover increased more rapidly in the peat treatment than in the shellrock treatment and was dominated by cattails. At the beginning of Phase 2, all of the cattail biomass in the peat treatment was removed when the treatment was restarted in March 2000. This allowed the shellrock treatment macrophyte cover to outstrip the peat cell for most of the second year of operation, but by the end of that period the peat cell emergent cover was comparable to the shellrock Test Cell. Submerged macrophyte cover estimates are also summarized for these two PSTA Test Cells in Exhibit 2-17. SAV rapidly invaded the 60-cm PSTA Test Cells during Phase 1, with the fastest growth by Hydrilla in the peat-based Test Cell. It took only 3 to 4 months for SAV to reach 90 percent or higher estimated cover in the peat-based PSTA Test Cells. By the end of the second year, both of these cells were nearly completely colonized by SAV, with *Hydrilla* dominant in the peat-based cell and *Chara* in the shellrock cell.

Exhibit 2-18 summarizes time-series data for estimated macrophyte cover in the FSCs. Fairly low cover of emergent macrophytes was maintained throughout the POR. With the exception of FSC-4 (peat-based), SAV cover was typically higher than emergent macrophyte cover. Dominant SAV in these cells was *Chara*.

EXHIBIT 2-16
Macrophyte Live Stem Counts for the Porta-PSTA Mesocosm Treatments





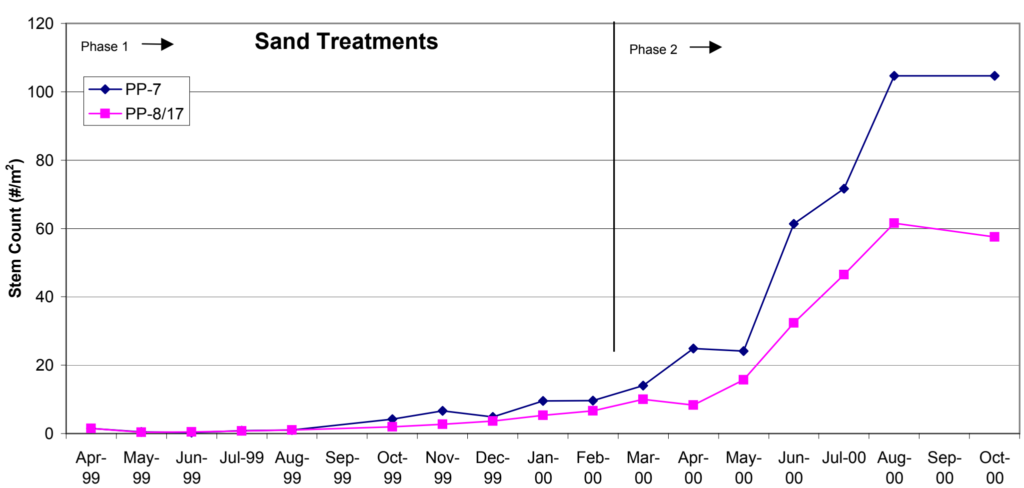


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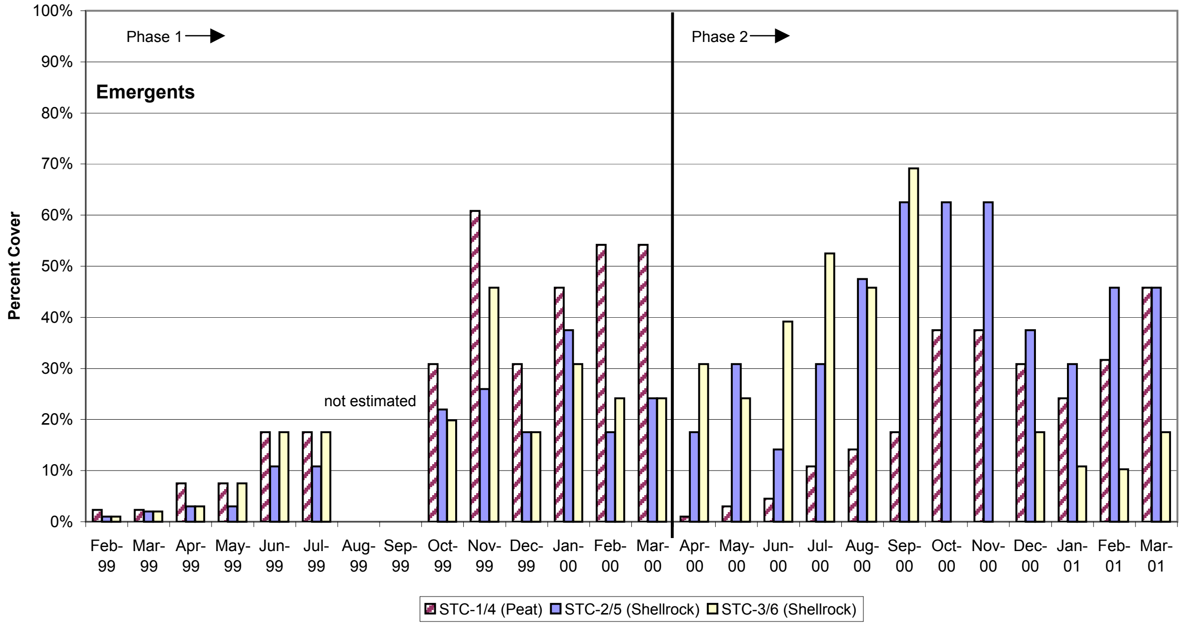
EXHIBIT 2-17

Macrophyte Plant Cover Estimates for the PSTA Test Cells



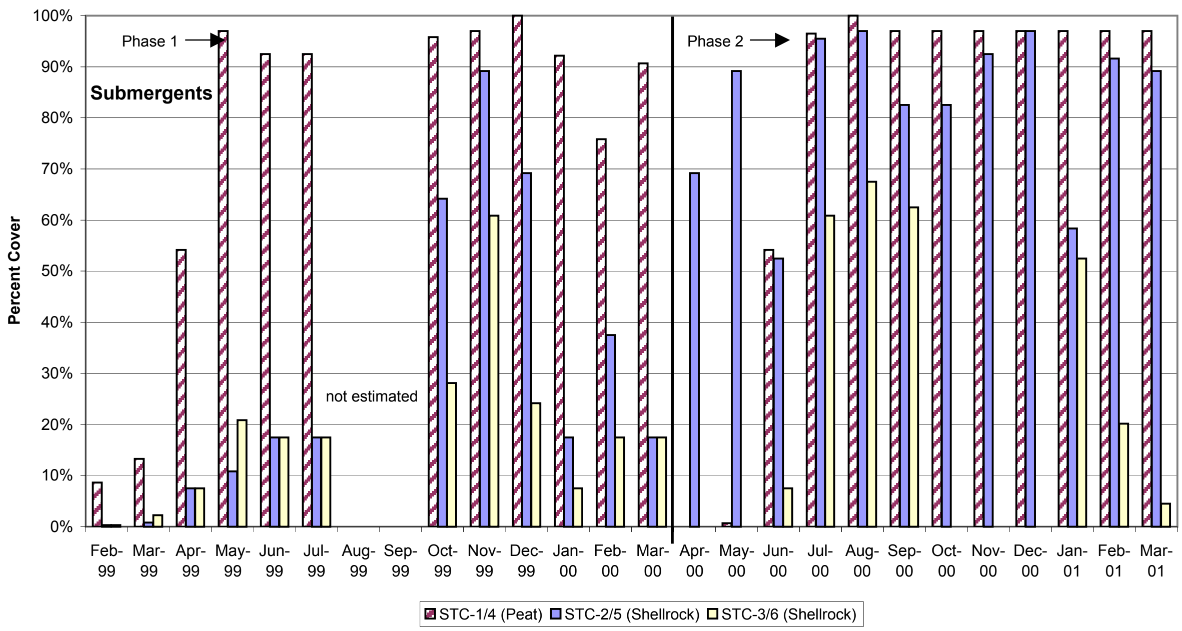


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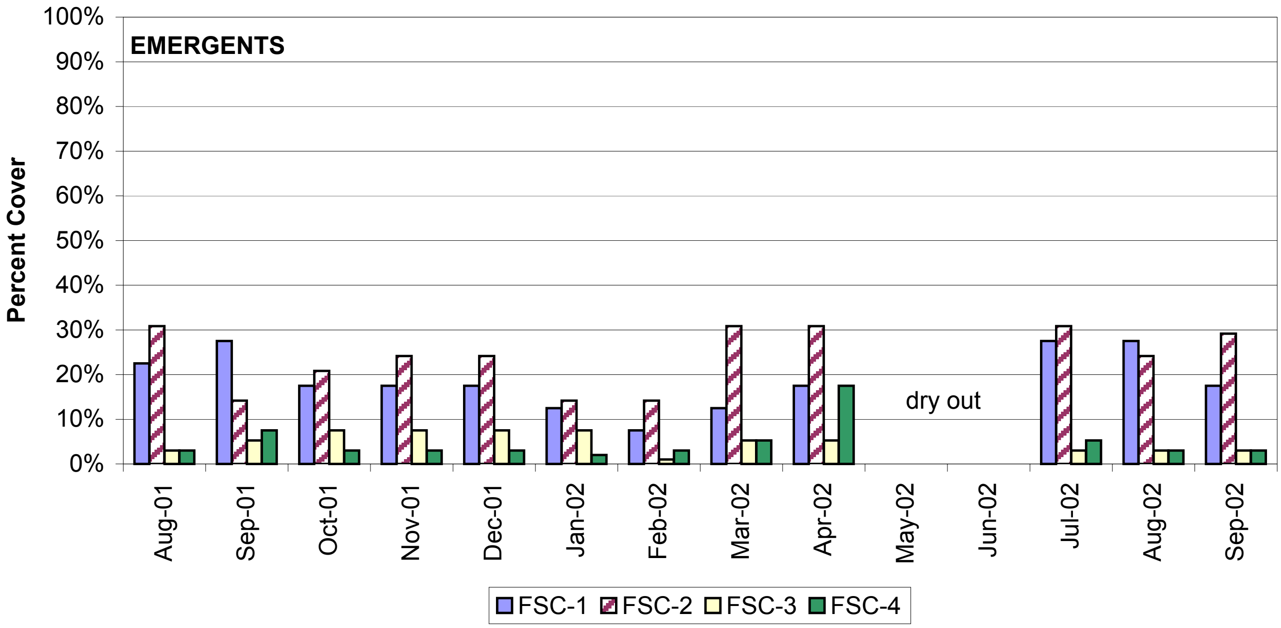
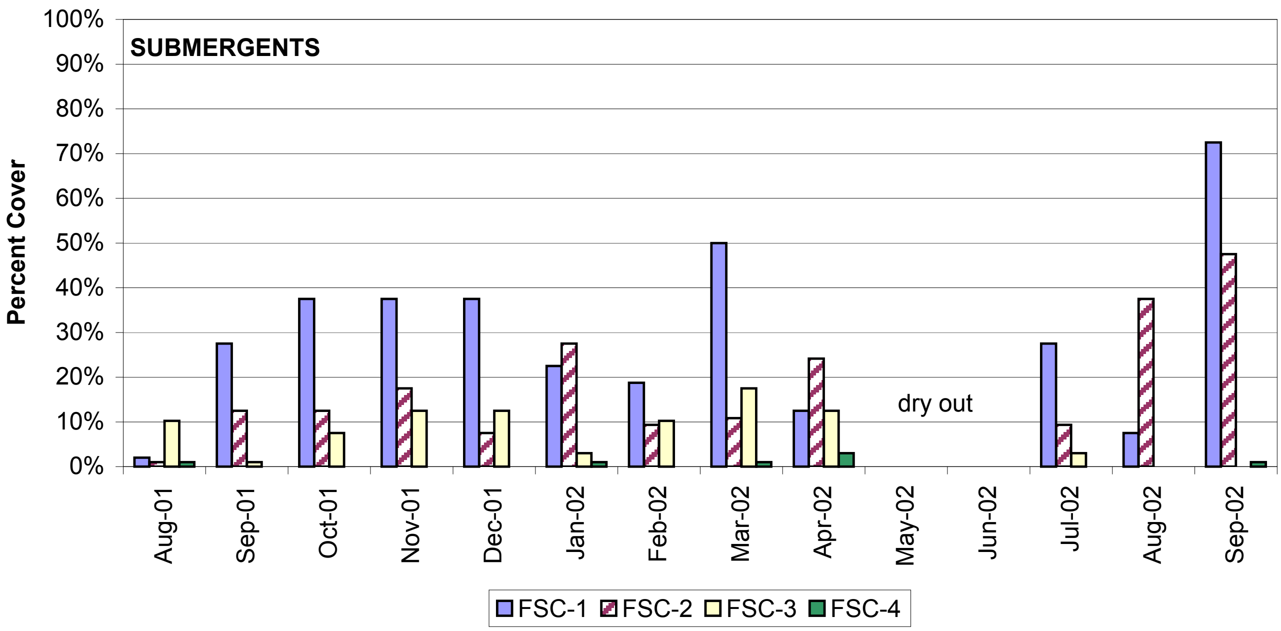
EXHIBIT 2-18
PSTA Field-Scale Macrophyte Plant Cover Estimates





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A key finding from the PSTA Research and Demonstration Project was that the former agricultural soils in the peat-based test systems were extremely susceptible to rapid colonization by cattails from the existing seed bank, even under 2 feet of water, and from the spread of submerged aquatic plants introduced from the feed water from STA-1W and STA-2. Factors that appeared to reduce macrophyte colonization were the soil type (much slower on limerock, sand, and shellrock than on the peat), water depth (faster emergent growth in shallow water than in deep water; faster SAV colonization in deeper water), and dry-out (significant emergent and SAV macrophyte cover decrease in treatment STC-6 during fall-winter dry-out and in FSC-4 during summer dryout).

2.4 Faunal Populations

There was minimal focus on the estimation of the faunal components of the PSTA test systems. However, many invertebrates and a few vertebrate animal species were observed in the PSTA Test Cells, Porta-PSTAs, and FSCs. The most visible consumers in the Porta-PSTAs were two species of snails that attained significant population densities in a limited number of the tanks. In order of relative dominance, the two snail species were *Helisoma* spp. and *Physa* spp. Counts were conducted on five dates to quantify the snail population. Snails were counted and removed.

Exhibit 2-19 summarizes the results of these snail counts. All of the numbers in this exhibit are minimum estimates because of the difficulty of seeing all of the snails. Counts from March 2000 represented the populations of snails harvested from the mesocosms at the end of Phase 1. The highest average snail densities were measured in Porta-PSTA treatments PP-6/16 (variable water regime shellrock), PP-5/15 (high load/re-circulation shellrock), PP-8/17 (sand), and PP-12 (shallow peat). The highest average density was 77 snails/m^2 of bottom area. Average snail weights were determined for the March 2000 samples. The average snail weight was 0.29 g DW per snail. Based on this conversion, the highest snail biomass values averaged approximately 27 g DW/m^2 in PP-8 (60-cm sand) and more than 6 to 15 g DW/m^2 in the other tanks with high snail densities.

These high snail densities were observed to dramatically modify the periphyton macroscopic structure. Wall and benthic periphyton mats were nearly eliminated in the tanks with high snail counts. Coherent periphyton mats were replaced by a flocculent collection of snail castings. The effects of this high snail productivity on P removal are discussed in Section 3.

No similar snail population increases were observed in the Test Cell PSTA mesocosms or in the FSCs, and it is currently hypothesized that this phenomenon may be an effect of the relatively small scale of the Porta-PSTAs and the resulting absence of a snail predator population. Optimal snail grazing is thought to maximize primary productivity in adapted spring ecosystems in Florida (Knight, 1983). Higher consumer levels must regulate snail densities to provide this stimulatory effect. The observation that snail density can significantly affect periphyton viability indicated that it may be important to pay

EXHIBIT 2-19
Porta-PSTA Snail Counts

						Sample Date												
						Oct-99		Nov-99		Dec-99		Mar-00		Jul-00		Averages		
Treatment #	**Substrate**	**Depth**	**HLR**	**Tank #**	**Snail**	**Total by Species**	**Tank Total**	**Total by Species**	**Tank Total**	**Total by Species**	**Tank Total**	**Total by Species**	**Tank Total**	**Total by Species**	**Tank Total**	**By Species**	**Tank Total**	**Density #/m^2**
1 / 13	PE / PE (Ca)	D / S	L / L	9	H	8	13	11	17	5	10	NS	0	9	9	8.3	9.8	1.63
					P	5		6		5		NS		0		4.0		
				11	H	6	8	3	4	0	7	NS	0	11	11	5.0	6.0	1.00
					P	2		1		7		NS		0		2.5		
				18	H	54	55	11	13	5	7	NS	0	0	0	17.5	15.0	2.50
					P	1		2		2		NS		0		1.3		
2 / 14	SR / LR	D / S	L / L	4	H	24	26	18	18	13	15	NS	0	12	14	16.8	14.6	2.43
					P	2		0		2		NS		2		1.5		
				7	H	4	4	1	1	0	0	NS	0	15	15	5.0	4.0	0.67
					P	0		0		0		NS		0		0.0		
				8	H	20	32	22	22	2	2	NS	0	14	14	14.5	14.0	2.33
					P	12		0		0		NS		0		3.0		
3	PE	S	L	12	H	28	30	3	4	8	8	22	26	20	20	16.2	17.6	2.93
					P	2		1		0		4		0		1.4		
				14	H	9	9	8	8	11	11	17	17	13	17	11.6	12.4	2.07
					P	0		0		0		0		4		0.8		
				17	H	72	75	44	65	15	36	42	49	48	62	44.2	57.4	9.57
					P	3		21		21		7		14		13.2		
4	SR	S	L	3	H	0	1	0	0	0	0	0	0	54	57	10.8	11.6	1.93
					P	1		0		0		0		3		0.8		
				5	H	0	1	0	0	0	0	0	0	63	64	12.6	13.0	2.17
					P	1		0		0		0		1		0.4		
				10	H	0	0	0	0	2	2	81	81	142	142	45.0	45.0	7.50
					P	0		0		0		0		0		0.0		
5 / 15	SR / SR	D / S	H / R	2	H	5	5	7	33	1	2	31	33	11	11	11.0	16.8	2.80
					P	0		26		1		2		0		5.8		
				13	H	152	156	68	76	17	18	248	258	37	40	104.4	109.6	18.27
					P	4		8		1		10		3		5.2		
				16	H	1	3	0	0	0	0	0	0	0	13	0.2	3.2	0.53
					P	2		0		0		0		13		3.0		
6 / 16	SR / SR	V / V	V / V	1	H	0	0	417	454	230	232	201	201	163	193	202.2	216.0	36.00
					P	0		37		2		0		30		13.8		
				6	H	345	382	353	360	207	211	301	301	21	21	245.4	255.0	42.50
					P	37		7		4		0		0		9.6		
				15	H	1	1	0	0	0	0	0	0	17	19	3.6	4.0	0.67
					P	0		0		0		0		2		0.4		
7	SA	D / S	L	19	H	6	7	0	2	0	0	0	0	6	6	2.4	3.0	0.50
					P	1		2		0		0		0		0.6		
8 / 17	SA / SA (HCl)	S / S	L / L	20	H	555	1143	571	594	502	509	NS	0	71	75	424.8	464.2	77.37
					P	588		23		7		NS		4		155.5		
9 / 18	PE (AS) / None	D / S	L / L	21	H	2	8	ND	ND	7	8	NS	0	NS	0	4.5	4.0	0.67
					P	6		ND		1		NS		NS		3.5		
10 / 19	SR (AS) / AM	D / S	L / L	22	H	1	2	ND	ND	0	0	NS	0	NS	0	0.5	0.5	0.08
					P	1		ND		0		NS		NS		0.5		
11	SR	S	L	23	H	7	7	4	4	4	21	106	120	NS	0	30.3	30.4	5.07
					P	0		0		17		14		NS		7.8		
12	PE	S	L	24	H	97	98	97	98	36	36	126	144	NS	0	89.0	75.2	12.53
					P	1		1		0		18		NS		5.0		
						Total	2066	**Total**	1773	**Total**	1135	**Total**	1230	**Total**	803			

Note:
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate
NS = not sampled, dry tank
ND = not determined (not visable)
H = *Helisoma* spp.
P = *Physa* spp.

more attention to this trophic level during future PSTA research and development efforts.

2.5 Community Metabolism/Productivity

Aquatic ecosystems contain numerous biological processes that consume and produce DO. The oxygen-consuming processes are referred to as community respiration (CR) and include cellular metabolism and decomposition processes. The oxygen-producing processes are referred to as primary productivity and include photosynthetic activities of submerged algae and plants in response to PAR or the input of light that can be used by the plants. These community-level metabolism measurements are indispensable for determining turnover of this ecological community.

Periphyton gross and net production have been routinely measured based on upstream-downstream diurnal DO profiles, corrected for atmospheric diffusion (Odum, 1956; Odum and Hoskins, 1957). These oxygen changes must be corrected for the effects of diffusion of oxygen into or out of the water column. Diffusion rate was not measured in the PSTA mesocosms until Phase 2. A value of 0.1 g $O_2/m^2/hr$ was initially used for correcting observed changes in the Phase 1 report (CH2M HILL, August 2000). This is a typical diffusion rate observed under relatively low flow conditions. Floating-dome diffusion studies were conducted in several of the Porta-PSTA and PSTA Test Cell mesocosms during Phase 2 (CH2M HILL, July 2002). Diffusion rates were found to be affected by nominal velocity and mesocosm size. Average diffusion rates used for correction of metabolism data for this final report are:

- Porta-PSTAs = 0.005 g $O_2/m^2/hr$
- Porta-PSTA with re-circulation = 0.011 g $O_2/m^2/hr$
- PSTA Test Cell = 0.009 g $O_2/m^2/hr$
- Field-Scale PSTA Cells = 0.01 g $O_2/m^2/hr$

Changes in DO content of the water column during a daily period can be used to estimate the processes of CR and photosynthesis. The combination of respiration and photosynthesis is called community metabolism (CM). This is also equal to gross primary production (GPP), a measure of the total oxygen fixed by the ecosystem. Respiration continues throughout the daylight and nighttime hours and is reported as CR. The difference between CM or GPP and CR is called net primary production (NPP). NPP can be reported for the full 24-hour day or just for the daylight portion (NPP day). The 24-hour NPP is an estimate of the accumulation of fixed organic matter. The approximate conversion between oxygen and carbon is 1:1 (Odum, 1971). The conversion between oxygen and AFDW is approximately 1:2. GPP is sometimes expressed as an efficiency by dividing the GPP converted to kilocalories (kcal) assuming a conversion of approximately 10 kcal/g O_2 (Odum, 1971) and converting PAR to kcal by the assumption that one Einstein (mole of photons) is equal to 52.27 kcal.

It is important in this study to note that CM estimates do not include above-water productivity or respiration. However, they do include respiration by emergent macrophyte roots and sediment oxygen demand.

Exhibit 2-20 summarizes the ecosystem metabolism estimates in the submerged portions of the ecosystem for all of the PSTA treatments for the POR. On the basis of these measures of primary productivity, relatively low net production is implied in spite of the visually observed and well-documented biomass production. High sediment oxygen demand is suggested, especially for the peat-based treatments.

Long-term average GPP ranged from 1.76 to 2.91 g $O_2/m^2/d$ in the peat-based mesocosms. However, average estimated NPP ranged from -0.18 to 0.02 g $O_2/m^2/d$ in these peat-based mesocosms. This negative to zero net production, in spite of the clear net production of plant biomass in these mesocosms, indicates that the peat soils were resulting in a sediment oxygen demand and root respiration. The P:R ratio, an indication of the autotrophic:heterotrophic nature of the ecosystems in the mesocosms, was typically close to 1.0 in the peat tanks. This was another indication of the heterotrophic dominance in these tanks, possibly from oxidation of peat soils. Estimated ecological efficiencies ranged from approximately 1.0 to 2.0 percent in these peat-based mesocosms.

Long-term average GPP ranged from 1.01 to 3.34 g $O_2/m^2/d$ in the Phase 1 and 2 shellrock-based mesocosms. Average NPP ranged from -0.18 to 0.04 g $O_2/m^2/d$. In sharp contrast to Phase 1 when there was a positive net productivity in all of the shellrock treatments, little to no net production was indicated in any of these treatments over the entire POR. The P:R ratio in the shellrock mesocosms ranged from 0.42 to 1.02 . Estimated ecological efficiencies ranged from approximately 0.6 to 1.8 percent in these mesocosms. Sediment oxygen demand and decomposition of initial soil organic matter may also be indicated by these data.

The Phase 1 and 2 sand-based mesocosms had similar GPP rates to the other treatments and consistently positive NPP rates, probably indicating less sediment or root oxygen demand in these relatively clean (organic-matter-free) soils. The Aquashade control metabolism rates are of special interest. Low GPP rates in these tanks (0.35 to 0.39 g $O_2/m^2/d$) confirm their low levels of algal productivity, but relatively high CR rates (0.67 to 1.12 g $O_2/m^2/d$) indicated the presence of an active microbial community. The P:R ratios in these tanks (0.35 to 0.52) were indicative of a strongly heterotrophic community.

The Phase 3 limerock-based treatments (FSC-1 and FSC-2) had relatively high average levels of GPP and CR (2.51 to 3.70 g $O_2/m^2/d$) and were slightly autotrophic as indicated by P:R ratios greater than 1.0 and slightly positive NPP (24 hr). Estimated ecological efficiencies were higher than for any other PSTA treatments.

The Phase 3 caprock FSC (FSC-3) had lower GPP and CR than the limerock cells and had a slightly negative estimated NPP (24 hr). Periphyton and SAV

EXHIBIT 2-20
PSTA Community Metabolism Data

Treatment	Phase	Substrate	Depth	HLR	GPP (day) g/m²/d	CR (24) g/m²/d	P/R Ratio	NPP (24hr) g/m²/d	PAR (24hr) mol/m²/d	Efficiency %
PP-1	1	PE	D	L	2.649	2.631	1.01	0.018	34.8	1.5
PP-2	1	SR	D	L	1.010	2.391	0.42	0.002	34.1	0.6
PP-3	1, 2	PE	S	L	1.756	1.804	0.97	-0.048	33.1	1.0
PP-4	1, 2	SR	S	L	3.342	3.368	0.99	-0.027	34.7	1.8
PP-5	1	SR	D	H	2.922	2.897	1.01	0.025	35.3	1.6
PP-6	1	SR	V	V	1.957	1.921	1.02	0.036	32.3	1.2
PP-7	1, 2	SA	D/S	L	2.584	2.536	1.02	0.047	31.4	1.6
PP-8	1	SA	S	L	1.508	1.404	1.07	0.105	25.9	1.1
PP-9	1	PE (AS)	D	L	0.350	0.669	0.52	-0.035	36.5	0.2
PP-10	1	SR (AS)	D	L	0.391	1.124	0.35	0.066	36.4	0.2
PP-11	1, 2	SR	S	L	2.802	2.836	0.99	-0.034	29.4	1.8
PP-12	1, 2	PE	S	L	1.942	2.074	0.94	-0.132	33.9	1.1
PP-13	2	PE (Ca)	S	L	2.156	2.236	0.96	-0.079	33.9	1.2
PP-14	2	LR	S	L	3.387	3.359	1.01	0.028	32.9	2.0
PP-15	2	SR	S	R	1.301	1.363	0.95	-0.062	33.4	0.7
PP-16	2	SR	V	V	2.435	2.464	0.99	-0.029	32.8	1.4
PP-17	2	SA (HCl)	S	L	3.119	3.004	1.04	0.115	35.9	1.7
PP-18	2	None	S	L	1.989	2.015	0.99	-0.026	35.5	1.1
PP-19	2	AM	S	L	1.870	1.830	1.02	0.039	35.5	1.0
STC-1	1	PE	D	L	2.908	3.065	0.95	-0.157	34.3	1.6
STC-2	1	SR	D	L	3.005	3.034	0.99	-0.015	34.9	1.6
STC-3	1	SR	V	V	2.263	2.271	1.00	-0.008	35.5	1.2
STC-4	2	PE (Ca)	D	L	2.418	2.757	0.88	-0.179	27.6	1.7
STC-5	2	SR	D	L	1.955	2.634	0.74	-0.176	29.9	1.3
STC-6	2	SR	V	V	2.943	2.961	0.99	-0.018	30.7	1.8
FSC-1	3	LR-PE	S	H	2.53	2.51	1.01	0.02	23.4	2.4
FSC-2	3	LR-PE	S	H	3.70	3.67	1.01	0.03	25.3	3.3
FSC-3	3	CR	S	H	1.48	1.51	0.98	-0.03	27.1	1.3
FSC-4	3	PE	S	H	2.48	2.54	0.98	-0.06	25.5	2.0

Notes:
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

cover and biomass were generally lower in this cell than in the adjacent limerock cells.

Exhibits 2-21 to 2-24 illustrate the temporal pattern of ecosystem metabolism in selected PSTA treatments. GPP (below water) in the peat soil mesocosms generally declined as macrophyte cover increased. This equated to an increasingly negative NPP in STC-1/4 and PP-3. When the emergent plants were removed from STC-4 at the beginning of Phase 2, the GPP instantly rebounded to high levels. As submerged macrophytes re-colonized this mesocosm (see Exhibit 2-17), the GPP quickly rebounded but again dropped off as emergent percent cover gradually increased. The GPP of the shellrock treatments shown in Exhibit 2-21 followed the annual solar cycle. It is interesting to note that NPP rates and the P:R ratio in the PSTA Test Cells appeared to decline during the last 8 months of the Phase 2 project period. This appears to be a result of decreasing GPP during the fall/winter seasons.

Exhibit 2-22 illustrates that GPP was higher in the limerock Porta-PSTA treatment than in the non-soil treatments. NPP was not very different between these treatments, and the P:R ratio averaged around 1.0 for limerock and non-soil control tanks. The Field-Scale limerock treatments responded similarly (Exhibit 2-24).

Exhibit 2-23 presents the community metabolism data for the variable water regime PSTA treatments. GPP and NPP appeared to increase following the first dry-out in late spring and declined after the fall/winter dry-out. The P:R ratio was typically near 1.0 for these treatments.

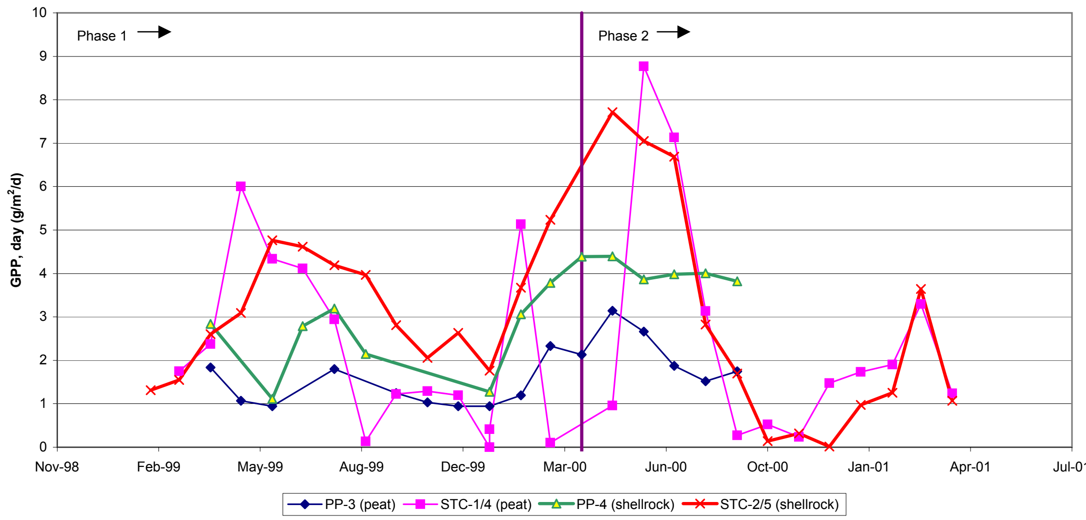
The GPP rates measured in this PSTA research were similar to values measured in submerged periphyton communities in WCA-2A (DWC, 1995) and elsewhere in the Everglades (Browder et al., 1994). DWC (1995) reported a range of GPP estimates between 5 and 14 g $O_2/m^2/d$ in WCA-2A. Browder et al. (1994) summarized GPP data for a variety of Everglades periphyton studies that gave ranges between minimum and maximum values approximately 0.4 to 14 g $O_2/m^2/d$. Typical average GPP values measured in the Everglades are approximately 1 to 5 g $O_2/m^2/d$.

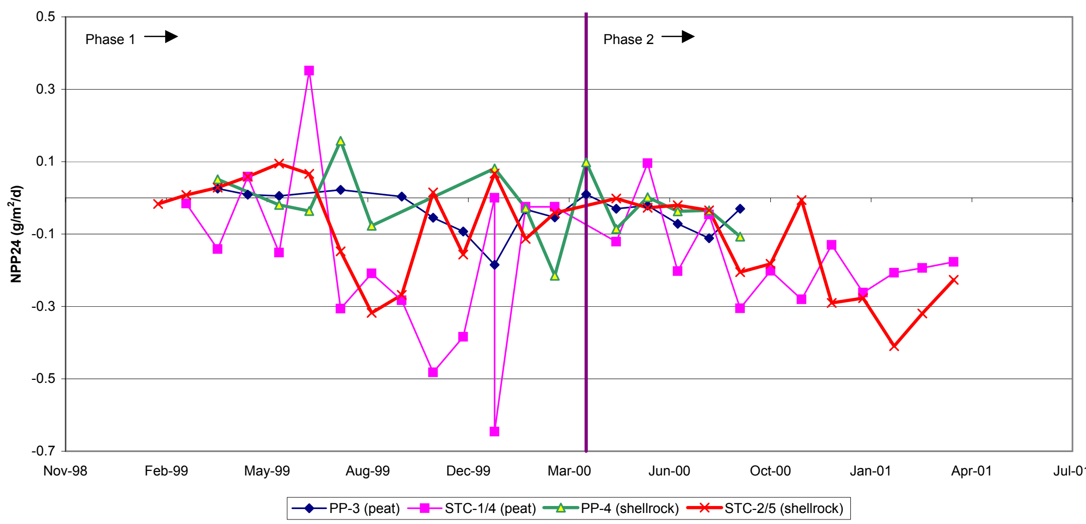
2.6 Summary of PSTA Viability

The small and large-scale PSTAs tested during this research and development project met all of the criteria of viability. Normal periphyton algal species assemblages typical of low-P Everglades waters became established at all three research scales. PSTAs displayed understandable community-level responses to environmental forcing functions, such as sunlight and antecedent soil chemistry, interacted with macrophyte plant communities in predictable ways, and contained faunal components that are important in elemental cycling and community structure.

This research effort demonstrated that periphyton-dominated ecosystems can be established in less than 1 year. Invasion by emergent macrophytes, both desirable and undesirable species, was problematic but not insurmountable. Use of

EXHIBIT 2-21
Temporal Pattern of Community Metabolism in Phase 1 and 2 Peat and Shellrock PSTA Treatments





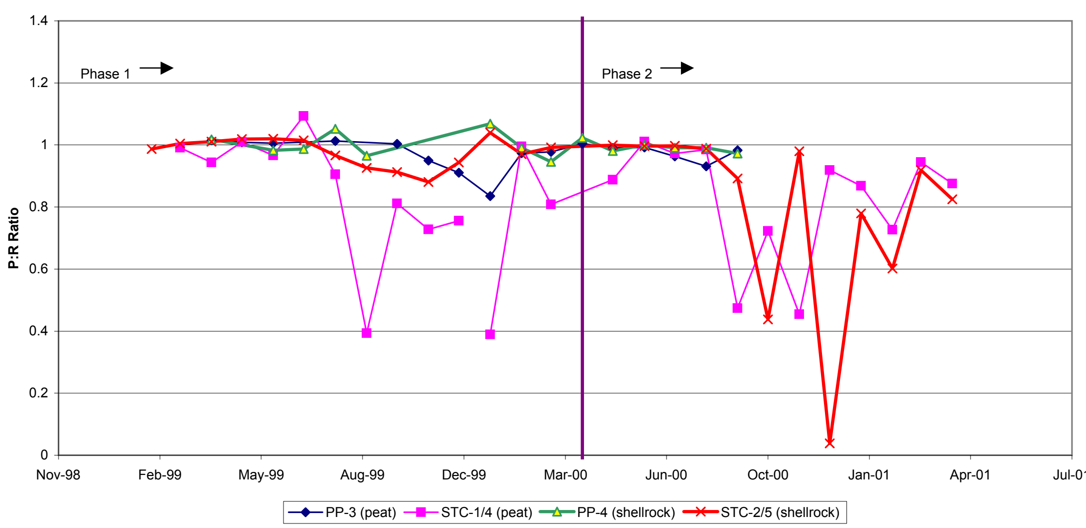
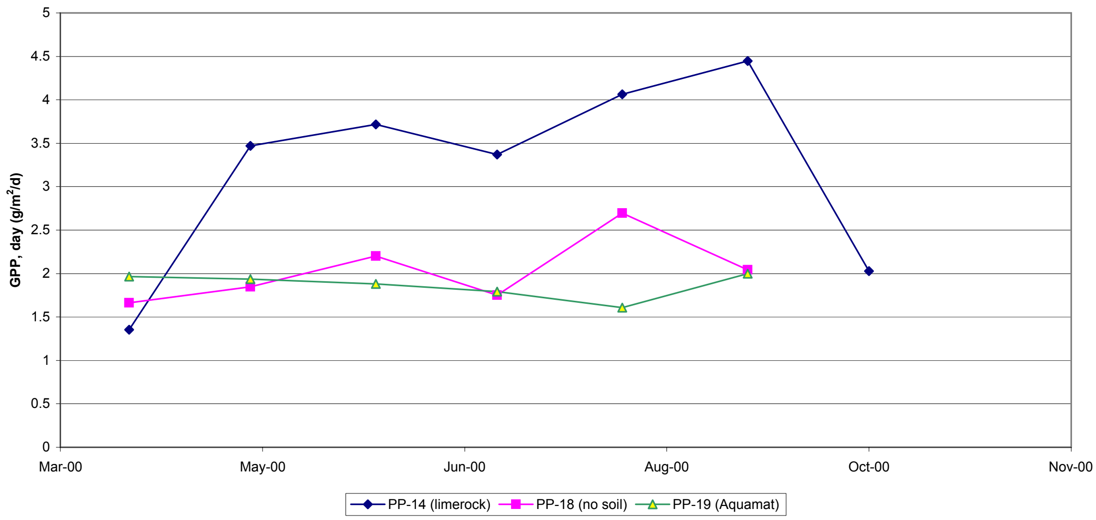
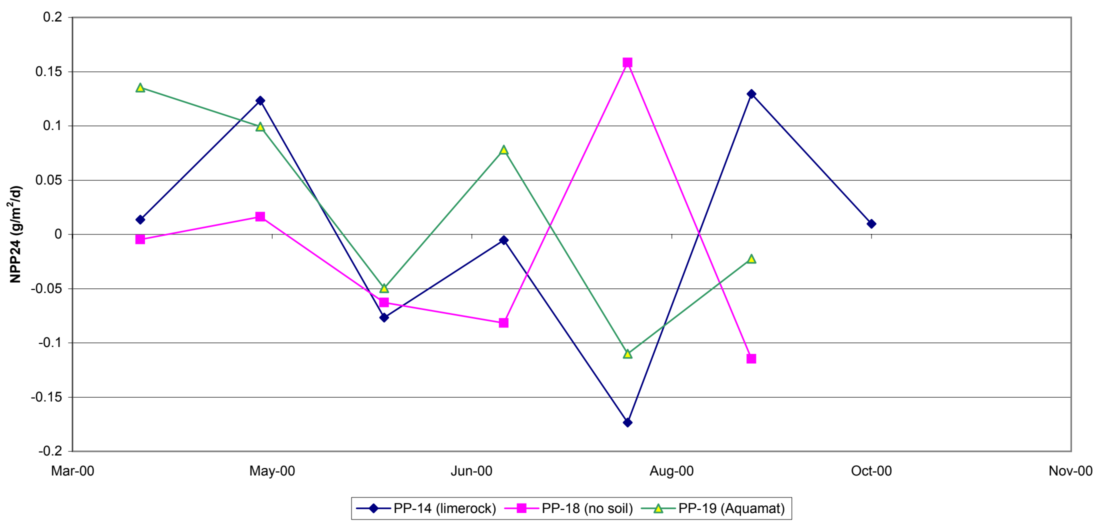


EXHIBIT 2-22
Temporal Pattern of Community Metabolism in Limerock, No Substrate, and Aquamat PSTA Treatments during Phase 2





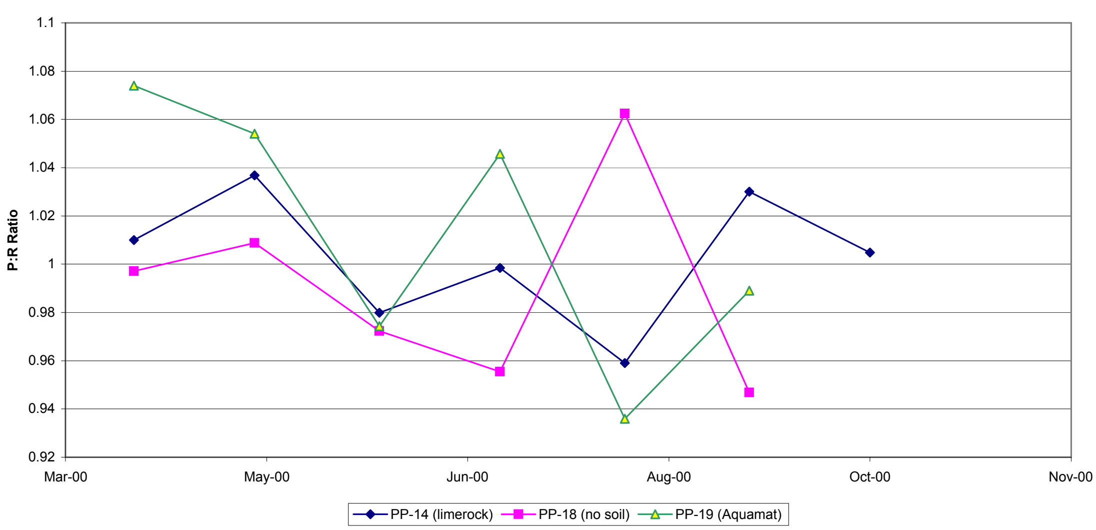


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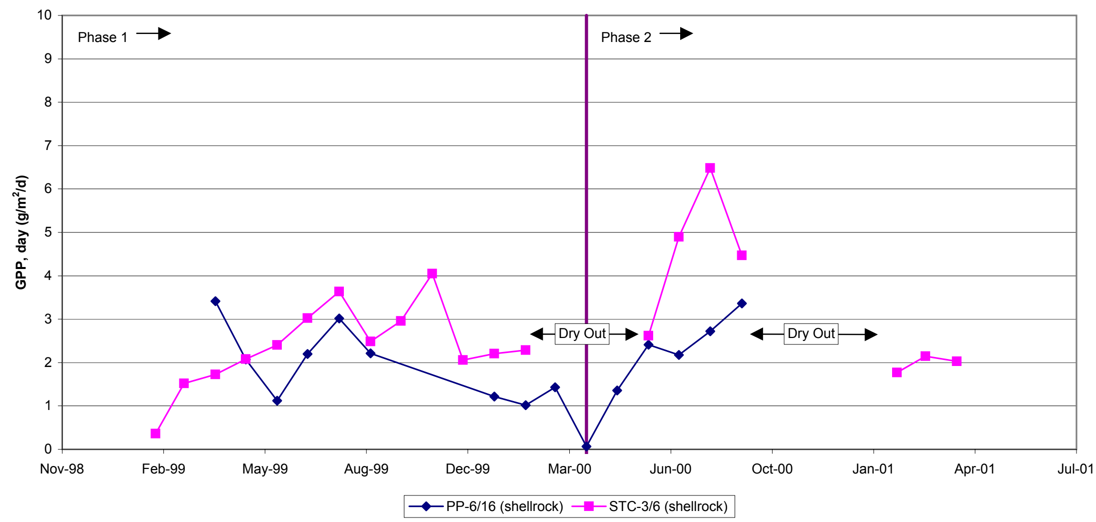
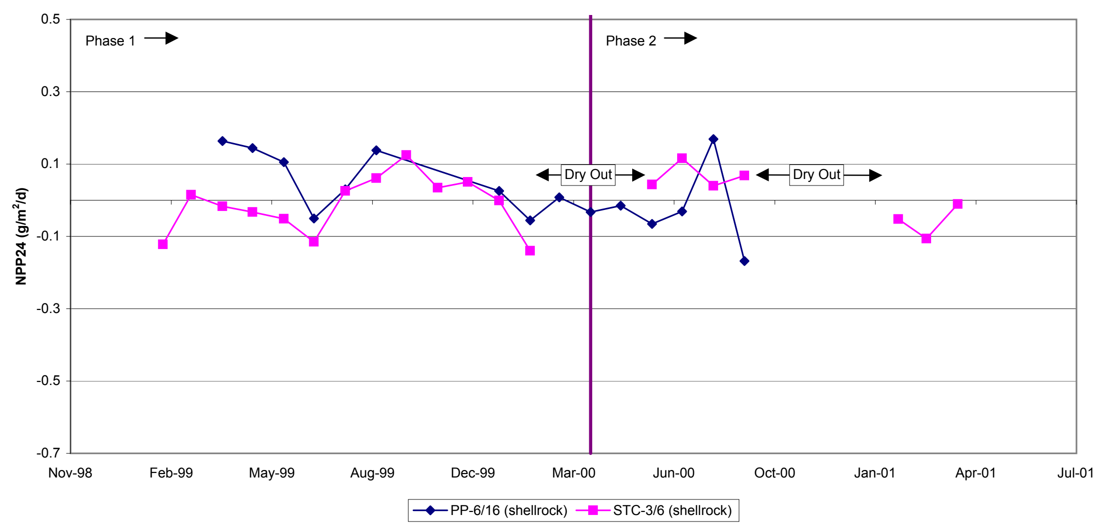
EXHIBIT 2-23
Temporal Pattern of Community Metabolism in Phase 1 and 2 Variable Water Depth PSTA Treatments





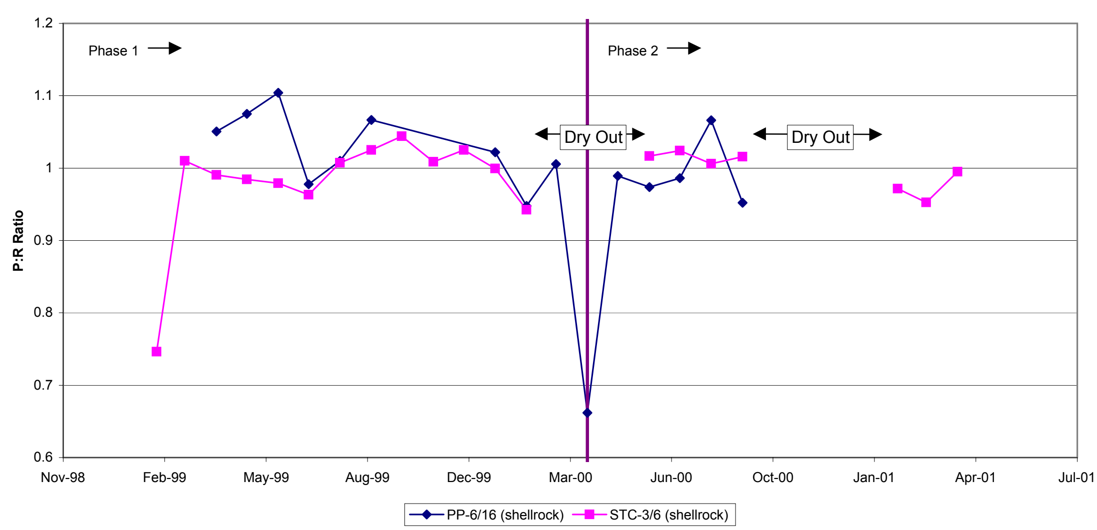


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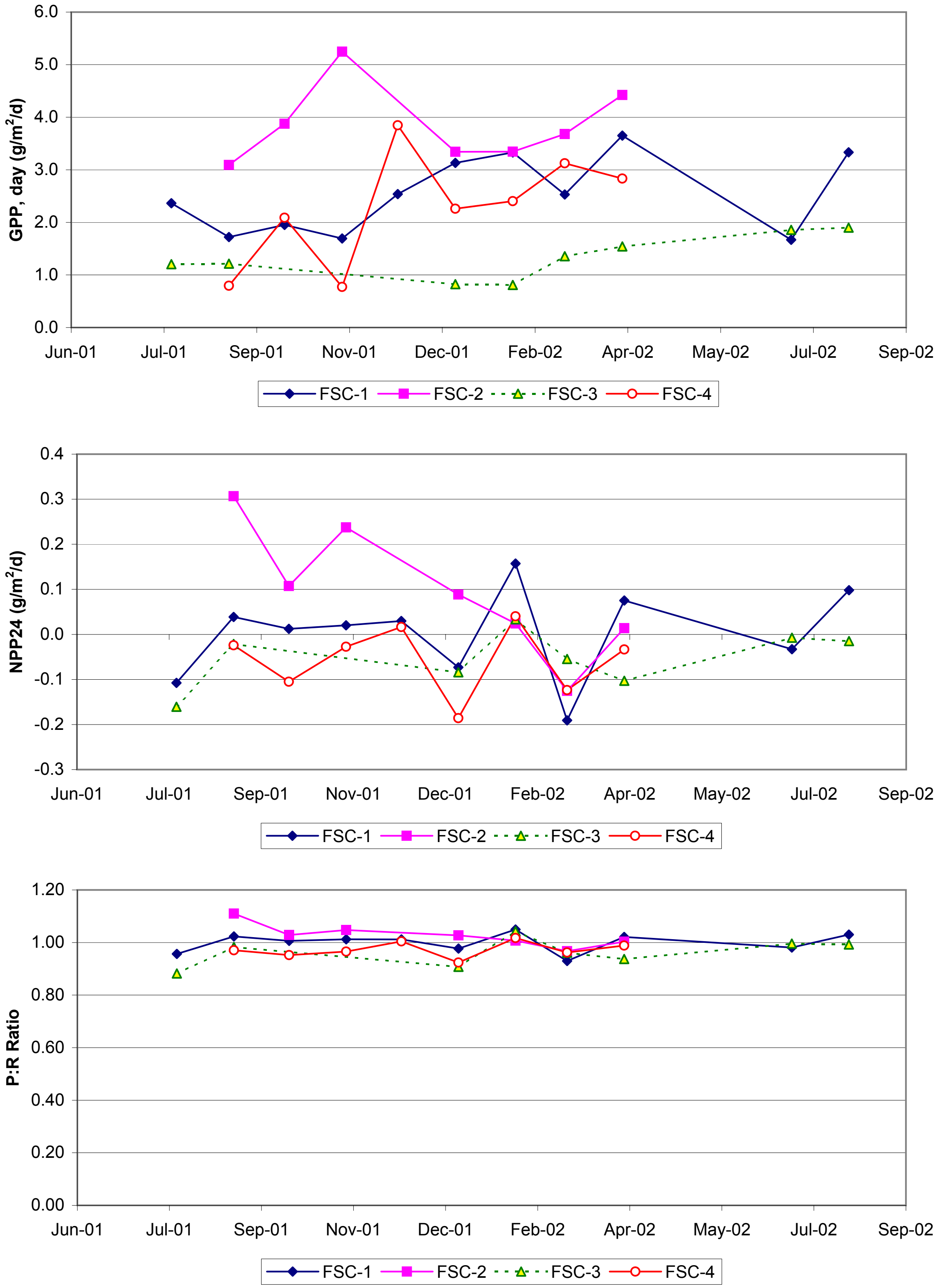
EXHIBIT 2-24
Temporal Pattern of Community Metabolism in the Phase 3 PSTA Field-Scale Cells



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low available-P antecedent soils reduced the rate of macrophyte colonization. Water depth control (increased water levels to lower macrophyte growth rates) is another tool that might be useful for decelerating the rate of emergent macrophyte growth. Both emergent and submerged macrophytes are not likely to be favored in PSTAs at the low end of the P concentration gradient.

Although a large periphyton biomass quickly developed on previously farmed peat (organic) soils, this periphyton community was relatively quickly dominated by volunteer or planted emergent and submerged macrophytes. For this reason, use of un-amended peat soils with high antecedent labile P content will likely require the greatest level of management to support a periphyton-dominated plant community. Soil selection for PSTA development is a cost issue, either initially to avoid unsuitable soils or during operation to control emergent macrophytes that tend to mine P from the soils and inhibit periphyton dominance. This high operational cost is not anticipated for peat soils with low antecedent concentrations of labile P.

On inorganic soils such as limerock, caprock, shellrock, and sand, the resulting periphyton community was viable after less than 1 year of development, and was similar in composition to natural Everglades periphyton communities. Such inorganic-soil-based communities also maintained an acceptable partial cover of emergent macrophytes with fewer cattails. High periphyton biomass and density was compatible with the spikerush populations established in the limerock and shellrock-based PSTAs. However, a shellrock or limerock-based system with dry-out appears to be the most viable-appearing PSTA because of reduced cover by both emergent and submerged macrophytes.

SECTION 3

Phosphorus Removal Performance and Effectiveness

3.1 Introduction

A primary objective of the PSTA Research and Development Project was to determine the effectiveness of this type of plant community for reduction of P loads to downstream surface waters. For the PSTA concept to be viewed as a useful P advanced treatment technology, it must be able to reduce concentrations and mass of TP in a predictable fashion. This P removal effectiveness must be repeatable based on specific design criteria, such as wetted area, substrate type and antecedent conditions, water depth, and flow rate. The main factors that control PSTA performance must be known to allow a defensible evaluation of the cost of full-scale implementation.

To be considered optimally effective, PSTAs must be able to:

- Lower average concentrations of TP to levels protective of downstream wetland and aquatic ecosystems. The planning-level target is an average of 10 µg/L TP.
- Reduce P mass load at a high enough rate to allow full-scale implementation within a realistic footprint.
- Perform TP removal in a predictable fashion that allows for successful design and reliable performance.
- Provide treatment under varying input load conditions.
- Recover from drought or flood conditions and return to a high level of performance within a reasonable time frame.
- Continue to perform into the foreseeable future with an affordable level of routine maintenance.

This section summarizes the Phase 1, 2, and 3 project findings related to the effectiveness of PSTA for P reduction in agricultural runoff.

3.2 Phosphorus Inflow Concentrations

Exhibit 3-1 summarizes the average data for various forms of P in the inflows to the PSTA test systems for the POR. The average inflow TP ranged from a low of 21.6 µg/L at the FSCs to 25.7 µg/L at the Porta-PSTAs. On average, approximately 43 to 62 percent of this TP was in the dissolved form, and the remainder was particulate P. Average DRP was 4.1 µg/L at the FSCs, 5.3 µg/L at the PSTA Test Cells, and 6.1 µg/L at the Porta-PSTAs.

As illustrated in Exhibits 3-2 and 3-3, inlet P concentrations were variable throughout the project period. While mean TP concentrations were similar at all three sites, TP reached maximum concentrations at the PSTA Test Cells during the late summer and fall of 1999 and mid-summer of 2000, while maximum TP values were recorded at the Porta-PSTAs in the spring of 1999 and throughout the first half of 2000. Highest TP concentrations were observed at the FSCs in the spring and late summer of 2002. These differences in TP inflow concentrations resulted from complex temporal variations in the concentrations of total dissolved phosphorus (TDP) and total particulate phosphorus (TPP) in the various inlet water supplies.

Exhibit 3-4 illustrates the net change in concentrations of various P forms between the raw water supply and the inflow sampling locations in the Phase 1 and 2 PSTA test systems. These data indicate that concentrations of TP were slightly reduced in the PSTA Test Cell inlet manifolds (average reduction of 1.6 µg/L) and in the Porta-PSTA manifolds (average reduction of 2.2 µg/L). The median reduction in TP concentration was approximately 1 µg/L at both sites. A similar decline was observed at the Field-Scale PSTA inflow canal where the average TP declined from approximately 24.5 to 20.4 µg/L between the inlet to the first cell (FSC-1) and the inlet to the final cell (FSC-4). TPP showed the greatest reduction between the feed water and the PSTA cell inlets, and dissolved organic phosphorus (DOP) increased by a lesser amount. The increase in TDP was less than the increase in DOP because of a slight decrease in the concentration of DRP. These types of subtle water quality changes are likely to occur in any full-scale raw water delivery system. Because source water TP concentrations were at times averaged in with PSTA cell inflow concentrations (when no specific inflow sample was available on the same date), the mass reductions described in this section partially incorporate these changes into the calculated performance estimates.

3.3 Phosphorus Removal Performance

3.3.1 Performance Periods

P outflow concentrations from the PSTA test systems were variable over the study period. Inlet and outlet P time-series plots for each mesocosm are

EXHIBIT 3-1

Average Inflow P Concentrations to South Test Cells, Porta-PSTA Mesocosms and Field-Scale Cells for the Period-of-Record

Parameter (µg/L)	South Test Cell Inflows					Porta-PSTA Inflows					Field-Scale PSTA Inflows				
	Avg.	Median	Max.	Min.	Count	Avg.	Median	Max.	Min.	Count	Avg.	Median	Max.	Min.	Count
Total phosphorus	23.0	20.7	102.0	12.0	103	25.7	20.3	154	11.7	74	21.6	18.0	64.0	8.0	76
Total particulate phosphorus	9.4	8.0	37.0	0.5	78	9.7	5.6	136	0.0	74	14.0	10.0	56.0	1.0	54
Total dissolved phosphorus	11.9	11.3	21.1	1.9	79	16.0	14.6	35.5	6.2	75	9.3	8.0	22.0	4.0	54
Dissolved reactive phosphorus	5.3	3.7	75.0	1.5	85	6.1	5.0	16.5	0.2	50	4.1	3.0	16.0	1.0	44
Dissolved organic phosphorus	8.8	7.7	25.9	1.2	49	7.4	7.6	13.4	0.0	29	5.1	5.0	12.0	0.0	44

Notes:

South Test Cells: February 23, 1999 - March 3, 2001

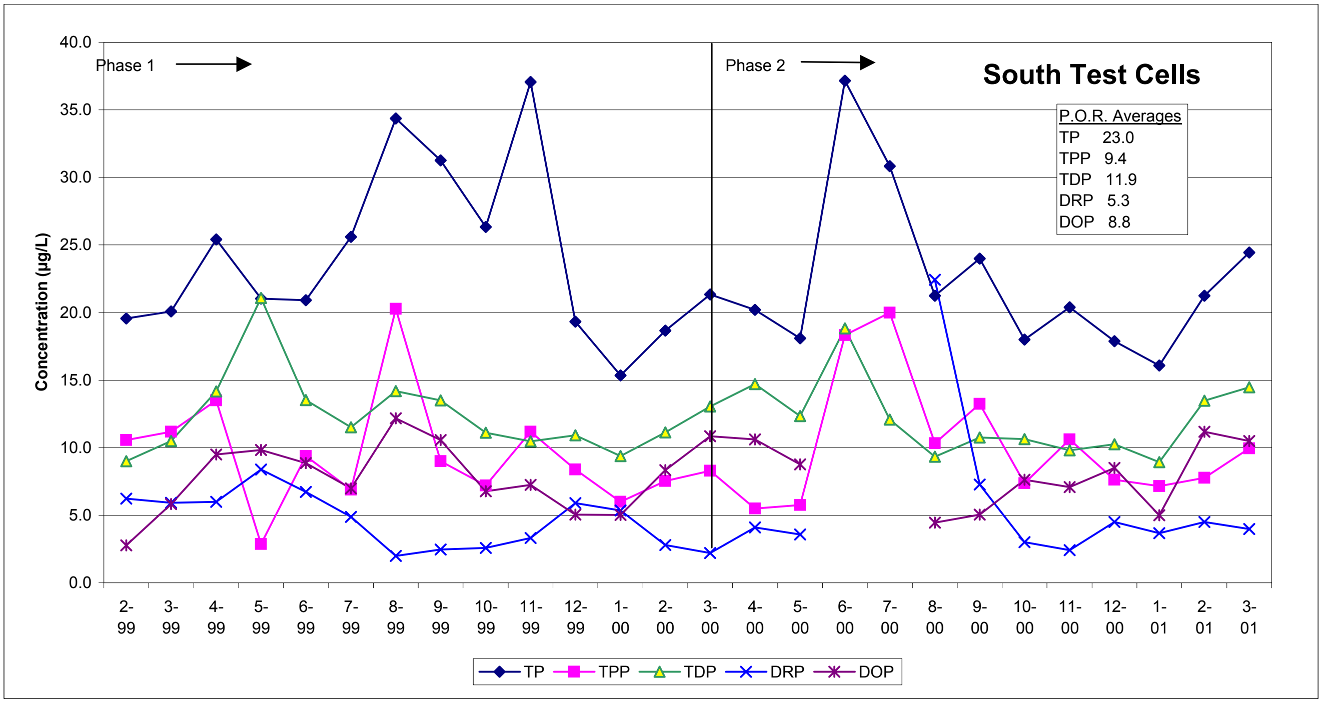
Porta-PSTAs: April 13, 1999 - October 2, 2000

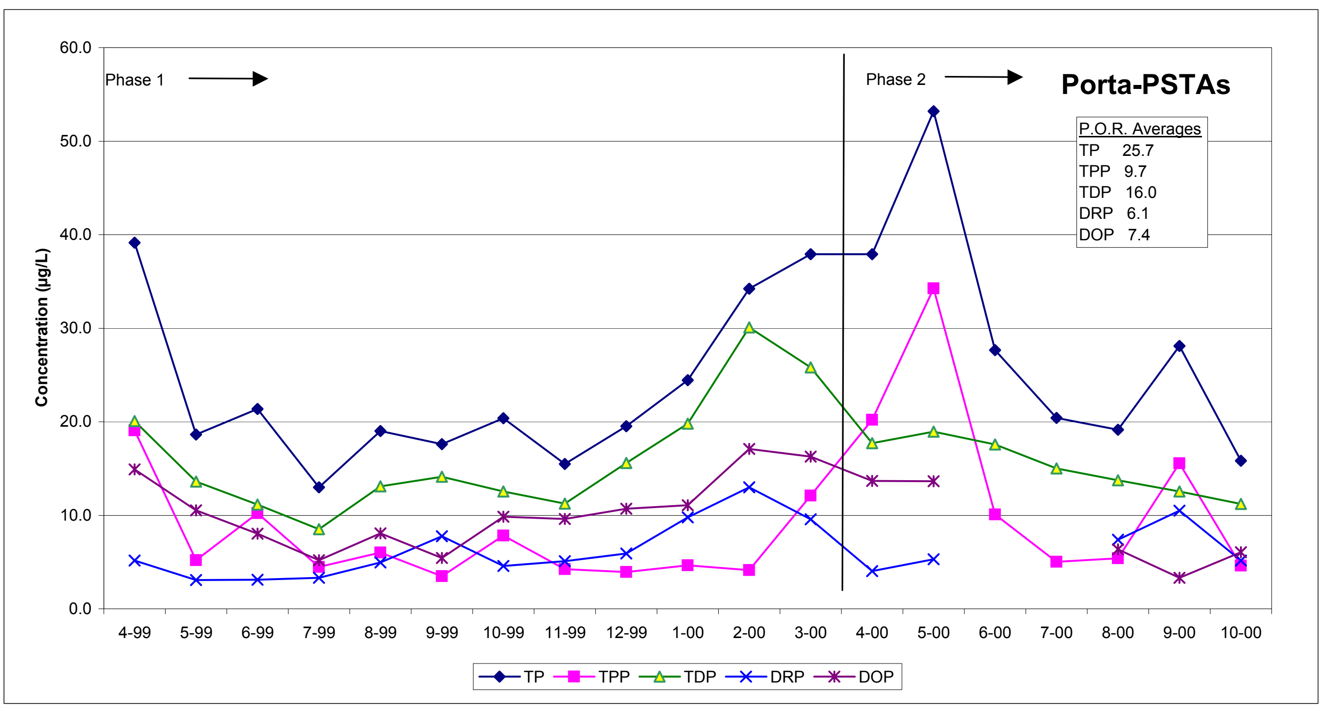
Field-Scale Cells: August 7, 2001 - Spetember 30, 2002

In some cases, individual P species do not add to TP because of differing sample sizes in averages.

EXHIBIT 3-2

Time Series of Input Concentrations of TP, TDP, TPP, DOP, and DRP in Source Water at the Phase 1 and 2 PSTA Test Sites





Notes:
TP = total phosphorus
TDP = total dissolved phosphorus
DOP = dissolved organic phosphorus
TPP = total particulate phosphorus
DRP = dissolved reactive phosphorus

EXHIBIT 3-3

Time Series of Input Concentraitons of TP, TDP, TPP, DOP, and DRP in Source Water at the Phase 3 PSTA Field-Scale Cells

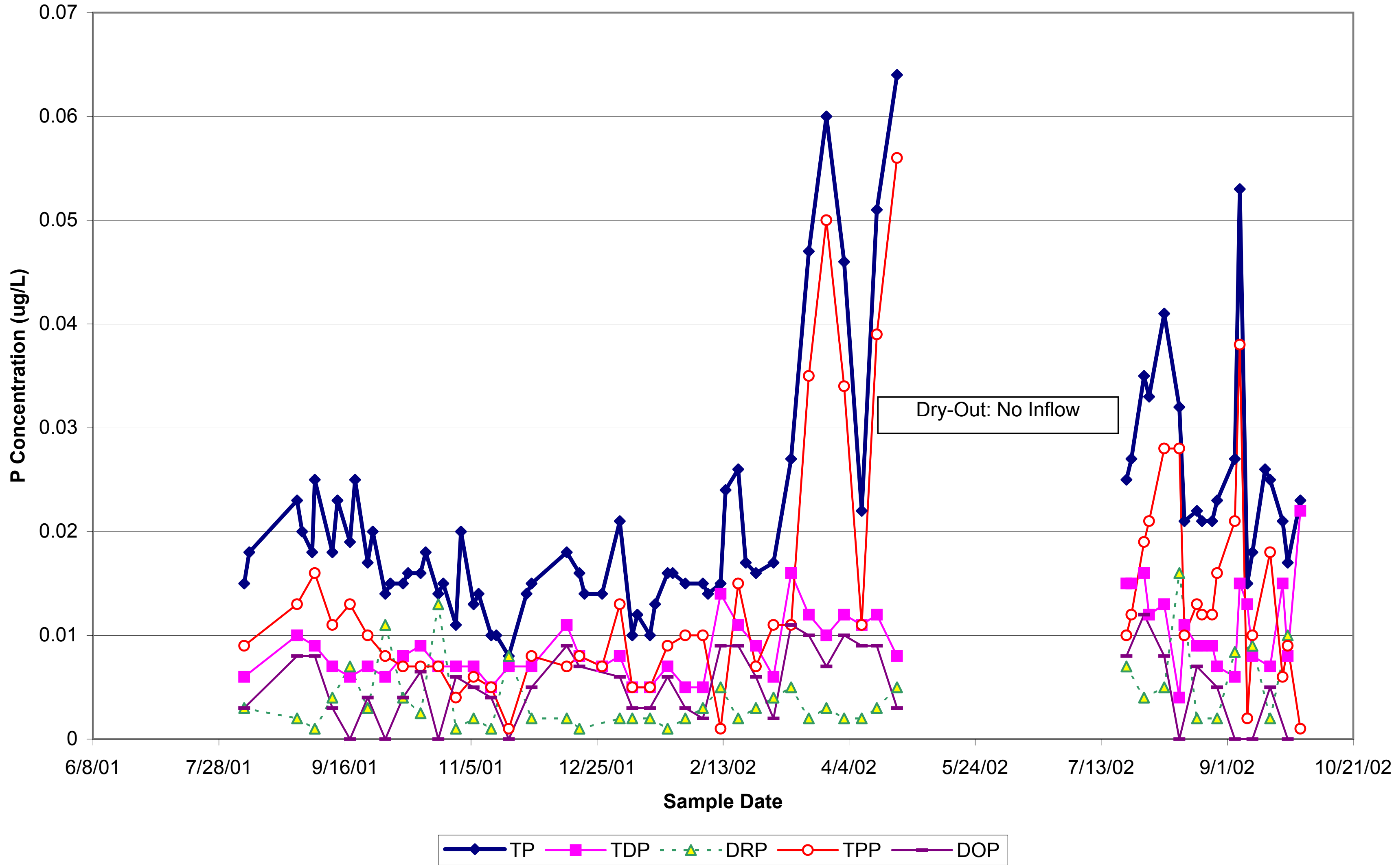


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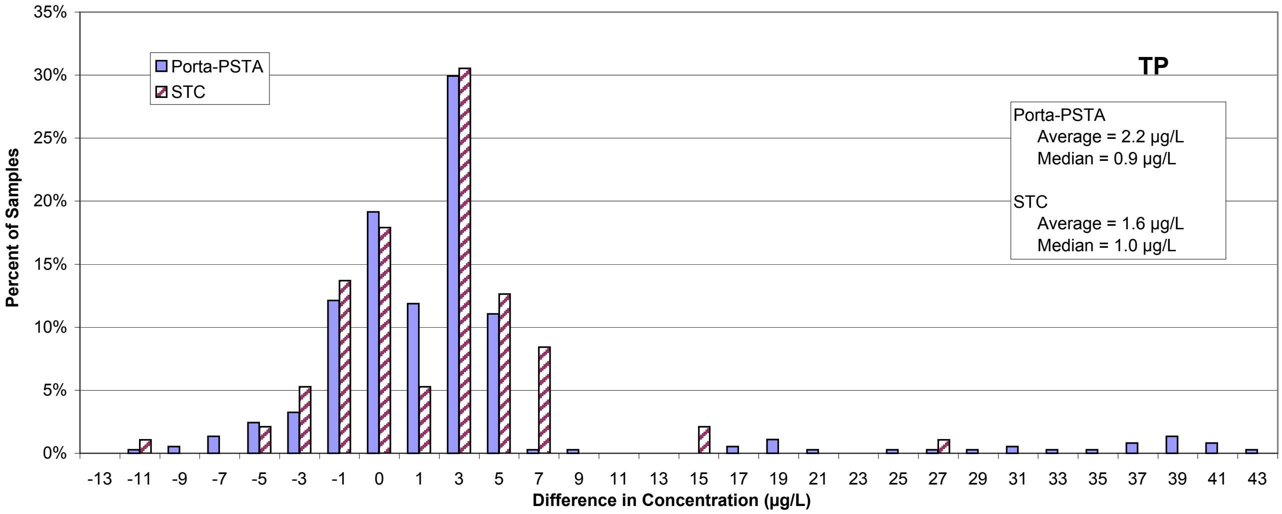
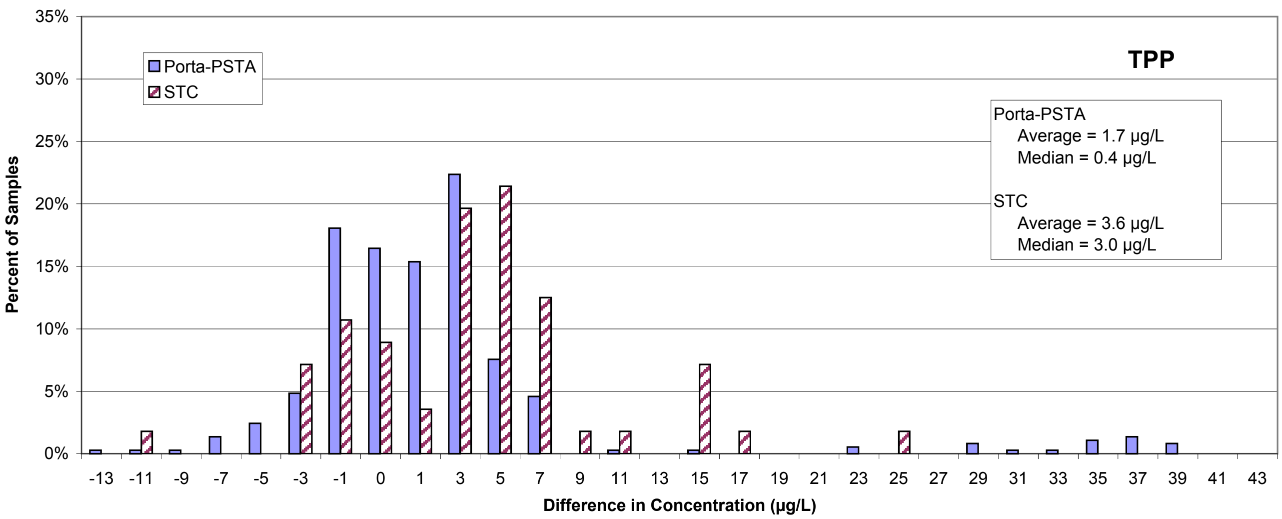
EXHIBIT 3-4

Difference Between Water Samples Collected from the Head Cell and Head Tank Stations and PSTA Inflow Stations for Phases 1 and 2





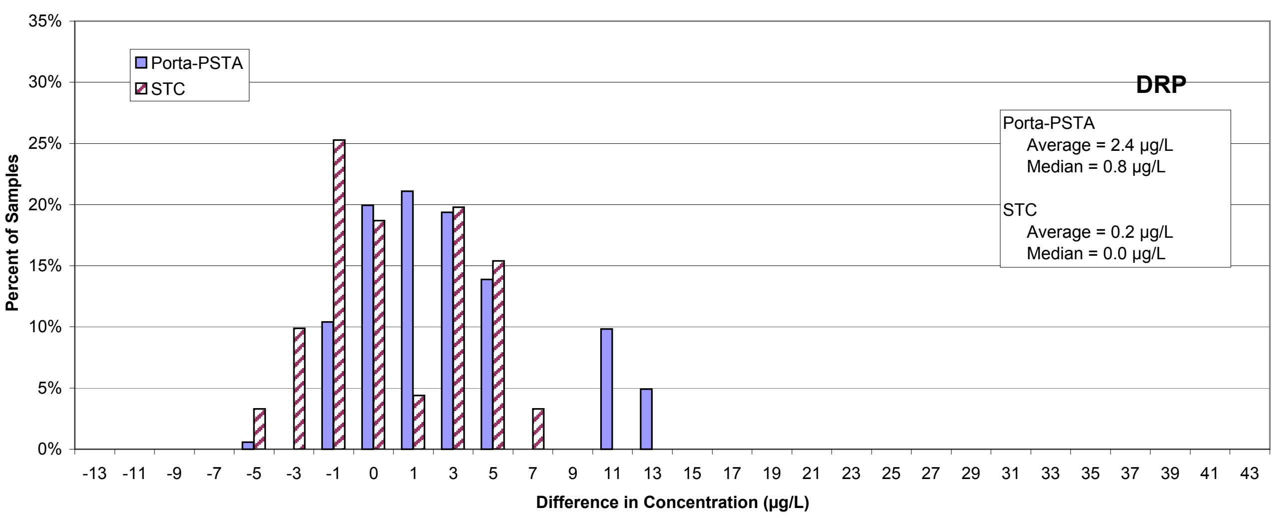
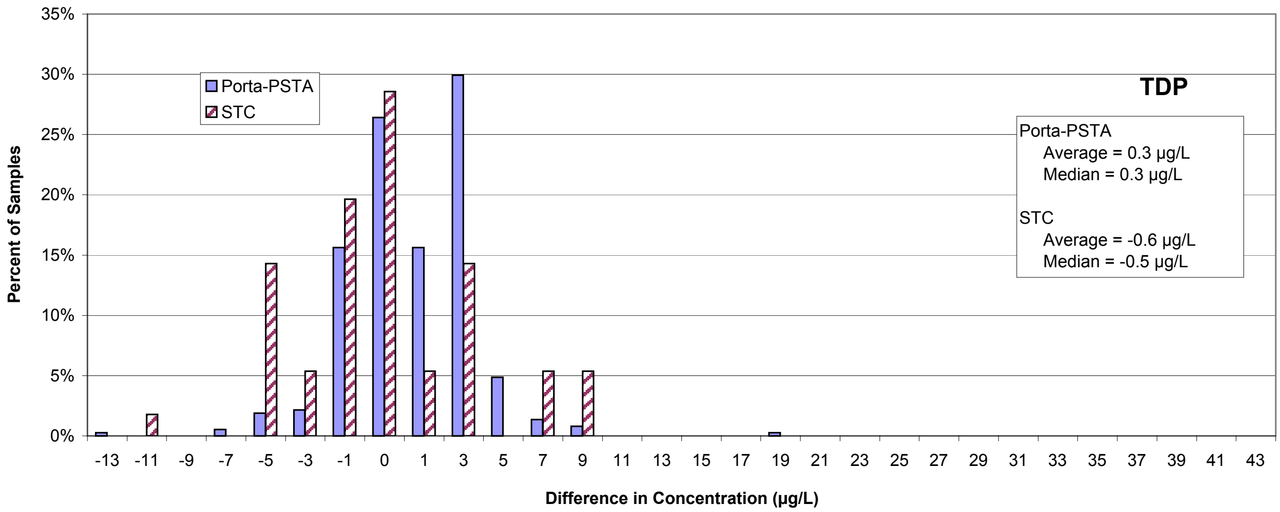
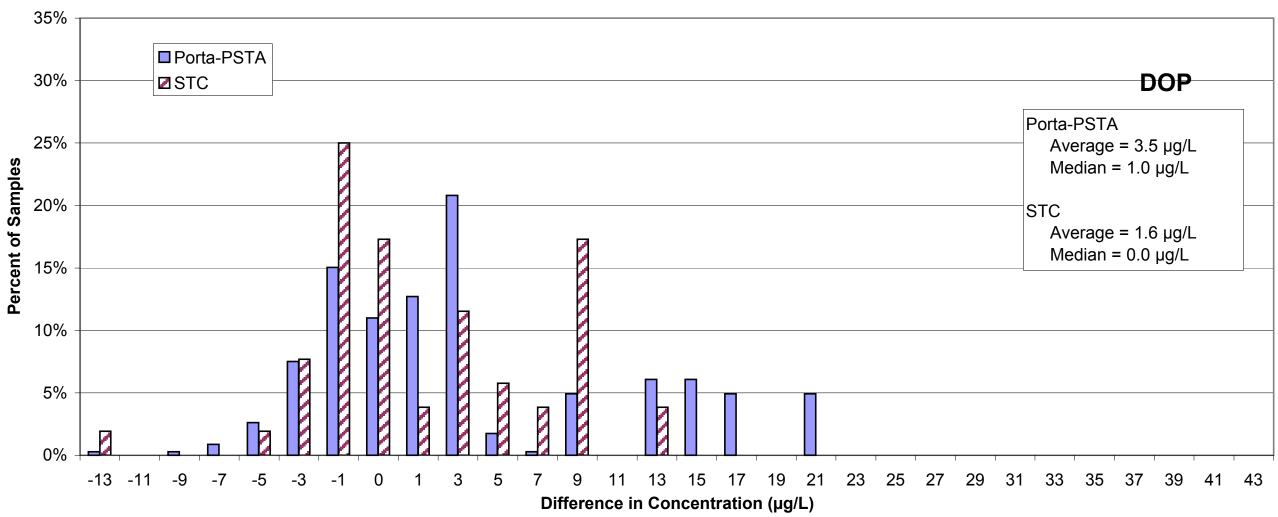


EXHIBIT 3-4

Difference Between Water Samples Collected from the Head Cell and Head Tank Stations and PSTA Inflow Stations for Phases 1 and 2





provided in Appendices C to E. PSTA performance data are summarized in this report for two operational periods, as described in Exhibit 3-5. The POR includes data for the entire testing period for each PSTA treatment. PSTA performance estimates for the POR present a very conservative view of P removal capability. This dataset includes the end of soil and plant growth startup phenomena.

The "Optimal Performance Period" (OPP) included a subset of the PSTA data for the non-startup portion of the POR for each experimental platform (Porta-PSTA tanks, PSTA Test Cells, and Field-Scale PSTA cells). The startup period prior to the OPP was typically 5 to 6 months in length. Performance estimates during the OPP were generally better than for the POR and represented an estimate of the long-term or steady-state P removal after completion of short-term startup phenomena.

3.3.2 Concentration Changes

Exhibit 3-6 summarizes the mean, median, maximum, and minimum concentrations for each P form during the POR. Exhibit 3-7 provides a similar summary for the OPP. The lowest POR average outflow TP concentrations were 11.7 µg/L for STC-5 (Phase 2 data only, which did not include any start-up effects), 14.2 µg/L for PP-17 (the sand-based Porta-PSTA with HCl rinse), 14.9 µg/L for FSC-3 (the scrape-down to caprock FSC), 15 µg/L for FSC-2 (the sinuous limerock FSC), 15.2 µg/L for PP-19 (the Aquamat [no soil] treatment), and 15.8 µg/L for PP-10 (shellrock-based Aquashade treatment) and PP-14 (limerock treatment). Median TP outflow concentrations were typically approximately 1 to 3 µg/L lower than average values. The POR median outflow TP concentration for STC-5 (shellrock Test Cell) was 11 µg/L. Minimum weekly TP values less than 10 µg/L were observed in 13 of the 25 PSTA treatments and in one Field-Scale treatment. POR average DRP values were less than 3.5 µg/L in all of the PSTA treatments, except for the Field-Scale peat system (4.4 µg/L).

Mean TP outflow concentrations for the OPP ranged from approximately 11.4 to 31.5 µg/L. Lowest mean outflow TP concentrations during the OPP were 11.4 µg/L for PP-17 (HCl-rinsed sand), 11.7 µg/L for STC-5 (shellrock), 13 µg/L for PP-2 (shellrock 60 cm), and 13.8 µg/L for PP-19 (Aquamat). Approximately 4 to 10 µg/L of this P was in the DOP form, and 4 to 8 µg/L was in the TPP form. All mean DRP outflow concentrations in the Phase 1 and 2 vegetated treatments were 2.2 µg/L or less. Average DRP outflow concentrations from the FSCs ranged from 3.0 µg/L in FSC-2 (sinuous limerock) to 5.1 µg/L in the peat cell (FSC-4).

3.3.3 Mass Removal

P mass loadings are a function of both inflow concentration and HLR. Exhibit 3-8 summarizes the average TP mass loading and removal data from the PSTA mesocosms based on the OPP described above. Inflow numbers in Exhibit 3-8 may be different than values in Exhibit 3-7 because head cell, head tank, and inflow canal numbers are averaged in with cell inflows to prepare these mass balances. OPP TP mass loadings averaged between 0.38 and

Exhibit 3-5

PSTA Period-of-Record and Optimal Performance Periods

Treatment	Phase	Cell	Substrate	Depth	HLR	Period of Record	# Days	Optimal Performance Period	# Days
PP-1	1	9,11,18	PE	D	L	4/13/99 - 3/13/00	335	10/4/99 - 1/10/00	98
PP-2	1	4,7,8	SR	D	L	4/13/99 - 3/13/00	335	10/4/99 - 1/10/00	98
PP-3	1, 2	12,14,17	PE	S	L	4/13/99 - 2/12/01	671	10/4/99 - 10/2/00	364
PP-4	1, 2	3,5,10	SR	S	L	4/13/99 - 2/12/01	671	10/4/99 - 10/2/00	364
PP-5	1	2,13,16	SR	D	H	4/13/99 - 3/27/00	349	10/4/99 - 3/27/00	175
PP-6	1	1,6,15	SR	V	V	4/13/99 - 3/13/00	335	10/4/99 - 3/13/00	161
PP-7	1, 2	19	SA	S	L	4/13/99 - 2/12/01	671	10/4/99 - 10/2/00	364
PP-8	1	20	SA	D	L	4/13/99 - 3/13/00	335	10/4/99 - 1/10/00	98
PP-9	1	21	PE (AS)	D	L	4/13/99 - 3/13/00	335	10/4/99 - 3/13/00	161
PP-10	1	22	SR (AS)	D	L	4/13/99 - 3/13/00	335	10/4/99 - 3/13/00	161
PP-11	1, 2	23	SR	S	L	4/13/99 - 2/12/01	671	10/4/99 - 10/2/00	364
PP-12	1, 2	24	PE	S	L	4/13/99 - 2/12/01	671	10/4/99 - 10/2/00	364
PP-13	2	9,11,18	PE (Ca)	S	L	4/17/00 - 2/12/01	301	6/5/00 - 10/2/00	119
PP-14	2	4,7,8	LR	S	L	4/17/00 - 2/12/01	301	6/5/00 - 10/2/00	119
PP-15	2	2,13,16	SR	S	R	4/3/00 - 2/12/01	315	6/5/00 - 10/2/00	119
PP-16	2	1,6,15	SR	V	V	5/1/00 - 2/12/01	287	6/5/00 - 10/2/00	119
PP-17	2	20	SA (HCl)	S	L	4/17/00 - 2/12/01	301	6/5/00 - 10/2/00	119
PP-18	2	21	None	S	L	4/17/00 - 2/12/01	301	6/5/00 - 10/2/00	119
PP-19	2	22	AM	S	L	4/17/00 - 2/12/01	301	6/5/00 - 10/2/00	119
STC-1	1	13	PE	D	L	2/23/99 - 3/6/00	377	7/6/99 - 1/31/00	209
STC-2	1	8	SR	D	L	2/23/99 - 3/27/00	398	7/6/99 - 3/27/00	265
STC-3	1	3	SR	V	V	2/23/99 - 3/6/00	377	7/6/99 - 3/6/00	244
STC-4	2	13	PE (Ca)	S	L	4/24/00 - 4/3/01	344	7/5/00 - 4/3/01	272
STC-5	2	8	SR	S	L	4/3/00 - 4/3/01	365	4/3/00 - 4/3/01	365
STC-6	2	3	SR	V	V	5/22/00 - 4/3/01	316	5/22/00 - 4/3/01	316
FSC-1	3	1	LR-PE	S	H	8/5/01 - 9/30/02	421	2/1/02 - 9/30/02	241
FSC-2	3	2	LR-PE	S	H	8/5/01 - 9/30/02	421	2/1/02 - 9/30/02	241
FSC-3	3	3	CR	S	H	8/5/01 - 9/30/02	421	2/1/02 - 9/30/02	241
FSC-4	3	4	PE	S	H	8/5/01 - 9/30/02	421	2/1/02 - 9/30/02	241

Notes:

Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

EXHIBIT 3-6

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Period-of-Record

								TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
PP-1	9,11,18	1	PE	D	L	Mean		22.3	17.7	6.4	8.6	16.1	9.3	6.4	2.4	10.9	7.8
						Median		19.0	15.7	4.6	7.6	14.5	8.7	5.0	2.1	10.0	7.4
						Max	3/13/00	45.0	66.0	22.0	53.0	35.5	16.5	16.5	6.3	22.5	13.5
						Min	4/13/99	11.7	10.3	0.0	0.3	6.2	5.5	1.8	1.2	0.0	3.7
						N		45	39	45	39	45	39	30	22	30	22
						StdDev		9.0	9.1	5.1	8.1	7.2	2.6	3.8	1.1	5.4	2.6
PP-2	4,7,8	1	SR	D	L	Mean		23.2	17.3	7.5	8.2	15.7	9.2	5.7	2.6	11.1	7.3
						Median		19.0	14.4	4.9	5.6	13.6	8.6	4.3	2.3	10.3	7.2
						Max	3/13/00	49.5	45.7	31.0	32.0	35.5	14.5	16.5	8.0	22.5	12.0
						Min	4/13/99	11.7	10.5	0.0	1.4	6.2	6.3	1.8	0.7	3.8	4.2
						N		41	36	41	36	41	36	27	22	27	22
						StdDev		10.1	8.9	7.0	7.6	7.1	2.3	3.6	1.7	5.2	2.2
PP-3	12,14,17	1, 2	PE	S	L	Mean		26.4	18.1	9.7	8.0	16.7	10.1	6.5	2.4	11.1	7.4
						Median		21.3	17.3	5.5	7.3	15.3	9.7	5.3	2.3	10.6	7.2
						Max	2/12/01	153.7	41.6	136.0	30.1	35.5	18.0	16.5	4.8	23.6	14.7
						Min	4/13/99	11.7	11.3	0.0	2.1	6.2	5.9	0.2	0.3	0.3	4.3
						N		76	77	76	77	77	77	53	27	53	27
						StdDev		17.4	5.2	15.9	4.4	6.7	2.7	3.8	0.9	5.4	2.6
PP-4	3,5,10	1, 2	SR	S	L	Mean		25.7	16.4	9.8	7.4	15.9	9.0	6.1	2.0	10.5	7.0
						Median		20.3	15.2	5.6	6.3	14.6	8.8	5.0	2.0	10.3	6.8
						Max	2/12/01	153.7	50.7	136.0	37.7	35.5	14.3	16.5	4.7	23.6	11.8
						Min	4/13/99	11.7	9.7	0.0	1.5	6.2	4.7	0.2	0.6	0.3	2.7
						N		75	75	75	75	76	75	51	26	51	26
						StdDev		17.4	6.1	16.1	5.1	5.7	2.3	3.6	1.0	4.9	2.7
PP-5	2,13,16	1	SR	D	H	Mean		23.1	18.2	6.8	8.0	16.3	10.1	6.3	2.1	11.0	8.1
						Median		19.3	16.3	4.6	6.5	14.1	9.3	4.8	1.9	9.8	7.7
						Max	3/27/00	45.0	35.7	22.0	22.7	35.5	17.7	16.5	5.3	22.5	15.3
						Min	4/13/99	11.7	11.1	0.0	1.9	6.2	6.2	1.8	1.1	3.8	4.3
						N		47	46	47	46	47	46	32	21	32	21
						StdDev		9.0	5.7	5.3	4.5	6.9	2.9	3.8	0.9	4.9	3.0
PP-6	1,6,15	1	SR	V	V	Mean		22.4	17.5	6.5	8.6	15.9	8.9	6.2	2.5	10.7	7.0
						Median		19.0	14.8	4.5	6.5	13.7	8.9	4.6	2.1	9.6	7.2
						Max	3/13/00	45.0	46.7	22.0	35.7	35.5	13.3	16.5	7.7	22.5	11.5
						Min	4/13/99	11.7	11.8	0.0	2.8	6.2	5.0	1.8	0.8	3.0	3.8
						N		46	45	46	45	46	45	31	21	31	21
						StdDev		8.6	7.6	5.1	6.6	6.7	2.2	3.8	1.5	4.8	2.2
PP-7	19	1, 2	SA	S	L	Mean		25.6	17.3	9.7	7.9	15.9	9.4	6.2	2.1	10.4	7.5
						Median		20.0	14.8	5.6	5.5	14.4	8.9	5.0	2.0	9.8	7.4
						Max	2/12/01	153.7	130.0	136.0	109.0	35.5	21.0	16.5	6.0	23.6	15.0
						Min	4/13/99	11.7	9.5	0.0	0.0	6.2	4.0	1.8	0.8	0.3	2.3
						N		74	73	74	73	75	73	50	23	50	23
						StdDev		17.4	14.3	16.1	12.9	6.0	3.1	3.5	1.3	5.1	3.3
PP-8	20	1	SA	D	L	Mean		22.4	20.0	6.5	10.5	15.9	9.5	6.3	2.2	10.5	7.7
						Median		19.0	16.1	4.7	7.3	13.4	9.2	5.1	2.0	9.0	7.2
						Max	3/13/00	45.0	88.0	22.0	70.0	35.5	18.0	16.5	5.0	22.5	17.0
						Min	4/13/99	11.7	12.5	0.0	2.6	6.2	5.9	1.8	1.0	0.7	3.1
						N		45	38	45	38	45	38	30	21	30	21

EXHIBIT 3-6

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Period-of-Record

								TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
						StdDev		8.9	12.5	5.1	11.1	7.2	2.6	3.8	0.9	5.4	3.3
PP-9	21	1	PE	D	L	Mean		22.5	18.5	6.6	7.6	16.0	11.0	6.3	2.7	10.7	7.9
			(Aquashade)			Median		19.0	16.1	5.0	6.5	13.6	9.5	5.0	2.2	9.1	7.5
						Max	3/13/00	45.0	38.1	22.0	31.1	35.5	27.0	16.5	8.4	22.5	15.0
						Min	4/13/99	11.0	10.3	0.0	0.0	6.2	5.0	1.8	0.9	3.8	3.7
						N		45	44	45	44	45	44	30	21	30	21
						StdDev		9.0	6.6	5.4	5.7	6.9	4.6	3.8	1.8	4.9	3.3
PP-10	22	1	SR	D	L	Mean		22.4	15.8	6.6	6.3	15.8	9.6	6.3	2.8	10.4	6.8
			(Aquashade)			Median		19.0	15.0	5.0	5.4	13.4	9.0	5.0	2.2	9.1	6.9
						Max	3/13/00	45.0	34.0	22.0	22.0	35.5	18.0	16.5	10.9	22.5	13.0
						Min	4/13/99	11.7	9.8	0.0	0.0	6.2	5.0	1.8	0.8	3.0	0.0
						N		46	44	46	44	46	45	31	22	31	22
						StdDev		8.6	5.0	5.0	4.2	6.8	2.8	3.7	2.4	4.9	2.9
PP-11	23	1, 2	SR	S	L	Mean		25.9	19.9	9.7	9.9	16.2	10.3	6.2	2.1	10.7	9.3
						Median		21.0	17.9	5.6	8.0	15.3	9.1	5.0	2.0	10.6	6.9
						Max	2/12/01	153.7	62.5	136.0	46.0	35.5	51.4	16.5	5.0	23.6	49.9
						Min	4/13/99	11.7	10.7	0.0	0.0	6.2	4.0	0.2	0.2	0.3	2.4
						N		74	72	74	72	75	74	50	25	50	25
						StdDev		17.5	10.0	16.1	8.5	6.1	5.8	3.6	1.0	5.2	9.0
PP-12	24	1, 2	PE	S	L	Mean		25.5	19.7	9.5	9.2	15.9	10.5	6.1	2.3	10.6	7.7
						Median		20.7	17.8	5.6	8.4	14.5	10.0	5.0	2.2	10.5	7.4
						Max	2/12/01	153.7	45.0	136.0	29.0	35.5	22.5	16.5	5.0	23.6	13.0
						Min	4/13/99	11.5	11.6	0.0	0.0	6.2	5.0	0.2	1.0	0.3	2.0
						N		74	72	74	72	75	74	50	24	50	24
						StdDev		17.4	6.4	16.1	5.4	6.2	2.9	3.6	0.9	5.2	2.6
PP-13	9,11,18	2	PE	S	L	Mean		31.0	18.9	15.4	8.5	15.5	10.6	6.4	1.9	9.1	4.3
			(Ca)			Median		23.2	19.3	9.2	7.3	14.3	9.7	5.2	1.8	7.8	4.4
						Max	2/12/01	153.7	40.3	136.0	24.7	30.3	19.7	14.0	2.5	23.6	5.0
						Min	4/17/00	15.8	8.7	2.0	2.7	9.3	4.7	3.7	1.3	0.3	3.3
						N		24	25	24	25	25	25	15	4	15	4
						StdDev		27.5	7.4	26.7	4.6	4.3	4.2	3.2	0.5	5.8	0.7
PP-14	4,7,8	2	LR	S	L	Mean		30.4	15.8	14.8	7.4	15.5	8.5	6.3	1.6	9.2	4.6
						Median		22.3	15.7	8.7	7.0	14.3	7.7	5.0	1.3	7.8	3.7
						Max	2/12/01	153.7	24.7	136.0	12.7	30.3	15.3	14.0	2.7	23.6	8.0
						Min	4/17/00	15.3	10.0	2.0	3.0	9.3	4.3	3.7	1.0	0.3	3.0
						N		24	25	24	25	25	25	15	4	15	4
						StdDev		27.4	4.5	26.6	2.6	4.4	3.2	3.3	0.8	5.9	2.3
PP-15	2,13,16	2	SR	S	R	Mean		30.8	17.9	15.1	8.1	15.6	9.9	6.2	2.4	9.5	3.8
						Median		24.1	16.7	9.3	7.7	14.3	9.0	5.3	2.5	9.3	3.7
						Max	2/12/01	153.7	31.7	136.0	16.3	30.3	17.3	14.0	3.0	23.6	5.0
						Min	4/3/00	15.7	9.3	2.0	4.0	9.3	5.0	3.7	1.7	0.3	3.0
						N		26	27	26	27	27	27	17	4	17	4
						StdDev		26.3	5.8	25.5	3.1	4.2	3.5	3.1	0.7	5.6	0.9
PP-16	1,6,15	2	SR	V	V	Mean		29.9	17.2	14.7	7.8	15.1	9.6	7.1	2.6	7.7	6.8
						Median		21.3	16.8	8.0	7.0	13.7	9.3	5.7	2.3	7.2	6.3
						Max	2/12/01	153.7	27.2	136.0	20.5	30.3	15.7	14.0	5.1	23.6	10.5
						Min	5/1/00	15.3	11.2	2.0	4.2	9.3	6.3	4.2	1.2	0.3	4.0

EXHIBIT 3-6

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Period-of-Record

Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
								Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
						N		20	20	20	20	21	21	11	5	11	5
						StdDev		30.0	4.4	29.1	3.6	4.6	2.5	3.5	1.5	6.4	2.4
PP-17	20	2	SA	S	L	Mean		30.4	14.2	14.7	5.3	15.7	8.9	6.2	2.0	9.4	6.3
			(HCl)			Median		22.3	13.0	8.7	4.0	14.3	9.0	5.0	2.0	7.8	5.0
						Max	2/12/01	153.7	30.0	136.0	19.0	30.3	16.0	14.0	3.0	23.6	11.0
						Min	4/17/00	15.0	7.0	2.0	0.0	9.3	4.0	3.7	1.0	0.3	3.0
						N		24	24	24	24	25	25	15	3	15	3
						StdDev		27.6	6.6	26.8	4.6	4.4	3.3	3.3	1.0	5.9	4.2
PP-18	21	2	None	S	L	Mean		30.5	16.5	14.9	6.6	15.5	10.4	6.4	2.0	9.2	5.0
						Median		22.3	15.0	9.0	5.0	14.3	9.0	5.0	2.0	7.8	5.0
						Max	2/12/01	153.7	32.0	136.0	20.0	30.3	28.0	14.0	3.0	23.6	6.0
						Min	4/17/00	16.0	8.0	2.0	0.0	9.3	5.0	3.7	1.0	0.3	4.0
						N		24	25	24	25	25	25	15	3	15	3
						StdDev		27.4	6.4	26.6	5.4	4.2	4.6	3.3	1.0	5.8	1.0
PP-19	22	2	None	S	L	Mean		30.3	15.2	14.6	5.4	15.6	10.0	6.2	1.2	9.4	4.5
			(Aquamat)			Median		23.2	14.0	8.7	4.0	14.3	9.0	5.0	1.0	7.8	5.0
						Max	2/12/01	153.7	35.0	136.0	23.0	30.3	20.0	14.0	1.5	23.6	6.0
						Min	4/17/00	15.0	7.0	2.0	0.0	9.3	4.0	3.7	1.0	0.3	2.5
						N		24	25	24	25	25	25	15	3	15	3
						StdDev		27.4	7.0	26.6	5.2	4.4	3.9	3.3	0.3	6.0	1.8
STC-1	13	1	PE	D	L	Mean		24.6	22.2	10.2	11.1	11.0	11.3	4.8	3.4	6.5	8.8
						Median		22.0	19.1	10.3	8.1	10.9	10.3	4.6	2.9	6.9	7.8
						Max	3/6/00	102.0	86.0	24.9	70.0	18.6	22.8	12.5	17.0	14.0	18.1
						Min	2/23/99	14.6	10.7	1.0	0.0	1.9	5.2	1.5	0.2	0.0	3.4
						N		50	52	27	52	27	52	50	30	27	30
						StdDev		13.1	12.9	5.6	11.8	3.3	4.0	2.8	3.1	3.4	3.8
STC-2	8	1	SR	D	L	Mean		24.0	17.3	8.0	7.1	12.5	10.3	4.7	3.2	8.3	9.0
						Median		21.0	14.9	6.5	6.0	12.1	8.2	4.2	2.3	7.8	8.0
						Max	3/27/00	102.0	57.0	21.1	46.0	27.8	22.4	13.0	16.6	17.6	19.0
						Min	2/23/99	12.5	8.5	0.0	0.0	1.9	5.2	1.5	0.7	0.0	0.2
						N		53	55	30	55	30	55	53	30	30	30
						StdDev		12.9	8.4	5.4	6.8	4.2	4.4	2.7	3.7	4.0	4.6
STC-3	3	1	SR	V	V	Mean		24.0	22.4	8.1	11.9	11.6	10.5	4.7	3.1	7.4	8.8
						Median		21.3	18.1	7.5	8.9	11.4	9.4	3.8	2.4	7.6	7.8
						Max	3/6/00	102.0	78.0	18.6	69.0	21.0	25.0	11.0	23.1	18.0	20.0
						Min	2/23/99	12.5	10.8	2.0	0.0	1.9	6.1	1.5	0.5	0.0	0.0
						N		50	52	27	52	27	52	50	30	27	30
						StdDev		13.2	12.1	4.4	10.9	3.2	4.0	2.7	3.9	3.7	4.2
STC-4	13	2	PE	S	L	Mean		22.1	29.1	10.3	13.1	11.7	15.8	6.7	2.0	7.6	10.8
			(Ca)			Median		20.0	21.5	9.0	9.0	11.0	11.0	3.7	1.9	7.8	10.1
						Max	4/3/01	64.0	186.0	43.0	83.0	21.0	103.0	75.0	5.1	13.0	25.9
						Min	4/24/00	12.0	9.0	2.0	0.0	7.0	5.0	1.9	1.0	0.0	5.7
						N		47	48	45	47	46	48	29	18	28	18
						StdDev		8.7	30.3	7.8	15.6	3.1	15.4	13.5	1.1	2.9	5.0
STC-5	8	2	SR	S	L	Mean		22.1	11.7	10.1	4.3	12.0	7.3	6.3	2.0	8.2	5.0
						Median		20.5	11.0	8.9	4.0	11.0	7.0	3.3	1.8	8.0	4.7
						Max	4/3/01	64.0	29.0	43.0	14.0	21.0	15.0	75.0	4.0	13.4	7.2

EXHIBIT 3-6

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Period-of-Record

Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	TP (µg/L) Inflow	TP (µg/L) Outflow	TPP (µg/L) Inflow	TPP (µg/L) Outflow	TDP (µg/L) Inflow	TDP (µg/L) Outflow	DRP (µg/L) Inflow	DRP (µg/L) Outflow	DOP (µg/L) Inflow	DOP (µg/L) Outflow
						Min	4/3/00	12.0	7.0	0.5	0.0	7.0	4.0	1.9	1.0	0.0	2.0
						N		50	51	48	50	49	51	32	17	31	17
						StdDev		8.5	3.7	7.7	2.5	3.2	2.2	12.9	0.9	3.0	1.5
STC-6	3	2	SR	V	V	Mean		23.7	18.8	11.4	8.1	12.2	10.7	9.0	1.8	7.7	9.1
						Median		23.0	18.5	10.4	7.0	11.3	10.0	3.4	1.0	8.0	10.0
						Max	4/3/01	47.0	56.7	37.0	40.7	22.0	16.0	75.0	4.0	14.0	12.0
						Min	5/22/00	15.0	9.0	2.0	2.0	7.0	4.5	2.0	1.0	0.0	5.5
						N		28	28	26	27	27	28	16	5	15	5
						StdDev		6.9	9.1	6.9	7.3	3.6	3.4	18.0	1.3	4.0	2.7
FSC-1	3	1	LR-PE	S	H	Mean		24.5	18.6	14.9	10.8	9.6	7.8	2.3	2.8	7.3	4.8
						Median		22.8	17.0	13.5	10.0	9.0	7.0	2.0	1.5	7.3	5.0
						Max	9/30/02	40.0	47.0	33.0	37.0	16.0	14.0	7.0	9.0	14.0	10.5
						Min	8/7/01	16.0	10.0	3.0	0.0	7.0	4.0	1.0	0.0	2.0	0.0
						N		12	55	12	39	12	39	12	31	12	31
						StdDev		7.9	7.5	8.3	7.2	2.7	2.3	1.9	2.5	3.3	2.6
FSC-2	3	2	LR-PE	S	H	Mean		21.5	15.0	12.0	7.2	9.5	9.8	3.5	2.6	6.1	7.1
						Median		20.0	14.0	13.0	7.0	9.0	9.0	2.5	2.0	5.0	5.0
						Max	9/30/02	30.0	35.5	17.0	20.0	15.0	39.0	10.0	13.0	13.0	38.0
						Min	8/7/01	16.0	9.0	1.0	0.0	6.0	4.5	0.5	0.5	2.0	0.0
						N		11	61	11	44	11	44	11	35	11	35
						StdDev		4.7	5.0	4.4	5.1	3.1	5.5	2.9	2.4	3.1	6.5
FSC-3	3	3	CR	S	H	Mean		20.6	14.9	12.8	8.4	7.8	7.2	3.2	2.6	4.7	4.6
						Median		21.0	14.0	13.0	9.0	7.0	6.5	2.0	2.0	6.0	4.0
						Max	9/30/02	32.0	25.0	23.0	17.0	10.0	16.0	9.0	16.0	7.0	11.0
						Min	8/7/01	14.0	9.0	6.0	0.0	7.0	4.0	1.0	0.5	0.0	0.0
						N		13	76	13	54	13	54	13	44	13	44
						StdDev		5.5	3.7	5.2	3.6	1.0	2.7	2.8	2.7	2.4	2.5
FSC-4	3	4	PE	S	H	Mean		20.4	27.7	10.0	16.8	10.8	12.6	3.8	4.4	7.0	7.6
						Median		17.5	24.5	9.5	15.0	8.0	12.0	2.5	3.0	6.0	6.0
						Max	9/30/02	37.0	59.0	19.0	46.0	21.0	22.0	12.0	11.0	19.0	15.0
						Min	8/7/01	11.0	9.0	0.0	2.0	5.0	7.0	2.0	1.0	3.0	3.0
						N		8	34	8	27	8	27	8	19	8	19
						StdDev		8.0	12.3	6.0	11.5	6.6	4.1	3.4	3.5	5.3	3.7

Notes:

Mesocosm Treatments: PP = Porta-PSTAs, STC = South Test Cells, FSC = Field-Scale Cell

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caproc

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

EXHIBIT 3-7

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Optimal Performance Period (Excluding Startup)

							Key	TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Dates	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
PP-1	9,11,18	1	PE	D	L	Mean		18.8	14.1	4.9	6.1	13.9	8.1	5.3	1.7	10.0	7.5
						Median		17.3	13.6	3.6	5.4	13.6	8.2	4.9	1.7	10.0	7.4
						Max	1/10/00	27.4	17.7	16.4	10.0	24.5	10.6	6.1	2.0	10.4	8.4
						Min	10/4/99	14.3	10.3	1.1	2.3	7.4	5.5	4.8	1.3	9.6	6.6
						N		15	15	15	15	15	15	3	3	3	3
						StdDev		4.2	2.4	3.7	2.3	3.9	1.6	0.7	0.4	0.4	0.9
PP-2	4,7,8	1	SR	D	L	Mean		19.1	13.0	5.0	4.7	14.1	8.2	5.1	1.3	10.8	7.6
						Median		18.0	11.9	4.3	4.9	13.6	8.2	5.0	1.6	10.9	7.4
						Max	1/10/00	27.4	16.7	16.4	6.8	24.5	10.9	5.9	1.7	11.2	8.4
						Min	10/4/99	14.3	10.7	1.7	1.4	7.4	6.3	4.4	0.7	10.3	7.0
						N		15	15	15	15	15	15	3	3	3	3
						StdDev		4.2	2.0	3.6	1.5	3.9	1.4	0.7	0.5	0.5	0.7
PP-3	12,14,17	1, 2	PE	S	L	Mean		28.3	17.0	10.8	7.3	17.4	9.8	7.7	2.4	11.9	6.4
						Median		23.8	17.2	5.7	7.3	16.0	9.5	6.1	2.4	12.1	6.8
						Max	9/25/00	153.7	29.3	136.0	16.0	35.5	18.0	16.5	3.0	23.6	8.0
						Min	10/4/99	14.3	11.6	1.8	2.1	7.4	5.7	2.7	1.7	0.3	4.3
						N		50	51	50	51	51	51	28	5	28	5
						StdDev		20.0	3.6	19.1	3.2	6.2	2.5	3.8	0.6	5.5	1.6
PP-4	3,5,10	1, 2	SR	S	L	Mean		28.8	14.6	11.2	5.8	17.5	8.9	7.7	1.5	11.9	5.4
						Median		25.2	14.3	6.2	5.3	16.2	8.9	5.9	1.4	12.3	6.1
						Max	10/2/00	153.7	23.0	136.0	12.7	35.5	14.3	16.5	2.0	23.6	7.6
						Min	10/26/99	14.3	9.7	0.6	1.5	7.4	4.7	2.7	0.6	0.3	2.7
						N		48	49	48	49	49	49	28	5	28	5
						StdDev		20.4	3.2	19.6	2.2	6.1	2.2	3.9	0.6	5.2	2.4
PP-5	2,13,16	1	SR	D	H	Mean		25.0	16.4	6.1	6.2	18.9	10.1	9.5	1.8	14.3	7.9
						Median		22.8	15.6	4.5	6.1	16.1	9.7	9.8	1.7	12.7	7.9
						Max	3/27/00	45.0	23.7	18.5	11.5	35.5	16.0	16.5	2.3	22.5	7.9
						Min	10/4/99	14.3	11.1	1.8	1.9	7.4	6.7	2.7	1.4	8.9	7.8
						N		26	26	26	26	26	26	13	3	13	3
						StdDev		9.0	3.5	4.4	2.1	7.8	2.5	3.8	0.4	4.5	0.1
PP-6	1,6,15	1	SR	V	V	Mean		24.1	14.5	5.6	6.1	18.5	8.4	9.9	1.0	14.0	7.3
						Median		22.2	14.1	4.5	5.8	15.9	8.4	10.5	1.0	13.3	6.8
						Max	3/13/00	45.0	20.6	16.4	12.5	35.5	13.1	16.5	1.3	22.5	8.5
						Min	10/4/99	14.3	11.8	1.3	2.8	7.4	5.0	4.6	0.8	8.7	6.4
						N		24	24	24	24	24	24	11	3	11	3
						StdDev		8.6	2.2	3.8	2.1	7.7	2.0	3.7	0.3	4.6	1.1
PP-7	19	1, 2	SA	S	L	Mean		27.8	15.2	10.5	6.0	17.3	9.1	7.5	1.2	12.0	5.9
						Median		24.0	14.2	5.7	5.0	16.0	8.9	5.6	1.0	12.0	6.0
						Max	10/2/00	153.7	28.5	136.0	20.0	35.5	17.5	16.5	2.0	23.6	8.7
						Min	10/4/99	14.3	9.5	0.8	0.0	7.4	4.0	2.7	0.8	0.3	3.0
						N		51	52	51	52	52	52	29	5	29	5
						StdDev		19.8	4.4	18.9	4.1	6.2	2.8	3.9	0.5	5.3	2.4
PP-8	20	1	SA	D	L	Mean		19.3	16.1	5.3	7.1	14.0	9.0	6.1	1.8	9.4	8.1
						Median		19.0	14.3	4.6	5.4	13.6	9.1	6.4	1.8	9.4	7.7
						Max	1/10/00	27.4	25.3	16.4	18.3	24.5	12.5	6.7	1.9	10.1	9.3
						Min	10/4/99	14.3	12.5	1.8	2.6	7.4	5.9	5.1	1.6	8.6	7.2
						N		15	15	15	15	15	15	3	3	3	3

EXHIBIT 3-7

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Optimal Performance Period (Excluding Startup)

Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
								Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
						StdDev		4.2	4.1	3.5	4.7	3.9	1.7	0.9	0.2	0.8	1.1
PP-9	21	1	PE	D	L	Mean		24.0	19.5	5.4	8.4	18.7	11.3	10.0	1.7	14.4	7.6
			(Aquashade)			Median		22.1	17.4	4.6	6.6	16.1	9.7	10.5	1.6	15.6	7.5
						Max	3/13/00	45.0	38.1	16.4	31.1	35.5	27.0	16.5	2.1	22.5	7.8
						Min	10/4/99	14.3	13.6	0.8	0.0	7.4	5.0	4.9	1.3	7.5	7.4
						N		24	24	24	24	24	24	11	3	11	3
						StdDev		8.8	6.3	3.8	6.6	7.8	5.1	3.6	0.4	4.7	0.2
PP-10	22	1	SR	D	L	Mean		24.2	14.6	5.6	5.0	18.6	9.7	9.8	3.9	14.4	5.1
			(Aquashade)			Median		21.2	14.0	4.6	4.9	16.1	9.4	10.5	1.9	14.0	6.4
						Max	3/13/00	45.0	24.0	16.4	11.9	35.5	15.0	16.5	10.9	22.5	7.6
						Min	10/4/99	14.3	9.8	0.9	0.9	7.4	5.0	3.4	0.8	9.1	0.0
						N		24	24	24	24	24	24	11	4	11	4
						StdDev		8.8	3.3	3.8	2.6	7.7	2.7	3.9	4.7	4.3	3.5
PP-11	23	1, 2	SR	S	L	Mean		28.1	17.8	10.5	8.0	17.5	9.6	7.7	1.7	12.2	6.1
						Median		24.0	17.8	5.7	7.7	16.2	9.4	6.0	1.8	12.6	6.9
						Max	10/2/00	153.7	27.0	136.0	20.0	35.5	25.0	16.5	3.0	23.6	9.4
						Min	10/4/99	14.0	10.7	0.0	0.9	7.4	4.0	2.7	0.6	0.3	3.0
						N		51	50	51	50	52	52	29	5	29	5
						StdDev		19.9	4.7	18.9	3.9	6.4	3.2	3.8	0.9	5.6	2.6
PP-12	24	1, 2	PE	S	L	Mean		27.8	18.6	10.3	8.1	17.5	10.6	7.6	2.3	12.1	6.3
						Median		24.0	17.2	5.3	7.6	16.1	10.2	6.0	1.6	12.2	6.8
						Max	10/2/00	153.7	37.0	136.0	23.0	35.5	22.5	16.5	5.0	23.6	9.9
						Min	10/4/99	14.0	11.6	0.0	0.0	7.4	5.0	2.7	1.0	0.3	2.0
						N		51	50	51	50	52	52	29	5	29	5
						StdDev		19.9	5.2	19.0	4.3	6.4	3.1	3.8	1.7	5.6	3.3
PP-13	9,11,18	2	PE	S	L	Mean		23.1	16.2	8.4	7.3	14.7	9.0	8.0	1.8	5.5	4.1
			(Ca)			Median		21.0	17.0	6.2	7.0	13.7	9.0	5.7	1.7	6.3	4.3
						Max	10/2/00	42.3	23.7	28.0	12.0	19.7	15.0	14.0	2.5	9.3	4.5
						Min	6/5/00	15.8	8.7	2.0	2.7	10.0	4.7	5.0	1.3	0.3	3.3
						N		16	17	16	17	17	17	7	3	7	3
						StdDev		7.2	4.9	6.5	2.8	2.9	3.1	4.2	0.6	3.3	0.6
PP-14	4,7,8	2	LR	S	L	Mean		23.1	14.5	8.4	7.3	14.6	7.3	7.8	1.2	5.5	4.8
						Median		21.0	13.7	6.8	7.0	13.7	7.3	5.0	1.0	6.3	3.3
						Max	10/2/00	42.3	22.3	28.0	11.7	19.7	12.0	14.0	1.7	9.3	8.0
						Min	6/5/00	15.3	10.0	2.0	3.0	10.0	4.3	4.3	1.0	0.3	3.0
						N		16	17	16	17	17	17	7	3	7	3
						StdDev		7.4	3.9	6.5	2.4	3.1	2.4	4.3	0.4	3.3	2.8
PP-15	2,13,16	2	SR	S	R	Mean		23.1	14.6	8.4	6.6	14.6	8.1	8.1	2.2	5.3	3.4
						Median		21.0	15.0	6.7	6.7	13.7	7.7	6.0	2.0	6.3	3.3
						Max	10/2/00	42.3	19.2	28.0	11.3	19.7	12.3	14.0	3.0	9.3	4.0
						Min	6/5/00	15.7	9.3	2.0	4.0	10.0	5.0	5.0	1.7	0.3	3.0
						N		16	17	16	17	17	17	7	3	7	3
						StdDev		7.3	2.9	6.5	1.9	2.9	2.4	4.1	0.7	3.2	0.5
PP-16	1,6,15	2	SR	V	V	Mean		23.1	17.0	8.4	7.7	14.6	9.3	8.2	2.1	5.2	5.8
						Median		21.0	16.0	6.7	7.0	13.7	9.3	6.7	2.3	6.3	5.8
						Max	10/2/00	42.3	27.2	28.0	20.5	19.7	14.0	14.0	2.8	9.3	7.5
						Min	6/5/00	15.3	11.2	2.0	4.2	10.0	6.3	5.0	1.2	0.3	4.0

EXHIBIT 3-7

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Optimal Performance Period (Excluding Startup)

							Key	TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Dates	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
						N		16	17	16	17	17	17	7	3	7	3
						StdDev		7.4	4.5	6.5	3.9	3.0	2.3	4.1	0.8	3.3	1.8
PP-17	20	2	SA	S	L	Mean		22.9	11.4	8.0	4.0	14.7	7.4	7.7	1.5	5.6	4.0
			(HCl)			Median		21.0	10.0	5.5	3.0	13.7	7.0	5.0	1.5	7.0	4.0
						Max	10/2/00	42.3	22.0	28.0	13.0	21.0	13.0	14.0	2.0	9.3	5.0
						Min	6/5/00	15.0	7.0	2.0	1.0	10.0	4.0	4.0	1.0	0.3	3.0
						N		16	17	16	17	17	17	7	2	7	2
						StdDev		7.4	3.8	6.7	2.8	3.2	2.5	4.4	0.7	3.3	1.4
PP-18	21	2	None	S	L	Mean		23.2	14.0	8.5	5.1	14.6	8.9	8.0	1.5	5.5	4.5
						Median		21.2	13.0	7.5	4.5	13.7	8.0	7.0	1.5	6.3	4.5
						Max	10/2/00	42.3	25.0	28.0	17.0	19.7	14.0	14.0	2.0	9.3	5.0
						Min	6/5/00	16.0	8.0	2.0	1.0	10.0	5.0	4.0	1.0	0.3	4.0
						N		16	17	16	17	17	17	7	2	7	2
						StdDev		7.1	4.4	6.5	3.7	2.9	2.8	4.2	0.7	3.3	0.7
PP-19	22	2	None	S	L	Mean		23.0	13.8	8.4	5.2	14.6	8.6	7.7	1.3	5.5	3.8
			(Aquamat)			Median		21.0	12.0	6.3	4.5	13.7	7.0	5.0	1.3	6.3	3.8
						Max	10/2/00	42.3	35.0	28.0	23.0	19.7	14.0	14.0	1.5	9.3	5.0
						Min	6/5/00	15.0	7.0	2.0	0.8	10.0	4.0	4.0	1.0	0.3	2.5
						N		16	17	16	17	17	17	7	2	7	2
						StdDev		7.4	7.5	6.5	5.3	3.0	3.3	4.4	0.4	3.3	1.8
STC-1	13	1	PE	D	L	Mean		27.1	16.3	9.7	7.0	10.5	9.5	4.0	2.2	6.2	7.1
						Median		22.8	14.3	10.3	5.5	11.5	9.4	2.6	2.2	6.5	6.4
						Max	1/31/00	102.0	31.7	24.9	21.1	13.6	20.4	9.0	4.3	11.0	11.6
						Min	7/6/99	14.6	10.7	1.0	0.0	1.9	5.2	1.9	0.9	0.0	5.1
						N		28	29	16	29	16	29	28	12	16	12
						StdDev		16.9	5.0	6.0	4.4	3.1	2.8	2.4	1.2	3.4	2.1
STC-2	8	1	SR	D	L	Mean		25.1	13.3	7.7	5.0	11.9	8.5	3.7	1.8	8.1	7.9
						Median		20.6	13.1	6.3	4.9	12.1	7.9	2.6	1.5	7.5	6.9
						Max	3/27/00	102.0	19.7	21.1	9.1	19.0	22.4	9.0	4.4	14.3	19.0
						Min	7/6/99	12.5	8.5	1.0	0.0	1.9	5.2	1.5	1.0	0.0	3.6
						N		36	37	24	37	24	37	36	13	24	13
						StdDev		15.4	2.6	5.4	2.3	3.2	2.9	2.3	1.1	3.7	4.2
STC-3	3	1	SR	V	V	Mean		25.1	17.1	7.7	8.4	11.0	8.8	3.7	1.9	7.2	7.0
						Median		21.0	15.5	7.2	7.5	11.4	8.2	2.7	1.9	7.6	6.5
						Max	3/6/00	102.0	30.7	18.6	19.4	14.3	14.0	9.0	2.8	12.3	12.5
						Min	7/6/99	12.5	10.8	2.0	3.6	1.9	6.1	1.5	1.0	0.0	4.0
						N		33	34	21	34	21	34	33	12	21	12
						StdDev		16.0	5.1	4.5	3.8	2.6	2.0	2.3	0.6	3.2	2.4
STC-4	13	2	PE	S	L	Mean		21.8	20.0	10.5	8.4	11.2	11.3	7.4	1.8	7.4	9.9
			(Ca)			Median		22.0	18.0	9.0	7.0	11.0	10.5	3.5	1.8	7.5	9.5
						Max	4/3/01	47.0	38.0	37.0	22.3	20.0	20.0	75.0	3.0	13.0	15.7
						Min	7/5/00	12.0	9.0	4.0	0.0	7.0	5.0	2.0	1.0	0.0	5.7
						N		39	39	37	38	38	39	23	17	22	17
						StdDev		6.5	8.4	6.2	5.2	2.8	3.8	15.1	0.8	3.2	3.3
STC-5	8	2	SR	S	L	Mean		22.1	11.7	10.1	4.3	12.0	7.3	6.3	2.0	8.2	5.0
						Median		20.5	11.0	8.9	4.0	11.0	7.0	3.3	1.8	8.0	4.7
						Max	4/3/01	64.0	29.0	43.0	14.0	21.0	15.0	75.0	4.0	13.4	7.2

EXHIBIT 3-7

Summary Statistics for Weekly Values of Phosphorus Concentrations During the Optimal Performance Period (Excluding Startup)

Treatment	Cell	Phase	Substrate	Depth	HLR	Statistics	Key Dates	TP (µg/L)		TPP (µg/L)		TDP (µg/L)		DRP (µg/L)		DOP (µg/L)	
								Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
						Min	4/3/00	12.0	7.0	0.5	0.0	7.0	4.0	1.9	1.0	0.0	2.0
						N		50	51	48	50	49	51	32	17	31	17
						StdDev		8.5	3.7	7.7	2.5	3.2	2.2	12.9	0.9	3.0	1.5
STC-6	3	2	SR	V	V	Mean		23.7	18.8	11.4	8.1	12.2	10.7	9.0	1.8	7.7	9.1
						Median		23.0	18.5	10.4	7.0	11.3	10.0	3.4	1.0	8.0	10.0
						Max	4/3/01	47.0	56.7	37.0	40.7	22.0	16.0	75.0	4.0	14.0	12.0
						Min	5/22/00	15.0	9.0	2.0	2.0	7.0	4.5	2.0	1.0	0.0	5.5
						N		28	28	26	27	27	28	16	5	15	5
						StdDev		6.9	9.1	6.9	7.3	3.6	3.4	18.0	1.3	4.0	2.7
FSC-1	3	1	LR-PE	S	H	Mean		26.3	18.2	16.1	10.1	10.1	8.3	3.0	3.3	7.1	4.9
						Median		25.0	17.5	13.0	10.0	10.0	8.0	2.0	2.3	6.0	5.0
						Max	9/30/02	40.0	47.0	33.0	37.0	16.0	14.0	7.0	9.0	14.0	10.5
						Min	2/1/02	16.0	10.0	3.0	0.0	7.0	5.0	1.0	0.0	2.0	0.0
						N		7	32	7	28	7	28	7	20	7	20
						StdDev		9.9	7.1	10.9	7.5	3.2	2.3	2.2	2.9	4.4	3.2
FSC-2	3	2	LR-PE	S	H	Mean		22.8	15.3	11.7	7.1	11.2	9.7	4.4	3.0	6.8	6.6
						Median		22.0	14.5	13.5	7.0	11.5	9.5	3.0	2.0	5.8	6.0
						Max	9/30/02	30.0	27.0	17.0	20.0	15.0	15.0	10.0	13.0	13.0	14.0
						Min	2/1/02	16.0	9.0	1.0	0.0	7.0	5.0	0.5	0.5	2.0	0.0
						N		6	32	6	28	6	28	6	20	6	20
						StdDev		5.3	5.0	5.6	5.5	3.3	2.9	3.7	3.0	4.1	4.1
FSC-3	3	3	CR	S	H	Mean		21.1	16.1	13.1	8.5	8.0	8.0	4.6	3.3	3.7	5.0
						Median		21.0	15.0	13.5	9.0	8.0	8.0	3.0	2.0	4.0	5.0
						Max	9/30/02	32.0	25.0	23.0	17.0	10.0	16.0	9.0	16.0	7.0	11.0
						Min	2/1/02	14.0	10.0	6.0	0.0	7.0	4.0	1.0	0.5	0.0	0.0
						N		7	35	7	31	7	31	7	22	7	22
						StdDev		6.0	4.0	5.6	4.0	1.2	3.2	3.3	3.4	2.9	3.1
FSC-4	3	4	PE	S	H	Mean		19.8	31.5	10.2	19.1	10.2	13.3	2.6	5.1	7.6	7.6
						Median		18.0	29.5	10.0	17.0	8.0	13.0	2.0	3.5	6.0	6.3
						Max	9/30/02	24.0	59.0	19.0	46.0	21.0	22.0	4.0	11.0	19.0	14.0
						Min	2/1/02	16.0	12.0	0.0	4.0	5.0	8.0	2.0	1.0	3.0	4.0
						N		5	24	5	21	5	21	5	14	5	14
						StdDev		3.9	12.3	6.9	11.6	6.5	3.9	0.9	3.8	6.6	3.5

Notes:

Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

EXHIBIT 3-8
PSTA Mesocosm TP Mass Balances for the Optimal Performance Period

Treatment	Cell	Phase	Substrate	Depth	HLR	TP (µg/L) Inflow	TP (µg/L) Outflow	Inflow (m^3/d)	Outflow (m^3/d)	Avg_flow (m^3/d)	q_avg (cm/d)	TP (g/m^2/yr) Inflow	TP (g/m^2/yr) Outflow	Removal (g/m^2/yr)	Removal (%)	Calc k_1 (m/yr)
PP-1	9,11,18	1	PE	D	L	18.8	14.1	0.577	0.545	0.561	9.62	0.645	0.466	0.178	27.6	10.11
PP-2	4,7,8	1	SR	D	L	19.1	13.0	0.550	0.541	0.546	9.17	0.611	0.424	0.187	30.6	12.92
PP-3	12,14,17	1, 2	PE	S	L	28.1	17.0	0.488	0.467	0.477	8.14	0.792	0.466	0.327	41.2	14.91
PP-4	3,5,10	1, 2	SR	S	L	28.2	14.6	0.499	0.506	0.503	8.31	0.812	0.449	0.363	44.7	19.91
PP-5	2,13,16	1	SR	D	H	25.0	16.4	1.039	1.003	1.021	17.32	1.547	0.979	0.568	36.7	26.74
PP-6	1,6,15	1	SR	V	V	24.1	14.5	0.271	0.285	0.278	4.51	0.406	0.258	0.147	36.3	8.35
PP-7	19	1, 2	SA	S	L	27.8	15.2	0.491	0.468	0.480	8.19	0.803	0.426	0.377	46.9	18.14
PP-8	20	1	SA	D	L	19.3	16.1	0.559	0.517	0.538	9.32	0.640	0.501	0.139	21.7	6.23
PP-9	21	1	PE (AS)	D	L	24.0	19.5	0.563	0.588	0.575	9.38	0.837	0.697	0.139	16.7	7.18
PP-10	22	1	SR (AS)	D	L	24.2	14.6	0.536	0.524	0.530	8.93	0.781	0.462	0.318	40.8	16.48
PP-11	23	1, 2	SR	S	L	28.1	17.8	1.546	1.525	1.535	8.59	0.831	0.531	0.300	36.1	14.42
PP-12	24	1, 2	PE	S	L	27.8	18.6	1.528	1.511	1.520	8.49	0.819	0.556	0.263	32.2	12.50
PP-13	9,11,18	2	PE (Ca)	S	L	23.1	16.2	0.518	0.505	0.511	8.64	0.715	0.495	0.220	30.7	11.28
PP-14	4,7,8	2	LR	S	L	23.1	14.5	0.518	0.570	0.544	8.63	0.726	0.520	0.205	28.3	14.53
PP-15	2,13,16	2	SR	S	R	23.1	14.6	0.481	0.448	0.464	8.01	0.668	0.394	0.274	41.1	13.39
PP-16	1,6,15	2	SR	V	V	23.1	17.0	1.062	1.113	1.087	17.70	1.471	1.144	0.326	22.2	19.63
PP-17	20	2	SA (HCl)	S	L	22.9	11.4	0.463	0.502	0.482	7.71	0.651	0.348	0.303	46.5	19.48
PP-18	21	2	None	S	L	23.2	14.0	0.470	0.588	0.529	7.84	0.654	0.521	0.133	20.3	14.47
PP-19	22	2	AM	S	L	23.0	13.8	0.515	0.542	0.528	8.58	0.700	0.450	0.249	35.6	15.92
STC-1	13	1	PE	D	L	27.1	16.3	108.8	117.2	106.8	4.03	0.424	0.240	0.184	43.4	7.44
STC-2	8	1	SR	D	L	25.1	13.3	119.9	108.8	114.4	4.44	0.429	0.204	0.225	52.4	10.38
STC-3	3	1	SR	V	V	25.1	17.1	108.4	86.2	97.3	3.69	0.384	0.219	0.165	43.0	5.15
STC-4	13	2	PE (Ca)	S	L	21.8	20.0	121.9	116.7	119.4	4.95	0.399	0.336	0.063	15.8	1.56
STC-5	8	2	SR	S	L	22.1	11.7	123.1	118.5	120.9	5.06	0.414	0.211	0.203	49.1	11.78
STC-6	3	2	SR	V	V	23.7	18.8	153.2	144.2	152.6	6.01	0.516	0.348	0.168	32.5	5.00
FSC-1	3	1	LR-PE	S	H	27.2	18.2	1470	586	1028	5.08	0.722	0.192	0.530	73.4	7.49
FSC-2	3	2	LR-PE	S	H	26.6	15.3	1839	809	1324	6.54	0.883	0.224	0.659	74.7	13.19
FSC-3	3	3	CR	S	H	26.1	16.1	1434	1242	1338	6.61	0.676	0.360	0.315	46.7	11.71
FSC-4	3	4	PE	S	H	25.2	31.5	1438	244	841	4.16	0.654	0.139	0.515	78.8	-3.38

Notes:
Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

1.55 $g/m^2/yr$. Removal rates for the OPP averaged between 0.063 and 0.66 $g/m^2/yr$. Average TP mass removal efficiencies ranged from approximately 16 to 52 percent in the lined cells and from 47 to 79 percent in the unlined FSCs where removals were increased because of high leakage rates. The highest Phase 1 TP mass removal rate was observed in treatment PP-5 (deep shellrock with high HLR), which also received the highest loading rate. A higher average TP mass removal rate was measured in FSC-2; however, an unquantified portion of this mass went to groundwater. The highest TP mass removal efficiencies were observed in three of the unlined FSCs and in treatments STC-2 (deep shellrock), PP-7 (unrinsed sand treatment), PP-17 (HCl-rinsed sand treatment), and PP-4 (shallow shellrock constant flow). The lowest mass removal rate was measured in STC-4, the peat-based Test Cell with calcium amendment. This cell also had the lowest mass removal efficiency.

These estimated mass removal rates did not account for atmospheric TP loadings. Detailed wet and dry TP atmospheric deposition values were not available during the period of this research. The estimated average rainfall TP was 18 μg/L between August 1998 and March 2000. Based on an annualized rainfall rate of 124 cm during the project period, this wet deposition from atmospheric sources was approximately 0.022 $g/m^2/yr$. This is equivalent to approximately 6 percent or less of the pumped TP loading rate. Dry atmospheric TP deposition may be greater than the amount delivered by rain alone. The estimated total atmospheric deposition of TP delivered by rain and particulate fallout is approximately 0.0464 $g/m^2/yr$ (Burns & McDonnell, 1999). Even this amount is only approximately 3 to 12 percent of the TP delivered in the pumped inflows, and therefore atmospheric TP inputs were not considered in these mass balances.

3.3.4 k-C* Model Parameter Estimates

Pollutant removal rates can be summarized as a simple logarithmic decay (first-order process) using inflow/outflow concentrations and hydraulic loading data. Wetland performance is tied more closely to surface area than to water volume (Kadlec and Knight, 1996), so an area-based model is typically more appropriate than a volumetric first-order model. A plug-flow hydraulic assumption was used for preliminary PSTA TP performance calibrations (CH2M HILL, August 2000). In this report, intrinsic TP removal rate constants are also presented based on the tanks-in-series model and on measured tracer residence time distributions in selected PSTA treatments.

The simplest expression of the first-order, area-based plug flow wetland performance model, assuming no net rainfall or seepage, is:

$$\ln (C_1/C_2) = k_1/q \qquad \text{[Equation 3-1]}$$

where:

C_1 = average inlet concentration, mg/L
C_2 = average outlet concentration, mg/L

k_1 = first-order, area-based rate constant, m/yr
q = average hydraulic loading rate, m/yr

This is the general form of the wetland model and can be referred to as the one-parameter or k_1 plug-flow model. Exhibit 3-8 includes the average treatment TP k_1 values estimated for the OPP. During this period, average treatment estimated k_1 values ranged from -3.4 to 27 m/yr. The highest OPP k_1 value was estimated for PP-5, the high HLR shellrock Porta-PSTA treatment. The lowest values were estimated for STC-4, the peat-based Test Cell with calcium amendment and FSC-4, the unlined peat-based PSTA. Most of the average estimated k_1 values were between 5 and 20 m/yr. It has previously been observed that k_1 is highly correlated with inlet loading of both TP and water (Kadlec, 2001b), and the PSTA data follow this trend. For comparison, the global average k_1 value for emergent marsh treatment wetlands is approximately 12.1 m/yr (range from 2.4 to 23.7 m/yr) (Kadlec and Knight, 1996), and the long-term average TP removal rate constant for the District's STA-1W (former ENRP) was reported as 18.4 m/yr (Chimney et al., 2000).

In general, wetland data indicate that internal and external loading of TP may result in non-zero, irreducible wetland water column constituent concentrations. For some purposes these concentrations may be so low as to be indistinguishable from zero. In other cases, effluent discharge goals approach the lowest constituent concentrations measured in natural wetlands. In these situations, the plug flow model can be corrected by introducing a second parameter that represents the lowest achievable or irreducible concentration that will occur in a treatment wetland, C*.

The two-parameter first-order, area-based plug flow model, or k-C* model, is:

$$\ln[(C_1-C^*)/(C_2-C^*)] = k/q \qquad \text{[Equation 3-2]}$$

where:

k = two-parameter model first-order, area-based removal rate constant, m/yr

Inlet and outlet concentration data can be combined with average HLR, q, to estimate k and C* for a given treatment wetland dataset. Average data for a period of time greater than the average HRT in the wetland should be used when making these parameter estimates. These parameters are most often calculated based on at least monthly, quarterly, or annual average datasets.

For some constituents, the value of k is dependent upon temperature. The modified Arrhenius equation that describes this dependency is:

$$k_T = k_{20}(\text{theta}^{[T-20]}) \qquad \text{[Equation 3-3]}$$

where:

theta = temperature correction factor
T = the average water temperature, deg C
k_T = k at T °C , m/yr
k_{20} = k at 20°C, m/yr

Tracer studies in the PSTA mesocosms indicated that they did not behave as pure plug flow reactors (see Appendix G for a complete description of the tracer test results). The tanks-in-series model has been used to describe the observed deviation of these systems from plug flow (Kadlec and Knight, 1996). This model assumes that flow through a PSTA is similar to a number of completely mixed stirred reactors in series. The number of reactors is estimated by the model to describe the observed distribution of tracer residence times. The tanks-in-series model can be written as:

$$(C_2-C^*)/(C_1-C^*) = (1+k_{TIS}/nq)^{-n} \qquad \text{[Equation 3-4]}$$

where:

k_{TIS} = the 2-parameter tanks-in-series, area-based removal rate constant (m/yr)

n = number of tanks-in-series

The plug flow reactor rate constant is now renamed as k_{PFR} and is related to k_{TIS} by the following equations:

$$k_{TIS} = nq[(e^{(-kPFR/q)})^{-1/n} – 1] \qquad \text{[Equation 3-5]}$$

$$k_{PFR} = nq[\ln(1+k_{TIS}/nq)] \qquad \text{[Equation 3-6]}$$

In all cases, $k_{TIS} \geq k_{PFR}$. If the number of tanks-in-series is more than approximately 7, then the two forms of the removal rate constant are nearly identical. It is important to note that because this is a two-parameter model, values for k_{PFR} and k_{TIS} should only be compared between treatments with attention to the C* estimate. A high C* results in a higher value for the rate constant for a given amount of P removal.

Tracer testing of the three research scales demonstrated widely different hydraulics as a function of system maturity and scale (see Appendix G for detailed tracer testing results). Tracer testing in the Porta-PSTAs estimated TIS from 1.4 to 2.2. Tracer testing in the PSTA Test Cells indicated 1.8 to 3.1 TIS during Phase 1 and from 3.8 to 4.1 TIS in Phase 2, after plant communities developed more completely. Preliminary tracer testing in two of the FSCs found approximately 9 TIS for a 5:1 length-to-width ratio and 25 TIS for FSC-2 (sinuous PSTA) with a length-to-width ratio of 45:1.

The PSTA OPP data were used to calibrate the k-C* model. All data collected during the OPP were utilized, and the Excel Solver routine was employed to provide the best-fit calibration to these datasets. The value for k_{PFR} was estimated with Solver and then k_{TIS} was calculated based on an assumed number of tanks-in-series using the typical values from the PSTA tracer studies. Solver tests with identical datasets returned equivalent parameters for both forms of the k-C* model.

Some of the individual PSTA treatment datasets were not robust enough to allow simultaneous calibration of k, C*, and the temperature correction factor (theta). Therefore, in some cases where Solver could not find a solution, it was assumed that C* was approximately equal to the lowest monthly average for a given dataset. In some cases, it was also assumed that theta was equal to 1.0, indicating no effect of temperature on k. When the model would provide an estimate of theta, it was found that it varied from 0.82 to 1.03. A value of theta less than 1.0 indicates that the TP removal rate constant increases at water temperatures less than 20 °C. A theta greater than 1.0 indicates that the actual TP removal rate constant was higher than the k_{20} value because the mean operational temperature was approximately 24.5°C.

Exhibit 3-9 summarizes the estimated average PSTA k-C* values for the OPP. Estimated C^*_{TP} values ranged from 5 to 32 µg/L. It is of interest to note that for those values of C* actually estimated by the model, the lowest were the Porta-PSTA treatments with either shellrock (6 µg/L) or acid-rinsed sand (5 µg/L) and the PSTA Test Cell with shellrock and constant water depth (7 µg/L). These low C* estimates may indicate that a large PSTA constructed on soils with very low concentrations of available TP may be able to achieve TP concentrations consistently less than 10 µg/L.

Estimated k_{PFR} values in the PSTA Test Cell treatments ranged from 5.5 to 42.5 m/yr. The estimated k_{PFR} values in the Porta-PSTA treatments were generally higher, ranging from 20.4 to 89 m/yr during the OPP. Estimated k_{TIS} values in the Porta-PSTAs ranged from 24 to 185 m/yr and from 5.8 to 76 m/yr in the Test Cells. Little effect of temperature was found on any of these k-C* model parameters.

When similar treatments were combined in this analysis, the Porta-PSTA peat and shellrock treatments returned similar values for k_{PFR} and k_{TIS}, although the shellrock treatments were approximately 15 percent higher. The removal rate constants for the other Porta-PSTA treatments were lower as was the C* estimate, except for the Aquashade treatments that returned a high C* and higher values of k_{PFR} and k_{TIS}.

Estimated model parameters from the OPP for the FSCs were similar to those returned from the smaller test systems. The measured number of TIS for these cells was higher based on the tracer test conducted during the spring of 2002.

3.3.5 Time Series for Key Treatments

Temporal trends in TP inflow and outflow concentrations and monthly average k_1 values are presented for the stable water regime peat and shellrock PSTA Test Cell treatments in Exhibits 3-10 and 3-11, respectively. Additional data collected from these systems by the District during the Phase 3 period are also plotted on these charts.

The startup effects on TP out and k_1 were clearly greater in the peat Test Cell than in the shellrock Test Cell. The peat Test Cell displayed this startup P release a second time following a batch-mode study in January and February 2000 and subsequent plant removal and soil liming. While outflow TP concentrations were generally lower in the shellrock treatment than in the peat treatment, the difference was not great except during startup conditions, during the batch test with no inflow to the peat cell, and during the last 3 months of Phase 2. This difference continued to increase during the Phase 3 period. After the longer

EXHIBIT 3-9

Model Parameters for the PSTA Treatments for the Optimal Performance Period

Treatment	Phase	Substrate	Depth	HLR	TP (mg/L)		HLR	Wtr Temp	k_{20PFR}	k_{20TIS}	# TIS	C*	Theta
					C1	C2	(m/yr)	(C)	(m/yr)	(m/yr)			
Porta-PSTAs													
PP-1	1	PE	D	L	0.020	0.014	34.9	22.7	61.9	99.6	***2.0***	0.015	0.87
PP-2	1	SR	D	L	0.020	0.013	33.4	22.0	46.5	67.2	***2.0***	0.011	0.98
PP-3	1, 2	PE	S	L	0.027	0.017	29.2	24.6	54.0	88.7	***2.0***	0.016	***1.00***
PP-4	1, 2	SR	S	L	0.027	0.014	30.5	24.7	43.2	62.9	***2.0***	0.011	1.02
PP-5	1	SR	D	H	0.025	0.017	62.8	21.7	68.1	90.4	***2.0***	0.011	0.90
PP-6	1	SR	V	V	0.026	0.015	16.5	21.1	39.6	76.5	***2.0***	0.013	0.95
PP-7	1, 2	SA	S	L	0.027	0.015	29.6	24.4	31.1	40.8	***2.0***	0.010	1.03
PP-8	1	SA	D	L	0.020	0.016	33.9	22.9	89.3	185.2	***2.0***	***0.015***	***1.00***
PP-9	1	PE (AS)	D	L	0.026	0.020	34.9	21.4	35.5	46.3	***2.0***	***0.016***	***1.00***
PP-10	1	SR (AS)	D	L	0.026	0.015	32.4	19.8	35.8	47.7	***2.0***	0.010	1.02
PP-11	1, 2	SR	S	L	0.027	0.017	32.3	24.4	39.6	54.6	***2.0***	0.013	0.96
PP-12	1, 2	PE	S	L	0.027	0.018	31.1	24.2	44.9	65.8	***2.0***	0.015	0.96
PP-13	2	PE (Ca)	S	L	0.022	0.015	31.8	28.1	20.4	24.1	***2.0***	***0.007***	***1.00***
PP-14	2	LR	S	L	0.022	0.014	32.0	28.3	27.6	34.6	***2.0***	***0.008***	***1.00***
PP-15	2	SR	S	R	0.022	0.014	29.4	31.0	26.4	33.3	***2.0***	***0.008***	***1.00***
PP-16	2	SR	V	V	0.022	0.016	64.1	28.7	45.0	53.9	***2.0***	0.006	0.96
PP-17	2	SA (HCl)	S	L	0.022	0.011	28.4	28.2	42.4	63.0	***2.0***	0.005	0.94
PP-18	2	None	S	L	0.023	0.013	29.5	28.0	32.8	43.9	***2.0***	***0.008***	***1.00***
PP-19	2	AM	S	L	0.022	0.013	31.6	28.1	28.6	36.2	***2.0***	***0.007***	***1.00***
South Test Cells													
STC-1	1	PE	D	L	0.027	0.016	16.2	24.6	34.9	51.1	***3.0***	0.013	0.92
STC-2	1	SR	D	L	0.025	0.013	16.3	25.2	31.7	44.6	***3.0***	0.010	0.96
STC-3	1	SR	V	V	0.025	0.018	13.2	23.8	42.5	76.2	***3.0***	0.016	0.93
STC-4	2	PE (Ca)	S	L	0.022	0.019	18.1	23.3	8.5	9.2	***3.0***	***0.013***	***1.00***
STC-5	2	SR	S	L	0.023	0.012	18.4	23.7	20.7	25.2	***3.0***	0.007	1.00
STC-6	2	SR	V	V	0.023	0.019	20.9	26.1	5.5	5.8	***3.0***	***0.010***	***1.00***
Porta-PSTA Summary													
		PE			0.025	0.016	30.9	24.9	48.0	72.6	***2.0***	0.014	0.97
		SR			0.024	0.015	40.1	24.7	56.7	82.5	***2.0***	0.013	0.97
		SA			0.025	0.015	30.6	24.1	33.0	43.8	***2.0***	0.011	1.03
		LR			0.022	0.014	32.0	28.3	27.6	34.6	***2.0***	***0.008***	***1.00***
		AS			0.026	0.018	33.7	20.6	40.6	55.8	***2.0***	0.014	***1.00***
		None			0.023	0.013	29.5	28.0	32.8	43.9	***2.0***	***0.008***	***1.00***
		AM			0.022	0.013	31.6	28.1	28.6	36.2	***2.0***	***0.007***	***1.00***
South Test Cells Summary													
		PE			0.024	0.018	17.3	23.9	58.5	108.5	***3.0***	0.018	1.03
		SR			0.024	0.015	17.2	24.6	68.6	143.2	***3.0***	0.015	***1.00***
Field-Scale Cells													
FSC-1	1	LR-PE	S	H	0.030	0.020	24.9	27.0	29.2	31.2	***9.0***	***0.012***	***0.90***
FSC-2	2	LR-PE	S	H	0.028	0.017	36.1	27.9	48.5	49.8	***25.0***	***0.010***	***0.98***
FSC-3	3	CR	S	H	0.027	0.017	34.3	27.1	62.5	69.3	***9.0***	***0.015***	***1.00***
FSC-4	4	PE	S	H	0.026	0.030	24.6	26.0	37.5	40.8	***9.0***	***0.032***	***1.00***

Notes:

Mesoosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, LR-PE = limerock fill over peat, CR = scrape-down to limestone caprock

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

TIS = tanks-in-series

bold and italics = values fixed in model

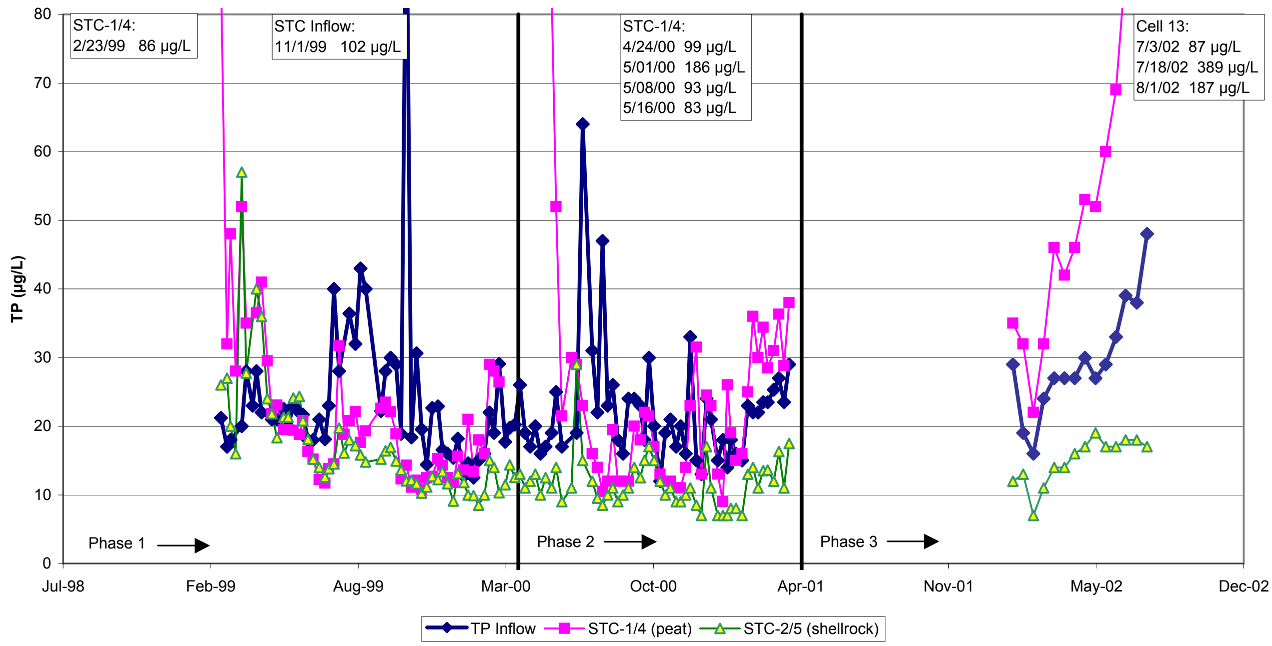


EXHIBIT 3-10

PSTA Test Cell TP Inflow and Outflow Concentrations in Treatments STC-1/4 (Peat) and STC-2/5 (Shellrock)

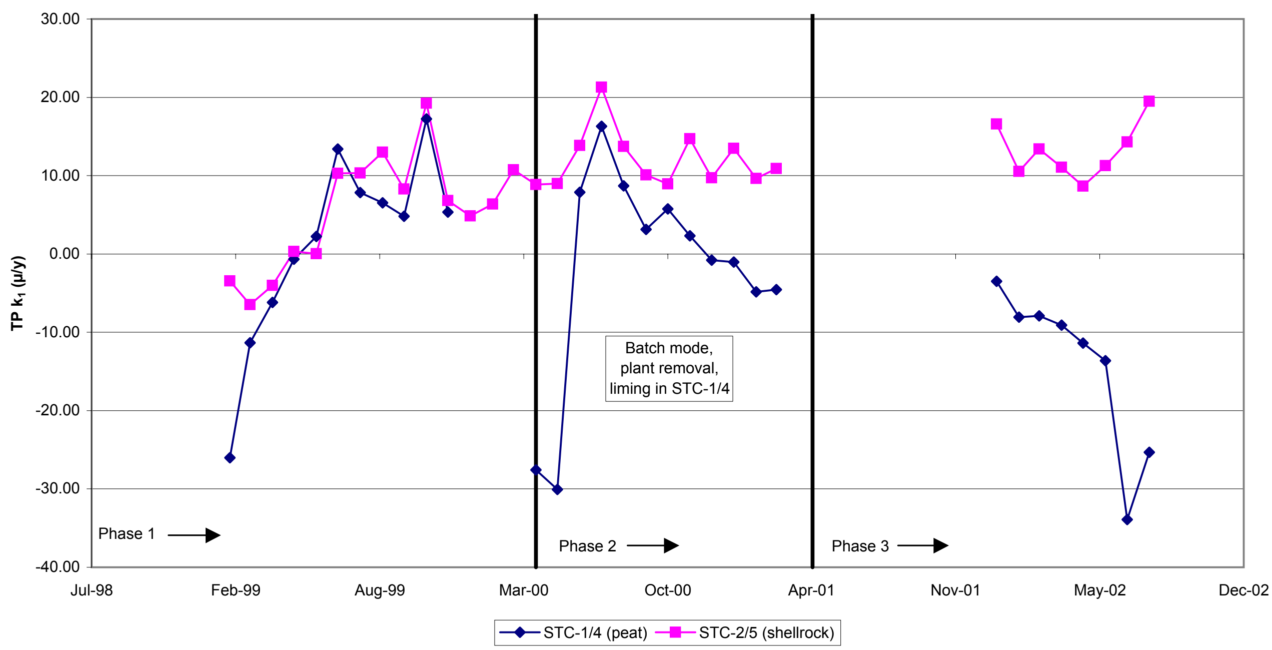


EXHIBIT 3-11

PSTA Test Cell k_{1TP} Values in Treatments STC-1/4 (Peat) and STC-2/5 (Shellrock) startup, the k_1 values for both treatments were similar during Phase 1. During the 24 months of Phases 2 and 3, the k_1 value for the peat cell never matched the k_1 for the shellrock cell and continued to decline until the end of the data collection period. The reason for the poorer performance of the peat PSTA Test Cell during Phases 2 and 3 appears to be related to macrophyte invasion. The k_1 value for the shellrock cell remained relatively steady throughout the study period. More recent data collected during the first half of 2002 in the shellrock Test Cell indicate that outflow TP concentrations are still in the same range approximately 3½ years following project startup (average TP=15 μg/L, range=10 to 18 μg/L for January–August 2002).

The same type of time-series graphs for the variable water regime PSTA Test Cells are presented in Exhibits 3-12 and 3-13 for TP inflow/outflow and k_1, respectively. The startup period for this cell also took approximately 5 months as was seen for the shellrock Test Cell with stable water flows and levels. The outflow TP level stayed fairly low in this cell, except for temporary increases following dry-out periods. The response during the first dryout—conducted in the spring of 2000—was an increasing and high k_1 value. The response to the second dryout—conducted during the fall and winter months of that same year—was a reduction in TP removal performance. This shellrock-based treatment also continued to perform well after 3½ years of operation, and outflow TP concentrations declined to pre-dry-out levels (average TP=13 μg/L, range=9 to 16 μg/L for January–August 2002).

Porta-PSTA treatments PP-3 (peat) and PP-4 (shellrock) were both operated for 18 months with 30 cm of water depth (Exhibits 3-14 and 3-15). Treatments PP-11 (shellrock) and PP-12 (peat) were operated under the same water depths and for the same time period, but were larger at 3 m x 6 m (Exhibits 3-16 and 3-17). The time series TP data for these four treatments are of interest because the only treatment variable in each pair is the soil type. For both pairs, the shellrock treatment was slightly better than the peat treatment during the first operational phase. The higher performance of the 1 m x 6 m shellrock mesocosms increased during Phase 2, but there was not as much difference between soil types for the larger mesocosms.

Time-series TP and k_1 data for the FSCs are summarized in Exhibits 3-18 through 3-25. The two limerock treatments (FSC-1 and FSC-2) and the caprock treatment (FSC-3) all had increasing TP removal rates following the 4- to 5-month startup period of variable removals. TP removal rates in all three treatments were much lower immediately following dryout during the summer of 2002 and then rose quickly soon after rewetting. Within 3 months after the end of the dryout, these cells had k_1 values ranging from approximately 23 to 47 m/yr (substantively higher than the pre-dryout k_1 values). Monitoring in the future of iterative dryout and rewetting cycles would help clarify whether this process could be used to further increase periphyton community development and higher k_1 values.

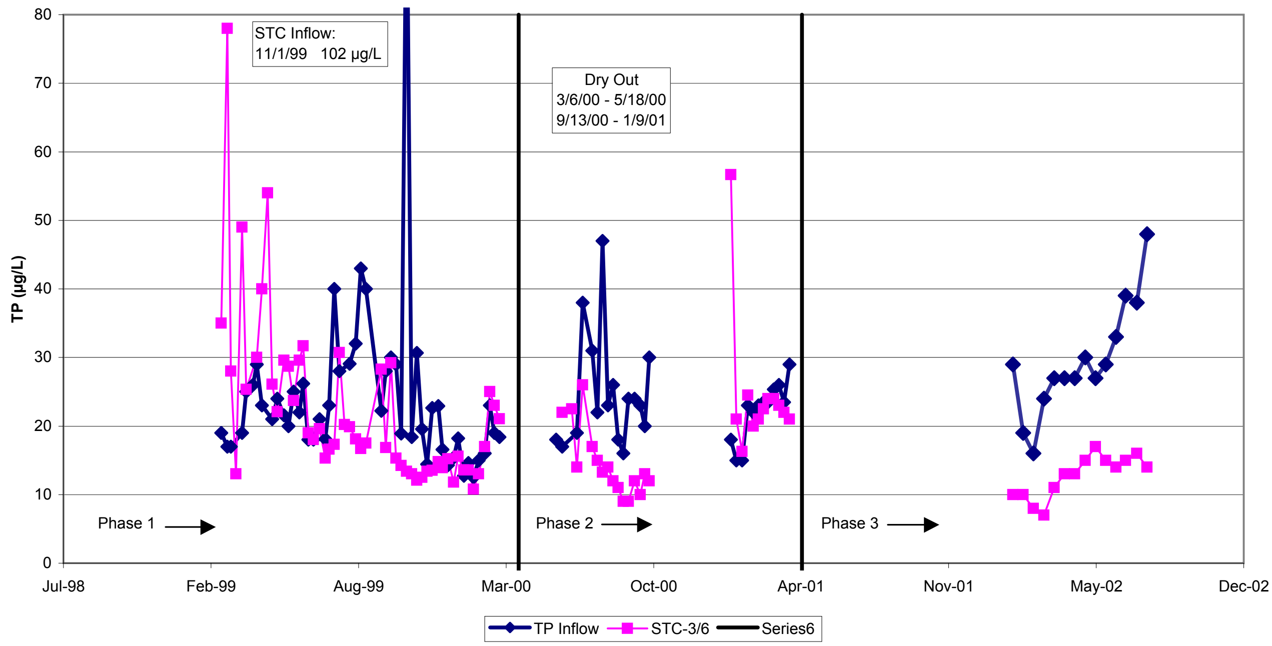


EXHIBIT 3-12
PSTA Test Cell TP Inflow and Outflow Concentrations in Treatments STC-3/6 (Shellrock with Dry-Down)

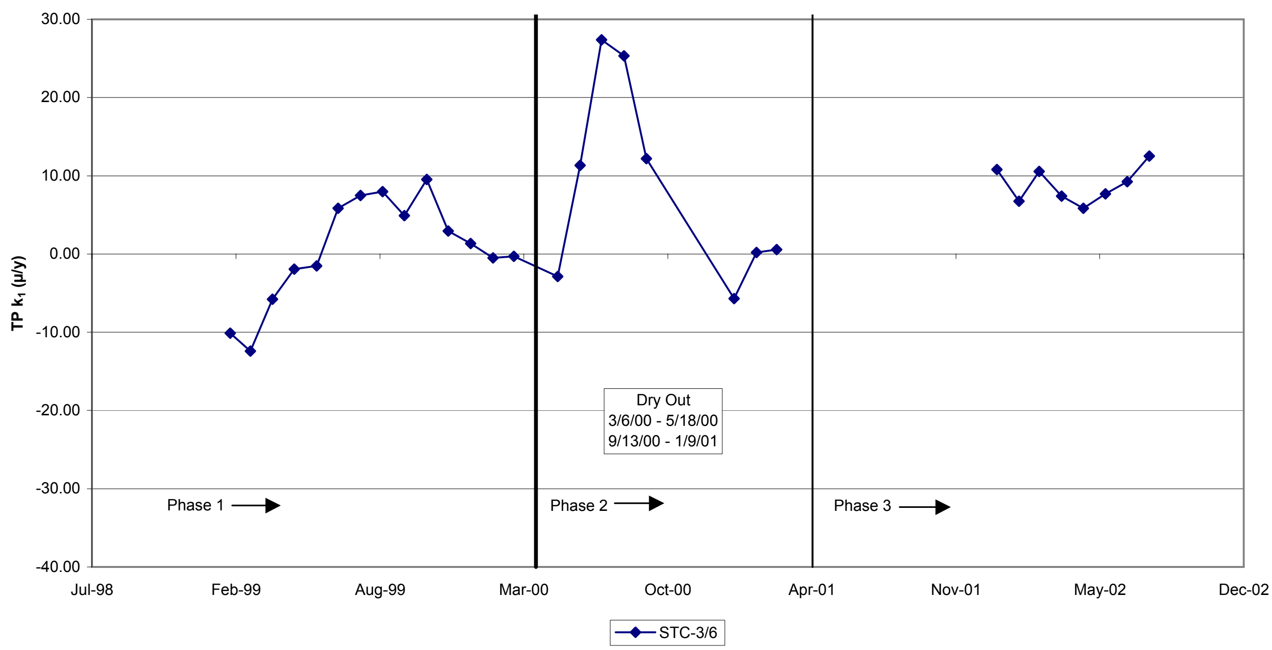


EXHIBIT 3-13
PSTA Test Cell k_{1TP} Values in Treatments STC-3/6 (Shellrock with Dry-Down)

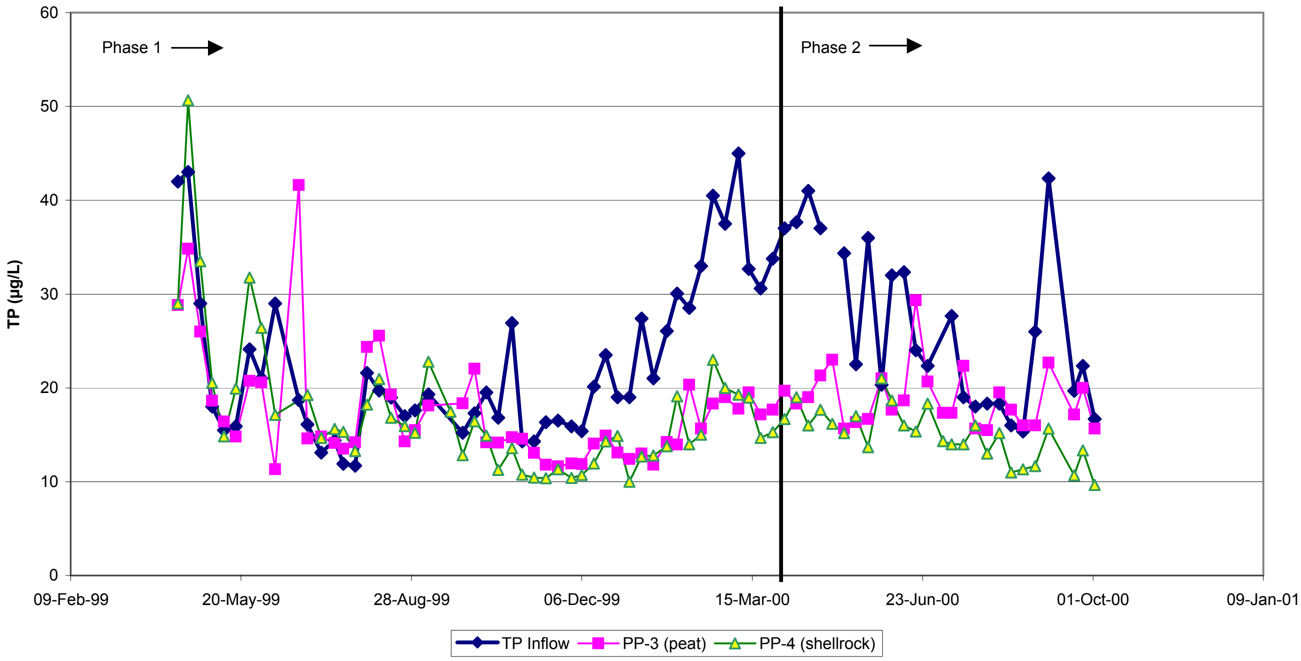


EXHIBIT 3-14
Porta-PSTA TP Inflow and Outflow Concentrations in Treatments PP-3 (1x6 m Peat) and PP-4 (1x6 m Shellrock) for the POR

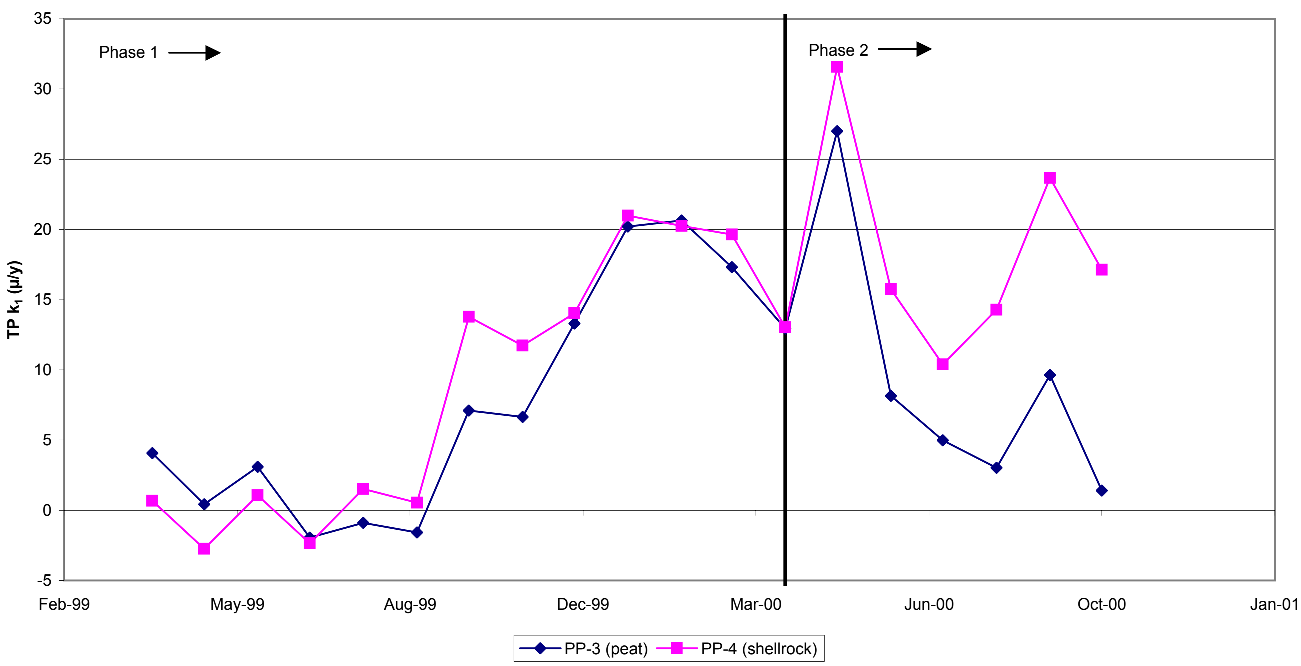


EXHIBIT 3-15
Porta-PSTA Test Cell k_{1TP} Values in Treatments PP-3 (Peat) and PP-4 (Shellrock) for the POR

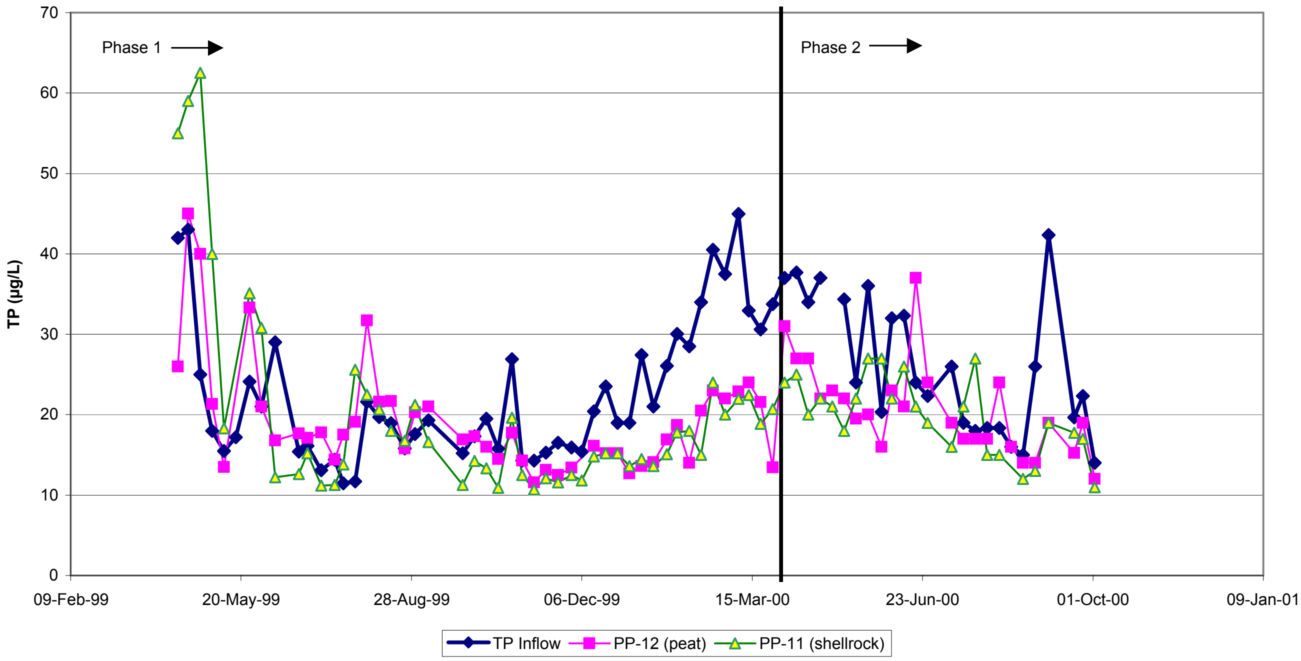


EXHIBIT 3-16
Porta-PSTA TP Inflow and Outflow Concentrations in Treatments PP-11 (3x6 m Shellrock) and PP-12 (3x6 m Peat) for the POR

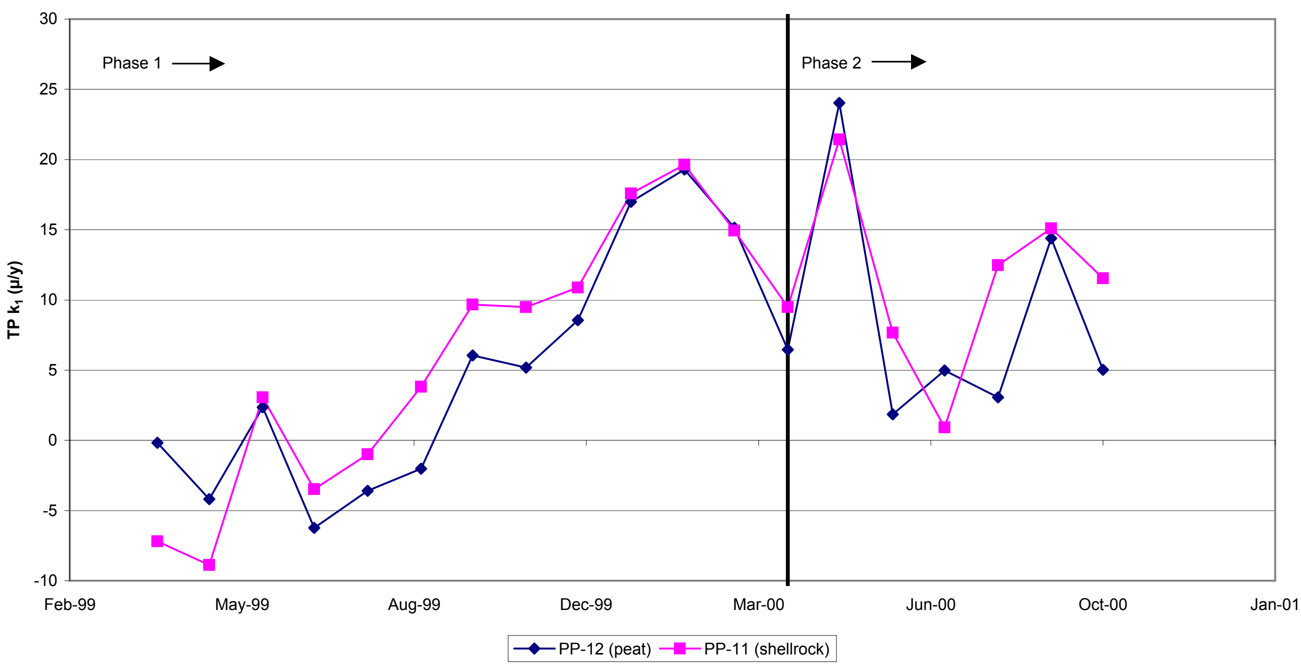


EXHIBIT 3-17
Porta-PSTA Test Cell k_{1TP} Values in Treatments PP-3 (Peat) and PP-4 (Shellrock) for the POR

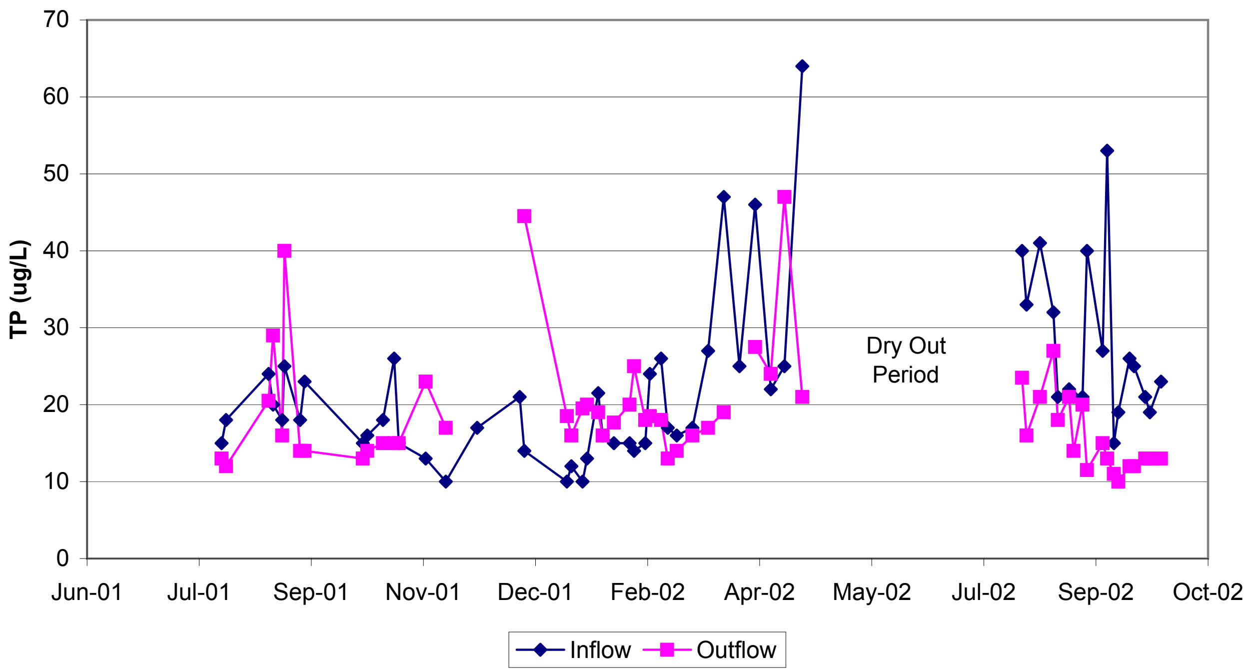


EXHIBIT 3-18
Time-Series of Average Monthly TP Inflow and Outflow Concentrations in Field-Scale PSTA Cell 1 (limerock fill)

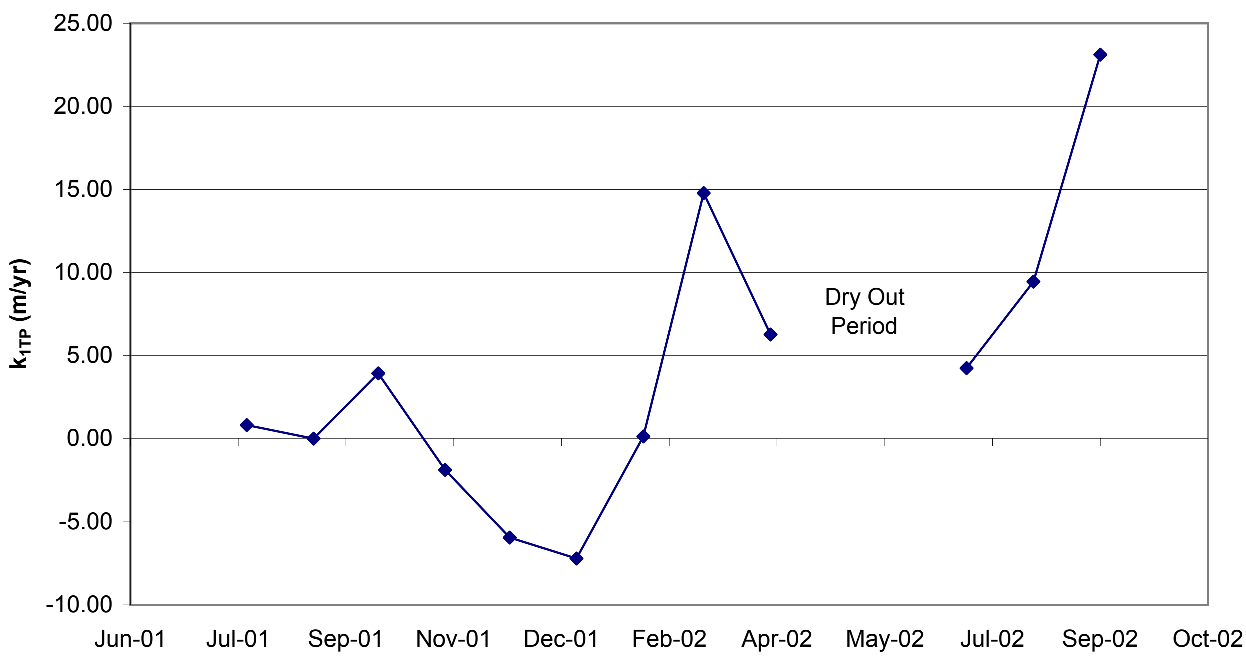


EXHIBIT 3-19
Time-Series of Average Monthly k_{1TP} Values in Field-Scale PSTA Cell 1 (limerock fill)

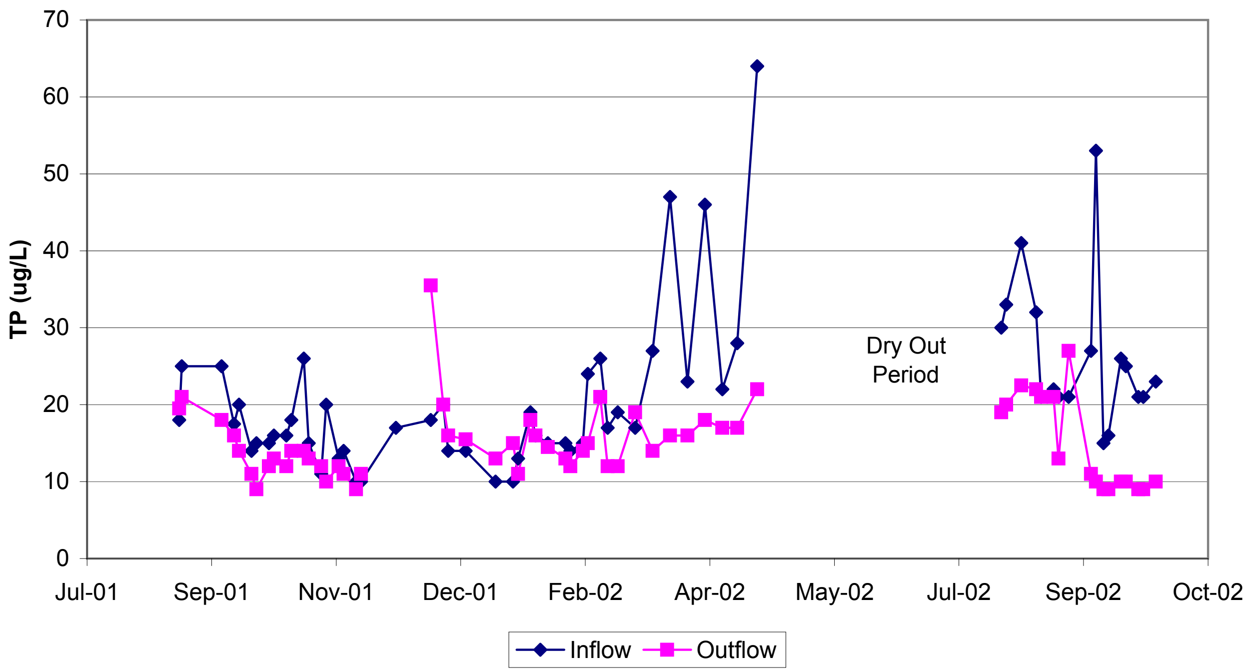


EXHIBIT 3-20
Time-Series of Average Monthly TP Inflow and Outflow Concentrations in Field-Scale PSTA Cell 2 (sinuous limerock fill)

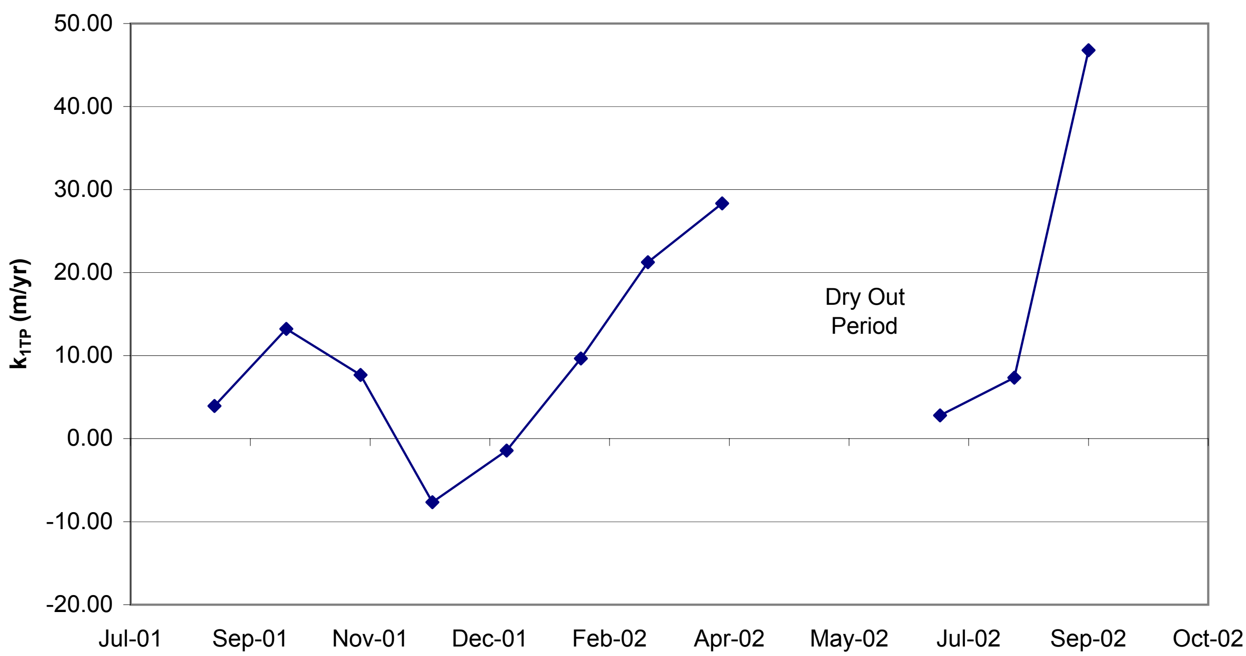


EXHIBIT 3-21
Time-Series of Average Monthly k_{1TP} Values in Field-Scale PSTA Cell 2 (sinuous limerock fill)

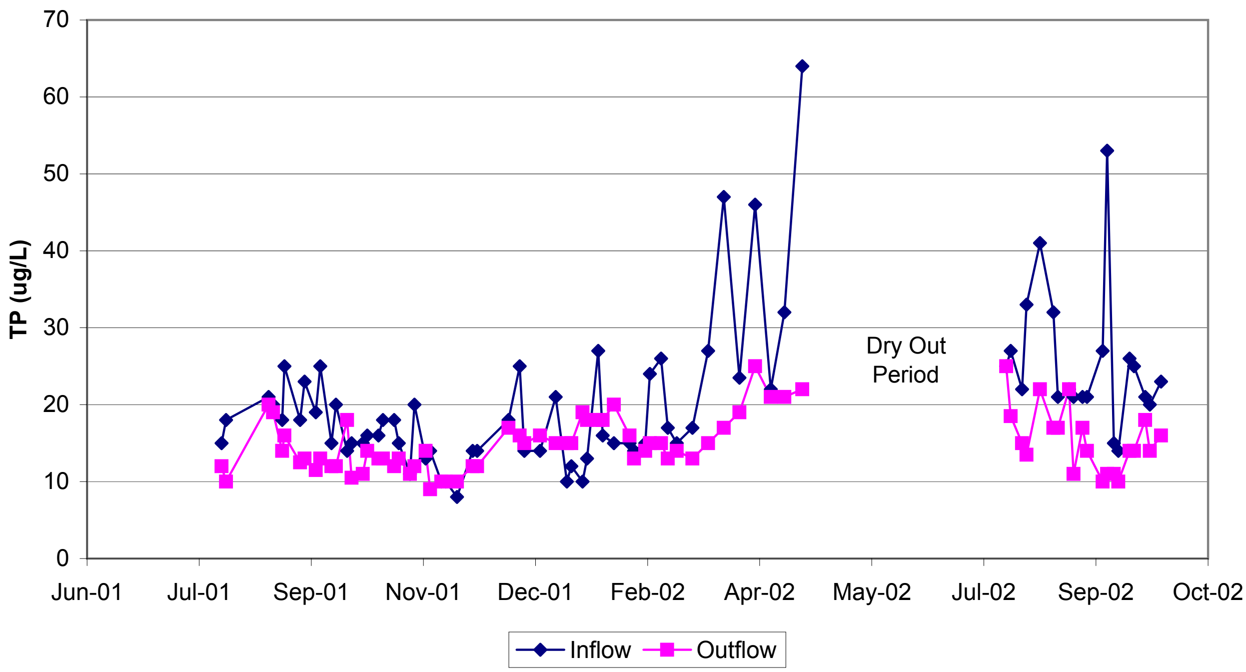


EXHIBIT 3-22

Time-Series of Average Monthly TP Inflow and Outflow Concentrations in Field-Scale PSTA Cell 3 (scrape-down to caprock)

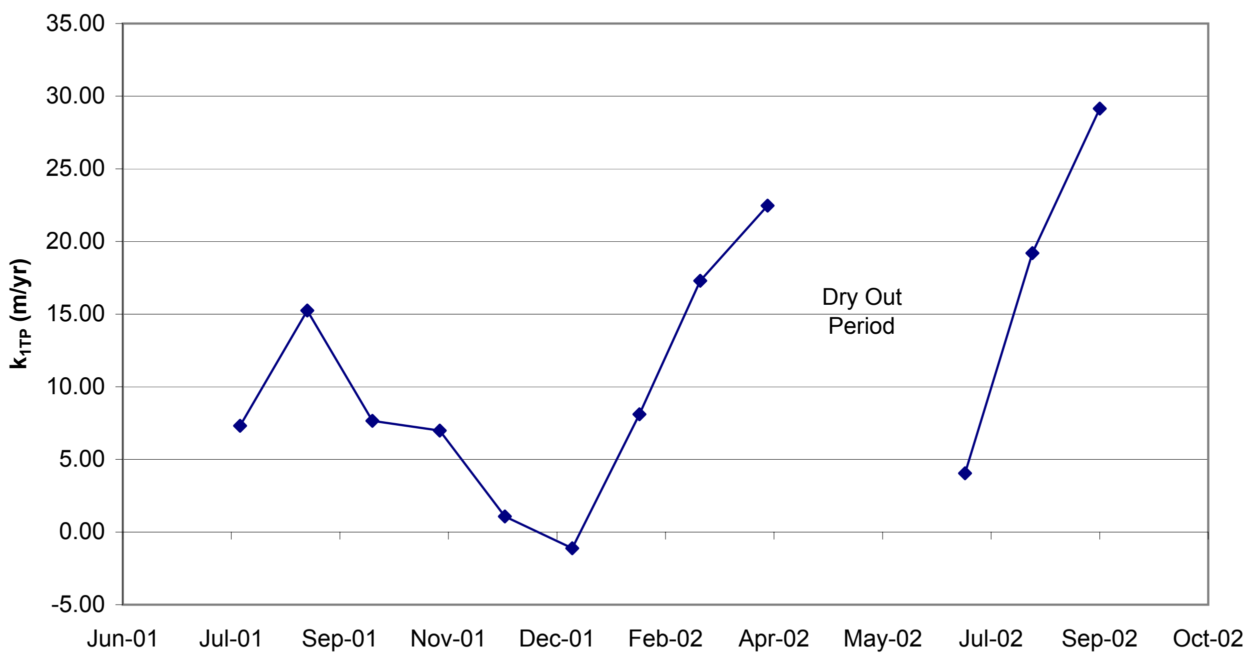


EXHIBIT 3-23

Time-Series of Average Monthly k_{1TP} Values in Field-Scale PSTA Cell 3 (scrape-down to caprock)

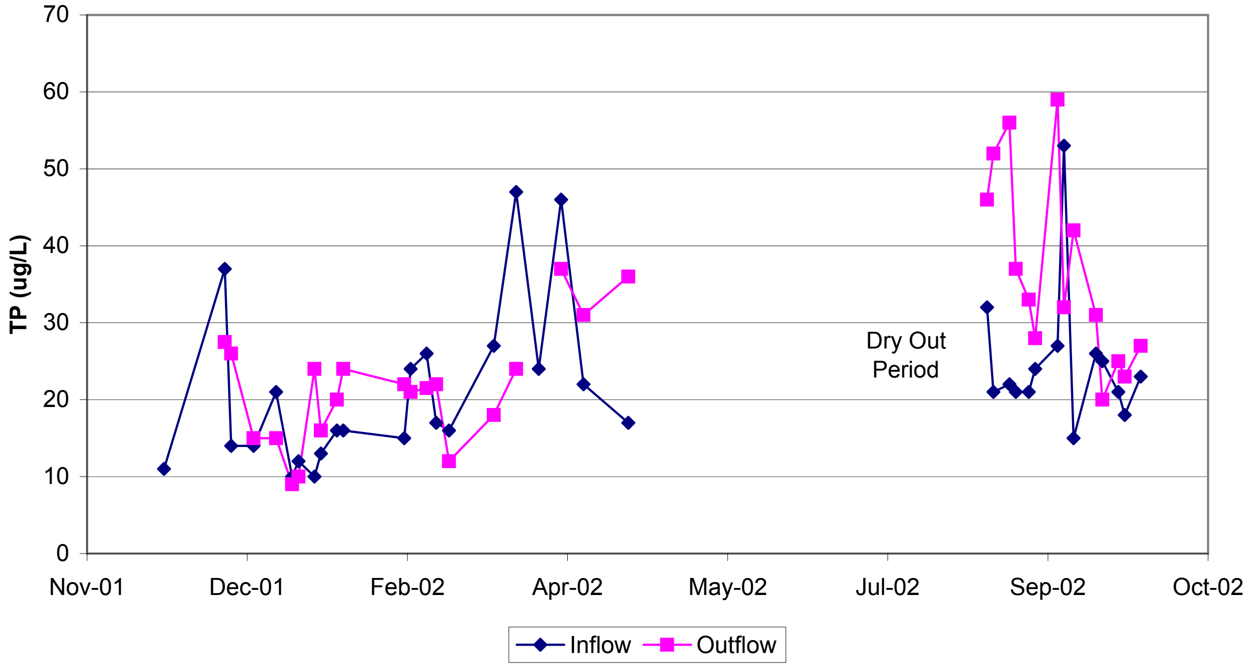


EXHIBIT 3-24
Time-Series of Average Monthly TP Inflow and Outflow Concentrations in Field-Scale PSTA Cell 4 (native peat)

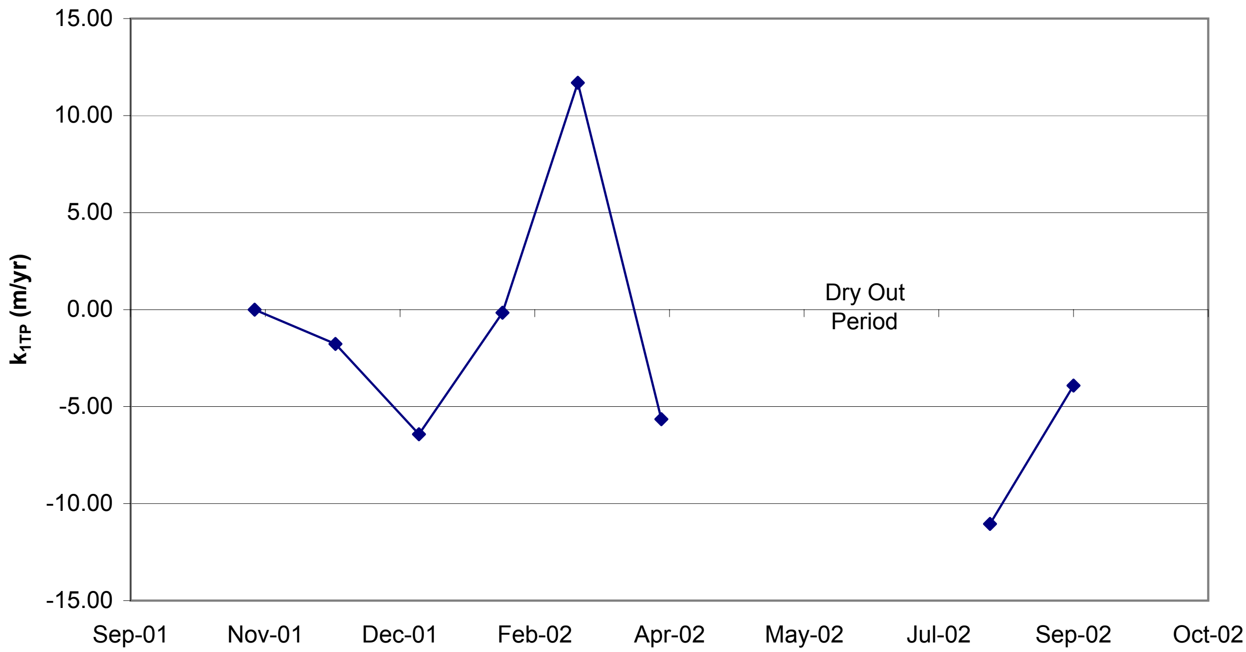


EXHIBIT 3-25
Time-Series of Average Monthly k_{1TP} Values in Field-Scale PSTA Cell 4 (native peat)

The peat-based Field-Scale Cell (FSC-4) had fairly poor TP removal performance since the beginning of the project and through September 2002 (see Exhibits 3-24 and 3-25). Outflow TP concentrations in this treatment have typically been higher than inflow concentrations since project startup.

3.3.6 Analytical Considerations for Low Phosphorus Concentrations

The results of the P monitoring of all PSTA experiments must be interpreted in light of the very low concentrations measured and the variability in those measurements introduced by natural causes and normal and unavoidable analytical error. Appendix A includes detailed descriptions of the P detection methods employed by the University of Florida Institute of Food and Agricultural Sciences (IFAS) labs, as well as the quality assurance/quality control (QA/QC) record of results from duplicate samples and equipment blanks collected over the course of the project. The University of Florida IFAS facilities have an approved quality assurance project plan (QAPP) filed with FDEP and consistently meet QA expectations in P measurement as a routine participant in the state's round-robin laboratory analysis. Equipment blanks collected during the sampling of the Porta-PSTAs yielded respective median DRP, TDP, and TP values of 1, 3, and 2 μg/L, respectively. Similar equipment blanks collected during the Test Cell sampling yield median DRP, TDP, and TP values of 1, 2, and 2 μg/L, respectively. At the FSCs, equipment blanks yielded respective median DRP, TDP, and TP values of 1, 2, and 1 μg/L, respectively.

Field duplicates collected during the sampling of the Porta-PSTAs yielded median DRP, TDP, and TP differences of 1, 1, and 2 μg/L, respectively. Similar field duplicate samples collected during the Test Cell sampling yielded median DRP, TDP, and TP differences of 5, 1, and 1 μg/L, respectively. At the FSCs, field duplicates yielded respective median DRP, TDP, and TP differences of 1, 1, and 1 μg/L, respectively.

Collectively, these data indicate a high level of quality control and consistency in the analyses employed during the PSTA project, but they also illustrate why experimental treatment differences on the order of 1 to 3 μg/L TP are at the nominal detection levels of the experimental methods approved and implemented during this study. The convention employed for this study is that analytical variation is uniform across all experimental treatments, and results were reported as received from the laboratory and after QA/QC review.

3.4 Treatment Effects

A large number of treatments were investigated in the PSTA test systems because of the many questions about PSTA effectiveness that existed at the start of the study. This section provides a summary of the observed effects of each key treatment variable on PSTA outflow TP concentration and TP removal performance.

3.4.1 Water Depth and Dry-Out

Water depth was one of the key treatment variables for the PSTA research. Three different water depth regimes were tested during Phase 1 and 2:

- Stable water levels at 60 cm
- Stable water levels at 30 cm
- Varying water depths between 0 and 60 cm

The effects of water depth on TP removal performance can be examined by comparison of treatment averages for outflow TP and k_1 for the OPP in Exhibit 3-26, by examination of the standard errors in the exhibit, and by a review of detailed statistical analyses presented in Appendix H. Standard errors were calculated based on all individual weekly values for TP out and for monthly values for k_1.

EXHIBIT 3-26
Depth Effects for the Optimal Performance Period

						TP Out (µg/L)		k_1 (m/y)		k-C* Model		
Treatment	**Cell**	**Phase**	**Substrate**	**Depth**	**HLR**	**Average**	**SE**	**Average**	**SE**	k_{PFR}	k_{TIS}	**C***
PP-1	9,11,18	1	PE	D	L	14.1	0.71	10.6	1.71	61.9	99.6	15.2
PP-3	12,14,17	1, 2	PE	S	L	17.0	0.46	12.7	0.97	54.0	88.7	15.5
STC-1	13	1	PE	D	L	16.3	0.92	8.3	1.60	34.9	51.1	12.9
STC-4	13	2	PE (Ca)	S	L	20.0	1.35	2.8	1.30	8.5	9.2	***13.0***
PP-2	4,7,8	1	SR	D	L	13.0	0.39	11.7	1.15	46.5	67.2	10.7
PP-4	3,5,10	1, 2	SR	S	L	14.6	0.32	16.8	0.80	43.2	62.9	11.4
PP-6	1,6,15	1	SR	V	V	14.5	0.41	7.9	0.79	39.6	76.5	13.4
STC-2	8	1	SR	D	L	13.3	0.43	9.1	1.03	31.7	44.6	10.0
STC-5	8	2	SR	S	L	11.7	0.52	11.5	0.83	20.7	25.2	6.6
STC-3/6	3	1, 2	SR	V	V	17.9	0.91	6.9	1.41	11.1	12.4	***10.0***

Notes:
Mesocosm Treatments: PP = Porta-PSTAs, STC = South Test Cells
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate
Weekly data used in calculations
bold and italics = values fixed in model

Average water depths between 30 and 60 cm in peat-based mesocosms did not have a statistically significant effect on PSTA performance. Shallow depth slightly increased the outflow TP concentration and had variable effects on the removal rate constant in the peat Porta-PSTA treatments. A decline in k_1 at the shallow depth was only observed in the peat-based PSTA Test Cell; however, this difference is potentially confounded by the soil treatment that occurred in this cell between Phase 1 and Phase 2.

Depth effects on the performance of shellrock-based PSTA treatments were not clear. Based on data from the OPP, the shallow Porta-PSTA shellrock treatment did not show a significant difference in average TP outflow concentration than the deep treatment, but the TP removal rate constant, k_1, was significantly higher in the 30-cm treatment. In the depth test in the shellrock Test Cells, the shallow treatment performed better than the deep treatment, both for outflow TP and for the TP removal rate constant and C*. The shellrock treatments with variable water regime generally had higher TP outflow concentrations and lower values for k_1. In conclusion, average water depths between 30 and 60 cm in shellrock mesocosms did not have a clear effect on performance for TP removal. Variable water depth accompanied by varying hydraulic loads reduced TP removal performance in the shellrock mesocosms.

Depth was not a treatment variable in the Field-Scale PSTA operations. All depths were controlled to approximately 30 cm to allow ample light for periphyton development and relatively higher velocity.

3.4.2 Soil Type and Amendments

Five types of soils and two non-soil controls were employed in the PSTA test systems:

- Peat (high organic content) agricultural soils
- Shellrock
- Sand (beach)
- Limerock
- Caprock
- No soil
- Synthetic substrate (Aquamat®)

Also, there were two soil amendments tested in Phase 2:

- Application of lime to the peat soils
- Rinsing the sand soils with dilute HCl

An additional soil amendment study was initiated during Phase 3, with preliminary results provided in Appendix I.

The effects of soil treatments on PSTA TP removal performance can be examined by comparing treatment combinations for the OPP (see Exhibit 3-27). At both water depths in the Porta-PSTA mesocosms, shellrock out-performed peat and sand. In the PSTA Test Cells, shellrock also outperformed peat. Sand treatments were not consistently better or worse than the peat treatments. The shallow sand treatment (PP-7) performed nearly as well as the comparable shellrock treatment.

Exhibit 3-27 also compares the performance of the Phase 2 Porta-PSTA treatments with limerock, HCl-rinsed sand, Aquamat, and no soil with the replicated peat and shellrock treatments. These data averages for the OPP indicate that the limerock and two non-soil treatments performed about as well as the shellrock treatment and better than the peat treatment, and the acid-rinsed sand treatment out-performed all of the other treatments, both in terms of achievable outflow

EXHIBIT 3-27
PSTA Soil Effects - Optimal Performance Period

						TP Out (µg/L)		k1 (m/y)		k-C* Model		
Treatment	**Cell**	**Phase**	**Substrate**	**Depth**	**HLR**	**Average**	**SE**	**Average**	**SE**	**kPFR**	**kTIS**	**C***
PP-1	9,11,18	1	PE	D	L	14.1	0.71	10.6	1.71	61.9	99.6	15.2
PP-2	4,7,8	1	SR	D	L	13.0	0.39	11.7	1.15	46.5	67.2	10.7
PP-8	20	1	SA	D	L	16.1	1.06	6.4	3.21	89.3	185.2	***15.0***
PP-3	12,14,17	1, 2	PE	S	L	17.0	0.46	12.7	0.97	54.0	88.7	15.5
PP-4	3,5,10	1, 2	SR	S	L	14.6	0.32	16.8	0.80	43.2	62.9	11.4
PP-7	19	1, 2	SA	S	L	15.2	0.61	15.3	1.30	31.1	40.8	10.3
PP-11	23	1, 2	SR	S	L	17.8	0.67	11.7	1.24	39.6	54.6	12.9
PP-12	24	1, 2	PE	S	L	18.6	0.73	9.9	1.30	44.9	65.8	15.2
STC-1/4	13	1, 2	PE / PE (Ca)	D/S	L	18.4	0.89	5.0	1.06	58.5	108.5	18.0
STC-2/5	8	1, 2	SR	D/S	L	12.4	0.36	10.5	0.66	47.2	76.4	10.2
PP-3	12,14,17	1, 2	PE	S	L	17.0	0.46	12.7	0.97	54.0	88.7	15.5
PP-4	3,5,10	1, 2	SR	S	L	14.6	0.32	16.8	0.80	43.2	62.9	11.4
PP-14	4,7,8	2	LR	S	L	14.5	0.79	14.8	1.79	27.6	34.6	***8.0***
PP-17	20	2	SA (HCl)	S	L	11.4	0.93	20.1	2.44	42.4	63.0	4.5
PP-18	21	2	None	S	L	14.0	1.06	15.5	2.27	32.8	43.9	***8.2***
PP-19	22	2	AM	S	L	13.8	1.83	17.4	3.15	28.6	36.2	***7.0***
FSC-1	1	3	LR	S	H	18.2	3.22	7.49	2.65	29.2	35.8	12
FSC-3	3	3	CR	S	H	16.1	2.72	11.71	3.03	62.5	86	15.0
FSC-4	4	3	PE	S	H	31.5	6.43	-3.4	2.95	37.5	48.9	32.0

Notes:

Mesocosm Treatments: PP = Porta-PSTAs, STC = South Test Cells

Substrate: PE = peat, SR = shellrock, LR = limerock, CR = caprock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

Weekly data used in calculations

bold and italics = values fixed in model

TP concentration and k_1. This result was especially notable because the k-C* model returned an estimated C* for this treatment of 4.5 µg/L. This concentration was lower than any other known measured C*, except for natural areas of the Everglades and could not be lowered further because of natural inputs of TP from rainfall.

Exhibit 3-27 also summarizes the Phase 3 data for the three FSCs with similar geometry but differing soil treatments. In this case, caprock slightly outperformed limerock, and both were superior to use of un-amended native peat soils.

It was observed during Phase 1 that peat soils released labile P to the water column at a higher rate and for a longer period than the calcium-based shellrock soils (CH2M HILL, August 2000). Phase 2 PSTA research was expanded to look at the effects of amending some of the peat (organic) soils with calcium minerals recommended by Ann et al. (2000) and by aluminum, calcium, and iron treatments during Phase 3.

PSTA South Test Cell Treatment 1 (STC-1 or Test Cell 13) was converted to South Test Cell Treatment 4 (STC-4) by the addition of approximately 1,580 kg of hydrated lime [$Ca(OH)_2$], providing an effective application rate of 7 metric tonnes per hectare (mt/ha). Porta-PSTA treatment PP-3 was converted to PP-13 using the same amount of lime addition. All emergent macrophytes in these mesocosms were removed as part of this process. Spikerush was replanted once the soil amendment was finished. The other notable difference between the conversion from STC-1 to STC-4 and from PP-3 and PP-13 was that the water depth was lowered in the PSTA Test Cell but not in the Porta-PSTA.

Exhibit 3-28 provides a comparison of the results from each of these four treatments. Results are summarized for the POR, the OPP, and for the last 60 days of each treatment. Comparison of outflow TP concentrations, TP mass removals, and k_1 indicate that there was no observed benefit of liming in the PSTA peat-based Test Cell. However, in the Porta-PSTA treatments, there was a significant benefit. The difference between these two mesocosm scales probably resulted from the method of lime addition. Lime was added to the PSTA Test Cell by hand broadcasting in the partially drained cell. This disturbed the peat sediments because of the foot traffic involved. Lime addition in the Porta-PSTA tanks was from outside the tank with minimal internal disturbance and without removing surface water. It appears that to be effective for controlling internal releases of TP, lime addition on a large scale would need to avoid or minimize soil disturbance conducted under flooded conditions.

EXHIBIT 3-28

PSTA Amended Peat Soils Data Summary

Treatment	Period	q_in (cm/d)	Wtr Depth (m)	TP (µg/L) Inflow	TP (µg/L) Outflow	TP ($g/m^2/yr$) Inflow	TP ($g/m^2/yr$) Outflow	Removal ($g/m^2/yr$)	Calc_k (m/yr)
STC-1	POR	4.6	0.64	25	27	0.43	0.50	-0.07	-1.2
(Peat)	OPP	4.6	0.65	29	17	0.50	0.28	0.22	9.3
	Last 60 d	4.7	0.66	28	13	0.48	0.17	0.31	13.3
STC-4	POR	5.1	0.28	23	32	0.42	0.54	-0.12	-6.6
(Peat - Ca)	OPP	5.1	0.29	22	19	0.40	0.33	0.07	2.0
	Last 60 d	5.1	0.28	23	30	0.42	0.46	-0.04	-5.1
PP-3	POR	7.4	0.30	29	19	0.75	0.47	0.28	12.1
(Peat)	OPP	8.0	0.31	27	17	0.77	0.46	0.30	13.7
	Last 60 d	7.0	0.30	22	18	0.58	0.42	0.16	5.5
PP-13	POR	8.1	0.33	30	18	0.84	0.50	0.34	14.8
(Peat - Ca)	OPP	8.8	0.34	21	13	0.66	0.40	0.26	14.6
	Last 60 d	8.9	0.34	22	11	0.71	0.35	0.37	21.3

Notes:
POR=period of record
OPP=optimal performance period

Research methods and initial results from the Phase 3 soil amendment study are summarized in Appendix I. Twelve small-scale tanks (1.14 m^2) were utilized in this study. Each tank was filled with approximately 15 cm of peat soils similar to the native soils in FSC-4. Two tanks were reserved as controls with no amendments. Four tanks received each of three chemical amendments (polyaluminum chloride, ferric chloride, or calcium hydroxide) at either high or low concentrations (two replicate tanks with each amendment and concentration). The "low" dose was calculated as the stoichiometric amount of active ingredient necessary to tie up the labile TP in the antecedent soil. The "high" dose was approximately four times that amount and was based on the measured soil TP concentration. Amendments were added in slurry form to the dry soils. The tanks were flooded to an approximate water depth of 30 cm and left in a batch mode (no flow-through) with periodic addition of make-up water for a period of approximately 10 weeks. Flow-through conditions at an HLR of approximately 6 cm/d was initiated at that time and maintained through the end of the study (approximately 18 weeks of flow-through conditions).

Preliminary results from this small-scale study indicated that there was no statistically significant TP concentration reduction benefit from any of the treatments compared to the controls. Through week 10 of the 18-week study, TP in the inflow averaged between 30 and 33 µg/L. The average internal or outflow TP concentration in each treatment was: control=32 µg/L, ferric chloride (high dose)=26 µg/L, ferric chloride (low dose)=29 µg/L, lime (high dose)=54 µg/L, lime (low dose)=43 µg/L, polyaluminum chloride (high dose)=28 µg/L, and polyaluminum chloride (low dose)=27 µg/L. Based on these incomplete results, it appeared that iron- and aluminum-based amendments were slightly more effective than unamended soils and that lime amendment worsened TP surface water concentrations. It was observed that addition of a lime slurry to the dry peat soils was destructive of the soil matrix, resulting in dissolution of a fraction of the soils and release or organic P. This observation was consistent with the effects observed previously in PSTA Test Cell 13 (STC-3 and STC-6) and Porta-PSTA soil amendment studies. It is concluded that addition of the lime slurry with high pH to flooded soils was preferable to addition to dry soils.

3.4.3 Hydraulic and Phosphorus Loading Rate

HLR was a treatment variable at the Porta-PSTA mesocosm scale. The only design difference between shellrock treatments PP-2 and PP-5 was hydraulic loading, with a two-fold difference between the two treatments. Data for the OPP indicate that increasing the hydraulic loading to an average rate of approximately 17 cm/d from 9 cm/d increased the average outflow TP concentration (from 13 to 16 µg/L), increased k_1 (from 13 to 27 m/yr), increased k_{PFR} and k_{TIS} (from 46 to 68 m/yr and from 67 to 90 m/yr, respectively), and had no effect on C* (11 µg/L for both treatments) (Exhibits 3-8 and 3-9).

It is clear from this comparison and from earlier regressions between HLR and TP mass removal (CH2M HILL, May 2001) that the removal rate constants in both the one- and two-sizing parameter TP removal models described above are a function of loading rate (see Exhibits 3-29 and 3-30). This relationship indicates that these models have limited utility for estimating treatment area because the removal rate constant chosen for a given flow and inlet load varies with the selected treatment footprint. It also indicates that TP removal rate constants for differing technologies can only be accurately compared when they are presented on the basis of TP loading.

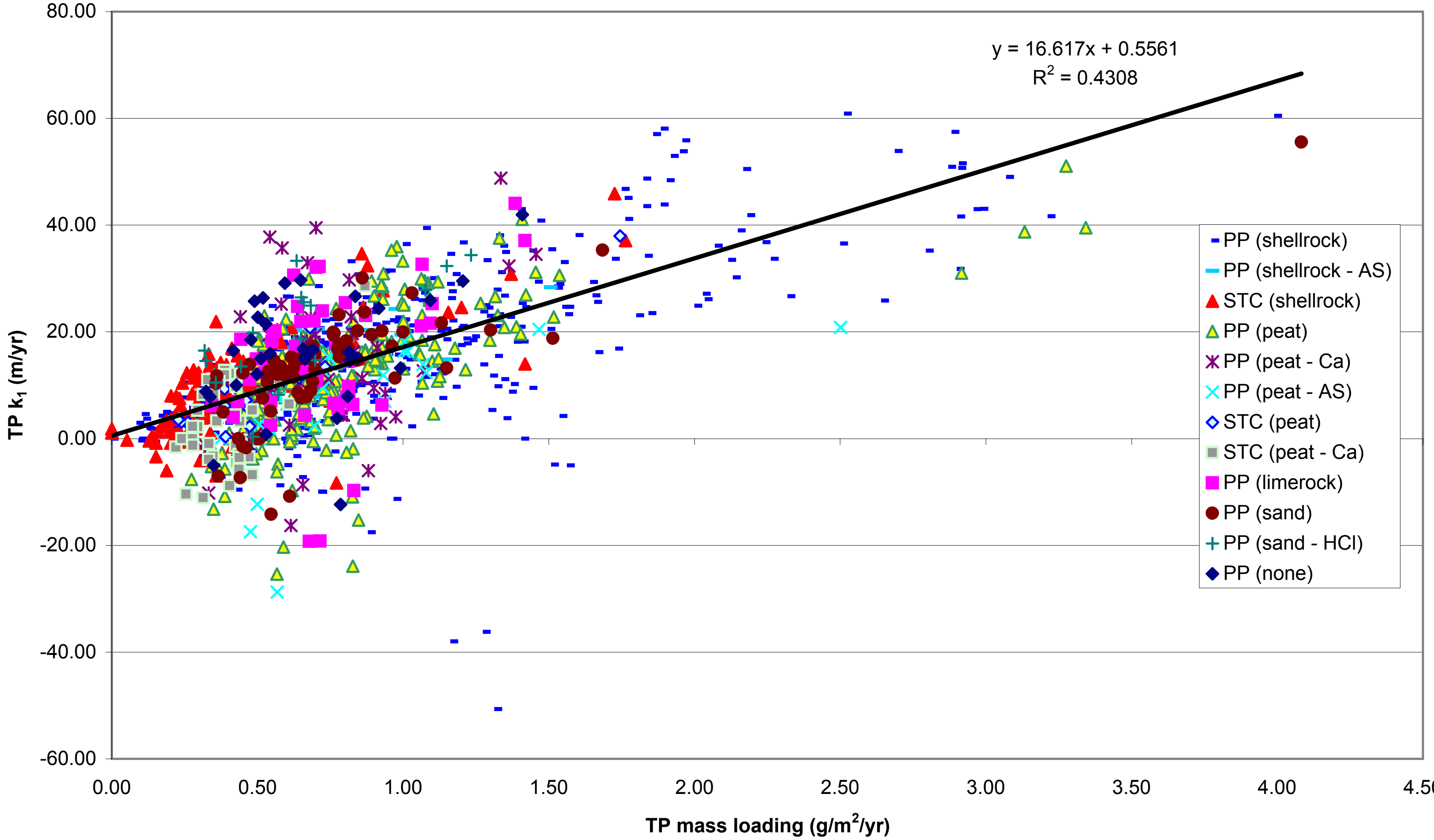


EXHIBIT 3-29

Relationship Between Inflow TP Mass Loading Rate and k_{1TP} for the Phase 1 and 2 PSTA Test Systems for the Optimal Performance Period

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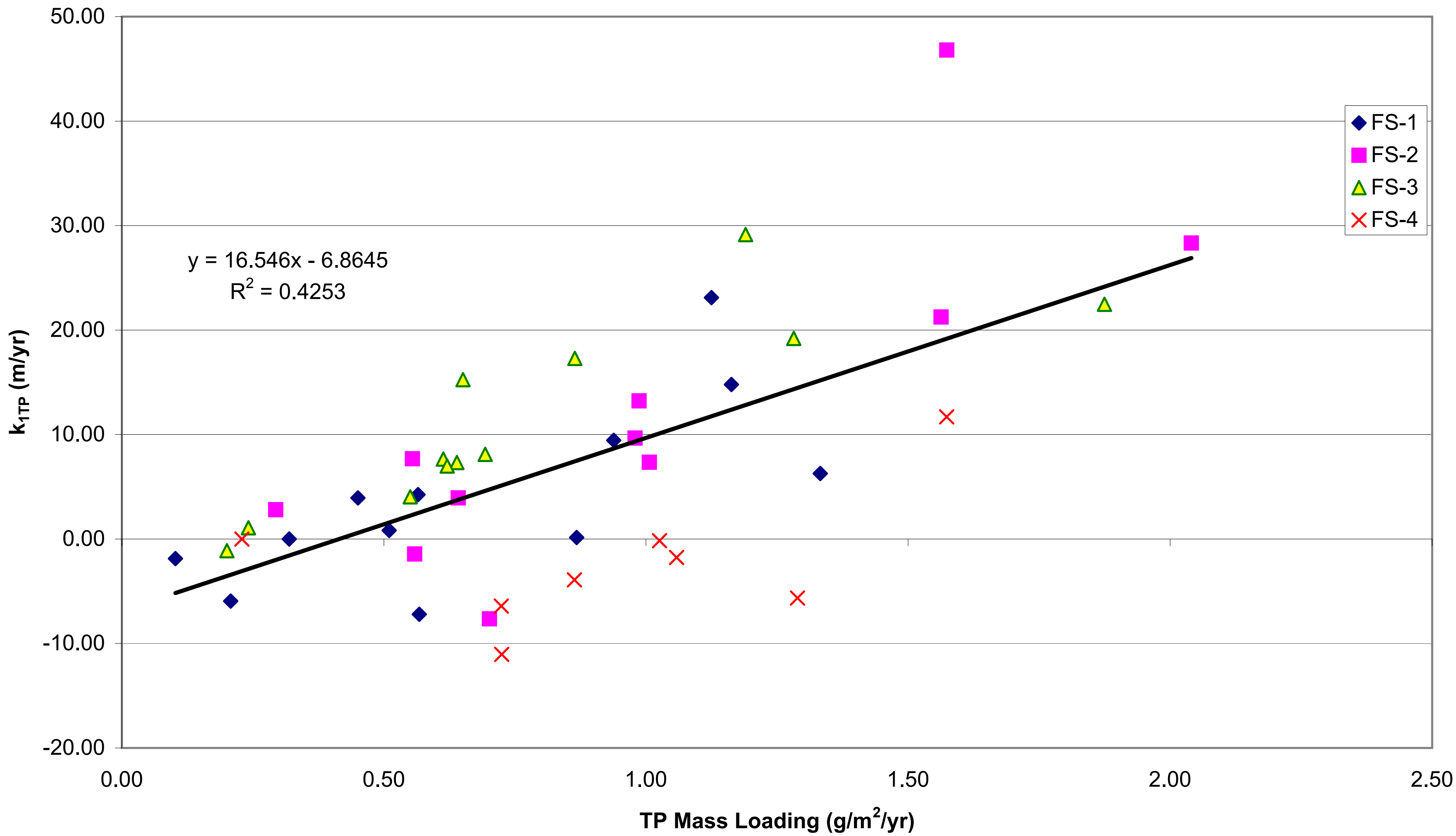

EXHIBIT 3-30
Relationship Between Inflow TP Mass Loading Rate and k_{1TP} for the PSTA Field-Scale Cells

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One impact of this finding is that it may be possible to remove a significantly greater mass of TP in a PSTA operated at a higher hydraulic loading, as long as the lowest possible outflow TP concentration is not desired downstream. This finding affects the potential trade-off between maximizing TP mass removed and minimizing effects of downstream TP concentrations.

3.4.4 Batch Operation

A batch-mode study (no flow-through) was conducted in selected Phase 1 PSTA treatments between January 18 and March 14, 2000. The purpose of this study was to determine whether TP concentration in the PSTA water columns would increase or decrease following cessation of inflows and whether these concentrations would level off to some stable value without pumped inflows. A decline could be interpreted to indicate the dominance of an external loading effect on TP outflow concentration. When loading of external TP is stopped, water column concentrations could be expected to decline to a new lower equilibrium concentration in response to a balance between internal loading and removal processes. A rise in TP concentration to a higher stable concentration is an indication that internal P loading from soils is greater than the gross biological removal rate of the periphyton community. Stable concentrations during the batch study would indicate a balance between internal loads and removals.

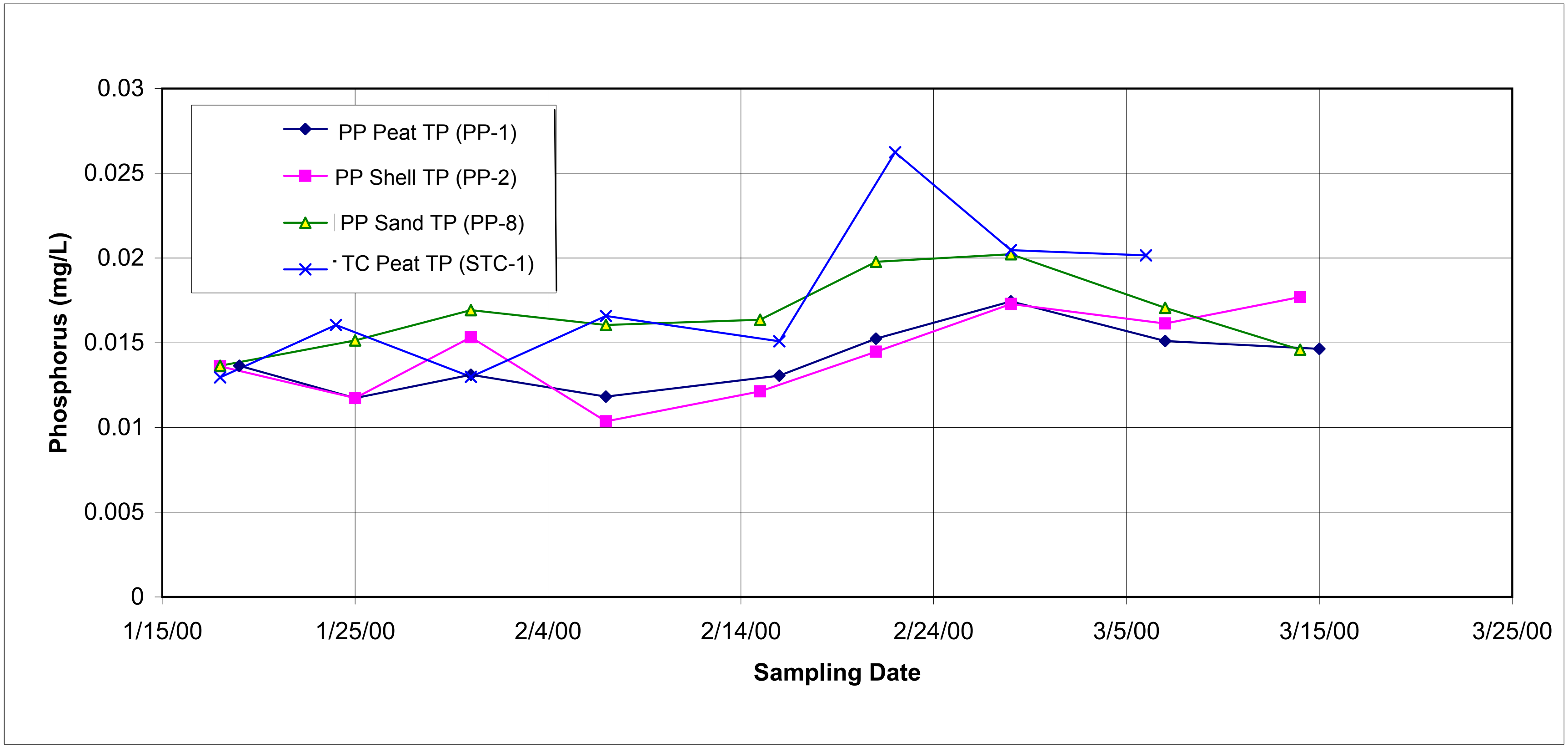
Exhibit 3-31 illustrates the results of the batch-mode study. TP water column concentrations increased or remained relatively constant in each of the mesocosms tested. None of the TP concentrations decreased during the 2-month period. Increases were generally in the range of 15 to 50 percent in the Porta-PSTAs that were tested. The STC-1 (peat) average water column TP concentration increased by approximately 54 percent. These results provide a convincing demonstration of the importance of internal P loading on the achievable C* in these PSTA mesocosms. Under the conditions of this study (first year, peat, shellrock, and sand soils, etc.), batch mesocosms did not attain TP concentrations less than 10 ppb and typically had values between 10 and 20 ppb. Rising TP water column concentrations in some treatments during the period of this batch study resulted from continuing soil releases of labile TP nearly 1 year after startup. This internal loading appeared to be highest in the peat-based PSTA Test Cell. A detailed description of the batch treatments is provided in Appendix D.

3.4.5 Velocity (Recirculation and Cell Configuration)

During Phase 2, PP-15 (shallow shellrock with recirculation) tested the effects of higher flow velocity on TP removal performance against a comparable treatment, PP-4, with low HLR. Both treatments were replicated in three Porta-PSTAs. PP-15 had re-circulation pumps installed to provide approximately 20 gallons per minute (gpm) of pumping from the downstream end of the tank

EXHIBIT 3-31

TP Water Column Concentrations During the Batch-Mode Study in Selected PSTA Mesocosms During Phase 1



back to the inflow baffle. This recirculation pumping resulted in a velocity increase with no increase in influent TP loading. The nominal velocity in PP-4 was 0.0014 cm/s; in PP-15, nominal velocity was approximately 0.5 cm/s. Actual average velocities during these Phase 2 investigations for the three replicates ranged from 0.18 to 0.34 cm/s because of variable pumping rates in the replicate mesocosms.

An initial increase in average TP outflow concentration was observed in PP-15 as a result of running the recirculation pumps (Exhibit 3-32). This resulted in a higher average of 18 µg/L in the recirculation treatment, compared to 17 µg/L in PP-4. However, no detectable difference in performance between the two treatments during the last 4 months of the test was observed. The OPP averages for these two treatments were nearly identical at approximately 15 µg/L. Exhibit 3-33 illustrates the time series for k_{1TP} values for these two treatments. Phase 2 OPP averages for PP-4 and PP-15 were 16 and 13 m/yr, respectively. In summary, installation of re-circulation and resulting higher velocities (190x increase) in the shellrock Porta-PSTAs did not provide any observed enhancement of TP outflow concentration or TP mass removal rate.

The Phase 3 Field-Scale PSTA design also provided an indirect test of velocity on TP removal performance. FSC-1 (length:width=5:1) and FSC-2 (length: width=45:1) were identical except for their length-to-width ratios. Resulting nominal velocities in FSC-2 (0.22 cm/s) were approximately three times higher than in FSC-1 (0.073 cm/s). FSC-2 outperformed FSC-1 with a lower average outflow TP concentration (15.3 vs. 18.2 µg/L for the OPP), higher k_1 (13.2 vs. 7.5 m/yr), and lower estimated C* (10 vs. 12 µg/L). However, hydraulics were greatly improved in FSC-2 compared to one of the other 5:1 cells (FSC-4), which may be the actual reason for improved performance rather than velocity. Performance of the Field-Scale high-velocity treatment did not appear to be better than the comparable Test Cell treatment (STC-5) or the recirculation Porta-PSTA treatment (PP-15).

3.4.6 Mesocosm Scale

All mesocosm research systems have certain limitations for scale-up to full-scale design (Bowling et al., 1980; Beyers and Odum, 1993). Reduced-size systems may have unrealistic surface-area-to-volume ratios and flow velocity regimes. Scale-up effects are likely when extrapolating from small test systems to larger, full-scale systems. The PSTA research included specific treatment combinations that provide some quantification of the effect of mesocosm scale on treatment performance. Two Porta-PSTA scales were tested: 1-m and 3-m-wide fiberglass tanks. Both sets of tanks were 6 m long, so the scale difference between these tanks was quantified as the depth: width ratio. The 1-m-wide Porta-PSTA tanks had a nominal depth: width ratio of either 0.6 or 0.3 depending on water depth. The 3-m-wide tanks had a nominal depth: width ratio of approximately 0.1. The PSTA Test Cells had a lower ratio, with a nominal depth:width ratio of approximately 0.02, the sinuous FSC had a ratio of 0.014, and the other FSCs were large enough to have an almost negligible scale effect (depth:width ratio=0.005).

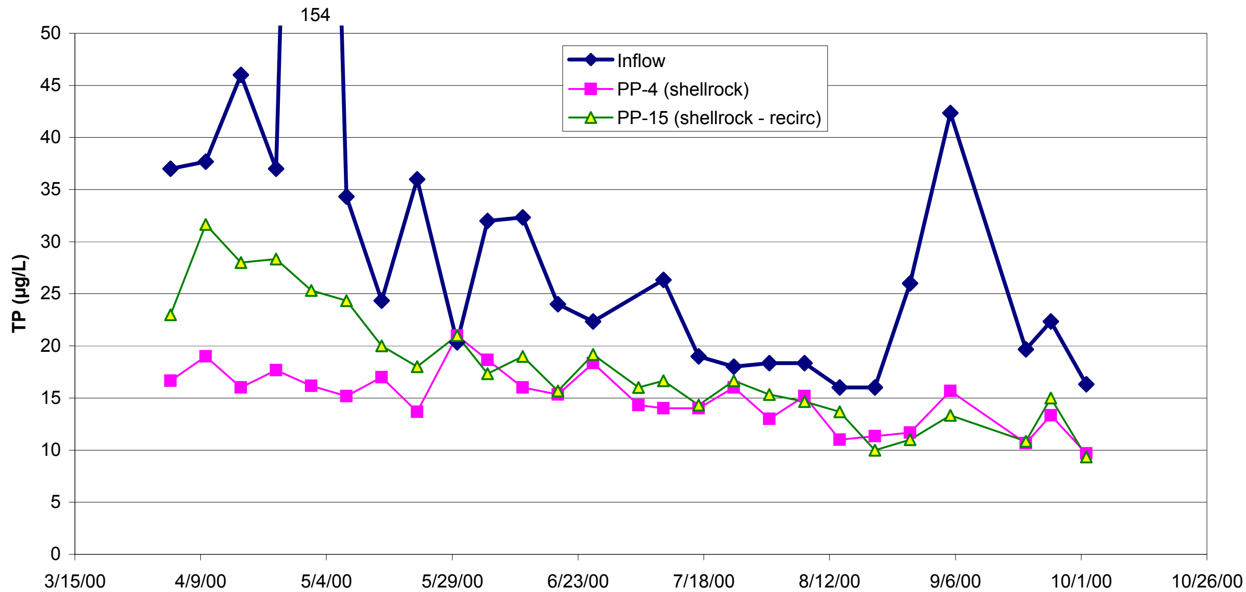


EXHIBIT 3-32
Porta-PSTA TP Inflow and Outflow Concentrations in Treatments PP-4 (Shellrock) and PP-15 (Shellrock with Recirculation) for Phase 2

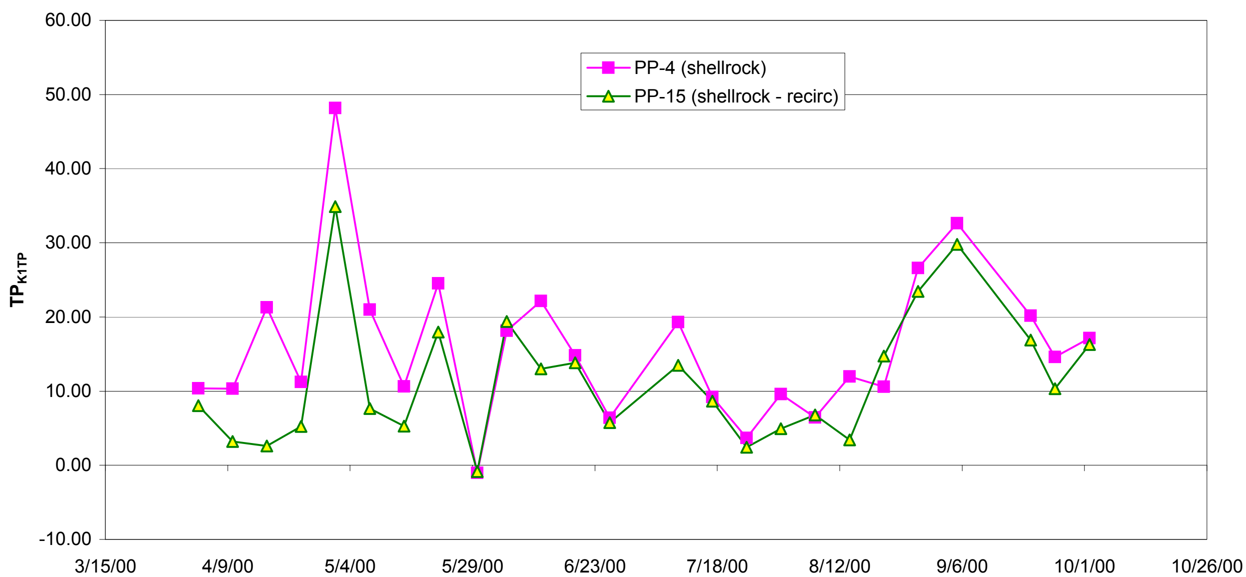


EXHIBIT 3-33
Porta-PSTA k_{1TP} Values in Treatments PP-4 (Shellrock) and PP-15 (Shellrock with Recirculation) for Phase 2

Exhibit 3-34 summarizes the effect of mesocosm scale on the key P performance indicators: average outflow concentration and k_1 for the OPP. For the peat-based PSTA mesocosms, increasing scale (reduced edge or wall effects) resulted in increasing outflow TP concentrations. The effect of scale on the TP one-parameter removal rate constant k_1 was not consistent but generally resulted in lower rate constants at large (more realistic) scales. For the shellrock treatments, increasing the scale had no consistent effect on either the TP outflow concentration or the value of k_1.

As a result, a consistent effect of mesocosm scale was not detected under this project, either because no relationship exists or because of limited replication and measurement sensitivity. If there was a scale effect, it appeared to be one of overestimation of TP removal performance in the smallest test systems. This line of reasoning indicates that conclusions from the Porta-PSTAs may be overly optimistic and that the data from the PSTA Field-Scale or Test Cells may be more reliable for extrapolation to full-scale design.

3.4.7 Periphyton and Macrophytes

Two Porta-PSTA control tanks were operated with Aquashade for comparison to the vegetated Porta-PSTA treatments to obtain an indication of the importance of periphyton and macrophytes on observed TP removal rates. These treatments, PP-9 (peat) and PP-10 (shellrock), were unreplicated and operated only during Phase 1. For both soil types, the outflow TP concentration (OPP) from the Aquashade control was higher than the corresponding vegetated tank (Exhibit 3-35). This difference was significant for the peat-based mesocosms but not for shellrock.

Aquashade effects on the average k_1 and k-C* model parameters (Phase 1 OPP) were not consistent. The Aquashade k_1 value was lower by 34 percent for the peat soils and was higher by 23 percent for shellrock soils. C* estimates were similar for each treatment pair.

The Aquashade peat tank had a higher TP outflow concentration, a greater estimated C*, and a lower estimated value for k_1 than the shellrock tank, providing additional evidence of greater internal loading from the peat soils than from shellrock. In addition, Aquashade treatments were nearly as effective for TP removal as treatments with fairly dense periphyton and macrophyte communities. Based on chlorophyll and biomass sampling, the Aquashade treatments were colonized by low levels of algae but also contained significant populations of heterotrophic microbes. These results may indicate that the net difference between TP removal and recycling effects of the periphyton and macrophytes is relatively minor and these processes offset each other to the point of having little consistent influence on the TP mass removal rate. However, the presence of periphyton and plants resulted in lower achievable TP outflow concentrations. A larger number of controls would have been beneficial to detect effects of periphyton and macrophytes. These data indicate that results from mesocosms must be interpreted with caution.

EXHIBIT 3-34
Mesocosm Scale Effects for the OPP

Treatment	Cell	Phase	Substrate	Depth:Width	Depth	HLR	TP Out (µg/L) Average	TP Out (µg/L) SE	k_1 (m/yr) Average	k_1 (m/yr) SE	k-C* Model k_{PFR}	k-C* Model k_{TIS}	k-C* Model C*
PP-1	9,11,18	1	PE	0.600	D	L	14.1	0.71	10.6	1.71	61.9	99.6	15.2
PP-3	12,14,17	1, 2	PE	0.300	S	L	17.0	0.46	12.7	0.97	54.0	88.7	15.5
PP-12	24	1, 2	PE	0.100	S	L	18.6	0.73	9.9	1.30	44.9	65.8	15.2
STC-1	13	1	PE	0.021	D	L	16.3	0.92	8.3	1.60	34.9	51.1	12.9
STC-4	13	2	PE (Ca)	0.021	S	L	20.0	1.35	2.8	1.30	8.5	9.2	***13.0***
FSC-4	4	3	PE	0.005	S	H	31.5	6.43	-3.4	2.95	37.5	48.9	*32.0*
PP-2	4,7,8	1	SR	0.600	D	L	13.0	0.39	11.7	1.15	46.5	67.2	10.7
PP-4	3,5,10	1, 2	SR	0.300	S	L	14.6	0.32	16.8	0.80	43.2	62.9	11.4
PP-11	23	1, 2	SR	0.100	S	L	17.8	0.67	11.7	1.24	39.6	54.6	12.9
STC-2	8	1	SR	0.021	D	L	13.3	0.43	9.1	1.03	31.7	44.6	10.0
STC-5	8	2	SR	0.021	S	L	11.7	0.52	11.5	0.83	20.7	25.2	6.6
FSC-2	2	3	LR	0.014	S	H	15.3	2.70	13.2	3.66	48.5	49.8	10.0
FSC-1	1	3	LR	0.005	S	H	18.2	3.22	7.5	2.65	29.2	35.8	**12.0**

Notes:
Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate
Weekly data used in calculations
bold = values fixed in model

EXHIBIT 3-35
Aquashade Treatment Results with Respect to Plant/Periphyton Effects for the OPP

							TP Out (µg/L)		k_1 (m/y)		k-C* Model		
Treatment	Cell	Phase	Plants/ Periphyton	Substrate	Depth	HLR	Average	SE	Average	SE	k_{PFR}	k_{TIS}	C*
PP-1	9,11,18	1	yes	PE	D	L	14.1	0.71	10.6	1.71	61.9	99.6	15.2
PP-9	21	1	no	PE (AS)	D	L	19.5	1.30	7.0	2.50	35.5	46.3	***16.0***
PP-2	4,7,8	1	yes	SR	D	L	13.0	0.39	11.7	1.15	46.5	67.2	10.7
PP-10	22	1	no	SR (AS)	D	L	14.6	0.68	15.3	1.36	35.8	47.7	9.8

Notes:
Mesocosm Treatments: PP = Porta-PSTAs, STC = South Test Cells
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade
Depth = S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate
Weekly data used in calculations
bold and italics = values fixed in model

3.5 Phosphorus Dynamics and Fate

The PSTA research data offer insight into the processes important in evaluating the potential of a periphyton-based concept for full-scale use. While the research design focused on assessing the "green box" parameters important in sizing a full-scale PSTA, information has been gained that improves understanding of the processes of TP cycling and the fate of the TP that is removed within the mesocosms. Specific processes discussed below include the fate of P in the mesocosm soils, the observed changes in non-reactive organic P forms, gross P accretion rates in new sediments, and the effects of snail grazing on the net P removal.

3.5.1 Soil P Interactions

Exhibit 3-36 summarizes PSTA soil data by treatment for the POR. Appendices C, D, and E provide detailed soil P data for the Test Cells, the Porta-PSTAs, and the FSCs, respectively. Shellrock soils had the highest TP concentrations, with average values in the Porta-PSTA and Test Cell routine soil cores ranging from 752 to 1,044 mg/kg. The average concentration was 919 mg/kg for shellrock. Porta-PSTA and Test Cell peat treatment averages ranged from 111 to 319 mg/kg, with an overall average TP of 223 mg/kg. The Field-Scale peat treatment had a higher TP average of 405 mg/kg. Sand treatments averaged between 20 and 28 mg TP/kg, with an overall average of 26 mg/kg. The Field-Scale limerock cells averaged 96 to 107 mg TP/kg and the caprock cell averaged 103 mg TP/kg. At the Porta-PSTA and Test Cell sites, TIP made up approximately 68 percent of the TP in the peat soils, 99 percent in the shellrock soils, and 46 percent in the sand soils. TIP was only approximately 20 percent of

EXHIBIT 3-36
Average Soil (upper 10 cm) Phosphorus Fractions (mg/kg) in the Phase 1 and 2 PSTA Test Systems

						Routine Soil Cores (Monthly)			Detailed Phosphorus Fractionation (Quarterly)	Inorganic Phosphorus Fractions		Organic Phosphorus Fractions		
Treatment	Phase	Cell	Substrate	Depth	HLR	TP	TIP	TOP	TP	Labile	Calcium-Bound	Labile	Moderately Labile	Residual
Porta-PSTAs														
PP-1	1	9,11,18	PE	D	L	208	117	91	190	4	75	10	7	43
PP-2	1	4,7,8	SR	D	L	1,044	950	94	840	3	887	2	-18	41
PP-3	1, 2	12,14,17	PE	S	L	177	108	69	222	4	90	10	5	49
PP-4	1, 2	3,5,10	SR	S	L	983	952	31	873	3	953	1	-21	42
PP-5	1	2,13,16	SR	D	H	985	932	53	1020	2	998	2	-24	36
PP-6	1	1,6,15	SR	V	V	975	966	9	839	2	914	2	-16	50
PP-7	1, 2	19	SA	S	L	28	12	16	30	1	5	0	1	12
PP-8	1	20	SA	D	L	24	13	11	24	1	3	2	2	5
PP-9	1	21	PE (AS)	D	L	206	116	90	223	6	85	8	6	53
PP-10	1	22	SR (AS)	D	L	941	932	9	975	4	967	1	-16	43
PP-11	1, 2	23	SR	S	L	925	916	10	977	3	947	1	-23	39
PP-12	1, 2	24	PE	S	L	207	144	64	187	4	120	9	4	49
PP-13	2	9,11,18	PE (Ca)	S	L	111	90	21	119	2	70	7	10	31
PP-15	2	2,13,16	SR	S	R	933	982	-49	981	3	975	0	-29	41
PP-16	2	1,6,15	SR	V	V	880	939	-59	1011	3	988	-1	-30	41
PP-17	2	20	SA (HCl)	S	L	20	9	11	30	2	16	-1	2	8
South Test Cells														
STC-1	1	13	PE	D	L	319	273	46	346	25	189	4	-15	53
STC-2	1	8	SR	D	L	831	793	38	837	3	781	1	-17	61
STC-3	1	3	SR	V	V	886	864	23	816	4	807	1	-10	52
STC-4	2	13	PE (Ca)	S	L	248	212	36	247	23	165	6	-10	52
STC-5	2	8	SR	S	L	752	767	-15	789	4	731	1	-21	48
STC-6	2	3	SR	V	V	899	878	20	927	3	986	1	-31	46
Porta-PSTA and South Test Cell Summary														
	1-2		PE			223	151	72	229	8	113	8	2	49
	1-2		PE (Ca)			180	151	29	196	15	127	6	-2	44
	1-2		SR			919	906	14	902	3	906	1	-21	45
	1-2		SA			26	12	14	27	1	4	1	2	9
	1-2		SA (HCl)			20	9	11	30	2	16	-1	2	8
	1-2		ALL			572	544	28	568	5	534	3	-11	41
Field-Scale Cells														
FSC-1	3	1	LR-PE	S	H	131	64	66	107	6	68	4	5	24
FSC-2	3	2	LR-PE	S	H	114	77	38	96	6	66	3	3	19
FSC-3	3	3	CR	S	H	111	71	40	103	4	69	6	3	29
FSC-4	3	4	PE	S	H	515	87	428	405	14	46	80	173	60

Notes:
Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade, CR = scrape-down to caprock
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

the TP in the Field-Scale peat soils. Total organic phosphorus (TOP) accounts for the rest of the TP in these soils.

Detailed P fractionation in the soils indicated that at the Porta-PSTA and Test Cell sites, approximately four times as much labile TP existed in peat soils than in the shellrock soils, and that the sand soils had approximately half as much as the shellrock soils (POR). The labile and moderately labile P in the Field-Scale peat soil was approximately 20 times higher than in the limerock soils in the other FSCs. The majority of the TP in the shellrock and limerock PSTA soils was calcium-bound, and approximately half of the TP in the peat soils was associated with calcium.

Soil sorption studies before startup and 1 year later are summarized in Exhibit 3-37 for the Phase 1 and 2 soils and in Exhibit 3-38 for the Field-Scale soils. The EPC0 is the estimated P concentration in the overlying water when there is no net release or uptake of P by the soil. If the ambient water P concentration is less than the EPC0, then the soils will release P to the water column. If the ambient water P concentration is higher than the EPC0, then P in the water column will be sorbed into the soils. The estimated EPC0 was much lower in the shellrock soils (2 to 3 µg/L) than in the peat and sand soils (13 to 51 µg/L). The Field-Scale limerock and caprock soils had an EPC0 (similar to the Phase 1 and 2 shellrock soils (2 to 4 µg/L). The Field-Scale peat soil had the highest EPC0 at 362 µg/L. These measurements indicate that the peat and sand soils can release P to the water column at higher water concentrations than the shellrock and limerock soils. The linear adsorption coefficient is much higher for the shellrock and limerock soils than for the peat and sand soils. This coefficient is measured with DRP and is not truly indicative of the potential for TP sorption actually observed in the PSTA test systems.

Exhibits 3-39 to 3-41 provide time series plots of TP, TIP, and TOP for selected Phase 1 and 2 peat, shellrock, and sand PSTA treatments, respectively. An average measurement for each parameter is indicated by the bold line on the trend charts. A clear declining trend in the TP and TIP soil concentrations in the peat-based PSTAs (Exhibit 3-39) was evident. This downward trend was significant during the first 2 to 3 months of operation and was most pronounced in the peat-based Test Cell (STC-1/4). A slight downward trend in soil TP appeared to continue throughout the Phase 1 and 2 POR, although measured changes were slight. TOP in these soils was relatively constant throughout the study period.

Initial soil TP concentration in PP-3 (peat) was 188 mg/kg at a bulk density of 0.33 grams per cubic centimeter (g/cm^3). The final TP content of these soils during the destructive sampling event in February 2001 was 130 mg/kg at an average bulk density of 0.36 g/cm^3. TIP declined from approximately 112 to 94 mg/kg in this treatment. Based on a 20-cm soil depth, this loss of TP from the substrate was equivalent to an estimated internal areal load of 2.9 g/m^2 for the study period.

No consistent trend in soil TP concentrations was evident for shellrock and sand (Exhibits 3-40 and 3-41). An apparent seasonal decline in TOP in the shellrock soils during the winter and spring of the first year of operation was observed,

EXHIBIT 3-37

Average Soil Phosphorus Sorption Characteristics During Phase 1

	EPCo (mg/L)		Kd (L/kg)		So (mg/kg)		TP (mg/kg)		DRP-water (mg/kg)		DRP-$NaHCO_3$ (mg/kg)		DRP-HCl (mg/kg)	
Substrate	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**	**Jan-99**	**Mar-00**
Peat	0.013	0.051	47.1	33	-0.6	-1.7	185	201	4.67	1.03	26.23	7.88	131	124
Shellrock	0.002	0.003	812	1349	-1.8	-4.6	1071	1003.5	1.27	0.03	8.70	3.34	855	940
Sand	0.014	ND	4.79	ND	-0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes: Kd = linear adsorption coefficient; So = initial adsorbed P at C=0 (negative sign indicates desorbable P); EPCo = equilibrium P concentration; ND = not determined

EXHIBIT 3-38

Sorption Isotherm Data from Phase 3 PSTA Field-Scale Cell Soils

Cell	P Sorption Parameters				P Range
	Kd L/kg	So mg/kg	EPCo mg/L	r2	mg/L
February 2001					
FS-1	380	-0.83	0.002	0.85	0.005 - 0.038
FS-2	614	-2.6	0.004	0.87	0.010 - 0.047
FS-3	1079	-2.5	0.002	0.78	0.007 - 0.034
FS-4	13	-4.8	0.362	0.83	0.462 - 3.27

Notes:
Kd = linear adsorption coefficient
So = initial adsorbed P at C=0 (negative sign indicates desorbable P)
EPCo = equilibrium P concentration

with an increasing trend in the summer and fall of the second year and a possible increase in TOP in the sand soils during the POR.

The initial soil TP concentration in PP-4 (shellrock) was 903 mg/kg at a bulk density of 1.31 g/cm^3. The final TP content of these soils during the destructive sampling event in February 2001 was 961 mg/kg at an average bulk density of 1.41 g/cm^3. TIP also increased slightly from approximately 912 to 938 mg/kg in this treatment. Based on a 20-cm soil depth, this increase of TP in the substrate was equivalent to an estimated 34 g/m^2 for the study period.

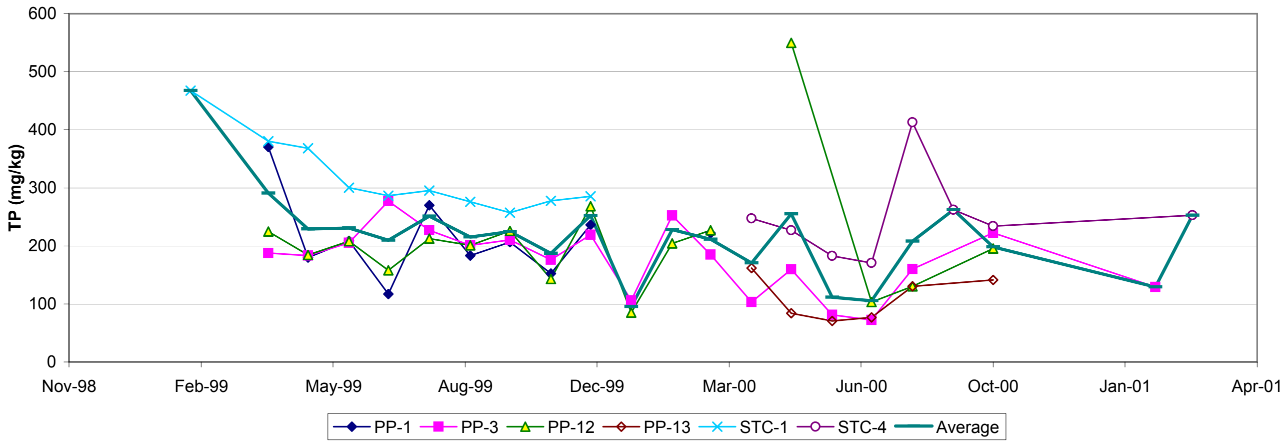
The initial soil TP concentration in PP-7 (untreated sand) was 16.6 mg/kg at a bulk density of 1.43 g/cm^3. The final TP content of these soils during the destructive sampling event in February 2001 was 20.0 mg/kg at an average bulk density of 1.42 g/cm^3. TIP declined from approximately 13.1 to 9.8 mg/kg in this treatment. Based on a 20-cm soil depth, the estimated increase of TP in these soils was equivalent to an estimated 0.88 g/m^2 for the study period.

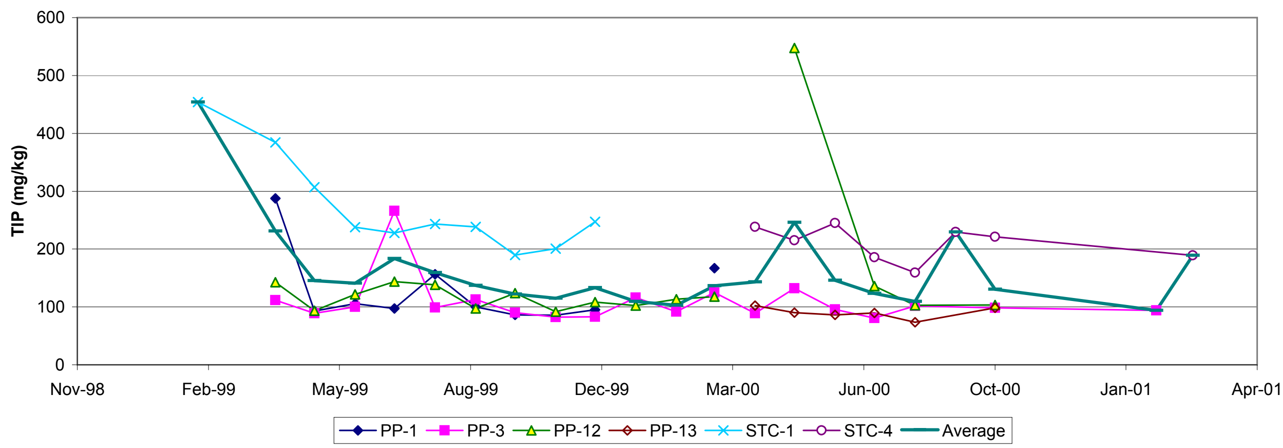
The initial soil TP concentration measured in the HCl-rinsed sand Porta-PSTA treatment PP-17 was 25.0 mg/kg at a bulk density of 1.16 g/cm^3. The final TP content of these soils during the destructive sampling event in February 2001 was 19.4 mg/kg at an average bulk density of 1.46 g/cm^3. TIP declined from approximately 10.7 to 8.3 mg/kg in this treatment. Based on a 20-cm soil depth, the estimated decrease of TP in these soils was equivalent to an estimated 0.12 g/m^2 for the period of this research.

Although average TP soil concentrations in the shellrock treatments were much higher than in the peat soils in Phase 2, the labile inorganic P concentration in the peat soils is higher. This finding reinforced the conclusion that a continuing potential exists for release of inorganic P from the organic soils in STC-1/4 (CH2M HILL, August 2000). While the mass release of labile P from these peat soils was probably too small to detect in the trend plots, this release likely contributed to the higher observed outflow TP concentration and the lower k_{1TP} value in this treatment.

EXHIBIT 3-39

Soil TP, TIP, and TOP Concentrations for PSTA Peat Treatments (POR)





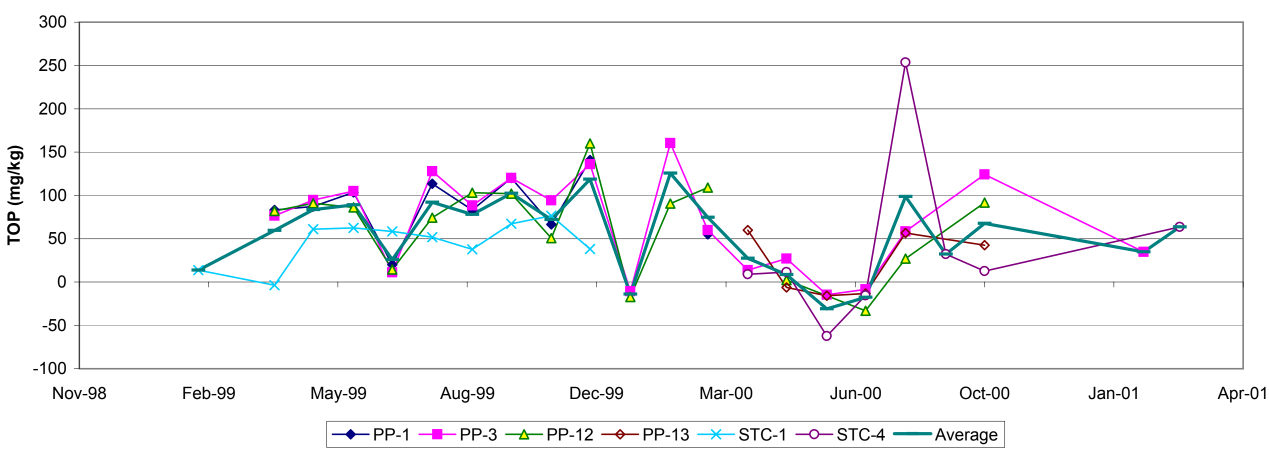
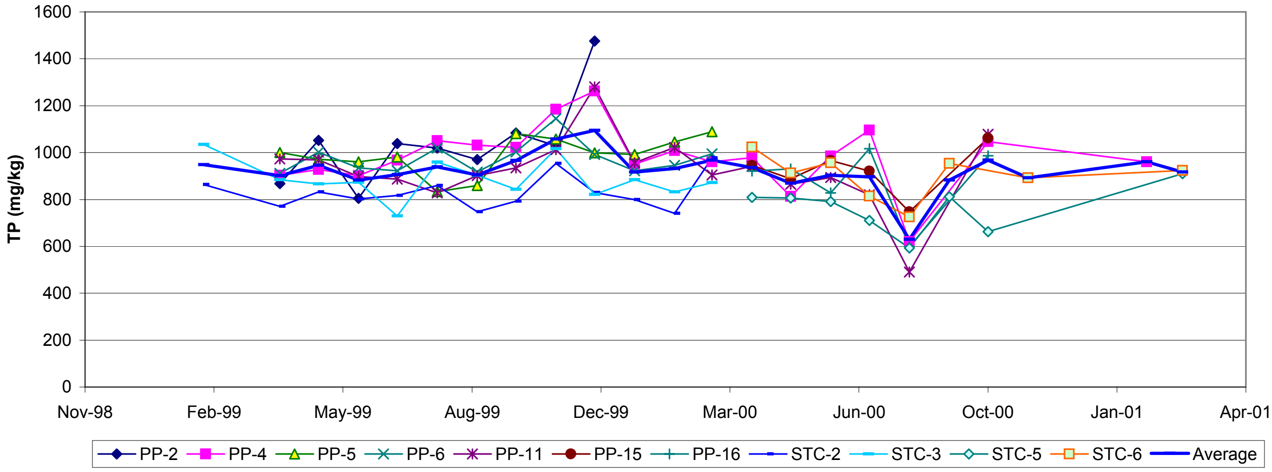
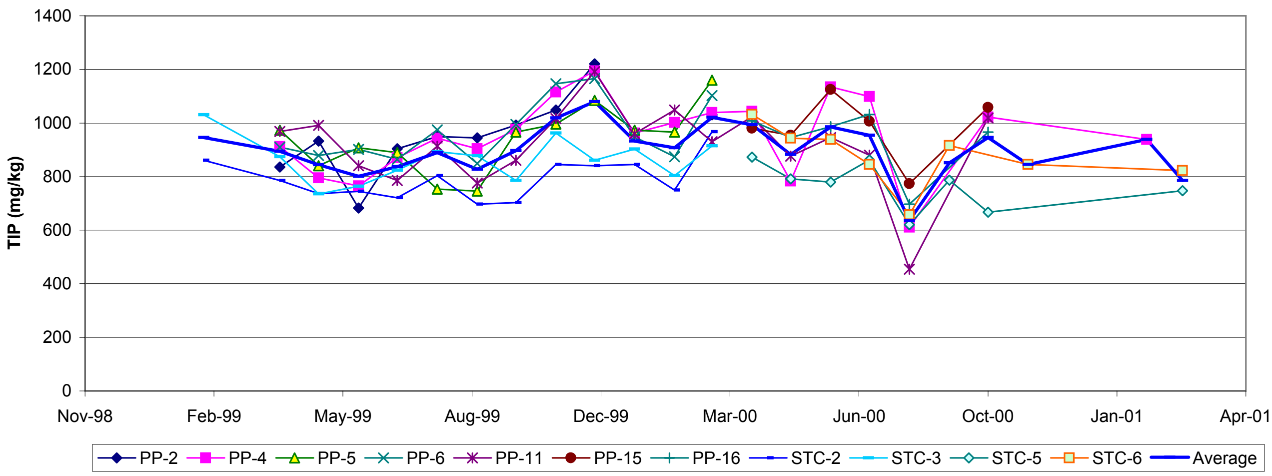


EXHIBIT 3-40
Soil TP, TIP, and TOP Concentrations for PSTA Shellrock Treatments (POR)





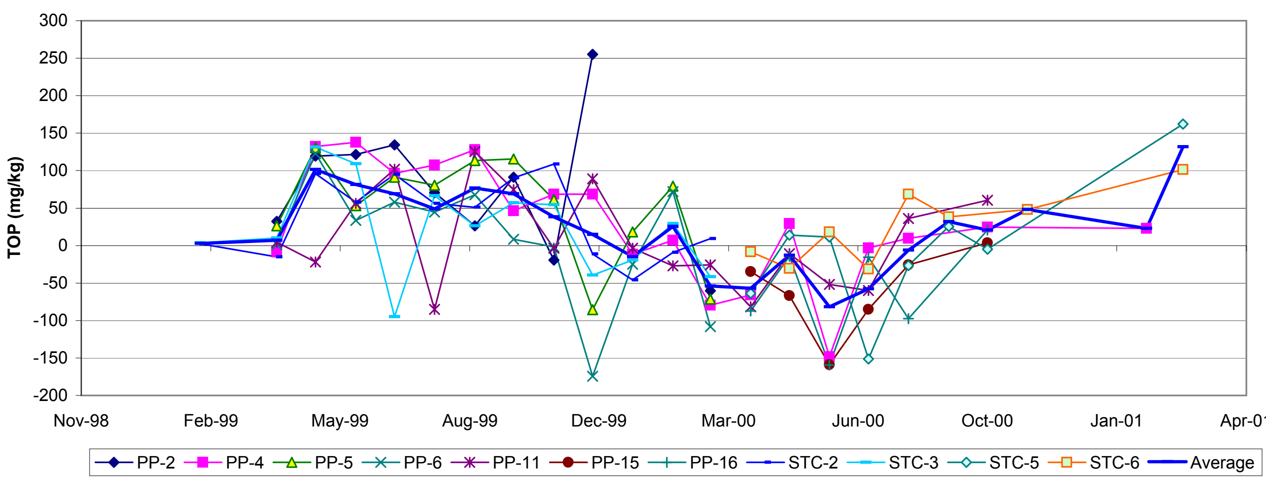
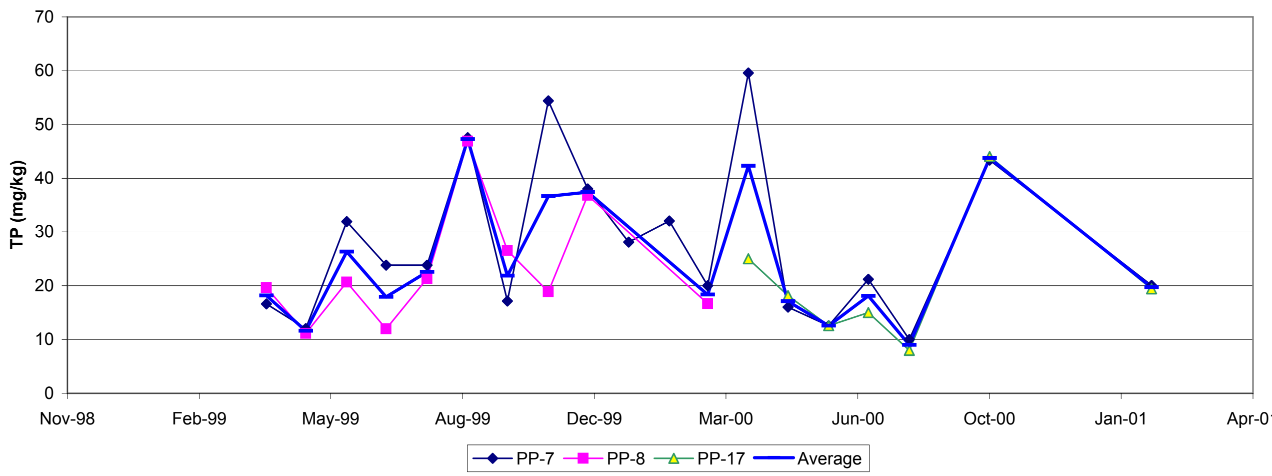
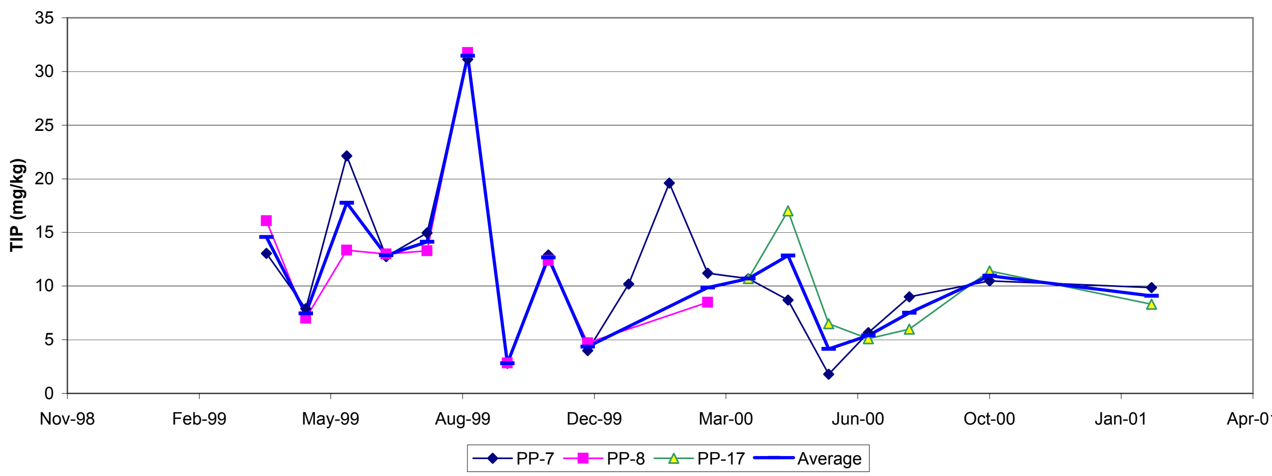
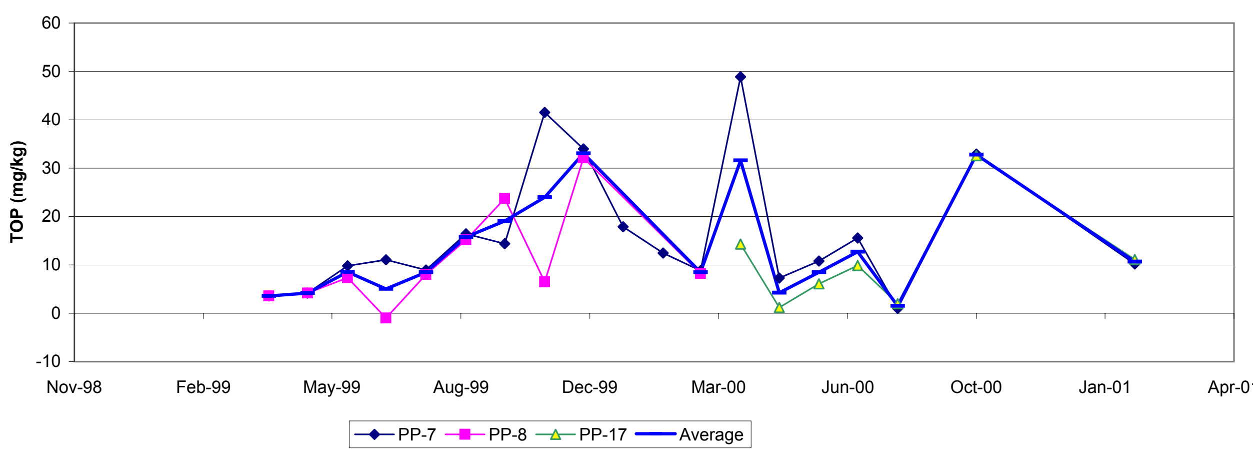


EXHIBIT 3-41

Soil TP, TIP, and TOP Concentrations for PSTA Sand Treatments (POR)







Mesocosm soils represent the largest storage of P as highlighted below assuming a 20-cm soil depth:

Peat-based soils: Based on a dry bulk density of 0.3 g/cm^3 and an average TP concentration of 200 mg/kg, peat-based systems contain approximately 12 g P/m^2. In February 2001, approximately 9.1 g P/m^2 was measured in the peat-based Porta-PSTAs during destructive sampling.

- **Shellrock soils:** Assuming a dry bulk density of 1.3 g/cm^3 and an average TP concentration of 1,000 mg/kg, shellrock soils contain approximately 260 g P/m^2. In February 2001, approximately 267 g P/m^2 was measured in shellrock Porta-PSTAs during destructive sampling.
- **Sand soils:** Based on a dry bulk density of 1.3 g/cm^3 and an average TP concentration of 30 mg/kg, sand contains approximately 7.8 g P/m^2. In February 2001, approximately 5.7 g P/m^2 was measured in sand Porta-PSTAs during destructive sampling.

These soil TP masses were significantly larger than the small mass of TP in the water column (approximately 0.006 to 0.012 g/m^2), in the plants and periphyton (typically less than 1 g/m^2), or the net amount removed in these test systems during the POR (0.06 to 0.57 g P/m^2). Small return fluxes of P from the mesocosm soils could result in net TP removal rates that are much less than the actual gross removals by the combined actions of periphyton/macrophyte growth and sediment accretion.

3.5.2 Periphyton Phosphorus

Total and inorganic P concentrations were also quantified in the periphyton communities throughout the study period. Non-reactive forms of P in the periphyton were also determined. Exhibit 3-42 summarizes these periphyton P data by treatment and soil type. Average periphyton TP ranged from 178 to 1,440 mg/kg in the various treatments. Phase 1 and 2 shellrock treatments reported the highest TP concentrations, with an overall average of 740 mg/kg. Peat treatments had an average TP concentration of 448 mg/kg in the periphyton mat, except for the calcium-amended treatment, which averaged 538 mg/kg. The periphyton in the Porta-PSTA limerock treatment averaged 183 mg/kg TP and 261 to 335 mg/kg in the Phase 3 limerock treatments. The periphyton in the caprock Field-Scale treatment averaged 178 mg/kg TP. The Phase 1 and 2 sand treatments had between 205 and 340 mg/kg TP, and the Aquamat treatment averaged 405 mg/kg TP. The non-soil control tank grew periphyton with an average TP concentration of 220 mg/kg.

Phase 2 destructive sampling in February 2001 further fractionated the periphyton TP and determined that TP concentrations depend to some extent on the periphyton growth habit. Benthic periphyton had the highest TP concentration in all treatments, except the sand treatment where the wall periphyton had higher TP concentrations.

EXHIBIT 3-42
Periphyton Mat Phosphorus Fractions (mg/kg) in the PSTA Mesocosms

						Routine Periphyton Cores (Monthly)			Detailed Phosphorus Fractionation (Quarterly)					
										Inorganic Phosphorus Fractions		Organic Phosphorus Fractions		
Treatment	Phase	Cell	Substrate	Depth	HLR	TP	TIP	TOP	TP	Labile	Calcium-Bound	Labile	Moderately Labile	Residual
Porta-PSTAs														
PP-1	1	9,11,18	PE	D	L	346	88	258	251	3	81	96	51	51
PP-2	1	4,7,8	SR	D	L	617	263	353	370	2	268	63	-3	44
PP-3	1, 2	12,14,17	PE	S	L	399	110	289	298	3	91	161	23	46
PP-4	1, 2	3,5,10	SR	S	L	800	259	541	571	2	320	46	1	38
PP-5	1	2,13,16	SR	D	H	744	212	532	456	2	284	92	11	47
PP-6	1	1,6,15	SR	V	V	706	236	470	539	1	330	39	-4	29
PP-7	1, 2	19	SA	S	L	385	49	335	154	1	69	45	13	20
PP-8	1	20	SA	D	L	295	36	259	103	1	41	78	38	25
PP-9	1	21	PE (AS)	D	L	366	119	247	268	3	63	98	5	34
PP-10	1	22	SR (AS)	D	L	554	326	227	214	2	54	78	8	25
PP-11	1, 2	23	SR	S	L	1,124	479	644	720	2	437	75	-7	62
PP-12	1, 2	24	PE	S	L	737	200	538	483	4	156	289	-3	92
PP-13	2	9,11,18	PE (Ca)	S	L	283	184	99	277	2	133	94	20	44
PP-14	2	4,7,8	LR	S	L	183	67	115	355	2	221	121	7	46
PP-15	2	2,13,16	SR	S	R	579	275	303	535	2	245	204	27	74
PP-16	2	1,6,15	SR	V	V	712	350	362	353	2	228	56	22	35
PP-17	2	20	SA (HCl)	S	L	205	65	140	90	3	47	51	11	29
PP-18	2	21	None	S	L	220	90	130	120	2	95	72	8	33
PP-19	2	22	AM	S	L	405	188	218	234	2	194	85	5	40
South Test Cells														
STC-1	1	13	PE	D	L	393	96	298	428	4	137	308	21	105
STC-2	1	8	SR	D	L	512	150	362	409	2	183	132	33	71
STC-3	1	3	SR	V	V	422	103	319	656	3	208	196	24	89
STC-4	2	13	PE (Ca)	S	L	793	220	573	653	24	125	306	63	90
STC-5	2	8	SR	S	L	669	128	540	311	3	69	187	24	36
STC-6	2	3	SR	V	V	1,440	345	1,095	508	2	266	204	32	93
Porta-PSTA and South Test Cell Summary														
	1-2		PE			448	123	326	338	3	104	192	22	68
	1-2		PE (Ca)			538	202	336	503	15	128	221	46	71
	1-2		SR			740	261	479	499	2	257	117	14	56
	1-2		LR			183	67	115	355	2	221	121	7	46
	1-2		SA			340	43	297	142	1	63	52	19	21
	1-2		SA (HCl)			205	65	140	90	3	47	51	11	29
	1-2		None			313	139	174	177	2	145	78	6	36
	1-2		ALL			556	186	370	374	3	174	127	17	52
Field-Scale Cells														
FSC-1	3	1	LR-PE	S	H	335	77	257	110	4	24	36	10	16
FSC-2	3	2	LR-PE	S	H	261	49	212	156	4	38	55	11	24
FSC-3	3	3	CR	S	H	178	46	132	150	3	46	28	8	22
FSC-4	3	4	PE	S	H	--	--	--	--	--	--	--	--	--

Notes:
Mesocosm Treatments: PP = Porta-PSTA, STC = South Test Cell, FSC = Field-Scale Cell
Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade
Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)
HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

Periphyton TIP was typically highest in the shellrock treatments with an average concentration of 261 mg/kg. The peat treatments were lower at 123 mg/kg TIP, except for the calcium-amended treatments with an average of 202 mg/kg TIP. The Field-Scale limerock and caprock treatments had low periphyton TIP (46 to 77 mg/kg), and the sand treatment had the lowest TIP concentrations (43 mg/kg). Non-soil controls were intermediate with an average of 139 mg/kg. Calcium-bound (non-reactive) TIP varied from 24 to 437 mg/kg in the periphyton. The shellrock and limerock treatments had the highest amount of calcium-bound TIP, while the sand treatments and Field-Scale limerock and caprock treatments had the least.

A large fraction of the periphyton TP was in a labile organic form. The highest concentration of labile organic P was found in the peat treatments, with an average of 192 mg/kg. The shellrock treatments averaged 117 mg/kg, and the sand treatments averaged 52 mg/kg. The Field-Scale limerock and caprock treatments had between 28 and 55 mg/kg of labile organic P.

These results indicate that periphyton in calcium-rich waters and over calcium-rich soils accumulate more TP than those over sandy or organic soils, which are relatively low in calcium. Clearly, a portion of the TP is in the form of soil particles lifted by benthic periphyton mats and re-deposited throughout the water column as metaphyton and floating mats. However, the periphyton P was much more available than the soil P described earlier. From 15 to 65 percent of this TP was labile organic P, whereas very little of the TIP was labile. An appreciable amount of the periphyton TP was in unavailable forms, both inorganic and organic. These fractions are most likely to be accreted and can result in long-term removal of P from the PSTA water column.

3.5.3 P Accretion Rates

Net accretion of P-bearing sediments was difficult to assess in the PSTA mesocosms. Benthic periphyton mats developed in most treatments and were subsequently lifted by gas bubble formation and redeposited or stranded at the water surface as floating mats. Horizon markers were variably exposed and re-covered by this periphyton mat movement and were not successfully retrieved at the end of the study. Independent assessment of a net accretion rate was not feasible over the time frame of this research, leaving estimation of net losses of P to differences in water mass loads. Gross sediment accretion rates were estimated from sediment trap data. Wet accretion refers to the unconsolidated settled material. Dry accretion is the oven dry weight of the trapped material. TP accretion is based on the dry weight times the TP content of the collected sediment, as summarized in Exhibit 3-43.

A large difference in the amount of TP deposited in the traps was observed between treatments, depending on soil type. The overall average Phase 1 and 2 PSTA TP accretion rate was estimated as approximately 0.31 g TP/m^2/yr, based on an average wet accretion of approximately 1.7 cm/yr of sediments. The average TP accretion rate for the shellrock treatments was higher at 0.51 g TP/m^2/yr . Based on field observations, a fraction of the TP deposition in the shellrock treatments was in the form of shellrock soils that were lifted with the

EXHIBIT 3-43

Sediment Trap Data from the PSTA Mesocosms (POR)

Treatment	Phase	Cell	Substrate	Depth	HLR	Wet Accretion (cm/yr)	Dry Accretion ($g/m^2/yr$)	TP Accretion ($g/m^2/yr$)	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Wet Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
Porta-PSTAs															
PP-1	1	9,11,18	PE	D	L	0.96	390	0.19	1.00	0.039	36.84	1.38	96.01	484	43
PP-2	1	4,7,8	SR	D	L	1.46	493	0.22	0.89	0.039	49.67	1.92	95.56	596	64
PP-3	1, 2	12,14,17	PE	S	L	0.78	211	0.12	1.27	0.026	59.29	1.45	97.55	594	32
PP-4	1, 2	3,5,10	SR	S	L	2.83	2799	1.95	0.95	0.089	124.26	13.02	90.74	618	79
PP-5	1	2,13,16	SR	D	H	1.45	512	0.32	0.90	0.041	54.80	2.27	95.56	688	64
PP-6	1	1,6,15	SR	V	V	0.94	552	0.36	0.86	0.070	31.18	2.38	91.87	725	72
PP-7	1, 2	19	SA	S	L	1.87	1292	0.06	1.18	0.065	100.80	7.03	93.36	54	78
PP-8	1	20	SA	D	L	0.15	67	0.03	0.87	0.043	5.92	0.29	95.00	454	78
PP-9	1	21	PE (AS)	D	L	0.49	217	0.17	1.00	0.049	21.39	0.96	95.13	770	47
PP-10	1	22	SR (AS)	D	L	1.49	219	0.20	0.61	0.015	39.69	0.97	97.48	908	70
PP-11	1, 2	23	SR	S	L	2.02	1061	0.75	1.56	0.055	76.19	5.32	92.63	492	74
PP-12	1, 2	24	PE	S	L	0.84	135	0.09	1.13	0.016	40.87	0.61	98.57	797	30
PP-13	2	9,11,18	PE (Ca)	S	L	2.50	324	0.12	0.47	0.020	135.51	4.45	96.31	394	61
PP-14	2	4,7,8	LR	S	L	0.29	57	0.01	1.16	0.023	23.87	0.79	97.08	300	65
PP-15	2	2,13,16	SR	S	R	2.52	703	0.45	1.12	0.038	127.62	4.67	96.31	638	64
PP-16	2	1,6,15	SR	V	V	1.54	376	0.18	0.71	0.044	98.34	5.18	94.22	490	73
PP-17	2	20	SA (HCl)	S	L	1.71	585	0.09	0.45	0.034	106.08	8.04	92.42	159	77
PP-18	2	21	None	S	L	2.69	333	0.08	0.34	0.012	125.58	4.58	96.35	247	64
PP-19	2	22	AM	S	L	2.04	537	0.10	0.57	0.026	158.70	7.39	95.34	188	67
South Test Cells															
STC-4	2	13	PE (Ca)	S	L	2.44	1130	0.55	0.52	0.059	282.76	21.06	90.72	680	76
STC-5	2	8	SR	S	L	2.69	602	0.45	0.56	0.024	347.37	13.13	95.64	691	63
STC-6	2	3	SR	V	V	3.52	422	0.27	0.35	0.014	154.73	5.80	96.11	650	58
Porta-PSTA and South Test Cell Summary															
	1-2		PE			0.77	238	0.14	1.10	0.032	39.60	1.10	96.82	661	38
	1-2		PE (Ca)			2.47	727	0.33	0.50	0.040	209.14	12.76	93.52	537	69
	1-2		SR			2.04	774	0.51	0.85	0.043	110.38	5.47	94.61	649	68
	1-2		LR			0.29	57	0.01	1.16	0.023	23.87	0.79	97.08	300	65
	1-2		SA			1.01	680	0.04	1.03	0.054	53.36	3.66	94.18	254	78
	1-2		SA (HCl)			1.71	585	0.09	0.45	0.034	106.08	8.04	92.42	159	77
	1-2		None			2.36	435	0.09	0.45	0.019	142.14	5.98	95.85	218	65
	1-2		ALL			1.69	592	0.31	0.84	0.038	100.07	5.12	95.00	528	64
Field-Scale Cells															
FS-1	3	1	LR-PE	S	H	2.92	2694	0.55	0.76	0.09	761.4	92.9	87.80	205	56
FS-2	3	2	LR-PE	S	H	3.47	1476	0.76	0.64	0.04	760.7	50.9	93.30	515	56
FS-3	3	3	CR	S	H	1.42	1024	0.19	0.81	0.07	395.7	35.3	91.10	190	68
FS-4	3	4	PE	S	H	1.58	1053	0.57	0.65	0.07	355.4	36.3	89.80	537	41

Notes:

Mesocosm Treatments: PP = Porta-PSTAs, STC = South Test Cells, FSCs = Field-Scale Cells

Substrate: PE = peat, SR = shellrock, LR = limerock, CR = caprock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade

Depth: S = shallow (30 cm), D = deep (60 cm), V = variable (0-30 cm or 0-60 cm)

HLR: L = low (6 cm/d), H = high (12 cm/d), V = variable (0-6 cm/d or 0-12 cm/d), R = recirculate

Sample Area = 154 cm^2 (14.0 cm diameter) - Phase 1 and 2; 707 cm^2 (30.0 cm diameter) - Phase 2 and 3 benthic periphyton mat and then re-deposited as sediments. The average TP deposition rate was lower in the smaller Phase 1 and 2 peat-based mesocosms (0.14 g/m^2/yr), and was even lower in the sand-based controls (0.04 g/m^2/yr). The Aquashade control mesocosms had TP sedimentation rates approximately equal to the peat-based mesocosms with 0.17 to 0.20 g TP/m/yr. The non-soil controls had slightly higher wet accretion rates (average 2.4 cm/yr) and relatively low TP accretion rates (0.09 g/m^2/yr).

The sediment accretion rates estimated in the Phase 3 FSCs were similar to or higher than those measured in the smaller PSTA test systems. The average wet accretion rate ranged from about 1.4 to 3.5 cm/yr and the dry accretion was higher than measured in the smaller systems (average 1,562 g DW/m^2/yr in Phase 3 compared to an overall average rate of 592 g DW/m^2/yr in the Phase 1 and 2 systems). The average TP accretion rate in the FSCs during Phase 3 was 0.52 g/m^2/yr.

3.5.4 Effects of Snail Grazing

High snail populations were not observed in the three PSTA Test Cells or FSCs, but snails were a dominant grazer in a subset of the Porta-PSTA mesocosms. In these systems, snails did not have a consistent effect on average periphyton biomass measured with cores; however, they did have an apparent effect on the average outflow TP concentration and on the net TP removal rate k_1 (Exhibit 3-44). At an average snail density greater than approximately 30 per m^2, the long-term outflow TP concentration was typically increased by approximately 1 to 3 µg/L.

The effect of snail density on average TP k_1 values was consistently detrimental. In PP-6 (shellrock with variable HLR), the k_1 value decreased by 40 percent at a snail density of 37 snails/m^2 and by 12 percent at a snail density of 52.3 snails/m^2. In PP-5 (deep shellrock with high HLR), k_1 was reduced by approximately 46 percent at a snail density of 21.2 snails/m^2. In PP-16 (shellrock with variable HLR), with a snail density of 32 snails/m^2, the k_1 value was reduced by 25 percent. Between the two sand controls (with different depths), a snail density of 93.6 snails/m^2 reduced k_1 by 52 percent.

Differences in snail density between the Porta-PSTAs appear to have been related to stochastic effects. Because of a lack of visual observations or counts of fish and birds, the lack of a snail population increase in the Test Cells and FSCs was assumed to be related to the ability of larger predators (birds and larger fish) to better manage snail populations as a result of the larger mesocosm scale. Therefore, snails are not likely to be a nuisance in a full scale system. This assumption requires further study and verification.

3.5.5 Groundwater Phosphorus Losses

Based on water balance information discussed in Section 1, the Field-Scale PSTAs had significant exchange of water with the surficial groundwater and adjacent surface waters. Shallow groundwater levels and phosphorus concentrations were routinely measured to quantify the magnitude of mass transport

EXHIBIT 3-44

Effects of Snail Density on Periphyton Biomass, Average TP Outflow Concentrations, and k_1 Values for Phase 1 and 2 Porta-PSTA Treatments

Treatment	Soil	Porta-PSTA Tank	Average Snail Density (#/m^2)	Average Periphyton Ash-Free Dry Weight (g/m^2)	Average TP Out (mg/L)	k_1 (m/yr)
PP-1	PE	9	1.7	617.6	0.014	7.9
		11	0.8	500.9	0.021	-1.2
		18	3.1	555.2	0.018	1.7
PP-2	SR	4	2.5	163.1	0.016	8.2
		7	0.2	226.4	0.017	6.0
		8	2.3	134.4	0.018	2.2
PP-3	PE	12	2.9	431.2	0.019	8.3
		14	2.1	257.7	0.014	16.5
		17	9.6	536.1	0.020	6.2
PP-4	SR	3	1.9	112.1	0.016	13.5
		5	2.2	131.8	0.016	13.1
		10	7.5	110.0	0.017	10.9
PP-5	SR	2	3.0	141.4	0.019	10.9
		13	21.2	109.1	0.019	9.1
		16	0.1	177.8	0.016	17.0
PP-6	SR	1	37.0	118.8	0.019	3.6
		6	52.3	117.3	0.017	5.3
		15	0.0	126.4	0.016	6.0
PP-7	SA	19	0.5	148.8	0.017	10.5
PP-8	SA	20	93.6	182.7	0.020	-0.6
PP-9	PE (AS)	21	0.9	951.1	0.019	5.5
PP-10	SR (AS)	22	0.1	170.8	0.016	9.5
PP-11	SR	23	5.1	131.3	0.020	7.3
PP-12	PE	24	12.5	362.6	0.020	7.2
PP-13	PE (Ca)	9	1.5	1785.8	0.020	14.8
		11	1.8	446.4	0.017	18.3
		18	0.0	889.6	0.020	11.3
PP-14	LR	4	2.3	113.7	0.013	25.3
		7	2.5	138.2	0.017	17.2
		8	2.3	93.5	0.017	16.9
PP-15	SR	2	1.8	243.1	0.018	15.4
		13	6.7	324.4	0.019	12.4
		16	2.2	90.3	0.016	15.2
PP-16	SR	1	32.2	173.7	0.017	19.2
		6	3.5	122.8	0.019	29.1
		15	3.2	191.9	0.016	22.4
PP-17	SA (HCl)	20	12.5	191.9	0.014	20.9
PP-18	None	21	NS	287.4	0.017	17.9
PP-19	AM	22	NS	174.7	0.015	20.3

Notes:

Mesocosm Treatments: PP = Porta-PSTAs

Substrate: PE = peat, SR = shellrock, LR = limerock, SA = sand, None = no substrate, AM = Aquamat, AS = Aquashade

NS = not sampled

of TP from the Field-Scale PSTAs to the surrounding ground water. Unfortunately, some of the net water losses were also to adjacent surface waters, as PSTA water was observed to penetrate the limestone levees and appear as surface seepage. Attempts at internal flow measurements were unsuccessful so the spatial quantification of flow losses could not be made with certainty. For purposes of model parameter estimation discussed earlier in this section, it was necessary to assume uniform leakage over the entire area of the Field-Scale PSTA cells.

The overall average TP measured in shallow groundwater in and around the Field-Scale site was 16.5 µg/L compared to an average TP input concentration to the PSTA cells of approximately 24 µg/L and an average surface outflow concentration for all four cells of 19 µg/L. TP concentrations in shallow wells within the FSCs (average=16.8 µg/L) were similar to concentrations in the surrounding wells (average=16.3 µg/L). There were no clear trends of increasing TP concentrations in any of the wells, except for the FSC-4 internal well during the 14-month period-of-record. TP concentrations in the FSC-4 center well increased from approximately 11 to 35 µg/L during the 14-month operational period. These data indicate that TP concentrations may be slightly reduced upon entry of surface water into the shallow groundwater, but that additional attenuation does not appear to occur within the immediate vicinity of the PSTA cells.

3.6 Summary of PSTA Effectiveness

In summary, this project has adequately demonstrated that constructed PSTAs have the capacity to reduce concentrations of TP from agricultural drainage waters to concentrations approaching 10 µg/L. Key findings of this work are that a thorough knowledge of antecedent soil TP loads and availability are of primary importance for predicting PSTA performance and, for a given amount of available soil, TP mass removal is closely tied to mass loading.

Specific conclusions from this project relevant to the effectiveness of constructed PSTAs for TP reduction include the following:

- Under the study conditions, the minimum achievable outflow TP concentrations from PSTA test systems constructed on shellrock soils were approximately 11 to 12 µg/L (during 2 years of operation). The lowest long-term average TP outflow concentrations were 17 µg/L on peat soils, 15 µg/L on sand soils, 11 µg/L on acid-rinsed sand soils, and approximately 14 to 15 µg/L on limerock soils, on scraped-down caprock, and in non-soil controls. The conclusions drawn from the Field-Scale PSTAs remain preliminary; it appears that these systems are still maturing, and it is possible that lower average TP concentrations may yet be attainable.
- TP removal rate constants generally increased following 3 to 5 months of startup to relatively high levels during the first year of operation. TP removal rates remained high in shellrock PSTA mesocosms for at least 3½ years of operation, but were variable or declined in peat mesocosms during the second and third years of operation.

- Antecedent soil type and conditions appear to have an effect on P removal performance during startup and during continuing operation for at least 3½ years. Labile reactive P in antecedent soils results in reduced performance and higher TP outflow concentrations. Batch-mode studies indicated that internal TP loading mechanisms are still active with the peat soil types tested even after 1 year of operation. This internal loading is likely responsible for the finding of a "glass floor" for TP outflow concentrations under the conditions of this PSTA research project.
- Higher TP loading rates resulted in higher TP mass removal rates with a related rise in average outflow concentrations. This finding indicates that mass load removals could be maximized if higher outflow concentrations were allowable.
- The scale of the PSTA research mesocosms may have had an effect on observed TP outflow concentrations and k values. Performance estimates from smaller-scale mesocosms may be overly optimistic compared to results from larger-scale treatment units. This finding leads to the conclusion that large-scale PSTA test systems (Test Cells and FSCs) should be prioritized for continued testing over work in smaller mesocosms.
- Increased outflow TP concentrations and variable removal rate constants in the Aquashade control mesocosms demonstrate the complex details related to P cycling in these PSTA test units. While high photosynthetic activity may be important for lowering TP to the lowest achievable concentrations, the presence of macrophytes, and to a lesser extent periphyton, may also slightly lower the net TP mass removal rate by increasing internal P recycle.
- TP accretion rates are generally comparable to net TP removal rates estimated by inflow-outflow mass balances. Wet accretion represents an average of approximately 2 cm/yr. Actual accreted sediments would be less than this amount, providing a preliminary indication that as long as adequate levee free board is provided, harvesting to remove accumulated sediments would not be required during the expected project life (>50 years).

These results indicate that PSTAs can be designed to remove TP from agricultural waters at low inlet TP concentrations typical of post-STA waters. Periphyton-dominated systems on substrates with low levels of labile P are able to achieve average outflow concentrations of 11 μg/L or less. However, net removal rate constants are not high at low inlet loading rates. This indicates that these periphyton-dominated treatment systems will require large land areas to achieve very low outlet TP concentrations.

By necessity, this research project has had a limited duration. For this reason, the long-term effectiveness of PSTAs for P management has not yet been fully proven. Some trends indicate that treatment performance may improve over time, especially if antecedent soils have low concentrations of labile P. Other data indicate that on organic soils that have a prior history of farming and fertilization, many years may be required to exhaust pre-existing P storages and fully integrate that P into newly-accreted periphyton residuals.

SECTION 4

PSTA Forecast Model, Conceptual Design, and Sustainability

4.1 Introduction

The PSTA Research and Demonstration Project has determined that periphyton-dominated mesocosms can remove TP from surface water inflows to relatively low outlet concentrations, comparable to or less than observed for any other non-chemical, advanced treatment technology alternative. However, because of the limited timeframe and scale of PSTA research facilities, the current assessment of sustainability of this removal performance and the overall cost of implementing and operating full-scale PSTAs remains preliminary.

This section provides the rationale and conceptual design of a full-scale PSTA for stormwater treatment of P. The basis of this conceptual design is performance forecasting using a model calibrated with data collected during the Phase 1 and 2 PSTA Research and Development Project. Because of the project scope and schedule, the PSTA conceptual design was completed prior to Phase 3 results being available (Field-Scale PSTA cells). This section updates the PSTA conceptual design published earlier in the Phase 1 and 2 report (CH2M HILL, July 2002) by also considering the Phase 3 findings.

The PSTA conceptual design formed the basis of a PSTA Supplemental Technology Standards of Comparison (STSOC) analysis to allow comparison of PSTA to other potential Advanced Treatment Technologies (ATTs). In addition to determining a realistic PSTA "footprint" and a cost estimate for construction and operation of a full-scale PSTA, the STSOC analysis requires consideration of issues related to sustainability. Sustainability refers to the "maintenance of function over a long time period" and specifically, the "continuing capability to remove and store P in a stable form" (Kadlec, 2001d).

To be considered sustainable, PSTAs must have the following characteristics:

- They must be able to consistently lower average concentrations of TP to levels protective of downstream environments for a long enough period to justify their implementation (capital and O&M) costs.
- Their ecological succession must be predictable enough to anticipate how often macrophyte management will need to occur.
- They must retain stored P in forms that will not create unpredictable future releases under foreseeable conditions of system dryout and flooding.
- They must not create short- or long-term internal or downstream nuisance conditions that will offset their beneficial P removal performance.

At this point in time, estimates of PSTA sustainability must be based on a combination of forecast modeling using computer-generated extrapolations from the existing database, from review of information from other research, including periphyton-dominated systems that are ecologically mature, and from the results of the PSTA STSOC. Current evidence concerning PSTA sustainability is summarized in this section along with a description of the PSTA Forecast Model and the results of the STSOC analysis.

4.2 PSTA Performance Forecasting

Computer models provide a useful tool for gathering information that cannot otherwise be obtained from experiments. The timeframe of the EFA and the cost of experimentation have required the construction of performance forecasting models of all of the "green" ATTs. These models are grounded on the best data that are available and are constructed to answer questions about performance and sustainability while incorporating the maximum complexity that can be supported by the data. Highly complex models with numerous state variables cannot be supported by the data and have been found to have limited usefulness for performance forecasting. Simpler models with three to four state variables are being used for modeling of dynamic STA responses. The PSTA Forecast Model is similar in model structure and complexity to the Dynamic Model for Stormwater Treatment Areas (DMSTA) being constructed as a platform for comparing all of the "green" P treatment technologies (Walker and Kadlec, 2000).

The DMSTA model is applicable to PSTA and provides a relatively accurate description of the observed P removal performance. However, the DMSTA model does not include key ecological components of importance to specific ecosystem-based technologies. For example, the DMSTA model provides no indication of the amount of organic matter that accumulates because of the primary productivity of green treatment systems and does not include the seasonal influence of solar radiation—one of the principal external energy inputs driving processes in treatment wetlands. Understanding the carbon-based storages in addition to P is important in foreseeing management issues that will arise as green technologies mature.

4.2.1 PSTA Forecast Model Description

Methods for forecasting PSTA operation and performance range in complexity from single- to multiple-parameter models. One- and two-parameter model calibration results (k_1 and k-C^* models) were presented in Section 3. In addition, a "Level 2" PSTA Model was developed using a Microsoft® Access platform and was partially calibrated to provide a more complete and mechanistic method for performance forecasting. This interim model was prepared to provide insight into the ongoing PSTA research but was subsequently deemed to have more complexity than could ultimately be supported by experimental data generated by this study. The interim model was described in the *PSTA Research and Demonstration Project 5th Quarterly Report* (CH2M HILL, January 2000).

The final PSTA Forecast Model uses Microsoft® Excel as an operating platform rather than Access. This change was made to widen the audience that could use the PSTA Forecast Model for assessing expected performance. The Phase 2 PSTA Forecast Model includes the following modifications from the "Level 2" Access model described in earlier project reports:

- Inclusion of external forcing functions to provide the best understanding of processes that control the natural periphyton-based treatment system, including sunlight (seasonally variable), rainfall (both direct and through stormwater inputs), and atmospheric inputs/outputs (ET and atmospheric P loads).
- Simplification of the Level 2 model to include only predictions of TP data.
- Addition of a more dynamic water balance with stage-storage relationships.
- Consideration of human management influences (construction of landform, water pumping and depth control, biomass removal, maintenance, and related actions).

4.2.2 Data Sources

Data from three South Test Cells for the 24-month operational period were used to calibrate the final PSTA Forecast Model. Each of these cells had a wet footprint of approximately 0.2 ha. The Porta-PSTA mesocosms were not used for model calibration because of their relatively small scale and because of the multitude of treatment variables. Those datasets could be used for model validation in the future, if desired. The Field-Scale PSTAs commenced operations in the summer of 2001. Data from these systems as well as supplemental data collected from the PSTA Test Cells will also provide an opportunity for future validation of the model calibrated using the PSTA Test Cell data. However, because of scope and budget constraints, no additional model calibrations or validations were conducted by CH2M HILL under Phase 3.

4.2.3 Model Construction

Exhibit 4-1 presents a diagram of the PSTA Forecast Model along with the major state variable equations and definitions of variables. The model consists of four principal component storages:

- water (W)
- TP in the water column (PW)
- periphyton biomass (B)
- TP in the biomass (PB)

In addition, an initial storage of labile P (P_L) is included to allow simulation of startup releases of TP from pre-existing soils and decaying vegetation. Each of these state variables is described in detail in the following paragraphs.
Exhibit 4-2 summarizes the equations used to calculate each pathway or storage component and identifies the data sources that are available for model calibration.

4.2.3.1 Water Column (W)

The water column component is represented by a general water balance equation. The water "state" at any time is the difference between the sum of the flow inputs (pumped inflow and precipitation) and outputs (flow over the weir, ET, and groundwater exchange).

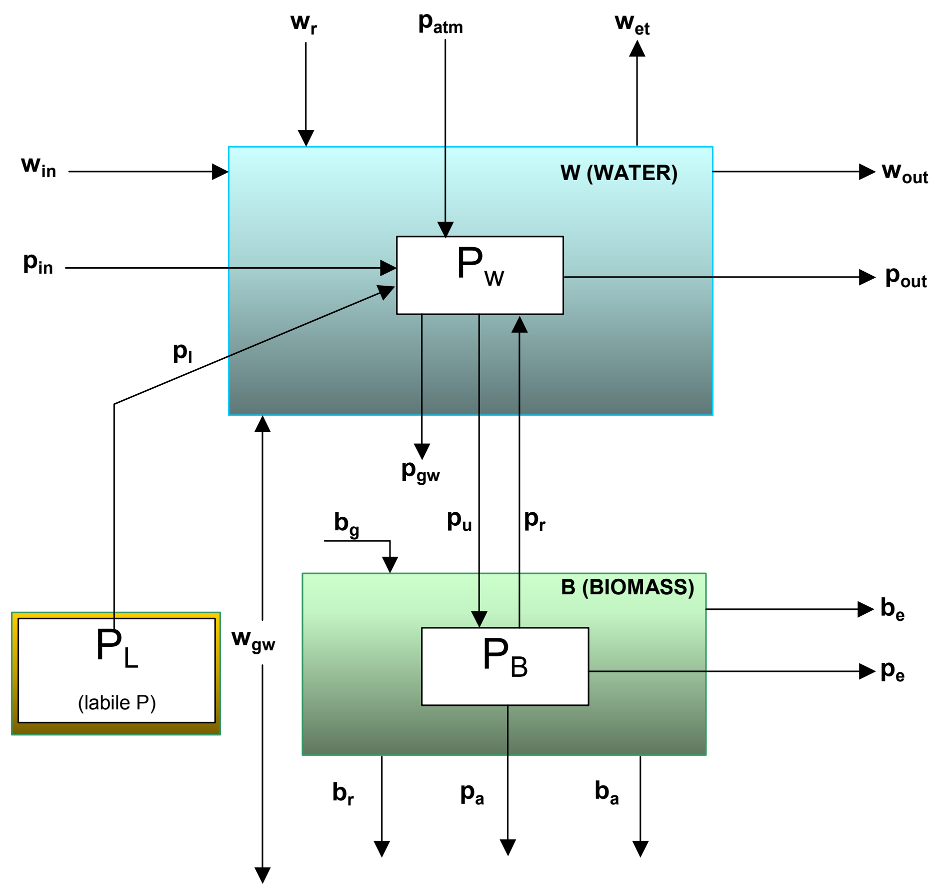
For model calibration, the pumped inflow and outflow over the weir were measured in the field. Precipitation data were provided by the District using on-site rain gauges. District ET data were utilized for estimates of this water loss at the PSTA research and demonstration site. No groundwater interactions were expected for water budgets for the PSTA Test Cells because all of these PSTA mesocosms are lined.

The final PSTA Forecast Model utilizes a single well-mixed tank hydraulic framework. This is based on the single-cell configuration of all of the PSTA research test units. Actual tracer data from the Phase 1 and 2 PSTA mesocosms indicated that their tracer residence time distributions could be best described as between 1.4 and 4.1 tanks-in-series (TIS). A 1.8 TIS model was constructed and tested. It was found that this model framework did not provide a better fit to the actual operational data than the single well-mixed tank model.

Based on treatment wetland theory, it is currently assumed that higher performance is likely at higher numbers of TIS (Kadlec and Knight, 1996; Kadlec, 2001b). This theoretical potential for PSTA performance enhancement was not apparent in Phase 1 and 2 treatment comparisons, though measured hydraulics improved during that period in the PSTA Test Cells. For this reason, the PSTA Forecast Model platform was not re-built to allow testing of multiple TIS. However, the existing DMSTA model platform with the PSTA Forecast Model equations was used for the sensitivity analysis of TIS and PSTA performance as described later in this section. The most recent PSTA data analyzed in Section 3 for the FSCs lends some initial support to the theory of performance

EXHIBIT 4-1

PSTA Phase 2 Forecast Model Diagram



$$\dot{W} = w_{in} - w_{out} + w_r - w_{et} - w_{gw}$$

$$\dot{P}_W = p_{in} - p_{out} + p_{atm} - p_u + p_r - p_{gw} + p_l$$

$$\dot{B} = b_g - b_r - b_e - b_a$$

$$\dot{P}_B = p_u - p_r - p_a - p_e$$

$$\dot{P}_L = - p_l$$

$\dot{W}$ = water state variable
w_{in} = pumped water supply to system
w_{out} = measured outflow from system
w_r = rainfall
w_{et} = evapotranspiration
w_{gw} = groundwater flow

$\dot{P}_W$ = TP in water column state variable
p_{in} = aerial loading rate of TP to water column
p_{out} = TP in outflow from system
p_{atm} = bulk atmospheric deposition of TP
p_u = TP uptake by biomass
p_r = TP returned from biomass to water column
p_{gw} = TP in groundwater

$\dot{B}$ = biomass (ash-free dry weight) state variable
b_g = biomass growth rate
b_r = biomass respiration rate
b_e = harvested biomass export rate
b_a = biomass accretion rate

$\dot{P}_L$ = Labile TP state variable
p_l = TP input from initial labile storage

$\dot{P}_B$ = TP in biomass state variable
p_a = TP accretion in sediments
p_e = TP exported with harvested biomass

EXHIBIT 4-2

PSTA Forecast Model State Variables, Coefficients, and Definitions

Variable		Calculated as	1° Units	Description
A	=	Wetted area	m^2	PSTA footprint area
W	=	$W_{initial} + \dot{W}dt$	m	water
$\dot{W}$	=	$w_{in} - w_{out} + w_r - w_{et} - w_{gw}$	m/d	water rate of change
w_{in}	=	Q_{IN} / A	m/d	pumped inflow
w_{out}	=	Q_{OUT} / A	m/d	water out
w_r	=	Rain	m/d	rainfall
w_{et}	=	ET	m/d	evapotranspiration
w_{gw}	=	seepage rate	m/d	groundwater exchange
P_w	=	$(P_{w\_initial} + \dot{P}_w dt)/W$	gTP/m^3	water column TP
$\dot{P}_W$	=	$p_{in} - p_{out} + p_{atm} - p_u + p_r - p_{gw} + p_l$	$gTP/m^2/d$	water column TP rate of change
p_{in}	=	$(C_{IN} * Q_{IN})/A$	$gTP/m^2/d$	TP in pumped inflow
p_{out}	=	$(P_W * Q_{OUT})/A$	$gTP/m^2/d$	TP in surface outflow
p_{atm}	=	C_{ATM} * Rain	$gTP/m^2/d$	bulk atmospheric deposition
p_u	=	$k_u \cdot P_W * B$	$gTP/m^2/d$	TP uptake by biomass
p_r	=	$b_r * P_B/B$	$gTP/m^2/d$	TP returned to water column from biomass/sediments
p_{gw}	=	$P_W * w_{gw}$	$gTP/m^2/d$	TP in groundwater exchange
p_l	=	$k_l\, P_L$	$gTP/m^2/d$	TP input from initial labile storage
B	=	$B_{initial} + \dot{B}dt$	$g\ AFDW/m^2$	Biomass (ash-free dry weight)
$\dot{B}$	=	$b_g - b_d - b_e - b_a$	$g\ AFDW/m^2/d$	Biomass rate of change
b_g	=	$k_g * (I/(k_{si} + I)) * (P_W/(k_{sp} + P_W)) * B$	$g\ AFDW/m^2/d$	biomass growth
b_r	=	$k_r * B^2$	$g\ AFDW/m^2/d$	biomass respiration rate
b_e	=	HB	$g\ AFDW/m^2/d$	biomass harvest
b_a	=	$k_a * B$	$g\ AFDW/m^2/d$	biomass accretion
H	=	user defined	d^{-1}	harvesting coefficient
P_B	=	$P_{B\text{-}initial} + \dot{P}_B dt$	gTP/m^2	TP in biomass
$\dot{P}_B$	=	$p_u - p_r - p_a - p_e$	$gTP/m^2/d$	TP in biomass rate of change
p_u	=	$k_u \cdot P_W * B$	$gTP/m^2/d$	TP uptake by biomass growth and luxury uptake
p_r	=	$b_r * P_B/B$	$gTP/m^2/d$	TP returned to water column from biomass/sediments
p_a	=	$b_a * P_B/B$	$gTP/m^2/d$	TP in accreted biomass
p_e	=	$b_e * P_B/B$	$gTP/m^2/d$	TP exported in harvested biomass
P_L	=	$PL_{\text{-}initial} + \dot{P}_L dt$	gTP/m^2	Initial labile TP
$\dot{P}_L$	=	$- p_l$	$gTP/m^2/d$	Labile TP rate of change
p_l	=	$k_l\, P_L$	$gTP/m^2/d$	TP input from initial labile storage

EXHIBIT 4-2
PSTA Forecast Model State Variables, Coefficients, and Definitions

Variable		Calculated as	1° Units	Description
k_g	=		d^{-1}	biomass growth rate
k_{si}	=		$E/m^2/d$	half saturation constant for PAR
k_{sp}	=		gTP/m^3	half saturation constant for water column TP
k_r	=		$m^2/gAFDW/d$	biomass respiration rate constant
k_a	=		d^{-1}	accretion rate constant
k_u	=		$m^3/gAFDW/d$	periphyton luxury uptake constant
k_l	=		d^{-1}	P release from labile storage rate constant
k_{1TP}	=	$(p_a+p_e-p_l)/P_W*365$	m/y	TP net settling rate
Q_{in}			m^3/d	inflow
Q_{out}			m^3/d	outflow
Rain			m/d	rainfall
ET			m/d	evapotranspiration
Weir Ht.			ft	weir height
C_{inTP}			mgTP/L	TP inflow concentration
C_{atmTP}			mgTP/L	TP in rainfall
I (PAR)			$E/m^2/d$	photosynthetically active radiation

enhancement at higher numbers of TIS. Thus, the conclusions developed below with the DMSTA model take on an enhanced credibility compared to earlier Phase 1 and 2 conclusions.

Water outflow in the PSTA Forecast Model is based on the weir design. The model provides either a horizontal or a v-notch weir. The v-notch weir expression was used to calibrate the model with data from the PSTA Test Cells. The horizontal weir with variable width was used for simulation of larger-scale PSTA systems.

4.2.3.2 Water Column TP (P_W)

TP in the water column is described as the concentration resulting from the net effects of the inflow and outflow concentrations, bulk atmospheric deposition, uptake by the biomass, losses to groundwater, and a return from sediments and biomass. Because this is a single, well-mixed tank model, P_W is equivalent to the outflow TP concentration.

For calibration, inflow and outflow TP concentrations were directly measured as part of routine monitoring. Bulk atmospheric P deposition was assumed to be equivalent to 17.64 µg/L (wet P = 10 µg/L and dry P = 10 mg/m^2/yr). Uptake of TP by biomass was derived from dry weight measurements of TP from algae and macrophyte samples. The return from sediments and biomass was estimated during the calibration process.

4.2.3.3 Biomass (B)

The biomass component consists of the AFDW (total organic content) of the benthic periphyton mat, epiphytic algae, tychoplankton, and detritus. Macrophytic plants are not explicitly included in the model because of the inherent variability of their populations and the limited resources devoted to their measurement. The biomass state variable depends on periphyton growth and respiration rates, algal export from the system measured as TSS, and accretion of algal solids in the detrital layer.

Periphyton growth is calculated as a function of incident solar radiation (I) using a Monod (Michaelis-Menten) expression, water column TP concentration with a Monod expression, and periphyton biomass. Periphyton respiration is modeled as a quadratic drain (proportional to the periphyton biomass squared). A linear (first order) expression was initially used but found to result in model instability. The quadratic expression has been found to be an effective model to describe growth of a variety of ecological plant communities.

Periphyton accretion is a first order expression based on the total periphyton biomass. Periphyton export only includes periphyton removed by harvesting.

4.2.3.4 Biomass TP (P_B)

TP in the biomass depends upon uptake from the water column, internal recycling, and losses to respiration (back to the water column), accretion of biomass, and export of biomass in the outflow water. Measured effluent concentrations for TSS were used to derive the export rates.

Periphyton TP uptake is proportional to the product of the water TP (P_W) and the amount of periphyton biomass (B). TP lost as a result of periphyton respiration is proportional to the product of the periphyton decay rate multiplied by the concentration of TP in B. The TP accretion rate and export rate are both based on the same relationship.

4.2.3.5 Labile TP Storage (P_L)

Startup data from most of the PSTA mesocosms indicated that there were initial storages of labile TP in the antecedent soils that entered the water column upon flooding. These initial storages are modeled as a tank that is initially full of TP with a single outlet to the water column. This addition to the model helps duplicate the startup behavior observed, not only at the beginning of the project, but also at the mid-point of the project when the sediments in the peat-based PSTA Test Cell were highly disturbed.

4.2.3.6 PSTA Dry-out

PSTA Test Cell 3 (treatment STC-3/6) was operated in a periodic dry-out mode to determine the effects of periphyton dry-out on a large scale. The PSTA Forecast Model was found to be unstable as water levels declined to near dry-out conditions. For this reason, it was decided to incorporate some logic switches to capture the main effects of dry-out. Two types of switches were included in the model. The first reduced the rates of biomass growth and decay by 90 percent when water depth fell below 1 cm. The second switch stopped calculating P_W when water levels were less than 15 cm. This switch was necessary to prevent mathematical integration problems associated with zero values.

4.2.4 Coefficient Estimation

As shown in Exhibit 4-2, the following 7 adjustable coefficients are required by the model:

- k_g (d^{-1}) periphyton biomass growth rate constant
- k_{si} ($E/m^2/d$) half saturation constant for solar radiation I (PAR)
- k_{sp} ($g\ TP/m^3$) half saturation constant for periphyton uptake of water-column TP
- k_r (m^2/g AFDW/d) periphyton biomass respiration rate constant
- k_a (d^{-1}) periphyton biomass accretion rate constant
- k_u (m^3/g AFDW/d) periphyton TP uptake rate constant
- k_l (d^{-1}) TP release rate constant from labile storage

PSTA mesocosm data were analyzed to develop preliminary estimates for some of these parameters. Only the shellrock treatment data were reviewed for this range-finding effort.

These correlations were found to be unsatisfactory for precise model calibration (see below). While they provide an initial understanding of the strengths and weaknesses of relationships between model variables, these data were not collected from experimental treatments where all variables except one were controlled. For this reason, final calibration of the PSTA Forecast Model used the Excel Solver routine to adjust all coefficients at one time to minimize the sum of squares for all of the major state variables simultaneously.

4.2.4.1 Biomass Growth Rate (k_g)

Biomass growth partially depends on the amount of biomass already present in the system at any given time. Measures of photosynthetic activity, such as GPP, provide insight into the rate at which the biomass community is growing. GPP estimates in units of DO change (g O_2/m^2/d) have been converted to ash-free dry weight by multiplying by a factor of 2x.

Regression analysis of monthly average values for GPP and total biomass in all of the shellrock treatments showed no clear correlation between these two parameters. This correlation suffers from the fact that many factors other than biomass and GPP vary during the operational period. However, for model calibration, the slope of the regression line provides an initial value for k_g of 0.0178 d^{-1}.

4.2.4.2 Half Saturation Constants for PAR and TP

The rate of biomass growth is also partially limited by solar radiation (i.e., photosynthesis) and the availability of nutrients. The PSTA Forecast Model assumes that both light and nutrient availability follow the Michaelis-Menten model, which implies that reaction rates increase with substrate concentration until a maximum reaction rate is approached. At that point, the addition of substrate no longer affects the reaction rate. The half saturation constant describes the substrate concentration required for the reaction to proceed at half its maximum rate.

Regressions of average monthly relationships between GPP and PAR in the shellrock treatments were prepared to provide a preliminary estimate of the light half-saturation constant. The reciprocals of GPP and PAR were plotted to linearize the Michaelis-Menten relationship. Datasets that follow the Michaelis-Menten equation plot as a line with a positive slope and a negative x-intercept. The value of the half saturation constant is given as -1/x-intercept. The average value of the half saturation constant for PAR, k_{si}, was 84.5 E/m^2/d. This value was used as a starting point for model calibration.

A similar regression was used to provide a preliminary estimate of the reciprocals of GPP and water column TP concentration in shellrock treatments. No clear Michaelis-Menten relationship was apparent for these data. The range of observed water column TP concentrations has probably not been wide enough to show the assumed limiting effect of TP on biomass growth. A value of 0.0 mg/L was used for the initial half saturation constant for TP (k_{sp}).

4.2.4.3 Biomass Respiration Rate (k_r)

Operational data were also used to develop a regression between biomass and CR in the PSTA shellrock-based treatments. There was no apparent correlation observed between these two parameters. However, because the model was found to be very sensitive to k_r and the CR rate, it was decided to use a quadratic drain to model this process. CR measurements were used to approximate the decay rate of biomass in the mesocosms. The slope of the regression line (0.0001 d^{-1}) was used as the initial model value for k_r.

4.2.4.4 Biomass Accretion Rate (k_a)

The rate of biomass accretion (k_a) at the sediment/water interface was not directly measured during the PSTA research. Horizon markers could not be recovered after an 18-month operational period. Sediment traps were used to estimate total accretion, but these values were a better representation of gross accretion than net accretion. Because no direct measure of net biomass and TP accretion was possible, this rate coefficient was estimated through the model calibration described below.

4.2.4.5 Periphyton Luxury Uptake Rate Constant (ku)

The rate of P uptake by the periphyton was not directly measured. Therefore, this model parameter was estimated through the calibration described below.

4.2.4.6 Release Rate Constant From Labile Storage (k_l)

This rate coefficient was estimated through the model calibration described below.

4.2.5 Model Calibration

The PSTA Forecast Model was calibrated using POR and OPP data from the three PSTA Test Cells. These systems were operated for slightly more than 2 years. The POR was approximately March 1999 through March 2001. The OPP varied slightly for the three PSTA Test Cell treatments. For treatment STC-1/4 (peat), the OPP included data from July 1999 through January 2000 and from July 2000 through March 2001. For STC-2/5 (shellrock, constant water regime) and STC-3/6 (shellrock, variable water regime), the OPP used for calibration was July 1999 through March 2001.

The PSTA Forecast Model was calibrated separately for the three test systems because of their very different soil types and water regimes. Test Cell 8 (treatments STC-2/5) provided a dataset for a shellrock-based PSTA with stable water levels. Test Cell 3 (treatments STC-3/6) represented a shellrock PSTA with fluctuating water depths, including dry-out. Test Cell 13 (treatments STC-1/4) data were applicable to a PSTA built on organic soils with high antecedent soil P concentrations.

Calibration was conducted as a preliminary fit of the actual and model data using the rate constants described above. Goodness of fit was determined by calculating the sum of squares of differences between individual records of P_W, P_{out}, k_{1TP}, B, P_B, P_B/B, b_g, b_r, and W. The Solver routine in Excel was used to automatically optimize adjustable coefficients to provide the lowest total sum of these individual sums of squares. POR and OPP average values for the actual data and the model were also calculated and referred to during model calibration. Various calibration runs were performed with differing groups of input parameters being varied. Effects of individual and grouped input parameters on each state variable were examined, and final parameter selection was based on the best overall fit to all of the state variables in the model.

Exhibit 4-3 illustrates a representative PSTA Forecast Model calibration sheet for Test Cell 8 (shellrock, constant water depth). Comparisons between predicted and actual measured data are summarized with regression coefficients (R^2). An accompanying sheet was used to overlay model and actual values for a visual assessment of goodness of fit (Exhibit 4-4). The ability to correlate the model output to actual data from multiple measured parameters provided significant power in calibration.

Exhibits 4-5 through 4-7 illustrate calibrated model fits for each of the three PSTA datasets for the POR datasets. Comparisons between actual data and model output are shown for W, TP_{out}, k_{1TP}, and b_g. All of the general trends in the actual data were reasonably well simulated by the PSTA Forecast Model.

Exhibit 4-8 provides values for all of the adjustable coefficients and initial conditions for each of the calibration datasets for both the POR and for the OPP. A relatively small range in calibrated model coefficients was found between the three PSTA Test Cells. There were noticeable changes between the calibrations for the POR and the OPP.

4.2.6 Sensitivity Analysis

Exhibit 4-9 provides the results of a sensitivity analysis of the adjustable coefficients for the shellrock test cell (Test Cell 8 OPP). Each coefficient was tested at one-half and at twice its calibrated value. The coefficients that consistently resulted in the largest changes in k_{1TP} and TP_{out} were k_u and k_r. The biological state variables and rates of productivity and respiration were also most affected by changes to the biomass growth and respiration rates (k_g and k_r, respectively) and the light half saturation constant (k_{si}).

4.2.7 Model Simulations

4.2.7.1 Effects of Different Forcing Functions

The PSTA Forecast Model calibrated to the shellrock test cell (Test Cell 8) OPP data has been tested for five general operational/management alternatives. These include the following hypothetical scenarios:

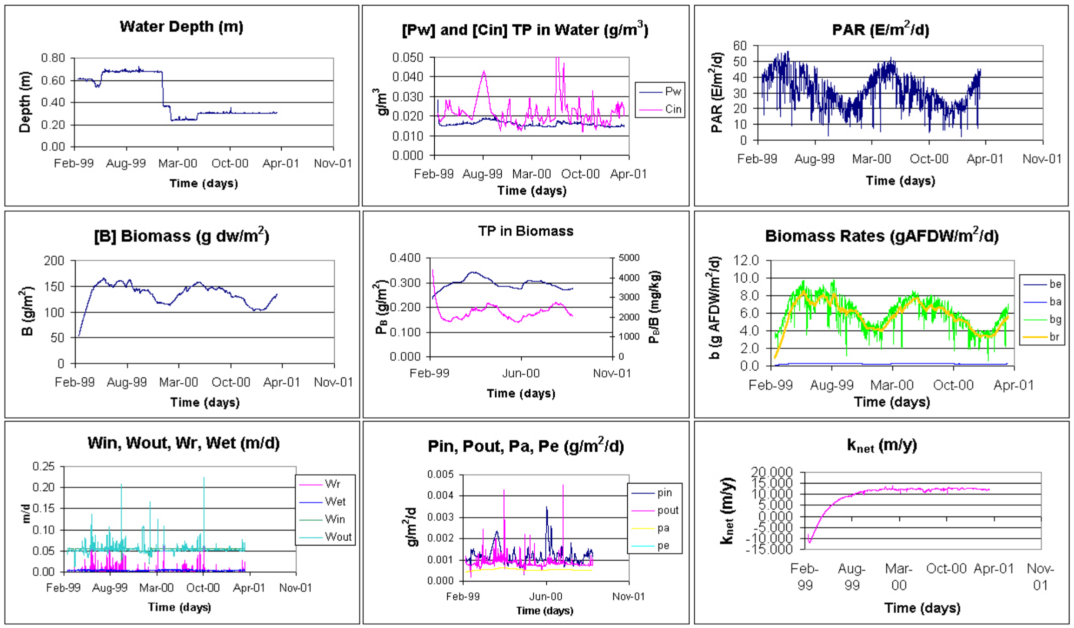
- PSTAs constructed on a leaky site with a vertical leakage rate of 0.02 or 0.04 m/d
- PSTAs receiving a steady inflow TP concentration of 100 ppb
- PSTAs receiving a steady inflow TP concentration of 50 ppb
- PSTAs with a harvest rate (H) of 0.001 d^{-1}
- PSTAs with a harvest rate of 0.0001 d^{-1}

EXHIBIT 4-3

Example PSTA Phase 2 Model Calibration Spreadsheet Illustrating PSTA Test Cell 8 Input Parameters and Model Output

Periphyton Stormwater Treatment Area (PSTA) Research and Demonstration Project - CH2MHILL
PSTA Phase 2 Phosphorus Forecast Model - South Test Cell 8

Wetland grade =	14.3	ft	Initial Pw =	0.028213	g/m^3	Time Step =	0.1	d
Starting Stage =	16.3	ft	Initial B =	53.2	g/m^2	Weir Equation =	90o V-notch	
Wetland Area at grade =	2240	m^2	Initial P_B =	0.2349	g/m^2	Weir Width =	1	ft
Volume below grade =	0	m^3	Initial P_L =	0.0860	g/m^2	Note: User inputs in red		
Leakance Rate =	0	m/d						



Adjustable Constants	
k_r =	0.000308086
k_g =	0.405816977
k_{si} =	31.53180233
k_{sp} =	0.053830944
k_a =	0.001814181
k_l=	0.01219983
k_u =	0.006008365
H =	0

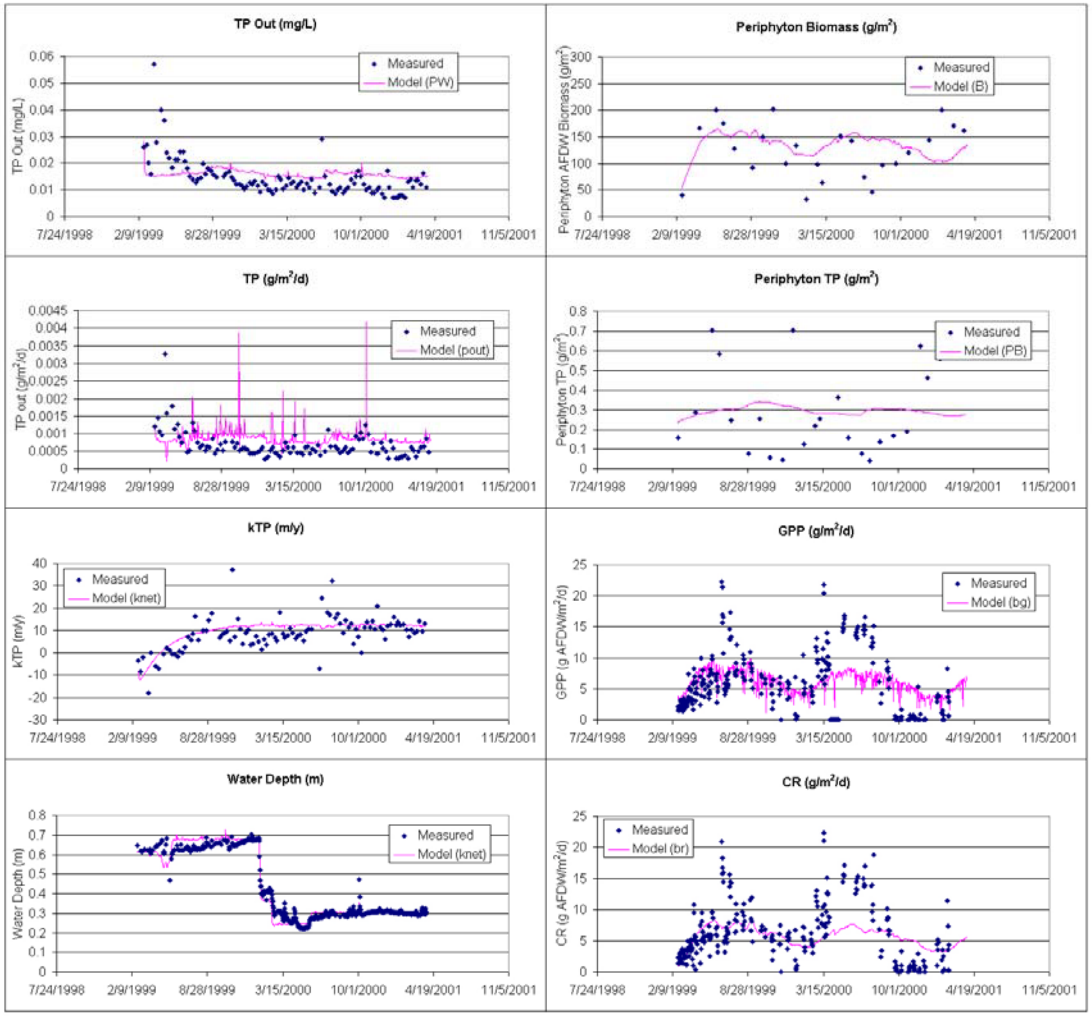
Parameter	P.O.R Avg Model	P.O.R Avg Data
HLR (m/y)	19.78	
TPin (g/m^3)	0.022	
TPout (g/m^3)	0.016	0.015
k_{1TP} (m/y)	6.54	8.31
W (m)	0.449	0.39291
P_W (g/m^3)	0.016	0.01456
B (g $AFDW/m^2$)	134.3	130.727
P_B (g/m^2)	0.296	0.29596
P_B/B (mg/kg AFDW)	2249	2284.65
b_g (g $AFDW/m^2/d$)	6.026	5.46425
b_r (g $AFDW/m^2/d$)	5.676	6.10028

Parameter	R^2	Sum Squares	%
P_w(mg/L)	-0.0186	0.005383286	0
p_{out}(g/m2/d)	-0.6090	2.50171E-05	0
k_{net}(m/y)	0.3069	4015.01	0
B(g/m2)	-0.0437	85841.10	0
P_B(g/m2)	-0.0510	1.20	0
P_B/B (mg/kg)	0.1643	32672877.72	0
b_g(g/m2/d)	0.1316	6179.96	0
b_r(g/m2/d)	0.2174	4841.10	0
W(m)	0.9622	0.55	0
			0

EXHIBIT 4-4

Example PSTA Phase 2 Model Calibration Spreadsheet Illustrating Actual and Predicted Results (Goodness of fit) for PSTA Test Cell 8

Periphyton Stormwater Treatment Area (PSTA) Research and Demonstration Project - CH2MHILL
PSTA Phase 2 Phosphorus Forecast Model - South Test Cell 8



Adjustable Constants	
k_r =	0.000308086
k_g =	0.405816977
k_{si} =	31.53180233
k_{sp} =	0.053830944
k_a =	0.001814181
k_l =	0.01219983
k_u =	0.006008365
H =	0

Parameter	R^2	SS
P_w(mg/L)	-0.019	0.0054
p_{out}(g/m2/d)	-0.609	3E-05
k_{net}(m/y)	0.3069	4015
B(g AFDW/m2)	-0.044	85841
P_B(g/m2)	-0.051	1.2007
P_B/B (mg/kgAFDW)	0.1643	3E+07
b_g(g AFDW/m2/d)	0.1316	6180
b_r(g AFDW/m2/d)	0.2174	4841.1
W(m)	0.9622	0.5497

Parameter	P.O.R Avg Model	P.O.R Avg Data
HLR (m/y)	19.78	
TPin (g/m³)	0.022	
TPout (g/m³)	0.016	0.015
k_{1TP} (m/y)	6.54	8.31

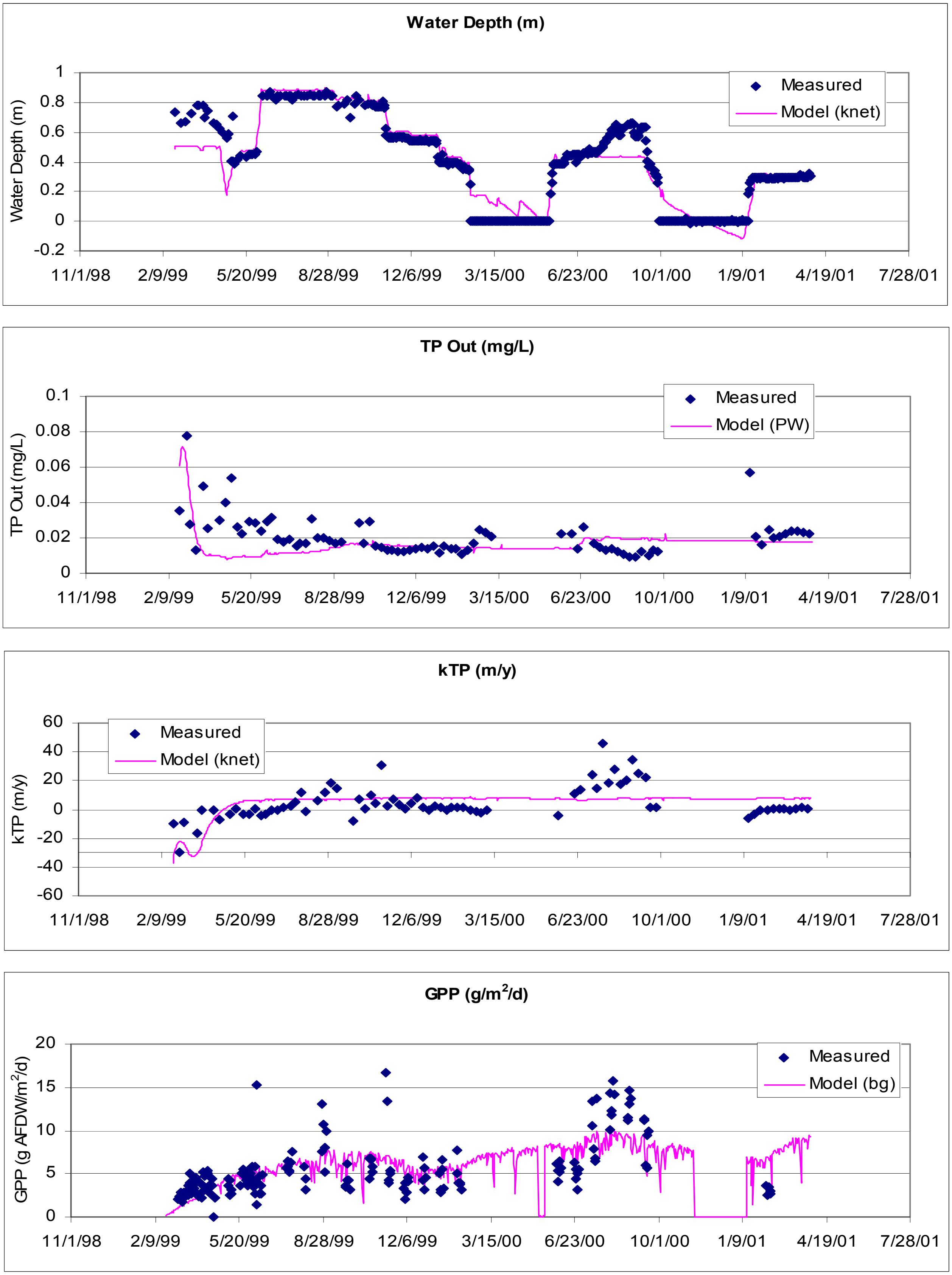
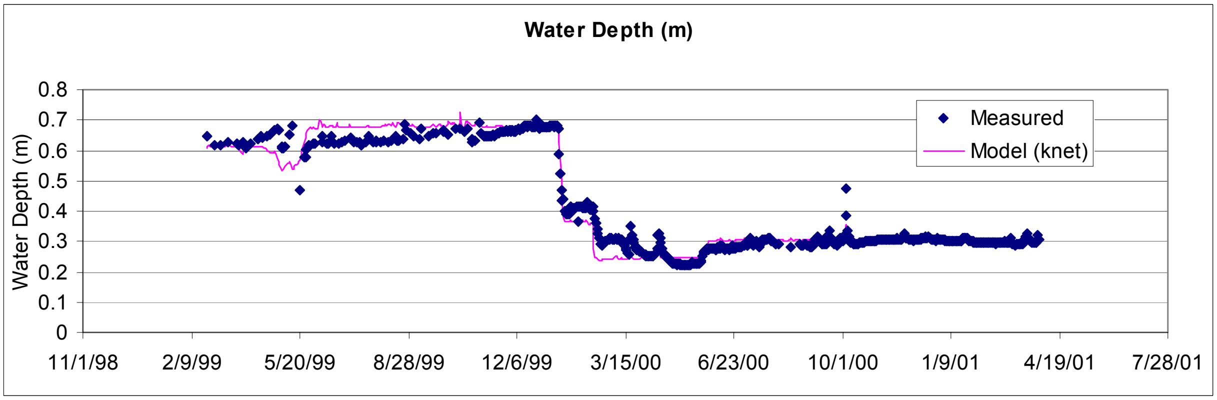
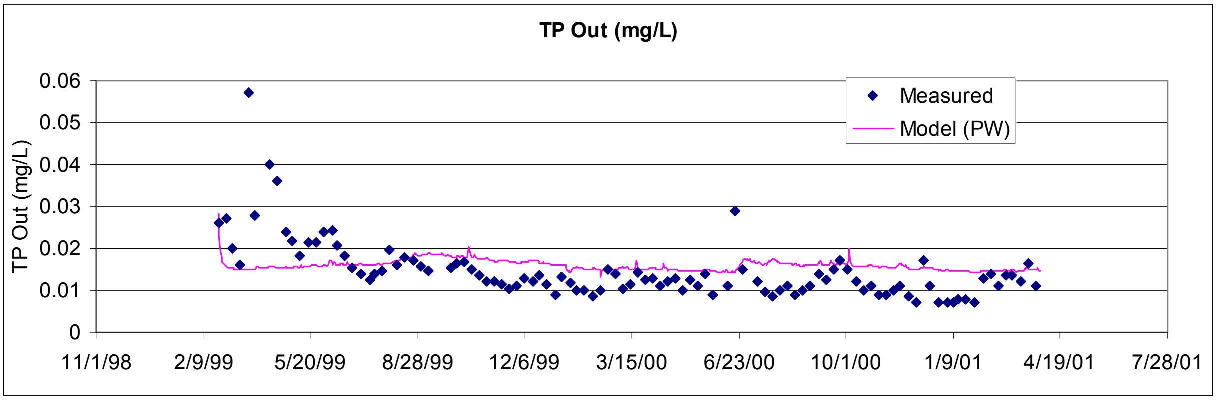
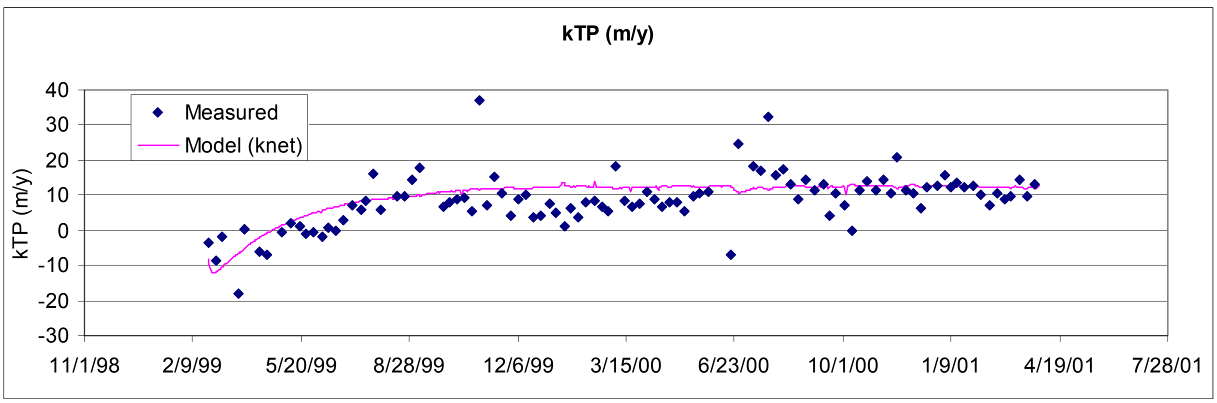


EXHIBIT 4-5
Detailed Comparison of PSTA Phase 2 Model Estimates and Actual Data from PSTA Test Cell 3 – Shellrock, Variable Water Regime







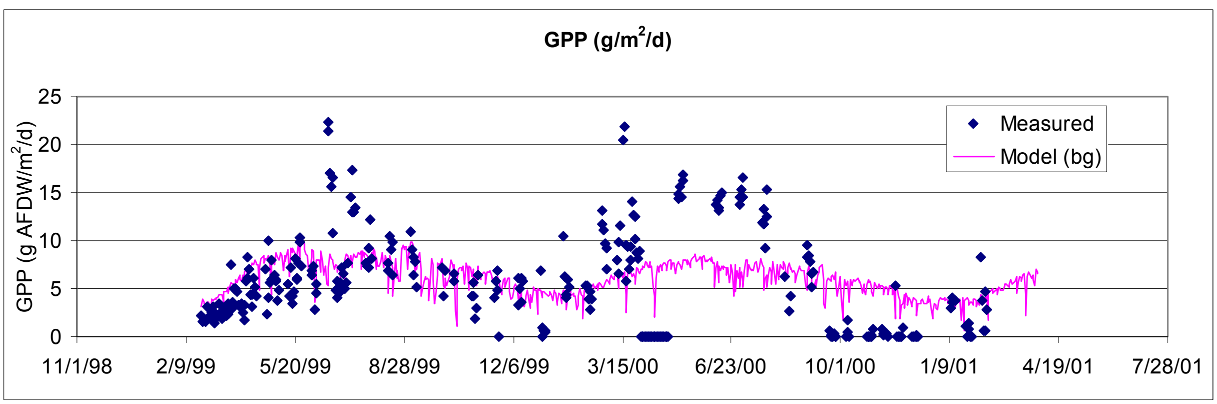
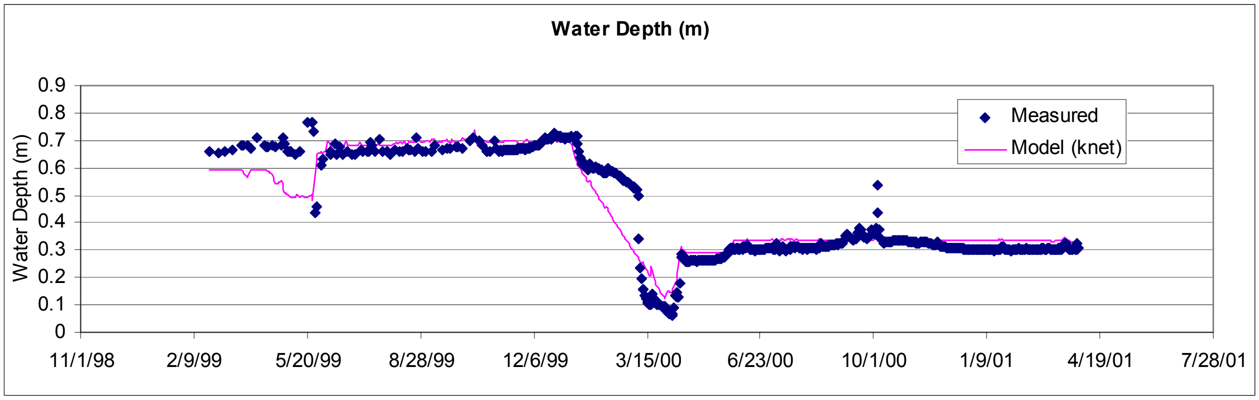
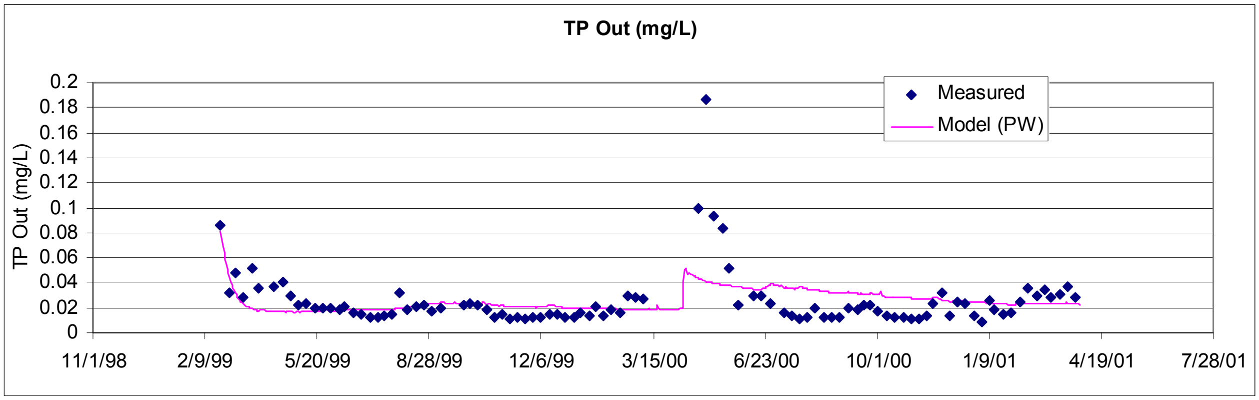
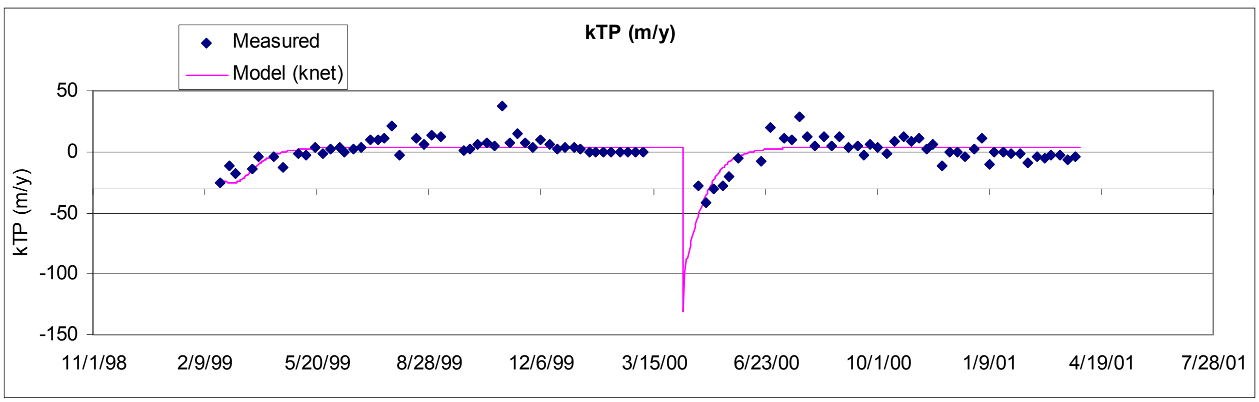


EXHIBIT 4-6
Detailed Comparison of PSTA Phase 2 Model Estimates and Actual Data from PSTA Test Cell 8 – Shellrock, Constant Water Regime







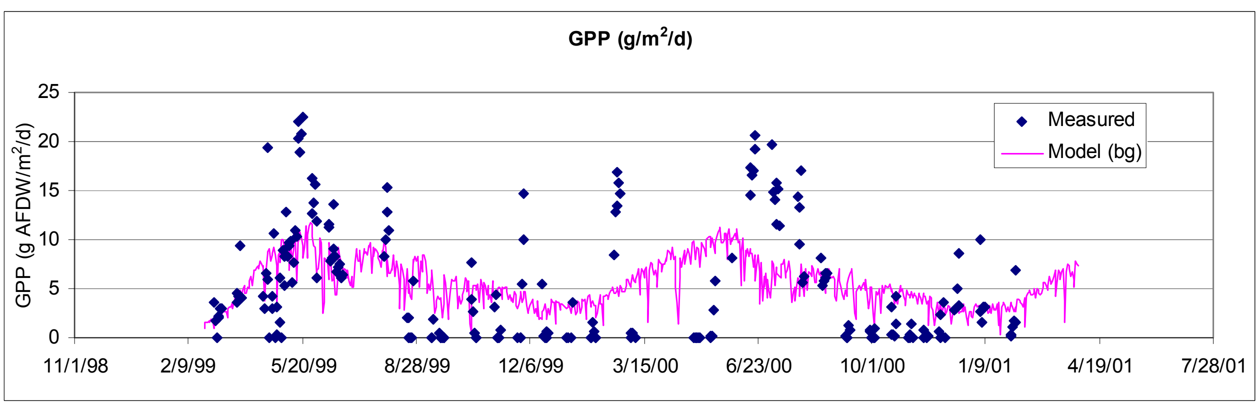


EXHIBIT 4-7
Detailed Comparison of PSTA Phase 2 Model Estimates and Actual Data from PSTA Test Cell 13 – Peat, Constant Water Regime, Soil Amendment

EXHIBIT 4-8
Comparison of PSTA Forecast Model Initial Values and Adjustable Coefficients for PSTA Test Cells

	Test Cell 8 (shellrock)		Test Cell 13 (peat)		Test Cell 3 (shellrock)	
	POR	**OPP**	**POR**	**OPP**	**POR**	**OPP**
Wetland Grade	14.3	14.3	14.3	14.3	14.2	14.2
Starting Stage	16.3	16.5	16.2	16.4	15.8	15.7
Wet Area (m^2)	2240	2240	2240	2240	2240	2240
Initial W (g/m^3)	0.028	0.014	0.081	0.012	0.061	0.020
Initial Biomass (g/m^2)	53	168	27	67	2	112
Initial P in Biomass (g/m^2)	0.2349	0.1734	0.0461	0.1173	0.0119	0.1201
Initial Labile P (g/m^2)	0.086	0.000	0.085	0.000	0.103	0.000
k_r (m^2/gAFDW/d)	0.000308	0.000325	0.000300	0.000300	0.000623	0.000668
k_g (d^{-1})	0.406	0.154	0.200	0.211	0.200	0.200
k_{si} ($E/m^2/d$)	31.5	66.7	114.2	118.4	15.7	17.6
k_{sp} (g TP/ m^3)	0.054	0.000	0.000	0.000	0.014	0.010
k_a (d^{-1})	0.00181	0.00142	0.00104	0.00040	0.00134	0.00093
k_l (d^{-1})	0.0122	0.0086	0.0603	0.0520	0.0597	0.0451
k_u (m^3/gAFDW/d)	0.00601	0.00829	0.00281	0.00527	0.00982	0.01511

Notes:
POR = period-of-record
OPP = optimum performance period

A matrix of the above factors was examined to provide an overall picture of model response. Existing inflow TP and environmental data were copied to provide a synthetic 5-year input dataset. Stable water depths of 30 cm and inflow rates of 134 m^3/d were tested. A summary of the model output is provided in Exhibit 4-10.

4.2.7.2 Effects of Leakage

A simulated average vertical leakage rate of 2 cm/d resulted in a very slight increase in k_1 and no significant decrease in TP_{out} for each of the PSTA configurations tested. Increasing the leakage rate to 4 cm/d did not affect the modeled performance of the Test Cells with constant water regime.

4.2.7.3 Effects of Periphyton Harvesting

Harvesting at a rate of 3.65 percent per year (H = 0.0001 d^{-1}) provided a slight improvement in long-term average PSTA outlet TP concentrations. Harvesting periphyton at a rate of 36.5 percent per year (H = 0.001 d^{-1} or approximately 7.3 wet metric tonnes per hectare per year [mt/ha/yr] or approximately 70 g dry weight/m^2/yr) slightly lowered projected TP outflow concentrations by approximately 2 to 3 ppb. Additional model runs (not illustrated in Exhibit 4-10) indicated that for harvesting to increase k_1 to approximately 17 m/yr and TP_{out} less

EXHIBIT 4-9
Results from a Sensitivity Analysis of Adjustable Coefficients for South Test Cell 8 (shellrock, constant water regime)

Adjustable Constants	Initial Value	Percent Adjustment	Adjusted Value		HLR (m/yr)	TP_{in} (g/m^3)	TP_{out} (g/m^3)	k_{1TP} (m/y)	W (m)	B (g AFDW /m^2)	P_B (g/m^2)	P_B/B (mg/kg AFDW)	b_g (g AFDW /m^2/d)	b_r (g AFDW /m^2/d)
				Actual Data Averages	19.8	0.022	0.012	11.8	0.38	128	0.268	2115	5.5	6.6
				Model Averages	19.8	0.022	0.012	11.9	0.41	136	0.296	2261	6.3	6.2
				Delta Δ (%)	**0.0**	**0.0**	**-0.7**	**1.1**	**9.8**	**6.3**	**10.4**	**6.9**	**14.6**	**-5.9**
k_r	**0.000325**	**50%**	**0.000488**	**Model**	19.8	0.022	0.015	7.4	0.41	92	0.251	2844	4.3	4.3
				Delta Δ (%)	**0.0**	**0.0**	**25.1**	**-37.6**	**9.8**	**-28.1**	**-6.7**	**34.5**	**-22.2**	**-34.8**
		-50%	**0.000163**	**Model**	19.8	0.022	0.007	21.6	0.41	265	0.360	1396	12.3	11.7
				Delta Δ (%)	**0.0**	**0.0**	**-39.0**	**83.1**	**9.8**	**107.4**	**34.2**	**-34.0**	**122.5**	**78.6**
k_g	**0.154**	**50%**	**0.230**	**Model**	19.8	0.022	0.012	12.1	0.41	204	0.298	1516	14.3	13.9
				Delta Δ (%)	**0.0**	**0.0**	**-1.6**	**2.6**	**9.8**	**59.2**	**11.1**	**-28.3**	**157.6**	**111.1**
		-50%	**0.077**	**Model**	19.8	0.022	0.013	11.4	0.41	70	0.291	4420	1.6	1.7
				Delta Δ (%)	**0.0**	**0.0**	**1.9**	**-3.2**	**9.8**	**-45.2**	**8.5**	**109.0**	**-70.4**	**-74.1**
k_{si}	**66.7403**	**50%**	**100.11**	**Model**	19.8	0.022	0.012	11.8	0.41	102	0.295	3034	3.6	3.5
				Delta Δ (%)	**0.0**	**0.0**	**0.3**	**-0.4**	**9.8**	**-20.3**	**9.7**	**43.5**	**-35.7**	**-46.5**
		-50%	**33.3702**	**Model**	19.8	0.022	0.012	12.1	0.41	207	0.298	1469	14.6	14.2
				Delta Δ (%)	**0.0**	**0.0**	**-1.6**	**2.7**	**9.8**	**62.2**	**11.1**	**-30.5**	**164.4**	**116.8**
k_a	**0.00142**	**50%**	**0.00213**	**Model**	19.8	0.022	0.011	13.9	0.41	134	0.265	2054	6.2	6.0
				Delta Δ (%)	**0.0**	**0.0**	**-10.0**	**17.8**	**9.8**	**4.7**	**-1.2**	**-2.9**	**12.9**	**-8.7**
		-50%	**0.00071**	**Model**	19.8	0.022	0.014	9.8	0.41	138	0.334	2514	6.4	6.4
				Delta Δ (%)	**0.0**	**0.0**	**10.8**	**-17.2**	**9.8**	**8.0**	**24.5**	**18.9**	**16.3**	**-3.0**
k_l	**0.0086**	**50%**	**0.0129**	**Model**	19.8	0.022	0.012	11.9	0.41	136	0.296	2261	6.3	6.2
				Delta Δ (%)	**0.0**	**0.0**	**-0.7**	**1.1**	**9.8**	**6.3**	**10.4**	**6.9**	**14.6**	**-5.9**
		-50%	**0.0043**	**Model**	19.8	0.022	0.012	11.9	0.41	136	0.296	2261	6.3	6.2
				Delta Δ (%)	**0.0**	**0.0**	**-0.7**	**1.1**	**9.8**	**6.3**	**10.4**	**6.9**	**14.6**	**-5.9**
k_u	**0.00818**	**50%**	**0.01228**	**Model**	19.8	0.022	0.009	17.2	0.41	136	0.335	2564	6.3	6.2
				Delta Δ (%)	**0.0**	**0.0**	**-23.7**	**45.4**	**9.8**	**6.3**	**24.9**	**21.2**	**14.6**	**-5.9**
		-50%	**0.00409**	**Model**	19.8	0.022	0.018	4.6	0.41	136	0.215	1630	6.3	6.2
				Delta Δ (%)	**0.0**	**0.0**	**44.0**	**-61.3**	**9.8**	**6.3**	**-20.0**	**-22.9**	**14.6**	**-5.9**

EXHIBIT 4-10
PSTA Phase 2 Model Performance for South Test Cell 8 (shellrock) Under a Variety of Test Conditions Including Vertical Leakage, Harvest, and Elevated Inflow TP Concentrations

		Vertical Leakage		Harvest	
Parameter	**Baseline**	**0.04 m/d**	**0.02 m/d**	**0.001 d^{-1}**	**0.0001 d^{-1}**
Inflow TP concentration = variable 5 year					
HLR (m/y)	21.83	21.83	21.83	21.83	21.83
Tpin (g/m^3)	0.023	0.023	0.023	0.023	0.023
PW (g/m^3)	0.0146	0.0146	0.0146	0.0121	0.0143
k1TP (m/yr)	9.60	9.59	9.60	13.70	10.05
W (m)	0.3707	0.3465	0.3606	0.3707	0.3707
B (g AFDW/m^2)	141.37	141.37	141.37	138.34	141.07
PB (g/m^2)	0.3589	0.3590	0.3589	0.2915	0.3508
PB/B (mg/kg AFDW)	2643.3	2644.1	2643.5	2193.7	2589.4
bg (g AFDW/m^2/d)	6.8738	6.8738	6.8738	6.7297	6.8594
br (g AFDW/m^2/d)	6.6977	6.6977	6.6977	6.4214	6.6698
Inflow TP concentration = 0.050 g/m^3					
HLR (m/yr)	21.83	21.83	21.83	21.83	21.83
TPin (g/m^3)	0.050	0.050	0.050	0.050	0.050
PW (g/m^3)	0.0294	0.0294	0.0294	0.0244	0.0288
k1TP (m/yr)	11.58	11.58	11.58	15.64	12.03
W (m)	0.3707	0.3465	0.3606	0.3707	0.3707
B (g AFDW/m^2)	141.37	141.37	141.37	138.34	141.07
PB (g/m^2)	0.7195	0.7196	0.7196	0.5848	0.7034
PB/B (mg/kg AFDW)	5302.1	5303.1	5302.5	4404.9	5194.7
bg (g AFDW/m^2/d)	6.8738	6.8738	6.8738	6.7297	6.8594
br (g AFDW/m^2/d)	6.6977	6.6977	6.6977	6.4214	6.6698
Inflow TP concentration = 0.100 g/m^3					
HLR (m/yr)	21.83	21.83	21.83	21.83	21.83
TPin (g/m^3)	0.100	0.100	0.100	0.100	0.100
P_W (g/m^3)	0.0566	0.0566	0.0566	0.0471	0.0555
k_{1TP} (m/yr)	12.42	12.41	12.42	16.45	12.86
W (m)	0.3707	0.3465	0.3606	0.3707	0.3707
B (g AFDW/m^2)	141.37	141.37	141.37	138.34	141.07
P_B (g/m^2)	1.3829	1.3831	1.3829	1.1247	1.3520
P_B/B (mg/kg AFDW)	10203.7	10205.1	10204.3	8484.3	9998.1
b_g (g AFDW/m^2/d)	6.8738	6.8738	6.8738	6.7297	6.8594
b_r (g AFDW/m^2/d)	6.6977	6.6977	6.6977	6.4214	6.6698

than 10 ppb for the Test Cell 8 (shellrock, constant water regime) base case, it would be necessary to harvest approximately twice as much, or 15 wet mt/ha/yr (H = 0.002 d^{-1}).

4.2.7.4 Effects of Higher Inlet TP Concentrations

Exhibit 4-10 also illustrates the modeled predictions for higher inflow TP concentrations of 50 and 100 ppb at the same hydraulic loading rate (HLR) as the Test Cell research (approximately 22 m/yr). For 50 ppb inflow, it is projected that a PSTA system built on shellrock would achieve an average outflow concentration of approximately 29 µg/L. At a steady inflow concentration of 100 µg/L TP, the average projected outflow TP would be 57 ppb. The respective k_1 values are estimated as approximately 11.6 and 12.4 m/yr for these two cases.

4.2.7.5 Simulation Using STA-2 Synthetic Dataset

The District's synthetic post-STA-2 dataset was used to provide a preview of PSTA performance under a 10-year period of variable inflows and TP concentrations. The average TP concentration into the PSTA for this period is approximately 37 ppb and the flow-weighted mean inflow concentration is 50 ppb. The average inflow rate for this dataset is approximately 531,000 m^3/d. The maximum daily inflow rate for this 10-year period is 6,270,000 m^3/d.

Performance of the proposed PSTA was tested with a variety of PSTA footprint areas, ranging from 500 to 8,000 ha. Projected long-term average outflow concentrations from the PSTA Forecast Model were 27 ppb for the design loading rate of approximately 5.3 cm/d (1,000 ha). At a higher loading rate of 11 cm/d (500 ha), the projected average outflow TP average is 32 ppb, with a flow-weighted mean concentration of 38 µg/L. The PSTA Forecast Model estimates that the PSTA area must be increased to approximately 2,672 ha to achieve a flow-weighted mean TP_{out} concentration of 20 ppb. Exhibit 4-11 illustrates the model predictions for this hypothetical case.

4.2.8 Potential PSTA Model Enhancements

The PSTA Forecast Model can be upgraded based on continuing data collection. Data from the PSTA Field- Scale Cells should be used to validate or modify the PSTA Forecast Model coefficients and performance.

A variety of changes could be made to the structure of the PSTA Forecast Model. These include additional work to simulate multiple PSTA cells in series. Additional research necessary to calibrate that model could be provided by additional work being planned in the North and South Test Cells. Improved performance and lower outflow TP concentrations will theoretically result from linking several PSTA cells in series. The PSTA model could also be upgraded by adding a macrophyte state variable. This addition would provide an integrated model that could be used to project the performance of a mixture of macrophytic and periphytic plant communities in an STA. During calibration of the PSTA Forecast Model, it was found that incorporation of biomass, community productivity, and community respiration were important for simulating the behavior of P dynamics.

EXHIBIT 4-11

PSTA Phase 2 Model Spreadsheet Illustrating Simulation Using Post STA-2 Synthetic Dataset

Periphyton Stormwater Treatment Area (PSTA) Research and Demonstration Project - CH2MHILL
PSTA Phase 2 Phosphorus Forecast Model - Post STA-2 10-Year Simulation

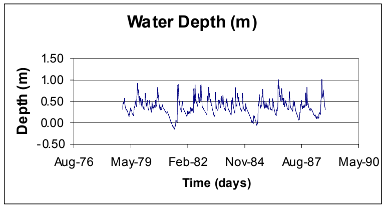
Wetland grade =	0	ft
Starting Stage =	1.0	ft
Wetland Area at grade =	30,189,186	m^2
Volume below grade =	0	m^3
Leakance Rate =	0	m/d

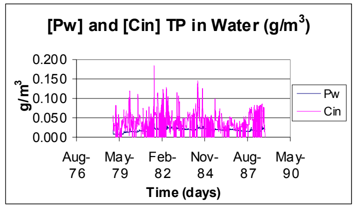
Initial Pw =	0.02	g/m^3
Initial B =	168.5	g/m^2
Initial P_B =	0.1734	g/m^2
Initial P_L =	0.0000	g/m^2

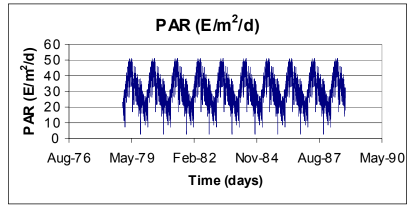
Time Step =	0.2	d
Weir Equation =	Rectangular	
Weir Width =	200	ft

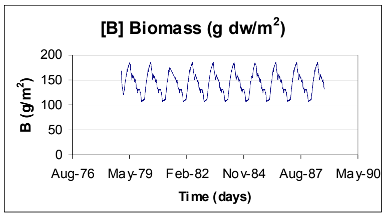
Note: User inputs in red

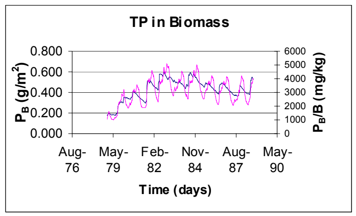
STA-2 Standard of Comparison Dataset - Post STA - No Bypass

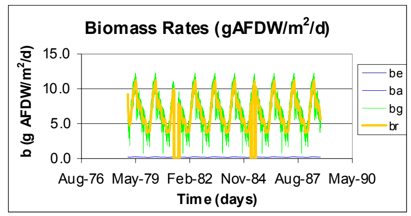


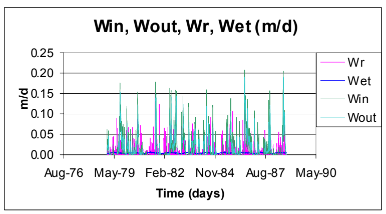


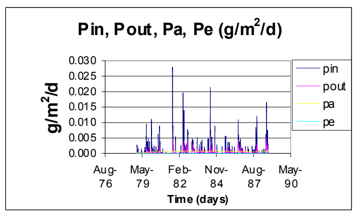


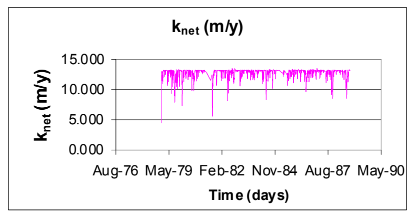












Adjustable Constants	
k_r =	0.000325408
k_g =	0.153562572
k_{si} =	66.74030767
k_{sp} =	0
k_a =	0.001417107
k_l=	0.00858974
k_u =	0.008293138
H =	0

Parameter	P.O.R Avg
HLR (m/y)	6.42
TPin (g/m^3)	0.037
TPout (g/m^3)	0.017
k_{1TP} (m/y)	5.88
W (m)	0.3652
P_W (g/m^3)	0.0174
B (g $AFDW/m^2$)	143.49
P_B (g/m^2)	0.428
P_B/B (mg/kg AFDW)	3080.7
b_g (g $AFDW/m^2$/d)	6.7492
b_r (g $AFDW/m^2$/d)	6.5561
Flow-Weighted	
TPin (g/m^3)	0.050
TPout (g/m^3)	0.020

Area (ac)	7460
Max Depth (ft)	3.33
Days	3560

The DMSTA model already provides a workable Excel platform that can deal with variable TIS, variable numbers of cells in series and/or in parallel, and with comprehensive reporting capabilities. It is recommended that any additional PSTA modeling efforts build on the DMSTA platform. Incorporation of sunlight and plant functional and structural measures in the DMSTA model would also provide a better basis for estimating factors affecting performance of all of the potential "green technologies."

4.3 PSTA Conceptual Design

The PSTA conceptual design was based on footprint estimates provided by the PSTA Forecast Model described above. Considerations to be included in the conceptual design were dictated by the STSOC methodology as described by PEER Consultants/Brown and Caldwell (1999) and outlined below. The final PSTA conceptual design had significant uncertainties related to the time and spatial scale of the PSTA Research and Demonstration Project. The impact of these uncertainties was a conservative estimate of size and cost for a full-scale PSTA. The actual magnitude of uncertainty associated with these estimates will only be clarified through continuing research at larger scales and over longer time periods.

4.3.1 Standards of Comparison Methodology

The STSOC methodology consists of nine informational requirements for each of the ATTs. As outlined below, five of the informational requirements are considered primary; the remaining four are characterized as ancillary:

Primary:

- The level of TP concentration reduction achievable by the technology (as determined from experimental data)
- The level of TP load reduction (as derived from model data)
- Compatibility of the treated water with the natural population of aquatic flora and fauna in the Everglades
- Cost-effectiveness of the technology
- Implementation schedule

Ancillary:

- Feasibility and functionality of the full-scale design and cost estimates
- Operational flexibility
- Sensitivity of the technology to fire, flood, drought, and hurricane
- Level of effort required to manage and the potential benefits to be derived from side streams generated by the treatment process

This comparison of technologies requires the use of the best available data related to P, removal performance, flexible engineering and operational components to attain maximum P-removal levels, and development of costs associated with the conceptual engineering design. It also mandates a comparison of the possible environmental effects of each technology with regard to the disposal of by-products and the effects on downstream waters.

The PSTA concept is one of the ATTs under review. CH2M HILL recently completed the two-phased evaluation of this technology at the STCs and Porta-PSTA mesocosms. PSTA research remains ongoing at the field-scale. Because completion of the STSOC analysis is time-sensitive, it is being conducted based solely on the results from the first two phases of the PSTA project's research efforts performed at the largest available research platform—the PSTA Test Cells.

Data from selected treatments (optimal design variations including shellrock and peat soils) were used to design and calibrate the PSTA Forecast Model. The purpose of this model is to predict long-term behavior and performance of a PSTA, based on extrapolation of existing data, both within and outside the loading rates tested in the mesocosm research. There are currently no full-scale PSTA datasets that could be used for additional model validation. The model results provide crucial information for use in comparing PSTA feasibility to that of the other ATTs.

The calibrated PSTA Forecast Model was subsequently used to simulate a 10-year POR using a synthetic dataset of TP concentrations and flows from STA-2 (post-STA) that was provided by the District. Because PSTA was not tested at higher inflow TP concentrations, this STSOC analysis does not include an evaluation of design and costs to treat post-Best Management Practices (BMPs) (STA-2 inflow) waters. Requirements of the STSOC methodology include using the PSTA Forecast Model to determine the PSTA footprint area necessary to achieve 10 (or lowest consistently achievable outflow concentration) and 20 µg/L flow-weighted mean outflow TP concentrations under 0, 10, and 20 percent inflow bypass scenarios. Since a sustained outflow TP level of 10 µg/L was not attained, the post-STA-2 evaluation is based on the lowest sustained outflow concentration (12 µg/L).

By necessity, the PSTA Forecast Model was used to estimate PSTA performance outside of the range of calibration data for some critical parameters. Some of the inflow concentrations tested for the STSOC analysis were above the observed averages in the PSTA research, as were ranges of hydraulic loading, water depths, and periods of dry out. Any use of the model outside of the calibration range is subject to greater error in estimated performance and may not be valid. All model-derived estimates are subject to some uncertainties.

This section summarizes information and findings related to each of the primary and ancillary STSOC data requirements listed above. In addition to answering those questions based on available information, it also provides conceptual designs and cost estimates of full-scale PSTAs for post-STA-2 water treatment. Finally, this section identifies the sensitivity of a number of PSTA design variables and the resulting uncertainty in estimated project costs. Additional critical research issues identified by this uncertainty assessment are described.

4.3.2 Description of Data Collection and Synthesis Methods

PSTA mesocosm operational data for chemical and physical water quality parameters were collected between February 1999 and April 2001 (see CH2M HILL 1999, January, February, and August 2000, and April and May 2001 for interim reports describing data collection methods and results). In addition to routine sampling throughout this 26-month operational period, there was a 5-week verification period with higher data collection intensity in two representative mesocosms. Data from the operational and verification collection periods have been combined to support the STSOC analysis described in this report.

4.3.2.1 STSOC Verification Sampling

Field data collection for STSOC verification was conducted from February 26 to April 4, 2001. Water samples were collected for chemistry analysis, and physical parameters were also measured at the time of sampling. Sampling was conducted using methods identified in CH2M HILL's Florida Department of Environmental Protection (FDEP)-approved Comprehensive Quality Assurance Plan (CompQAP) No. 910036G and clarified in the PSTA QAPP approved by the District. P analyses were conducted by the University of Florida IFAS under their CompQAP No. 910051. Environmental Conservation Laboratories (ENCO) analyzed the total organic carbon (TOC) samples per their CompQAP No. 960038. PPB Environmental Laboratory (PPB) analyzed the remaining parameters under their CompQAP No. 870017G.

4.3.2.2 Sampling Locations

PSTA research has been ongoing at three Test Cells within the STA 1-W Project for 2 years. STSOC verification period monitoring was performed at two of these cells after 2 years of operation, South Test Cell 8 (PSTA Treatment STC-5: shellrock base, 30-cm water depth) and South Test Cell 13 (PSTA Treatment STC-4: peat base with calcium amendment, 30-cm water depth). Water quality was monitored at the south head cell outlet and at the outlets from the two individual PSTA Test Cells.

At the time of the STSOC analysis, the PSTA Test Cells represented the largest scale PSTAs tested and were typical of the other PSTA mesocosms in terms of operational conditions and treatment performance. Additional work at the Field-Scale PSTA site reinforces the applicability of the Test Cell data.

4.3.2.3 Flow Measurements

Inflow measurements from the south head cell were calculated according to District data and knowledge of the inflow orifice size. Inflows to the STCs are relatively constant because they all originate from a single head cell. The water level in the south head cell is maintained within a relatively small range by an automatic pumping system.

Outflows from the PSTA Test Cells were calculated based on weir staff gauge measurements (approximately two per week) and the equation for flow over a 90-degree V-notch weir.

4.3.2.4 Water Quality Parameters and Sampling Methods

Composite samples were collected three times per week during a 5-week period (approximately five HRTs) using automated ISCO samplers. Samples were collected at the frequencies given and analyzed for parameters listed in Exhibit 4-12.

Samples were transferred into pre-cleaned and properly labeled sample containers following collection. Sample preservatives were either included in the sample containers provided by the laboratory or added to the sample immediately after collection. TDP, DRP, and the dissolved metal parameters were filtered using a 0.45 micrometer (µm) filter. All samples were placed in coolers with ice immediately following collection, filtering, and/or preservation and shipped to the appropriate laboratory the same day by overnight express.

4.3.2.5 Quality Assurance

All testing and sample handling was completed as outlined in the QAPP prepared for execution of field activities using proper completion of chain-of-custody forms, sample preservation, and handling of samples. Sample kit preparation, tracking, analysis of samples, and data validation procedures were followed by laboratory personnel as outlined in the laboratory's CompQAP.

Field meters were calibrated by the field team in accordance with the manufacturer's recommendations. Calibration results were recorded and maintained with the field data sheets for each event.

Field QA/QC samples were collected at the following rate:

- Duplicates (10 percent of total samples)
- Equipment Blanks (5 percent of total samples)

Exhibit 4-13 shows the number of field samples and QA/QC samples collected during the data verification stage of the STSOC sampling.

4.3.3 Summary of PSTA Performance

The STSOC methodology requires summarization of ATT performance. Performance measures that must be assessed include:

- Minimum achievable outflow TP concentration (flow weighted, seasonal means, minimum, maximum, standard deviation, and percentiles)
- TP mass removal efficiency (effects of TP mass loading, inflow TP concentration, HLR, HRT, and water depth)

EXHIBIT 4-12
STSOC Water Quality Parameter and Sampling Frequencies

Parameters	Units	Analytical Method	Method Detection Limit	Sampling Frequency
Group A				
TP	mg/L as P	EPA 365.4	0.001	24 hr composite/ 3 per week
Group B				
TDP	mg/L as P	EPA 365.1	0.001	Twice per week grab[a]
DRP	mg/L as P	EPA 365.1	0.0004	Twice per week grab[a]
Turbidity	NTU	EPA 180.1	0.1	Twice per week grab[a]
Color	CU	EPA 110.2	5	Twice per week grab[a]
Group C				
TSS	mg/L	EPA 160.2	2	One per week
TOC	mg/L	EPA 415.1	1	One per week
Alkalinity	mg/L as CaCO3	EPA 310.1	1	One per week
TDS	mg/L	EPA 160.1	3	One per week
Sulfate	mg/L	EPA 375.4	1.5	One per week
Chloride	mg/L	EPA 325.2	0.2	One per week
TKN	mg/L as N	EPA 351.2	0.1	One per week
Nitrate/Nitriteb	mg/L as N	EPA 353.2	0.004	One per week
NH3	mg/L as N	EPA 350.1	0.003	One per week
Group D				
Dissolved Al	µg/L	EPA 202.2/200.7c	4.5	5 times
Dissolved Fe	µg/L	EPA 200.7	4	5 times
Dissolved Ca	mg/L	EPA 200.7/60.0	0.013	5 times
Dissolved Mg	mg/L	EPA 200.7/60.0	0.01	5 times
Dissolved K	mg/L	EPA 258.1	0.04	5 times
Dissolved Na	mg/L	EPA 200.7	0.15	5 times
Reactive Silica	mg/L	EPA 370.1	0.2	5 times
Group E				
Inflow/Outflow				
Conductivity	µs/cm	NA	NA	Twice per week
DO	mg/L	NA	NA	Twice per week
pH	units	NA	NA	Twice per week
Temperature	°C	NA	NA	Twice per week

Notes:
NA = Not applicable; field readings will be collected *in situ*.
NS = Not specified in the STSOC guidelines
°C = degrees Celsius
TDP = total dissolved phosphorus
TDS = total dissolved solids
TSS = total suspended solids

[a]Twice per week grab collected to meet FDEP filtering requirements and short holding times (48 hours).
[b]To be consistent with current monitoring at the PSTA Test Cells, nitrate/nitrite will be reported instead of each component separately.
[c]Aluminum samples below approximately 100 µg/L are analyzed by EPA 202.2 (GFAA); samples above approximately 100 µg/L are analyzed by EPA 200.7 (ICP).

EXHIBIT 4-13

Number of STSOC Water Quality Samples by Parameter Group

Parameter Group[a]	STSOC Suggested	PSTA Samples				
		Total per Station	No. of Stations	Total Field Samples	QA/QC Samples	Total Samples
A	40[b]	15	3	45	8	53
B	40[b]	10	3	30	5	35
C	13	5	3	15	3	18
D	5	5	3	15	3	18
E	Not specified	10	3	30	0	30

Note:
[a]See Exhibit 4-12 for parameter groups
[b]Includes TP, TDP, and DRP

Sections 2 and 3 of this report provide a complete summary of the study results for the three project phases. Those sections indicate that data from the three PSTA Test Cells (treatments STC-1/4 – peat, constant water regime; STC-2/5 – shellrock, constant water regime; and STC-3/6 – shellrock, variable water regime) are representative of the typical performance of the Porta-PSTA mesocosms that share the same treatment variables and of the larger Field-Scale PSTA cells. In that these data sets still represent the best PSTA performance data available, these results from the peat- and shellrock-based PSTA Test Cells were used for this STSOC analysis and were used to calibrate the PSTA Forecast Model. Results from two of those PSTA Test Cells (STC-1/4 and STC-2/5) were subsequently used for STSOC verification testing.

Performance results for the two above-referenced PSTA Test Cells are briefly summarized below for three periods:

- POR: all data collected from startup to completion (February 1999 through April 2001)
- Optimal (post-startup) performance period: July 1999 through April 2001
- STSOC Verification Performance Period (VPP): March and April 2001

4.3.3.1 Routine PSTA Monitoring

Period-of-Record

POR results for the entire Phase 1 and 2 period (February 1999 to April 2001), which include the period during system startup, are summarized in Exhibit 4-14. All mean concentrations are reported as flow-weighted. An average inflow TP of 23 μg/L was reduced to an average of 15 μg/L by the shellrock-based treatment system, and an average of 26 μg/L in the peat-based treatment system. It is suspected that release of P from the peat resulted in higher TP concentrations in Test Cells outflows than in inflows. Results for all of the other monitored parameters are also summarized in Exhibit 4-14.

Time series plots of the TP for Test Cell inflows and outflows from each of the two Test Cells for the POR are provided in Exhibit 4-15. In general, the shell-rock-based PSTA Test Cell was more effective at reducing various P forms, nitrogen forms, and concentrations of other water quality parameters.

EXHIBIT 4-14

PSTA Test Cell STSOC Weekly Averaged Data for the Period-of-Record

TREATMENT CELL		STC 1/4 (Peat/Peat-Ca) 13						STC 2/5 (Shellrock) 8					
PARAMETER	**STN**	**Average**	**Median**	**StdDev**	**Max**	**Min**	**N**	**Average**	**Median**	**StdDev**	**Max**	**Min**	**N**
TP (µg/L)	Inflow	23.4	21.0	11.2	102.0	12.0	97	23.1	21.0	11.0	102.0	12.0	103
	Outflow	25.5	19.5	23.1	186.0	9.0	100	14.6	12.9	7.1	57.0	7.0	106
TPP (µg/L)	Inflow	10.3	9.0	7.0	43.0	1.0	72	9.3	8.0	6.9	43.0	0.0	78
	Outflow	12.0	8.2	13.7	83.0	0.0	99	5.8	4.9	5.4	46.0	0.0	105
TDP (µg/L)	Inflow	11.5	11.0	3.2	21.0	1.9	73	12.2	11.7	3.6	27.8	1.9	79
	Outflow	13.4	11.0	11.2	103.0	5.0	100	8.8	8.0	3.8	22.4	4.0	106
SRP (µg/L)	Inflow	5.5	4.0	8.4	75.0	1.5	79	5.3	3.9	8.1	75.0	1.5	85
	Outflow	2.9	2.5	2.6	17.0	0.2	48	2.7	2.0	3.1	16.6	0.7	47
DOP (µg/L)	Inflow	7.1	7.3	3.2	14.0	0.0	55	8.3	8.0	3.5	17.6	0.0	61
	Outflow	9.6	8.0	4.3	25.9	3.4	48	7.5	6.2	4.2	19.0	0.2	47
TN (mg/L)	Inflow	2.11	2.20	0.51	3.55	0.85	56	2.07	2.14	0.58	3.48	0.62	56
	Outflow	1.90	2.05	0.80	3.46	0.44	25	1.85	1.97	0.66	3.22	0.62	26
TKN (mg/L)	Inflow	2.07	2.10	0.45	3.52	0.83	57	2.03	2.08	0.52	3.45	0.62	57
	Outflow	1.90	2.08	0.86	3.46	0.05	29	1.96	2.05	0.66	3.22	0.62	30
NO_2NO_3 (mg/L)	Inflow	0.07	0.05	0.06	0.24	0.00	57	0.07	0.05	0.06	0.22	0.00	57
	Outflow	0.01	0.00	0.02	0.08	0.00	29	0.01	0.00	0.01	0.03	0.00	30
NH_3 (mg/L)	Inflow	0.08	0.06	0.06	0.23	0.02	29	0.08	0.06	0.06	0.23	0.02	29
	Outflow	0.02	0.02	0.02	0.11	0.00	23	0.02	0.02	0.02	0.07	0.00	23
OrgN (mg/L)	Inflow	2.00	2.03	0.54	3.35	0.77	29	1.91	2.03	0.63	3.28	0.59	29
	Outflow	1.82	1.92	0.95	3.35	0.05	23	1.88	2.08	0.73	3.22	0.60	23
TOC (mg/L)	Inflow	36.63	36.50	6.00	50.10	21.65	65	36.08	35.40	5.89	50.10	21.65	71
	Outflow	40.29	40.70	9.89	69.00	20.70	29	38.79	39.50	6.78	53.10	23.45	30
TSS (mg/L)	Inflow	3.07	3.00	2.46	14.00	0.50	64	3.15	3.00	2.49	14.00	0.50	70
	Outflow	3.77	3.75	2.66	10.00	0.50	27	3.91	3.00	4.03	22.00	0.50	29
Ca (mg/L)	Inflow	69.23	71.60	14.29	100.00	34.00	60	69.54	71.27	12.80	100.00	44.95	66
	Outflow	47.25	54.00	17.48	71.00	15.70	23	56.36	62.00	13.38	75.50	30.00	25
Alkalinity (mg/L)	Inflow	252	257	44	318	120	64	252	257	42	318	120	70
	Outflow	206	223	59	278	100	27	229	246	46	288	123	29
Wtr Temp (^oC)	Cell Avg	24.45	24.91	4.46	31.39	11.90	93	24.28	24.43	4.61	32.49	12.48	104
pH (units)	Cell Avg	7.98	7.72	0.67	9.57	7.09	92	7.93	8.02	0.50	9.20	7.01	103
Conductivity (µmhos/cm)	Cell Avg	1062	1087	179	1407	559	92	1072	1095	172	1371	602	103
TDS (g/L)	Cell Avg	0.69	0.71	0.10	0.85	0.41	80	0.70	0.71	0.10	0.88	0.41	97
DO (%)	Cell Avg	57.07	45.22	44.79	157.95	2.68	86	77.51	91.42	40.41	145.86	2.16	104
DO (mg/L)	Cell Avg	4.92	3.86	3.52	11.95	0.21	93	6.40	7.53	3.25	11.90	0.17	104

Note: Calculations based on weekly averages.

µmhos/cm = microhoms per centimeter

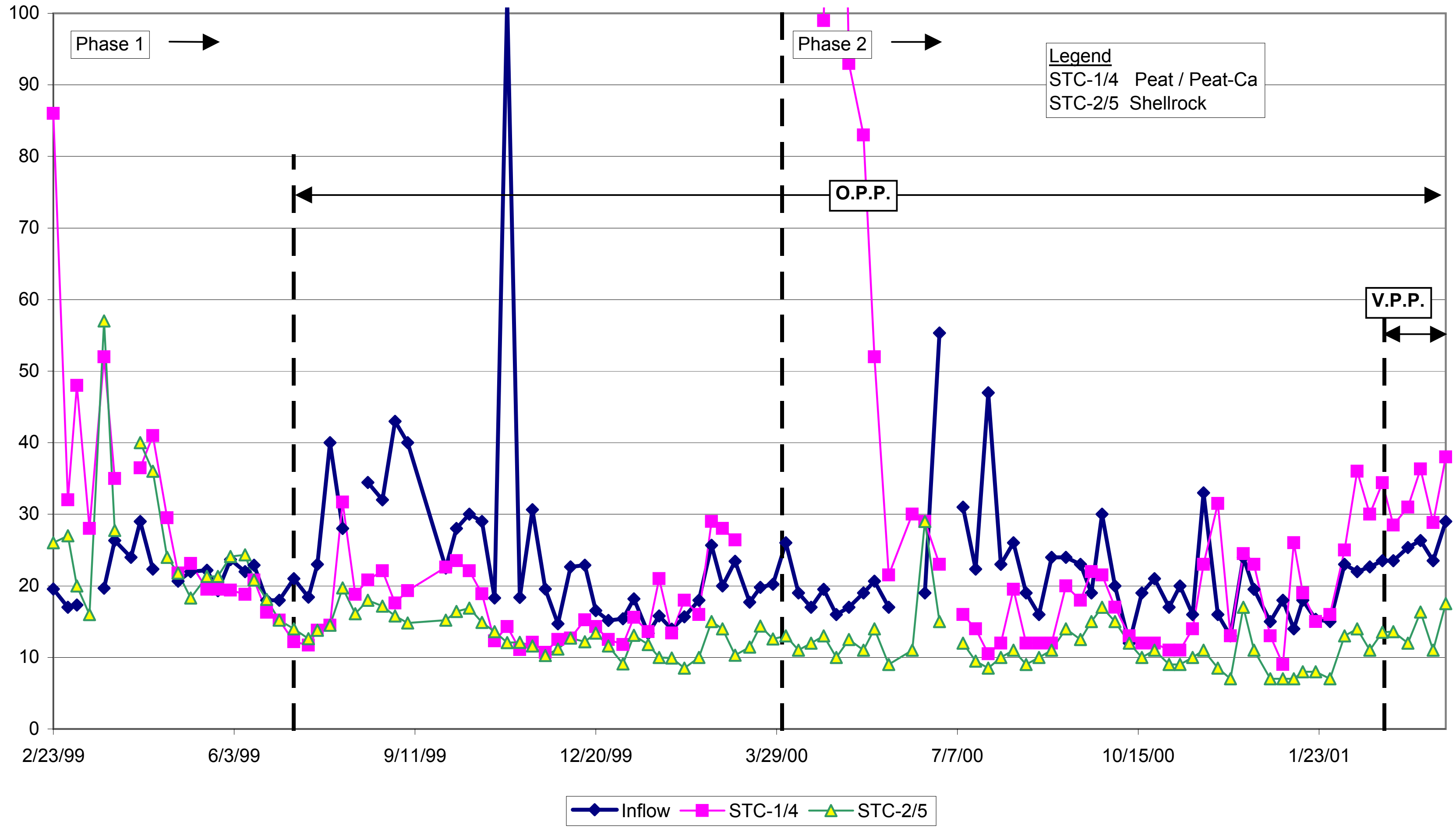


EXHIBIT 4-15
PSTA Test Cell Weekly Average TP Concentration Performance Summary Timeseries

Note(s):
POR = Entire Period-of-Record
OPP = Optimal Performance Period
VPP = Verification Performance Period

ex4-15.xls/030130009
W022003001DFB

Optimal Performance Period

The dates for the OPPs for the shellrock-based and peat-based PSTA Test Cells were slightly different because of operational changes made between Phases 1 and Phase 2. The shellrock-based Test Cell operated optimally from July 1999 through early April 2001. The peat-based Test Cell operated optimally from July 1999 through January 2000. It also operated optimally following plant removal and lime applications from July 2000 (following a second startup release of labile P from the peat soils) through early April 2001.

Operational results for these periods are summarized in Exhibit 4-16. The average inflow TP of 23 µg/L was reduced to an average of 12 µg/L in the shellrock-based treatment system, and from an average inlet concentration of 24 µg/L to an outflow average of 18 µg/L in the peat-based treatment system. Results for all of the other monitored parameters are also summarized in Exhibit 4-16. During the OPP, the peat-based PSTA Test Cell was more effective than the shellrock-based PSTA Test Cell at reducing various nitrogen forms and concentrations of several other water quality parameters (calcium, TSS, and alkalinity). Performance for both Test Cells was better during the OPP than during the startup periods (typically 4 months in length) that are excluded from this data set.

4.3.3.2 STSOC Verification Performance Period Results

Phosphorus Results

Detailed P results for the 5-week VPP are presented in Exhibit 4-17. Individual inflow TP values ranged from 19 to 30 µg/L over this period, with an average inflow value of 25 µg/L. Individual TP outflow values from the shellrock-based test cell (South Test Cell 8) ranged from 8 µg/L to 19 µg/L with an average outflow value of 14 µg/L. It consistently showed a reduction in P concentration throughout the time period evaluated. South Test Cell 13, the peat-based PSTA system, exhibited outflow values ranging from 20 µg/L to 41 µg/L, with an average outflow value of 33 µg/L, showing a net increase of TP in the system during the VPP. Exhibit 4-18 provides a graphical representation of TP values collected over the 5-week period. Exhibit 4-19 provides a detailed summary of weekly values for all parameters sampled during the VPP.

TP removal in the peat-based PSTA Test Cell during the 5-week verification sampling period was not typical of performance over the longer OPP. Prior to this VPP, routinely collected outflow TP data from the peat-based PSTA Test Cell were normally lower than the TP inflow concentrations. Starting in December 2000 and during the STSOC VPP in February through April 2001, outflow TP concentrations from this cell were typically higher than inflow concentrations. The reason for this rise in P export was not confirmed.

Similar net increases in TP were also commonly observed in the District's STA optimization research at the STA-1W STCs that were colonized with cattails (SFWMD, 2001).

Although there was some seasonal decline in TP removal efficiency in the shellrock-based PSTA Test Cells during the VPP (late winter with sub-optimal

EXHIBIT 4-16

PSTA Test Cell STSOC Weekly Averaged Data for the Optimal Performance Period

TREATMENT		STC 1/4 (Peat/Peat-Ca)						STC 2/5 (Shellrock)					
CELL		13						8					
PARAMETER	STN	Average	Median	StdDev	Max	Min	N	Average	Median	StdDev	Max	Min	N
TP (µg/L)	Inflow	24.0	22.7	12.2	102.0	12.0	67	23.4	20.6	11.9	102.0	12.0	86
	Outflow	18.4	15.8	7.4	38.0	9.0	68	12.4	12.0	3.4	29.0	7.0	88
TPP (µg/L)	Inflow	10.2	10.0	6.1	37.0	1.0	53	9.3	8.0	7.0	43.0	0.5	72
	Outflow	7.8	6.0	4.9	22.3	0.0	67	4.6	4.5	2.4	14.0	0.0	87
TDP (µg/L)	Inflow	11.0	11.0	2.9	20.0	1.9	54	12.0	11.7	3.2	21.0	1.9	73
	Outflow	10.5	9.8	3.5	20.4	5.0	68	7.8	7.6	2.6	22.4	4.0	88
SRP (µg/L)	Inflow	5.5	3.1	10.3	75.0	1.9	51	4.9	3.1	9.0	75.0	1.5	68
	Outflow	2.0	2.0	0.9	4.3	0.9	29	1.9	1.5	1.0	4.4	1.0	30
DOP (µg/L)	Inflow	6.9	7.3	3.3	13.0	0.0	38	8.1	8.0	3.3	14.3	0.0	55
	Outflow	8.7	7.1	3.2	15.7	5.1	29	6.2	5.6	3.2	19.0	2.0	30
TN (mg/L)	Inflow	2.20	2.34	0.47	2.94	0.85	36	2.18	2.30	0.56	3.48	0.62	41
	Outflow	1.86	2.07	0.61	2.60	0.44	16	2.05	2.08	0.56	3.22	0.65	21
TKN (mg/L)	Inflow	2.16	2.23	0.40	2.76	0.83	37	2.14	2.21	0.50	3.45	0.62	42
	Outflow	1.89	2.09	0.76	2.96	0.05	20	2.13	2.14	0.56	3.22	0.65	25
NO_2NO_3 (mg/L)	Inflow	0.07	0.05	0.06	0.20	0.00	36	0.06	0.05	0.06	0.22	0.00	41
	Outflow	0.01	0.00	0.01	0.03	0.00	20	0.01	0.00	0.01	0.03	0.00	25
NH_3 (mg/L)	Inflow	0.08	0.06	0.06	0.23	0.02	19	0.08	0.06	0.06	0.23	0.02	24
	Outflow	0.02	0.02	0.01	0.04	0.00	15	0.02	0.02	0.02	0.07	0.00	18
OrgN (mg/L)	Inflow	2.06	2.16	0.49	2.72	0.77	19	2.03	2.11	0.61	3.28	0.59	24
	Outflow	1.79	2.05	0.86	2.94	0.05	15	2.10	2.13	0.65	3.22	0.63	18
TOC (mg/L)	Inflow	37.69	37.00	5.90	50.10	21.65	41	36.97	36.50	5.83	50.10	21.65	55
	Outflow	41.01	40.85	9.62	69.00	26.40	20	40.01	40.50	6.33	53.10	29.00	25
TSS (mg/L)	Inflow	3.05	2.00	2.50	13.00	0.50	40	2.97	2.00	2.39	13.00	0.50	54
	Outflow	3.46	3.04	2.64	10.00	0.50	18	4.08	3.00	4.38	22.00	0.50	24
Ca (mg/L)	Inflow	75.91	77.45	11.34	100.00	55.20	36	73.47	73.80	10.70	100.00	52.30	50
	Outflow	50.60	56.50	15.97	71.00	22.80	14	58.14	62.50	11.49	75.50	40.00	20
Alkalinity (mg/L)	Inflow	269	268	30	318	197	40	262	260	29	318	197	54
	Outflow	218	237	52	278	100	18	231	244	41	288	130	24
Wtr Temp (^oC)	Cell Avg	23.60	22.72	4.58	31.39	11.90	66	23.87	23.45	4.78	32.49	12.48	85
pH (units)	Cell Avg	7.73	7.58	0.52	9.30	7.09	65	7.79	7.84	0.45	9.20	7.01	84
Conductivity (umhos/cm)	Cell Avg	1061	1080	151	1407	636	65	1076	1078	143	1350	673	84
TDS (g/L)	Cell Avg	0.68	0.69	0.09	0.83	0.42	66	0.69	0.68	0.09	0.86	0.41	85
DO (%)	Cell Avg	45.37	36.12	37.62	157.95	2.68	66	71.27	70.68	41.79	145.86	2.16	85
DO (mg/L)	Cell Avg	3.75	3.03	2.94	11.94	0.21	66	5.93	6.35	3.41	11.90	0.17	85

Note: Calculations based on weekly averages.

EXHIBIT 4-17
Detailed PSTA Phosphorus Results for the Verification Performance Period, February through April 2001

Date	Head Cell (PSTA Inflow)			South Test Cell 8 Outflow			South Test Cell 13 Outflow		
	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)	TP (µg/L)	TDP (µg/L)	SRP (µg/L)
02/27/01	22	15	3	13	9	1	38	18	2
02/28/01	19	--	--	12	--	--	33	--	--
03/01/01	23	14	3	14	4	2	37	19	4
03/05/01	30	15	3	17	9	2	37	18	3
03/07/01	20	10	2	13	8	2	24	15	3
03/09/01	24	--	--	8	--	--	20	--	--
03/12/01	23	--	--	9	--	--	22	--	--
03/13/01	24	11	2	11	7	1	33	17	2
03/15/01	24	13	3	13	7	3	41	18	3
03/19/01	24	--	--	13	--	--	39	--	--
03/20/01	27	15	4	19	7	5	36	14	3
03/26/01	25	--	--	10	--	--	32	--	--
03/27/01	22	11	8	11	7	3	37	15	2
03/28/01	24	10	2	12	6	1	27	13	2
03/29/01	20	10	2	10	6	1	24	13	2
04/03/01	29	--	--	18	--	--	38	--	--

Exhibit 4-18
Inflow and Outflow TP Concentration Trends from the STA 1-W PSTA Test Cells 8 (Shellrock) and 13 (Peat)

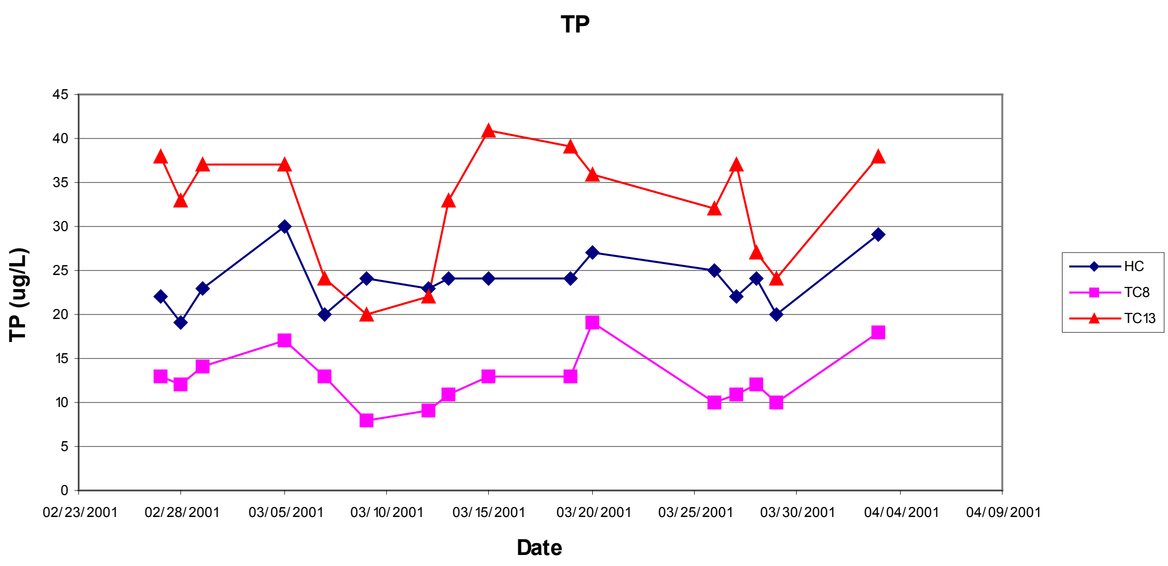


EXHIBIT 4-19

PSTA STSOC General Parameter Results, February - April 2001

Station	Date	Color (CPU)	Turbidity (NTU)	Alkalinity as $CaCO_3$ (mg/L)	TOC (mg/L)	Chloride (mg/L)	Ammonia, as N (mg/L)	TKN (mg/L)	NO_2/NO_3 (mg/L)	TDS (mg/L)	TSS (mg/L)	Silica (mg/L)	SO_4 (mg/L)	Aluminum (µg/L)	Calcium (mg/L)	Iron (µg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Head Cell	02/28/2001	120	1.5	296	45.7	195	0.036	2.33	0.082	742	4	15.2	55	48.3[d]	76.9	8.2	31.4	16.8	144
	03/01/2001	160	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/05/2001	140	1.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/07/2001	180	0.9	318	40.5	193	0.189	2.22	0.134	788	2	21	52.4	<4.5	78	<2.5	31.4	15.8	150
	03/13/2001	150	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/15/2001	140	1.1	304	47.2	218	0.044	2.76	0.184	806	10	20.1	55	<4.5	72.8	2.15	31.4	14.9	156
	03/20/2001	160	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/27/2001	120	0.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/28/2001	160	0.65	272	49.7	234	0.051	2.72	0.123	795	4	20.3	55.6	<4.5	40	3.4	32.2	15.9	164
	03/29/2001	175	0.80	272	50.5	229	0.053	2.50	0.124	785	3	20.7	56.1	<4.5	68.7	<2.5	30.7	14.4	153
	04/03/2001	180	1.20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Test Cell 8 Outflow (Shellrock)	02/28/2001	140	1.2	274	46.8	193	0.006	2.51	<0.004	737	3	15.9	54.6	<8.0	64.2	43.4[a]	31.3	14.4	144
	03/01/2001	140	1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/05/2001	140	3.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/07/2001	180	0.75	262	45	207	0.032	2.13	<0.004	777	5	20.9	55.2	<4.5	63.6	6.4	32.5	17.3	154
	03/13/2001	150	1.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/15/2001	140	1	276	48	218	0.02	2.76	<0.004	756	7	21.6	52.3	<4.5	57.9	11.5	31.2	15.5	156
	03/20/2001	160	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/27/2001	125	1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/28/2001	160	1.0	244	54.3	234	0.023	2.84	<0.004	777	<2	22.7	60.5	<4.5	56.7	4.7	31.5	15.2	158
	03/29/2001	125	0.85	252	51.9	234	0.018	2.80	<0.004	788	<2	21.9	52.7	<4.5	56.5	4.1	31.6	14.9	160
	04/03/2001	75	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Test Cell 13 Outflow (Peat-Ca)	02/28/2001	160	1.3	240	50.8	190	<0.003	2.07[b]	<0.004	685[c]	7	19.0	56.7	<8.0	47.5	<4.0	33.3	14.6	147
	03/01/2001	NS	NS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/05/2001	160	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/07/2001	200	1.1	236	45.3	213	0.034	2.16	<0.004	738	4	23.4	52.4	<4.5	46.4	3	33.1	17.5	154
	03/13/2001	150	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/15/2001	160	1.2	236	47.6	220	0.021	2.96	<0.004	690	10	20.5	49.9	<4.5	40.3	5.6	32.6	15.7	158
	03/20/2001	160	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/27/2001	125	2.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/28/2001	160	1.7	224	50.8	233	<0.003	2.72	<0.004	733	<2	22.6	49	<4.5	39.6	4.3	31.9	16	163
	03/29/2001	175	1.0	224	52.1	231	0.014	2.83	<0.004	742	3	22.1	48.5	<4.5	40.1	4.7	32.2	15.7	161
	04/03/2001	75	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Class III WQ Criteria (Fresh)		NC	<29 above background	Not depressed below 20	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	<1,000	NC	NC	NC

NOTES:

NS = No sample available; the bottle cap became loose during shipment resulting in the loss of the sample.

NC = No applicable Class III water quality criterion.

mg/L = milligram per liter

µg/L = microgram per liter

[a] PPB reported an iron concentration of 35 µg/L for the re-analysis of this sample.

[b] Value originally reported as <0.10. Sample re-analyzed by PPB

[c] Value originally reported as <3. Sample re-analyzed by PPB

[d] PPB reported an aluminum concentration of 56.4µg/L for the re-analysis of this sample

periphyton community development), the results from these Test Cells were more typical of results that had been observed during the previous OPP.

These observations indicate that the STSOC VPP data sets should not be used alone for drawing final conclusions concerning the ability of PSTAs to remove TP. The full OPP for the shellrock Test Cell was used as the basis for determining the lowest achievable outflow TP concentration for the full-scale PSTA conceptual design. The lowest long-term (approximately 21 months) achievable flow-weighted TP concentration for PSTAs determined by the Phase 1 and 2 research was 12 µg/L for a shellrock-based treatment. Although lower long-term outflow TP concentrations may be achievable with other treatments not tested as part of this project, 12 µg/L was used for the STSOC analysis.

General Parameter Results

Detailed analytical results for non-P parameters for the VPP are presented in Exhibit 4-19. Statistics for these data were presented in Exhibit 4-20. There was little variability observed for any of these parameters during this 5-week period.

Turbidity ranged between 0.65 and 3.5 nephelometric turbidity units (NTU) in all samples. Turbidity increased slightly between the head cell and the outflow from the peat-based PSTA cell. Alkalinity ranged from 224 to 318 mg/L as $CaCO_3$, with higher levels in the shellrock-based Test Cell outflow than in the peat-based cell. Alkalinity was reduced in the outflows of both Test Cells compared to the inflow. TOC ranged from 45 to 54 mg/L with no statistically significant change through the Test Cells and no difference observed between the two soil treatments.

Chloride concentrations ranged from 190 to 234 mg/L and were conservative in both PSTA Test Cells. Inorganic nitrogen forms were reduced in both Test Cells compared to the inflow from the head cell; however, organic nitrogen concentration was not reduced in the shellrock-based Test Cell and only slightly reduced in the peat-based cell. TDS ranged from 685 to 806 mg/L, and concentrations were only slightly reduced in both PSTA Test Cells. TSS concentrations ranged from <2 to 10 mg/L. The average TSS concentration increased between the head cell and the peat-based Test Cell outflow and decreased in the shellrock-based cell. Silica concentrations ranged from 15.2 to 23.4 mg/L and increased slightly with passage through the two Test Cells.

Sulfate ranged from 48 to 60 mg/L and did not change significantly with passage through the PSTA Test Cells.

Except for questionable results for one sample, aluminum concentrations were below the detection level of 4.5 µg/L. Calcium concentrations ranged from 40 to 77 mg/L and were reduced with the passage of water through both of the PSTA test cells. Iron concentrations ranged from <2.5 to 43.3 µg/L. In general, there was no apparent change in iron concentration with passage of the water through the PSTA test cells. Magnesium concentrations ranged from 31 to 33 mg/L and showed no changes through the test cells. Likewise, potassium concentrations ranged between 15 and 18 mg/L and showed no changes through the PSTA Test Cells. Sodium concentrations ranged from 144 to 161 mg/L and also were conservative with passage through the PSTA cells.

EXHIBIT 4-20

PSTA Test Cell STSOC Weekly Averaged Data for the Verification Performance Period

TREATMENT CELL		STC 1/4 (Peat/Peat-Ca) 13						STC 2/5 (Shellrock) 8					
PARAMETER	STN	Average	Median	StdDev	Max	Min	N	Average	Median	StdDev	Max	Min	N
TP (µg/L)	Inflow	25.1	24.4	2.2	29.0	23.5	6	25.3	24.4	2.3	29.0	23.5	6
	Outflow	32.8	32.7	4.0	38.0	28.5	6	14.0	13.6	2.5	17.5	11.0	6
TPP (µg/L)	Inflow	10.1	10.8	2.7	12.5	6.0	5	10.1	10.8	2.7	12.5	6.0	5
	Outflow	15.7	15.2	4.1	22.3	11.5	5	5.5	4.9	1.9	8.8	4.0	5
TDP (µg/L)	Inflow	14.3	12.8	3.4	20.0	11.3	5	14.5	12.8	3.8	21.0	11.3	5
	Outflow	16.1	17.0	2.2	18.7	13.6	5	7.8	8.0	0.9	8.8	6.5	5
SRP (µg/L)	Inflow	3.7	2.7	1.9	7.0	2.3	5	4.3	2.7	3.2	10.0	2.3	5
	Outflow	2.6	2.7	0.3	3.0	2.1	5	2.1	2.0	0.6	3.0	1.3	5
DOP (µg/L)	Inflow	10.6	10.3	2.2	13.0	7.3	5	10.2	10.3	1.8	12.0	7.3	5
	Outflow	13.5	14.3	1.9	15.7	11.5	5	5.7	5.7	1.1	7.0	4.5	5
TN (mg/L)	Inflow	2.64	2.73	0.25	2.94	2.35	5	2.67	2.73	0.27	2.94	2.35	5
	Outflow	2.50	2.55	0.38	2.96	2.07	5	2.55	2.52	0.27	2.82	2.13	5
TKN (mg/L)	Inflow	2.50	2.57	0.22	2.76	2.22	5	2.52	2.61	0.23	2.76	2.22	5
	Outflow	2.10	2.55	1.18	2.96	0.05	5	2.55	2.52	0.27	2.82	2.14	5
NO_2NO_3 (mg/L)	Inflow	0.15	0.13	0.05	0.20	0.08	5	0.15	0.13	0.05	0.22	0.08	5
	Outflow	0.00	0.00	0.00	0.00	0.00	5	0.00	0.00	0.00	0.00	0.00	5
NH_3 (mg/L)	Inflow	0.08	0.05	0.06	0.19	0.04	5	0.08	0.05	0.06	0.19	0.04	5
	Outflow	0.02	0.02	0.01	0.03	0.00	5	0.02	0.02	0.01	0.03	0.01	5
OrgN (mg/L)	Inflow	2.42	2.51	0.27	2.72	2.03	5	2.44	2.56	0.28	2.72	2.03	5
	Outflow	2.08	2.54	1.18	2.94	0.05	5	2.53	2.50	0.27	2.80	2.10	5
TOC (mg/L)	Inflow	46.04	46.70	3.50	50.10	40.50	5	45.84	45.70	3.48	50.10	40.50	5
	Outflow	47.52	47.60	3.17	50.80	43.50	5	47.65	46.80	3.29	53.10	44.65	5
TSS (mg/L)	Inflow	4.90	4.00	3.05	10.00	2.00	5	4.70	4.00	3.07	10.00	2.00	5
	Outflow	5.47	4.00	3.04	10.00	2.33	5	3.60	3.00	2.19	7.00	1.00	5
Alkalinity (mg/L)	Inflow	296	296	17	318	272	5	296	296	17	318	272	5
	Outflow	235	236	7	240	223	5	263	264	13	276	248	5
Color (CU)	Inflow	156	156	14	180	140	6	156	156	14	180	140	6
	Outflow	147	158	37	180	75	6	136	143	32	160	75	6
Turbidity (NTU)	Inflow	1.17	1.20	0.23	1.40	0.75	6	1.17	1.20	0.23	1.40	0.75	6
	Outflow	1.50	1.45	0.35	1.90	1.10	6	1.34	1.28	0.41	2.13	0.95	6
Chloride (mg/L)	Inflow	209.4	206.5	18.6	231.5	193.0	4	209.4	206.5	18.6	231.5	193.0	4
	Outflow	213.8	216.5	17.7	232.0	190.0	4	213.0	212.5	17.3	234.0	193.0	4
TDS (mg/L)	Inflow	781.5	789.0	27.5	806.0	742.0	4	781.5	789.0	27.5	806.0	742.0	4
	Outflow	712.6	713.8	29.1	738.0	685.0	4	763.1	766.5	20.8	782.5	737.0	4
Silica (mg/L)	Inflow	19.2	20.3	2.7	21.0	15.2	4	19.2	20.3	2.7	21.0	15.2	4
	Outflow	21.3	21.4	2.0	23.4	19.0	4	20.2	21.3	2.9	22.3	15.9	4
SO_4 (mg/L)	Inflow	54.6	55.0	1.5	55.9	52.4	4	54.6	55.0	1.5	55.9	52.4	4
	Outflow	51.9	51.2	3.5	56.7	48.8	4	54.7	54.9	1.8	56.6	52.3	4
Dissolved Ca (mg/L)	Inflow	70.5	74.9	11.0	78.0	54.4	4	70.5	74.9	11.0	78.0	54.4	4
	Outflow	43.5	43.4	4.0	47.5	39.9	4	60.6	60.8	3.9	64.2	56.6	4
Dissolved Aluminum (µg/L)	Inflow	13.8	2.3	23.0	48.3	2.3	4	13.8	2.3	23.0	48.3	2.3	4
	Outflow	2.7	2.3	0.9	4.0	2.3	4	2.7	2.3	0.9	4.0	2.3	4
Dissolved Iron (µg/L)	Inflow	3.5	2.2	3.2	8.2	1.3	4	3.5	2.2	3.2	8.2	1.3	4
	Outflow	3.8	3.8	1.6	5.6	2.0	4	16.4	9.0	18.2	43.4	4.4	4
Dissolved Magnesium (mg/L)	Inflow	31.4	31.4	0.0	31.5	31.4	4	31.4	31.4	0.0	31.5	31.4	4
	Outflow	32.8	32.9	0.6	33.3	32.1	4	31.6	31.4	0.6	32.5	31.2	4
Dissolved Potassium (mg/L)	Inflow	15.7	15.5	0.8	16.8	14.9	4	15.7	15.5	0.8	16.8	14.9	4
	Outflow	15.9	15.8	1.2	17.5	14.6	4	15.6	15.3	1.2	17.3	14.4	4
Dissolved Sodium (mg/L)	Inflow	152.1	153.0	6.5	158.5	144.0	4	152.1	153.0	6.5	158.5	144.0	4
	Outflow	155.3	156.0	6.4	162.0	147.0	4	153.3	155.0	6.5	159.0	144.0	4
Wtr Temp (^oC)	Cell Avg	22.75	22.64	0.82	23.92	21.66	6	21.00	21.69	2.21	23.45	17.14	6
pH (units)	Cell Avg	7.63	7.55	0.18	7.87	7.47	6	7.46	7.46	0.03	7.50	7.41	6
Conductivity (umhos/cm)	Cell Avg	1223	1225	39	1264	1174	6	1273	1264	40	1350	1236	6
TDS (g/L)	Cell Avg	0.78	0.79	0.03	0.81	0.75	6	0.75	0.81	0.17	0.86	0.41	6
DO (%)	Cell Avg	29.79	30.01	10.40	45.09	18.44	6	35.02	33.51	14.29	57.50	17.20	6
DO (mg/L)	Cell Avg	2.60	2.63	0.81	3.73	1.49	6	2.83	2.37	1.39	5.39	1.46	6

Note:

Calculations based on weekly averages.

CU = color unit

NTU = nephelometric turbidity unitsturbidity units

g/L = grams per liter

In summary, there was very little effect of the PSTA treatments on any of the general water quality parameters, including metals. The only observed significant effects were positive, with the reduction of inorganic nitrogen concentrations. Calcium concentrations were also reduced slightly. During this VPP, the peat-based PSTA Test Cell did not produce reductions of TSS and turbidity as had been previously observed. This slight increase in export of particulate matter was also reflected in the TPP results discussed earlier. As stated above, the impaired performance of the peat-based PSTA Test Cell may have been an issue related to the scale of these Test Cells or the availability of labile TP in the peat soils. As described below, assessment of performance and development of conceptual design criteria is based on the results from the shellrock-based PSTA Test Cell for the OPP.

In addition to the toxicity and algal growth potential testing (Test Cells 8 and 13), the District conducted sampling for mercury in two of the PSTA South Test Cells as part of the STSOC sampling program (Rawlik, 2001). Test Cell 8 had a shellrock substrate, while Test Cell 13 was peat-based. Total mercury (THg) and methyl mercury (MeHg) were sampled weekly by the District at the source water inflow and at the outlet of each Test Cell for 5 weeks starting on March 15, 2001. Filtered and unfiltered water samples were analyzed for THg and MeHg. Periphyton and mosquitofish (*Gambusia affinis*) were also collected from these systems for analysis. Detailed methods and results of the District's mercury sampling are summarized in Rawlik (2001). Results are briefly summarized as follows:

- A total of 51 of the 60 water samples had values below the Practical Quantification Level (PQL).
- THg in the water varied between approximately 0.5 and 3.1 nanograms per liter (ng/L); filtered THg was typically in the range of 0.5 to 1.1 ng/L; MeHg ranged from 0.03 to 0.11 ng/L; filtered MeHg ranged from 0.02 to 0.1 ng/L.
- There were no consistent differences in water concentrations of any of the mercury forms between the inflow and the outflows from the two PSTA Test Cells.
- Mercury concentrations in the Test Cell periphyton tissues were highly variable, but most importantly, periphyton mercury concentrations in the two PSTA Test Cells were lower than those in periphyton collected from the inflow source. THg in the periphyton was below 1 ng/g (wet weight) and is comparable to values reported for periphyton tissues collected from locations in WCA-2B; MeHg in the periphyton was below 0.03 ng/L (wet weight) and was significantly lower than concentrations reported for periphyton tissues from elsewhere in the Everglades.
- All of the mercury in the fish was found to be in the methylated form; mercury concentrations in the PSTA South Test Cell 8 fish were about 4 to 5 ng/g (wet weight) and about twice as high in the fish from the inflow source; no fish were collected from PSTA Test Cell 13 (peat-based cell)

These results indicated that the PSTA Test Cells did not show any evidence of increasing mercury concentrations in inlet water, periphyton, or fish compared to comparable samples from the inflow source.

4.3.4 Full-Scale PSTA Conceptual Design

A conceptual design for a full-scale PSTA downstream from STA-2 was developed for the purposes of providing a basis for cost evaluation and comparing this technology to other ATTs. Based on the information available to date about PSTA performance, it is premature to proceed with the final design of anything other than a prototype or demonstration-level PSTA project, such as Phase 3 of the District's PSTA Research and Demonstration Project. Long-term monitoring results from that larger-scale site will be helpful in determining whether continued pursuit of the use of PSTAs in support of Everglades restoration is justified and, if so, those data will be needed to develop refined criteria for PSTA design.

The conceptual PSTA design described in this report includes the following components:

- Estimation of the PSTA footprint necessary to achieve flow-weighted mean outflow TP concentrations of 12 and 20 μg/L based on the synthetic post-STA-2 dataset and assuming three bypass options (no bypass, 10, and 20 percent bypass)
- Size and layout of engineering works including levees, canals, pump stations, and water control structures
- Description of likely site preparation options and soil amendments
- Unit costs for principal construction items
- 50-year present worth cost estimates for the various configurations evaluated
- Sensitivity of land area and cost estimates to various forecasting and design assumptions

4.3.4.1 PSTA Footprint

PSTAs are a relatively low-management but land-intensive treatment option that is dependent on environmental energy inputs from the sun and the atmosphere. The primary energy input is solar radiation (insolation). This radiation provides key wavelengths necessary for primary productivity of the periphyton and other plants and maintains the ambient temperature of the water and biological material. The PSTA heat balance is in turn maintained in a quasi-equilibrium by evapotranspiration—the evaporation of water and transpiration by vascular plants such as emergent macrophytes within the PSTA.

Because the PSTA is a solar-powered system, it must have a large aerial extent to grow enough periphyton and other plants to capture very low TP concentrations through biological uptake and to sequester that TP in the form of calcium- and carbon-bound accreted sediments. No harvesting of biomass or sediments is envisioned for this process, so TP must be effectively stored within the PSTA footprint to achieve a useful project life (e.g., in excess of 50 years). As described above, the PSTA has been shown to be able to achieve TP outflow concentrations as low as 12 µg/L on a 2-year average basis, and possibly lower concentrations (8 to 10 µg/L) at low inlet loadings and for relatively shorter periods of time (up to a few months). Because 12 µg/L was the lowest average achieved on a sustained basis during PSTA demonstration testing, this is the lowest value used for conceptual design and cost estimating. The mass action rule (first order process) indicates that the area required to accomplish this low TP outflow concentration and possible lower concentrations is vastly greater than the area needed to achieve higher outflow concentrations.

4.3.4.2 PSTA Forecast Model Results

The only PSTA Forecast Model calibration data set used for this analysis was the one for the OPP for the shellrock Test Cell treatment (STC-2/5). This was the calibration dataset that best represents optimal performance of a PSTA built on soils with minimum startup interference from antecedent soil P loads and minimum encroachment from emergent macrophytes. No infiltration was included in these model runs because there was no recorded infiltration in the calibration dataset. It is likely that some infiltration will occur in a full-scale PSTA built on permeable soils. Because infiltration is not included in the model estimates of required PSTA areas, they will be more conservative than area estimates based on a leaky footprint.

The calibration dataset for the peat-based Test Cell PSTA was not used for STSOC analysis due to the apparent affects of start-up conditions and continuing release of labile P within the relatively short time frame of data collection. As described below, soil amendments, such as limerock, shellrock, or lime additions, or selection of a site with low available TP, will be necessary to develop a full-scale PSTA with this expected level of performance. Otherwise, necessary footprint areas are likely to be larger than those estimated below. For this preliminary conceptual design, a 2-foot cover of limerock is assumed to be needed to provide this low level of labile TP. Application of 2 feet of limerock was found to be necessary to achieve a complete cover without upwelling of organic soils during construction of the PSTA field-scale cells (Marty Braun, personal communication). Use of 2 feet of limerock is likely the most conservative (costly) method of amending pre-existing soils at the site of a full-scale PSTA. The effects of this conservative assumption on project costs are described later in this section.

The PSTA technology was not experimentally evaluated for treatment of post-BMP (high TP) agricultural runoff waters. Post-BMP TP concentrations (typically greater than 50 to 150 µg/L) result in a shift to dominance by green algae and away from the calcareous blue-green species associated with low TP concentrations. While this type of eutrophic periphyton community naturally occurs in many wetlands receiving higher TP inputs and is capable of significant TP uptake, it was not the type of periphyton community envisioned for the PSTA concept in attempting to reach a planning target of 10 ppb TP removal. For these reasons, the PSTA technology was not evaluated for treatment of post-

BMP waters. Rather, this technology was only evaluated for treatment of post-STA waters (typically less than 50 µg/L of TP).

Actual inflow TP concentrations to the PSTA research cells were typically well below 50 µg/L and averaged less than half that value. This means that modeling PSTA performance starting at an inflow flow-weighted mean TP of 50 µg/L requires extrapolation outside the mean input TP data set (but not outside individual recorded TP input concentrations) used for model calibration. This adds an additional level of uncertainty related to model estimates of the necessary PSTA footprint area.

Six specific scenarios were tested with the PSTA Forecast Model:

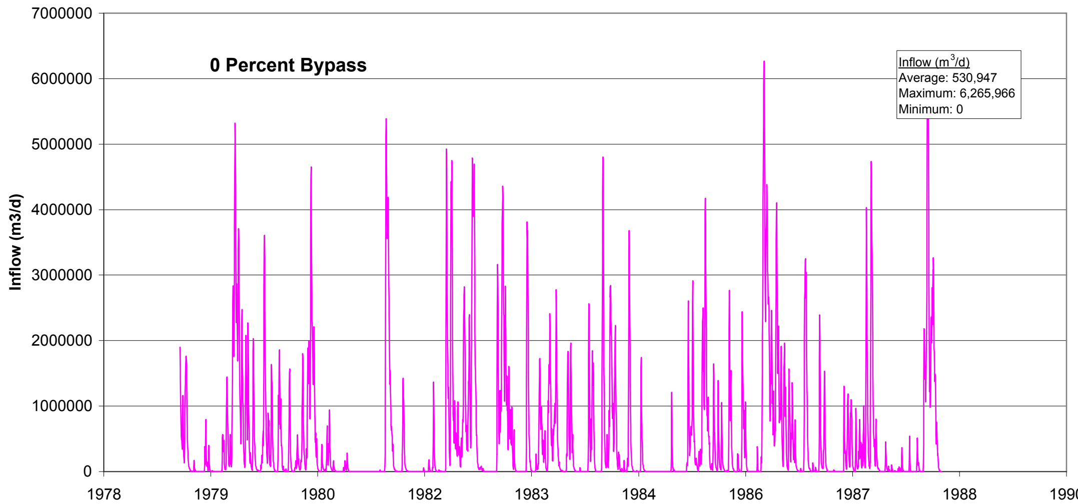
- Flow-weighted mean outflow TP of 12 µg/L with 0, 10, and 20 percent inflow bypass
- Flow-weighted mean outflow TP of 20 µg/L with 0, 10, and 20 percent inflow bypass

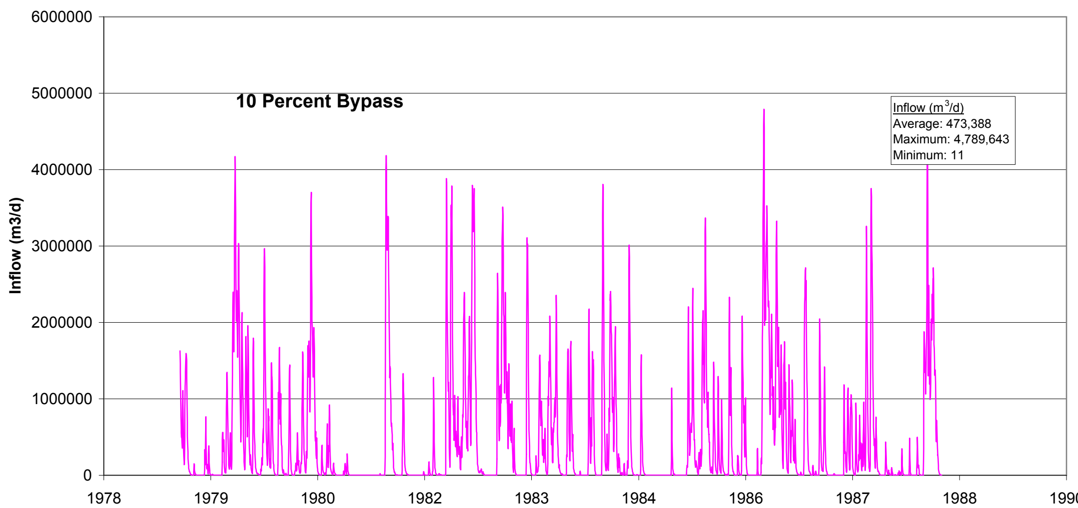
These six scenarios were simulated using a 10-year synthetic data set supplied by the District. This data set mimics the flows and TP loads resulting from hypothetical STA-2 performance for a 10-year POR. Exhibits 4-21 and 4-22 provide summaries and time-series plots of the key components of this data set in terms of average, minimum, maximum, and flow-weighted mean flows and TP concentrations for each of the bypass options. Bypass amounts were subtracted from peak flows (to the extent possible) using a bypass weir, the elevation of which was determined mathematically to capture the 10 and 20 percent bypass flows.

The benefits of constructing an upstream flow equalization basin (FEB) for possibly reducing the PSTA footprint were investigated by use of the PSTA Forecast Model. Water depths in the FEB were limited to 4.5 feet. Model runs determined that addition of flow equalization did not significantly reduce the overall footprint (FEB+PSTA) needed to achieve the target TP goals downstream. For this reason, the PSTA conceptual design that follows does not include flow equalization.

Exhibit 4-23 provides a summary of the estimated PSTA footprint areas needed for each of the six post-STA-2 discharge scenarios. These estimated areas range from 2,026 to 6,198 ha (5,006 to 15,316 acres). Estimated maximum outflow volumes, TP concentrations, and resulting average and maximum water depths in the PSTAs for each of these scenarios are also summarized in Exhibit 4-23. These areas, flows, and water depths were used to develop the cost estimates for full-scale PSTA construction and operation.

It is clear from these estimates that attainment of TP outflow concentrations near the apparent background attainable by these natural systems requires substantially larger land areas. Additional modeling conducted on the DMSTA platform using the PSTA Forecast Model equations has also indicated that hydraulic assumptions may have a significant effect on the estimated footprint area (Dr. Bill Walker, personal communication).





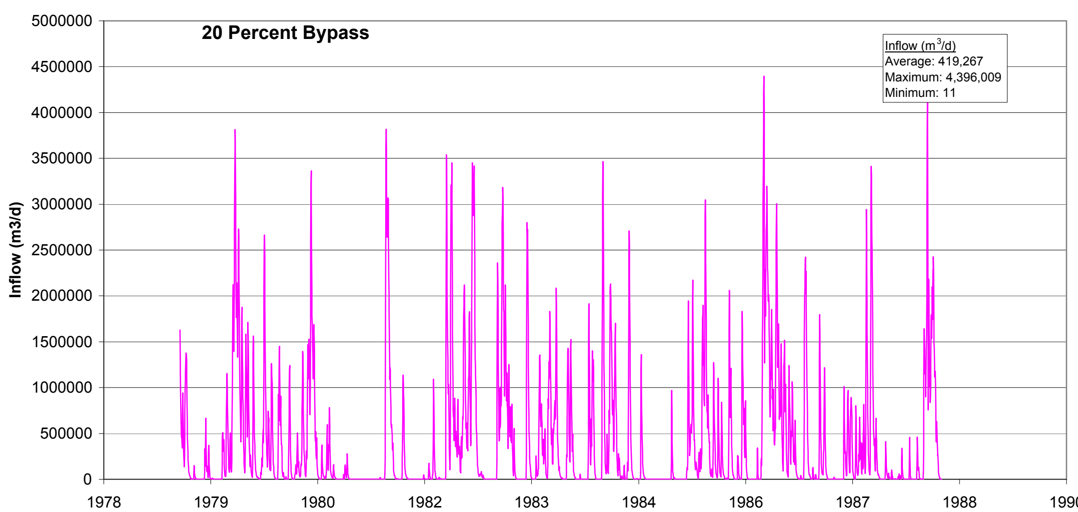


EXHIBIT 4-21

Post-STA Flow Time Series with 0, 10, and 20 Percent Bypass

EXHIBIT 4-22
Post-STA TP Mass Load Time Series with 0, 10, and 20 Percent Bypass

EXHIBIT 4-23
Estimated PSTA Footprint Areas Needed to Meet Six Outflow TP Concentrations and Flow Bypass Options for Post-STA (1/79 - 9/88)

Percent Bypass		**0**	**10**	**20**
Q_in (m^3/d)	Average	530,947	473,388	419,267
	Maximum	6,265,966	4,789,643	4,396,009
	Minimum	0	11	11
TP_in (g/m^3)	Average	0.037	0.037	0.037
	Flow Weighted	0.050	0.049	0.049
	Maximum	0.184	0.184	0.184
	Minimum	0.000	0.000	0.000
TP_in (kg)	Total	94,480	83,020	73,646
Average TP_out = 0.012 g/m^3				
Q_out (m^3/d)	Average	500,682	447,366	396,198
	Maximum	4,677,323	3,629,628	3,405,009
	Minimum	0	0	0
TP_out (g/m^3)	Average	0.011	0.011	0.011
	Flow Weighted	0.012	0.012	0.012
	Maximum	0.020	0.019	0.019
	Minimum	0.006	0.006	0.006
TP_out (kg)	Total	21,392	19,112	16,927
TP_eff (%)		77.4	77.0	77.0
Required Area (ac)		**15,316**	**13,241**	**11,791**
Max Depth (ft)		3.02	2.71	2.64
Avg Depth (ft)		1.18	1.16	1.13
Percent Dry Days (%)		4.38	4.33	4.21
Average TP_out = 0.020 g/m^3				
Q_out (m^3/d)	Average	518,129	462,460	409,575
	Maximum	5,869,914	4,494,949	4,134,046
	Minimum	0	0	0
TP_out (g/m^3)	Average	0.017	0.018	0.018
	Flow Weighted	0.020	0.020	0.020
	Maximum	0.038	0.036	0.036
	Minimum	0.007	0.007	0.007
TP_out (kg)		36,894	32,929	29,165
TP_eff (%)		60.9	60.3	60.4
Required Area (ac)		**6,603**	**5,639**	**5,006**
Max Depth (ft)		3.35	2.97	2.86
Avg Depth (ft)		1.20	1.19	1.16
Percent Dry Days (%)		2.81	2.42	2.39
Q_bypass (m3/d)		0	52,974	106,286
TP_bypass (kg)		0	10,355	19,554

Notes:
PSTA outlet weir width 200 ft, bypass weir width 100 ft; bypass data are from 0.1 d timestep analysis; Time Step = .02; Areas based on flow weighted means; Total Number of days in period of record = 3,560 days

The Excel platform of the PSTA Forecast Model was designed to facilitate parameter estimation and simulation but not to test the effects of hydraulic variables. When it was recognized that the number of TIS may have significant effects when sizing PSTAs to reduce TP concentrations over a relatively broad range (50 to 12 µg/L), it was decided to use the DMSTA model platform to conduct a sensitivity analysis of the effect of the number of TIS on the estimated full-scale PSTA footprint area.

Two analytical approaches were tested. In the first test, the one CSTR PSTA Forecast Model was rerun with 2 through 4 TIS to estimate the land area needed to achieve 20 and 12 µg/L at 0-percent bypass. In the second test, the PSTA Forecast Model was recalibrated on the DMSTA platform based on 3 TIS (the average value between Phase 1 and 2 tracer tests). This recalibrated model was then simulated for 1, 2, and 4 TIS. These two approaches both provide a range of estimated PSTA areas. The results of both approaches are presented to demonstrate the sensitivity of PSTA area estimates to the actual residence time distribution.

Exhibit 4-24 summarizes the effect of the number of TIS on the estimated PSTA area. In the first test, the one CSTR PSTA Forecast Model was run assuming 1 through 4 TIS. In this analysis, the estimated footprint area to achieve 20 µg/L was reduced from approximately 2,670 to 1,580 ha (6,600 to 3,900 acres) for 4 TIS, and from 6,200 to 2,870 ha (15,300 to 7,100 acres) for 12 µg/L. In the second test where the PSTA Forecast Model was recalibrated on a 3 TIS platform, the estimated area ranged from 3,440 to 2,190 ha (8,500 to 5,400 acres) for the 20 µg/L target and from 8,780 to 3,970 ha (21,700 to 9,800 acres) for 12 µg/L.

EXHIBIT 4-24

Sensitivity Analysis of Different Hydraulic Efficiencies (Tanks-in-Series [TIS]) on Estimated PSTA Areas for Post STA-2 Dataset with 50 µg/L Inflow TP

Estimated Treatment Area (ac) to Meet TP Out Goal		
# TIS	**TP = 20 ug/L**	**TP = 12 ug/L**
PSTA Forecast Model with 1 CSTR		
1	6,600	15,300
2	4,600	8,900
3	4,100	7,700
4	3,900	7,100
Recalibrated PSTA Model with 3 TIS		
1	8,500	21,700
2	6,200	12,800
3	5,800	10,800
4	5,400	9,800

Note:

This analysis was conducted on the DMSTA platform using the PSTA Forecast Model Equations and model parameters from STC 8 (shellrock) for the OPP. Post STA-2
10-Year Simulation with 0 bypass.

CSTR = continuously stirred tank reactor

Uncertainty with regard to the correct number of TIS during PSTA design can be reduced by a great extent by creating internal cross levees with discreet outlet points. These cells in series are directly comparable to the TIS hydraulic model. If additional tracer research was to determine that the typical PSTA TIS averages about 2, then inclusion of two PSTA cells in series will be equivalent to the 4 TIS scenarios simulated in Exhibit 4-24.

Additional modeling was conducted to evaluate the effect of reducing the assumed inflow TP concentration on the resulting estimated PSTA footprint area. Inflow concentrations were reduced in the post-STA-2 data set, and the PSTA Forecast Model was simulated for the various target outflow TP concentrations and bypass scenarios. As expected, lowering the TP inflow concentration and load reduces the estimated PSTA footprint. Exhibit 4-25 illustrates the results of this analysis. Lowering the input TP from 50 to 25 µg/L lowered the estimated PSTA area from approximately 2,670 to 450 ha (6,600 to 1,100 acres) for an outflow goal of 20 µg/L and 0-percent bypass, and from approximately 6,200 to 2,180 ha (15,300 to 5,400 acres) for an outflow goal of 12 µg/L and 0-percent bypass. This analysis highlights the importance of using the best possible input water quality and flow estimates and modeling techniques during final design of a PSTA.

EXHIBIT 4-25
Estimated PSTA Areas Based on Alternate Post-STA Average Inflow TP Concentrations

Area Needed In Acres				
Flow Wt Avg TP Inflow (ug/L)	**Flow Wt Avg TP Outflow**	**Percent Bypass**		
		0	**10**	**20**
	Range			
25		5,391	4,581	4,069
30		7,414	6,346	5,635
40		11,410	9,855	8,766
50		15,316	13,241	11,791
	20 µg/L			
25		1,109	885	790
30		2,214	1,842	1,637
40		4,423	3,741	3,321
50		6,603	5,639	5,006

Note:

Results are based on the PSTA Forecast Model and model parameters for the OPP. Post STA-2 10-Year Simulation with 0 bypass.

One additional sensitivity analysis was conducted with the PSTA Forecast Model. Full-scale PSTA areas needed to achieve 20 and 12 µg/L with 0-percent bypass were estimated based on the effects of deep percolation losses of water with associated TP (no recycle). The effects of average leakage between 0 (base case) and 0.6 cm/d were estimated with the PSTA Forecast Model. Exhibit 4-26 summarizes the results of this analysis. The estimated PSTA footprint area needed to reduce flow-weighted TP from 50 to 20 µg/L was reduced from approximately 2,670 to 2,226 ha (6,600 to 5,500 acres) and from 6,200 to 4,371 ha (15,300 to 10,800 acres) for a goal of 12 µg/L.

EXHIBIT 4-26
Sensitivity Analyses of Effects of Deep Percolation (Leakage) on Estimated PSTA Area for the Post STA-2 Dataset with 50 µg/L Inflow TP

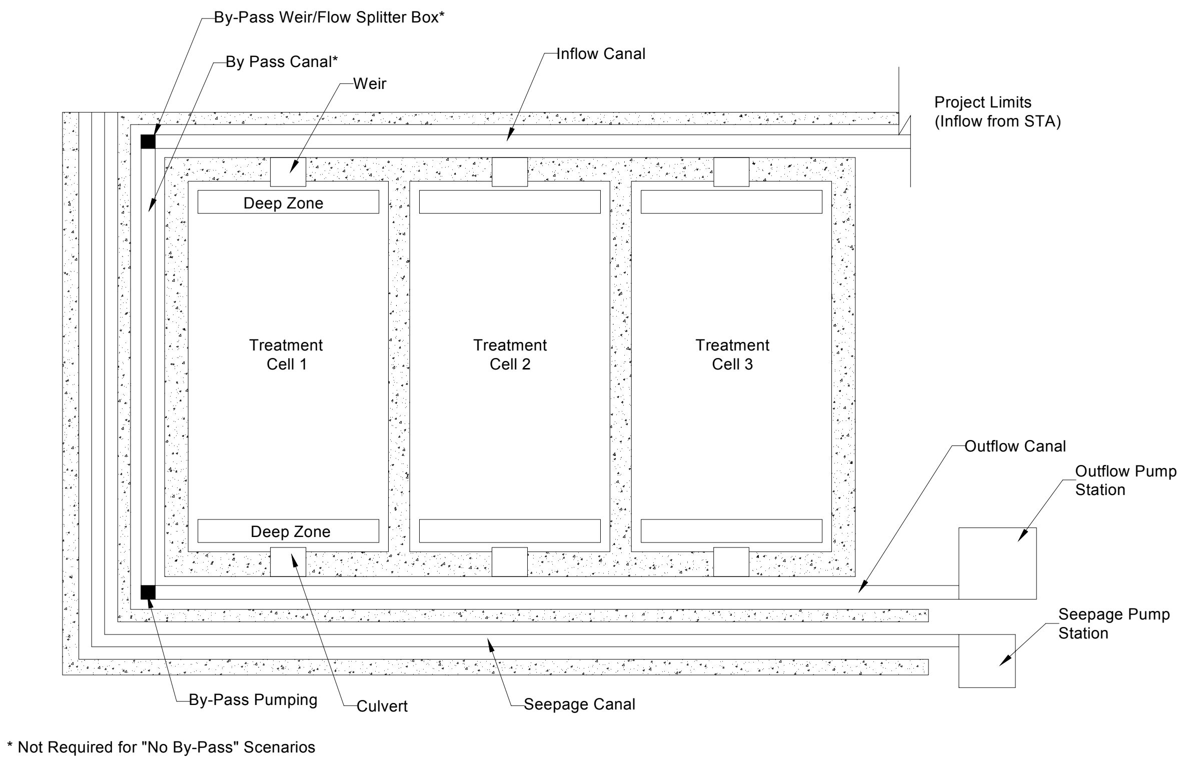
	Estimated Areas (acres) to Meet Flow-Weighted TP Out Concentration	
Average Leakage (cm/d)	**20 µg/L**	**12 µg/L**
0.00	6,600	15,300
0.15	6,500	14,400
0.30	6,200	13,100
0.60	5,500	10,800
1.20	4,700	7,200

Note:
Post STA-2 10-Year Simulation with 0 bypass. Results are based on the PSTA forecast model using STC 8 (shellrock) model parameters for the optimum performance period.

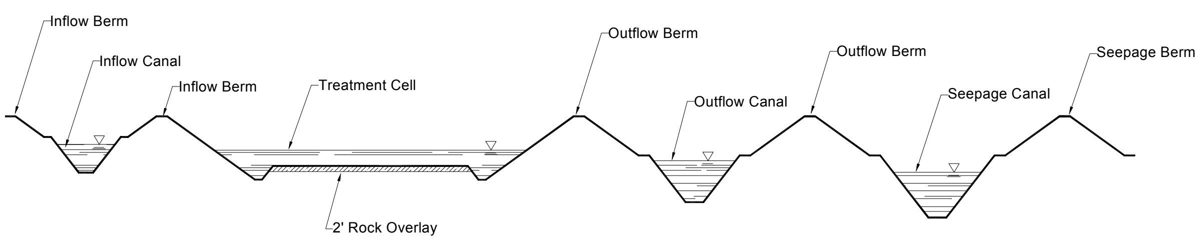
4.3.5 PSTA Conceptual Design

Exhibit 4-27 provides a plan and profile view of a conceptual post-STA-2 PSTA needed to meet the expectations required by the STSOC analysis. This conceptual design includes:

- An inflow canal
- Multiple gated inlet weirs for each treatment cell to convey water from the inlet canal into the PSTA cells
- Three parallel PSTA treatment cells with inlet and outlet deep zones for flow distribution and collection
- A bypass pumping station
- A bypass structure with weir
- A bypass canal to convey bypasses around the PSTA
- Double-barreled culverts with gates to convey water from the treatment cells to the outflow canal
- An outflow canal
- An outflow pump station
- A seepage control canal
- A seepage pump station



Plan View



Cross Section

EXHIBIT 4-27
Plan View and Cross Section of Conceptual Full-Scale PSTA System

No inflow pumping station was incorporated into the conceptual design based on the assumption that the outflow pumping station from STA-2 would be utilized to provide inflow to the PSTA treatment system. No periphyton or macrophyte planting is envisioned for the full-scale PSTA cells. Development of calcareous periphyton and sparse emergent macrophyte cover will be encouraged through water depth control and herbicide applications. Additional assumptions used in the development of the conceptual design are presented in Exhibit 4-28.

EXHIBIT 4-28
Assumptions Used for Conceptual Design

Component	Assumption
Inflow Water TP Levels	50 µg/L (post-STA-2 level)
Treatment of Bypass Water	None
Flow Equalization Requirements	None
Aspect Ratio for Treatment Cells	1.5 L x 1 W
Number of Treatment Cells	3
Depth of Shellrock Base	2 feet
Levee Height	3 feet greater than maximum operating stage
Levee Side Slopes	2.5 H x 1 V
External Levee Top Width	10 feet
Internal Levee Top Width	6 feet
Canal Side Slopes	2 H x 1 V
Maximum Canal Velocity	2.5 feet per second

4.3.5.1 Design Considerations

As discussed previously, the nature of the onsite soils has a significant impact on PSTA performance. If existing soils have low available (water soluble) P levels (< 2 mg/kg), then minimal P leaching from the soil should occur and no soil amendment is necessary. However, if existing soils are higher in available P, then leaching of P is probable, and the site must be modified either by adding limerock over the surface of the entire PSTA or by removing the existing soils down to the underlying caprock. Another potential, intermediate option is the use of soil amendments to lock available P in the soils to prevent its release. The efficacy of each of these soil pre-treatment options has not been previously investigated at a field scale, but some research is underway (see Appendix I). For the STSOC analysis, a worst-case scenario requiring application of a 2-foot thick cap of limerock placed over the onsite soils was evaluated.

Other factors that would significantly affect the cost and operation of a full-scale PSTA are the types and configuration of the water control structures and flow distribution methods utilized. The first consideration in the selection of water control structures was the type of structures used in previously constructed projects (i.e., STA-2). It is anticipated that using similar types and sizes of water control structures in the construction of a full-scale PSTA as are used in other Everglades restoration projects would result in the components being more readily available and less expensive than custom components. Therefore, 50-foot wide gated weirs were selected for use as inflow water control structures, and double-box culverts (varying in width from 20 to 25 feet) were used for outflow water control structures.

Flow distribution is controlled through a variety of methods: the use of gated inflow and outflow control structures, the implementation of multiple inflow water control structures, and the incorporation of deep zones within the treatment cells. All of the inflow and outflow structures were designed with gates that could be operated either locally or remotely. This design feature controls flow distribution by allowing gate settings, and thus flow through the gates, to be varied. Additionally, it provides flexibility in treatment cell operation by allowing cells to be isolated and removed from operation. Finally, the use of multiple inflow water control structures and deep zones at the head and tail of each treatment cell allows for pseudo-passive flow distribution within the system. The incorporation of each of these design components allows for maximum flexibility in operation of the full-scale system while attempting to minimize the construction and operational costs.

Bypass and seepage canals and pump stations were also included in the design. Two bypass situations (10 percent and 20 percent) were considered for each treatment scenario evaluated (e.g., outflow TP levels of 12 and 20 µg/L). The bypass structure was designed to act as a small flow equalization basin thereby limiting the actual flow into the bypass canal. The bypass canal was sized to accommodate approximately 35 and 65 cfs of flow with 0.5 feet of freeboard for the 10 percent and 20 percent bypass scenarios, respectively. Flows of these magnitudes account for approximately 87 percent of the bypassed flows encountered during the 10 percent bypass scenario and for approximately 81 percent of the bypassed flows during the 20 percent scenario. Higher flow volumes will be accommodated through storage in the bypass structure and by increased flow velocities in the bypass canal. The bypass pump station was sized to accommodate the full range of flows for both bypass situations.

The seepage canal and pumping station were sized assuming a seepage rate of 33 cubic feet per day (cf/d) per foot of levee length per foot of head. This rate was proposed as a recommended seepage loss rate for use in design of the maximum capacity of seepage collection canals and seepage return pumps by Burns & McDonnell for STA 3/4 (Burns & McDonnell, December 1999). As described above, the estimated PSTA footprint area is a function of seepage. Zero seepage was assumed for the base-case sizing estimates. However, it is acknowledged that a seepage canal will be necessary in the final design and that considerable site-specific information will be necessary to accurately predict seepage rates.

The various PSTA footprint areas and bypass features for the six investigated conceptual design scenarios resulted in differing canal and levee lengths for each option. Exhibit 4-29 summarizes the additional design details for each of these options.

4.3.5.2 Hydraulic Analysis

Detailed hydraulic analyses were not conducted in developing the full-scale PSTA concept. The PSTA Forecast Model has a water balance component but does not estimate head loss through the vegetation. At question is whether a

EXHIBIT 4-29
PSTA Standards of Comparison (STSOC) Post-STA-2 Design Criteria Summary

	Various Bypass Scenarios for 20 ppb					
Design Criteria	**No 20 ppb P**	**10% 20 ppb P**	**(By-pass) 20 ppb P**	**No 12 ppb P**	**10% 12 ppb P**	**20% 12 ppb P**
Total Treatment Area, acres	6,603	5,639	5,006	15,316	13,241	11,791
No. of Treatment Cells	3	3	3	3	3	3
Treatment Cell Area, acres	2201	1880	1669	5105	4414	3930
Average Water Depth, ft.	1.14	1.14	1.13	1.18	1.17	1.15
Maximum Water Depth, ft	3.35	2.97	2.86	3.02	2.71	2.64
Total Land Required, acres	6,885	5,888	5,237	15,727	13,607	12,134
Inflow Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
No. of Inflow Control Structures per Cell	4	4	4	4	4	4
Inflow Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Inflow Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Inflow Levee Height, ft.	9.75	9.25	9	9.5	9	9
Outflow Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
No. of Outflow Control Structures per Cell	2	2	2	2	2	2
Type of Outflow Control Structures	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert
Outflow Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Outflow Levee Height, ft.	8.5	8	8	8.25	7.75	7.75
Interior Levee Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50
Interior Levee Height, ft.	8.5	8	8.00	8.25	7.75	7.75
Side Levee Length, mi.	2.62	NA	NA	3.99	NA	NA
By-Pass Canal Length, mi.	NA	2.42	2.28	NA	3.71	3.50
No. of By-Pass Control Structures	0	1	1	0	1	1
By-Pass Levee Length, mi.	NA	2.42	2.28	NA	3.71	3.50
Seepage Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Seepage Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Side Seepage Canal Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50
Side Seepage Levee Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50

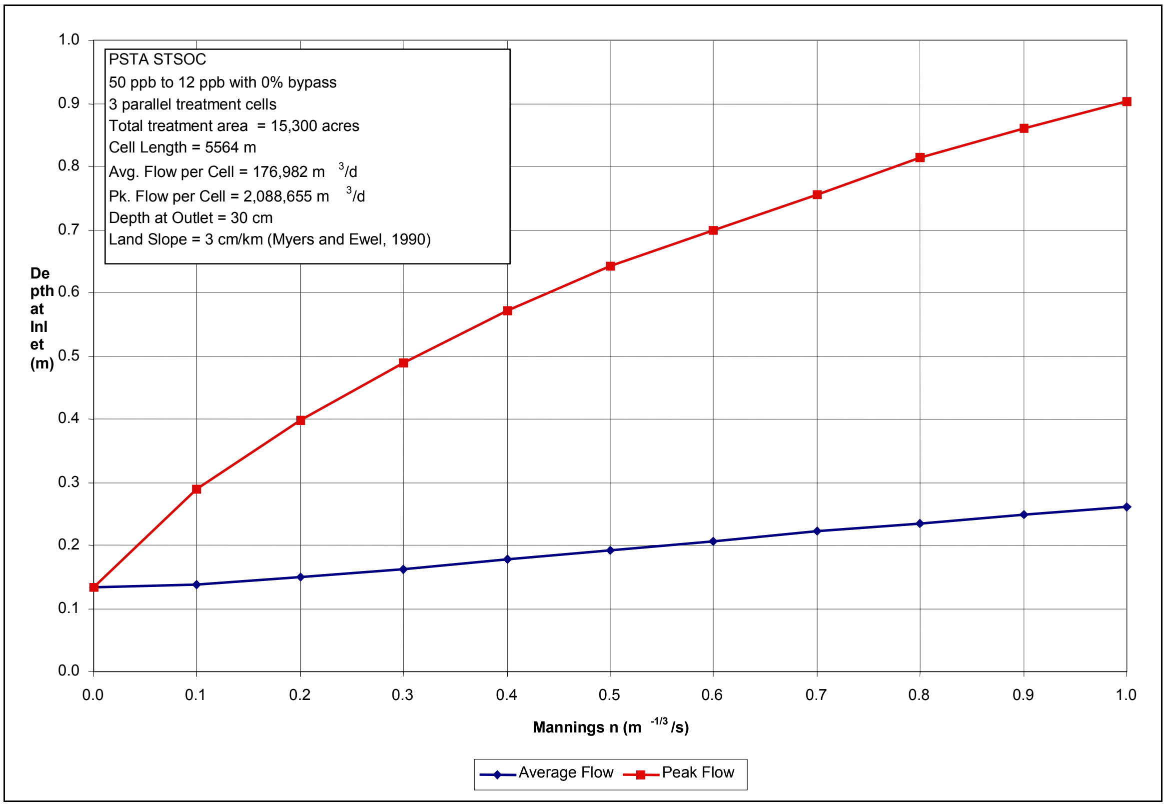
Notes:
ppb = parts per billion
NA = not available

full-scale PSTA could be operated within the range of depths that have been evaluated at the mesocosm and field scales.

Head loss through a wetland system is a function of topographic slope, flow length, flow rate, substrate roughness, and vegetative resistance. The effects of substrate roughness and vegetative resistance are expressed in terms of a Manning's "n" value. Manning's "n" values for wetlands range from approximately 0.2 to greater than 10 $s/m^{1/3}$ (Kadlec and Knight, 1996). STA 1-W "n" values average approximately 0.8 for dense cattail stands and are typically less than 0.5 for open water/SAV. No "n" values have been measured to date in large-scale PSTA systems. It is reasonable to expect, however, that PSTA "n" values should be no higher than those for SAV systems.

A preliminary analysis of potential head loss through a full-scale PSTA was prepared for the worst-case scenario (i.e., longest flow path) that requires a reduction in TP concentrations from 50 to 12 µg/L with no bypass. Exhibit 4-30 shows the influence of variable Manning's "n" values on the inlet depth of a full-scale PSTA based on a weir-controlled outlet depth of 30 cm. This weir height is consistent with the PSTA Forecast Model. Myers and Ewel (1990) report that the natural grade in the Everglades area is approximately 3 cm/km.

EXHIBIT 4-30
Effect of Manning's "n" on Inlet Water Depth for a Full-Scale PSTA with Inflow TP of 50 µg/L, Outflow TP of 12 µg/L, and Outlet Weir Height of 30 cm at Average and Peak Flow Rates



At the average flow rate (177,000 cubic meters per day [m³/d] per cell), the outlet weir controls system hydraulics. This is indicated by the calculated inlet depth being lower than the outlet depth. Kadlec and Knight (1996) refer to this condition as "distance-thickening" flow. At the peak flow rate (2,089,000 m³/d), the inlet depth is more strongly influenced by Manning's "n." Within the range of likely "n" values (0.2 to 0.5) that might be observed in a full-scale PSTA, the inlet depth increases to approximately 65 cm (2.1 feet). Under maximum flow conditions, the weir design used in the PSTA Forecast Model results in water depths at the downstream end of the PSTA to approximately 0.8 to 1.0 m (2.6 to 3.3 feet) (Exhibit 4-22). The total water depth at the upstream end of the PSTA under maximum flow conditions would be less than 1.5 m (5 feet) for short durations. The planned inflow levee height is 2.7 to 2.9 m (9 to 9.5 feet), which should provide adequate freeboard and protection against overtopping.

4.3.6 Cost Estimates

Cost estimates were developed using a unit cost spreadsheet provided by the District. This spreadsheet provided specific items to be considered in the development of costs as well as unit prices for many of the items. Additional guidance for the preparation of the cost estimates was obtained from the *Basis of Cost Estimates for Full Scale Alternative Treatment Supplemental Technology Facilities* (PEER Consultants/Brown and Caldwell, 1999). Finally, cost-estimating spreadsheets provided by the District for the STSOC analysis provided guidelines for a summary of costs, present worth analyses, and unit treatment costs. Project-specific costs were developed from a combination of vendor quotations, previous construction costs for Everglades-related projects, and cost estimation (Exhibit 4-31). These costs were provided to the District for review and modified based upon District comments.

EXHIBIT 4-31

STSOC - PSTA Project-Specific Costs

Item/Task	Unit	Unit cost
50' inflow weir with gate	per structure	$110,000
5' X 20' outflow box culvert with gate	per structure	$119,000
5' X 25' outflow box culvert with gate	per structure	$148,000
5' X 35' outflow box culvert with gate	per structure	$207,000
By-pass structure	per structure	$5,270
5' wide by-pass weir without gate	per structure	$5,000
Levees - Internal-7.5' (4.5' SWD)	$/mile	$251,000
Levees - Internal-7.75' (4.5' SWD)	$/mile	$266,000
Levees - Internal- 8' (4.5' SWD)	$/mile	$281,000
Levees - Internal-8.5' (4.5' SWD)	$/mile	$313,000
Levees - External- 7' (4.5' SWD)	$/mile	$398,000
Levees - External- 7.75' (4.5' SWD)	$/mile	$457,000
Levees - External- 8.5' (4.5' SWD)	$/mile	$525,000
Laying rock base	$/acre	$31,000
Pump Stations>3,000 cfs	$/cfs	$7,950
Canals - Maintenance	$/acre	$500
Demolition Costs	Lump sum	20% capital cost
Replacement Items	Lump sum	50% 0f outflow costs
Salvage of Land	Lump sum	original land cost
FPL Improvements	Lump sum	$211,200
Sampling and monitoring	Lump sum	$3,120

Note:
See Appendix J for detailed assumptions.

Detailed construction cost estimates for each of the six operational scenarios are provided in Appendix J. Exhibit 4-32 summarizes the overall cost analyses results, not considering additional costs for STA 2. The estimated range of total capital costs associated with achieving a TP level of 20 µg/L is approximately

$321,886,000 to $408,515,000. With a target finished water TP level of 12 μg/L, this cost range increases to approximately $663,698,000 to $843,799,000.

EXHIBIT 4-32
Costs for Full-Scale PSTA Implementation, Including 2 Feet of Limerock Fill

Cost Component	12 μg/L, No bypass	12 μg/L, 10% bypass	12 μg/L, 20% bypass	20 μg/L, No bypass	20 μg/L, 10% bypass	20 μg/L, 20% bypass
Capital Costs	$843,798,569	$737,832,446	$663,697,737	$408,514,840	$357,406,344	$321,886,004
Operating Costs	$1,581,898	$1,483,448	$1,417,593	$1,367,755	$1,292,178	$1,255,048
Demolition/ Replacement Costs	$20,691,746	$16,867,324	$15,739,170	$20,935,504	$16,971,599	$14,797,671
Salvage Costs	($73,210,339)	($63,342,812)	($56,483,392)	($32,050,978)	($27,407,667)	($24,378,828)
Lump Sum/ Contingency Items	$761,200	$811,200	$811,200	$761,200	$811,200	$811,200

The detailed analysis of O&M costs for the PSTA is also provided in Appendix J. Estimated annual costs ranged from approximately $1,418,000 to $1,582,000 for a system with an outflow TP of 12 μg/L and from approximately $1,255,000 to $1,368,000 for a system with an outflow TP of 20 μg/L. These O&M costs are expected to include any costs associated with management of emergent macrophytes.

Present worth costs were calculated for a 50-year period based on an interest rate of 4 percent. Exhibit 4-33 provides a summary of the 50-year present worth costs for the PSTA alternatives described above. These costs ranged from $361,033,000 to $888,945,000. These costs are equivalent to unit costs of $0.17 to $0.35 per thousand gallons treated and $699 to $1,096 per pound of TP removed, as detailed in Appendix J.

EXHIBIT 4-33
Present Worth Costs for PSTA Conceptual Design Scenarios

		Without STA2 Costs			With STA2 Costs		
Target	Bypass	50-Year Present Worth Cost	$/lb TP removed	$/1000 gallons treated	50-Year Present Worth Cost	$/lb TP removed	$/1000 gallons treated
12 ppb	0	$888,942,000	$1,076	$0.35	$1,024,403,000	$1,240	$0.40
	10	$778,473,000	$1,078	$0.34	$913,935,000	$1,265	$0.40
	20	$702,761,000	$1,096	$0.35	$838,222,000	$1,307	$0.41
20 ppb	0	$455,089,000	$699	$0.18	$590,558,000	$907	$0.23
	10	$399,095,000	$705	$0.17	$534,557,000	$944	$0.23
	20	$361,029,000	$718	$0.18	$496,491,000	$987	$0.25

Finally, an analysis of costs considering the inclusion of existing STA-2 facilities was completed. It was requested that this cost analysis be included because of the assumptions that 1) a full-scale PSTA system would receive post-STA-2 inflow, 2) that the system would, in all likelihood, be constructed as an add-on to STA-2, and 3) that the PSTA system would utilize some of the STA-2 components (i.e., outflow pumping station). A summary of costs, including those for STA-2, is presented in Exhibit 4-34; a summary of the 50-year present worth, modified to include STA-2 costs, is provided in Exhibit 4-33.

EXHIBIT 4-34
Costs for Full-Scale PSTA Implementation Including STA-2 Costs

Cost Component	12 µg/L, No bypass	12 µg/L, 10% bypass	12 µg/L, 20% bypass	20 µg/L, No bypass	20 µg/L, 10% bypass	20 µg/L, 20% bypass
Capital Costs	$945,680,219	$839,714,096	$765,579,387	$510,396,490	$459,287,994	$423,767,654
Operating Costs	$1,691,413	$1,592,963	$1,527,108	$1,477,270	$1,401,693	$1,364,563
Demolition/ Replacement Costs	$56,127,116	$52,302,694	$51,174,540	$56,370,874	$52,406,969	$50,233,041
Salvage Costs	($103,141,989)	($93,274,462)	($86,415,042)	($61,982,628)	($57,339,317)	($54,310,478)
Lump Sum/ Contingency Items	$761,200	$811,200	$811,200	$761,200	$811,200	$811,200

The limerock placement comprises approximately 80 to 90 percent of the PSTA construction cost. Total present worth costs would be reduced by approximately 60 to 70 percent if PSTA performance could be assured without the limerock fill, and to a lesser extent if the amount of limerock fill could be reduced. As an example of this cost differential, Exhibit 4-35 provides an estimate of the present worth and unit removal costs if the 2-foot limerock fill is reduced to 1 foot, without STA-2 costs included. Based on research conducted to date, it appears that the limerock would not be necessary if antecedent soils have low available TP concentrations or if a chemical soil amendment could be used to tie up existing soluble TP in the soil column. Preliminary estimates of the cost of a hydrated lime soil amendment for soils in the vicinity of STA-2 is approximately $1,300 per acre (as opposed to the $31,000 per acre assumed for 2 feet of limerock fill). Exhibit 4-35 also provides a rough cost estimate using a lime soil amendment. This assumption reduces the estimated present worth costs for a full-scale PSTA to $173,000,000 for the 20 µg/L TP goal and $234,000,000 for the 12 µg/L goal. Due to the major cost impact of this limerock fill, additional work to minimize the costs associated with initial labile TP concentrations should be undertaken prior to final PSTA alternative analysis and design.

EXHIBIT 4-35
STSOC Cost Comparison with and without Shellrock (without STA-2 costs)

Target	12 ppb			20 ppb		
Percent Bypass	**0**	**10**	**20**	**0**	**10**	**20**
Treatment Area (ac)	15,316	13,241	11,791	4,767	3,926	3,473
With 2-ft Shellrock						
50 yr Present Worth ($)	889	778	703	455	399	361
$/Pound TP Removed	1,076	1,078	1,096	699	705	718
$/1000 gallons	0.35	0.34	0.35	0.18	0.17	0.18
With 1-ft Shellrock						
50 yr Present Worth ($)	561	495	451	314	278	254
$/Pound TP Removed	679	686	703	482	492	505
$/1000 gallons	0.22	0.22	0.22	0.12	0.12	0.13
With Lime Soil Amendment						
50 yr Present Worth ($)	234	212	198	173	158	147
$/Pound TP Removed	283	294	309	265	279	292
$/1000 gallons	0.09	0.09	0.10	0.07	0.07	0.07

Notes:
50 yr Present Worth in millions of dollars
Assumes lime addition=$1,300/acre

4.3.7 STSOC Analysis

This section summarizes the conclusions of the PSTA STSOC analysis for the primary and ancillary evaluation criteria:

Primary:

- The level of TP concentration reduction achievable by the technology (as determined from experimental data)
- The level of TP load reduction (as derived from model data)
- Compatibility of the treated water with the natural population of aquatic flora and fauna in the Everglades
- Cost effectiveness of the technology
- Implementation schedule

Ancillary:

- Feasibility and functionality of the full-scale design and cost estimates
- Operational flexibility
- Sensitivity of the technology to fire, flood, drought, and hurricane
- Level of effort required to manage, and the potential benefits to be derived from, side streams generated by the treatment process

In addition to these evaluation criteria, this section summarizes the remaining uncertainties relevant to implementation of a full-scale PSTA ATT.

Exhibit 4-36 compares each of these STSOC criteria relative to the six different operational scenarios of no bypass, 10 percent, and 20 percent diversion for mean outflow TP concentrations of 12 µg/L and 20 µg/L. Results for each evaluation criterion are further described in the following paragraphs.

4.3.7.1 Level of P Concentration Reduction

Based on the data collected by the District's PSTA Research and Demonstration project summarized in Section 3, the minimum achievable TP concentration by PSTA can be assessed based on differing assumptions. These assumptions include:

- All data, including startup (POR)
- Optimal performance data averaged over approximately 18 months (OPP)
- VPP
- Minimum monthly average
- Minimum single measurement (weekly)

Exhibit 4-37 provides a summary of the minimum achievable TP concentration for PSTA based on each of these assumptions. Where possible, these concentrations are reported as flow-weighted means. Based on this summary, it appears that the minimum achievable TP outflow concentration from a constant-flow, shellrock-based PSTA receiving an average inflow concentration of approximately 23 to 24 µg/L of TP at an HLR of approximately 6 cm/d would be between 7 and 14 µg/L. For a peat-based PSTA with high antecedent available soil P concentrations, the range is 9 to 32 µg/L. Based on the observations described above for the peat-based PSTA Test Cell during the VPP, the more likely range of performance based on the OPP is from 9 to 18 µg/L of TP.

The shellrock-based PSTA Test Cells showed a TP removal efficiency of approximately 46 percent, and a flow-weighted mean TP outflow concentration of 12 µg/L during the OPP. Nearly all TP outflow values were lower than their respective inflow values for the shellrock-based Test Cell. A net export of TP occurred in the peat-based PSTA Test Cell during the VPP and the POR. However, during the OPP, the peat-based PSTA removed approximately 25 percent of the inlet TP mass and achieved a long-term average outflow concentration of 18 µg/L.

Percentile distributions of TP concentrations in the outflows from the two constant water regime PSTA Test Cells are illustrated in Exhibit 4-38 for each of the performance periods. This analysis indicates that median outlet TP concentrations for the peat-based PSTA range from 16 to 33 µg/L. For the shellrock-based cell, the median concentration ranges from 12 to 14 µg/L. The 75th percentile outlet TP concentrations are between 22 and 36 µg/L for the peat-based Test Cell and 14 to 16 µg/L for the shellrock-based cell. Other percentiles are also summarized on Exhibit 4-38.

EXHIBIT 4-36
STSOC Evaluation Criteria for Full-Scale PSTA Design Scenarios

Criterion	No Bypass	10% Bypass	20% Bypass
Mean Outflow TP Concentration of 12 µg/L			
Level of P Concentration Reduction[a]	76 percent	67 percent	60 percent
Total Phosphorus Load Reduction[a]	76 percent	67 percent	60 percent
Compliance with Water Quality Criteria	Yes	Yes	Yes
Cost-Effectiveness ($/lb.)	$1,076	$1,078	$1,096
Implementation Schedule	72 months	72 months	72 months
Feasibility and Functionality of Full-Scale Design	high	high	high
Operational Flexibility	high	high	high
Sensitivity to Fire, Flood, Drought, and Hurricane	no	no	no
Residual Solids Management	none	none	none
Mean Outflow TP Concentration of 20 µg/L			
Level of P Concentration Reduction[a]	60 percent	53 percent	47 percent
Total Phosphorus Load Reduction[a]	60 percent	53 percent	47 percent
Compliance with Water Quality Criteria	yes	yes	yes
Cost-Effectiveness ($/lb.)	$699	$705	$718
Implementation Schedule	72 months	72 months	72 months
Feasibility and Functionality of Full-Scale Design	high	high	high
Operational Flexibility	high	high	high
Sensitivity to Fire, Flood, Drought, and Hurricane	no	no	no
Residual Solids Management	none	none	none

Notes:

[a]Concentration and load reductions are based on the PSTA Forecast Model simulations and include the TP contribution of bypassed flows.

All information in this table is based on assumptions as stated in the text and incorporates uncertainties related to model forecasts, limited experimental testing, and full-scale operational experience.

EXHIBIT 4-37
PSTA Test Cell STSOC TP Mass Removal Summary

		Flow-weighted TP (µg/L)		Mass Removal Efficiency (%)
		Inflow	Outflow	
STC 1/4	POR	22.5	25.0	-10.8
(Peat/Peat-Ca)	OPP	23.9	17.9	25.4
	VPP	24.5	32.0	-30.7
	Min Month	--	12.1	--
	Min Week	--	9.0	--
STC 2/5	POR	21.9	14.3	34.8
(Shellrock)	OPP	22.6	12.2	46.2
	VPP	24.6	13.3	46.0
	Min. Month	--	7.4	--
	Min. Week	--	7.0	--

Note:
Calculations based on weekly averages.

For the purposes of this STSOC assessment, the long-term minimum achievable average TP of 12 µg/L from the shellrock Test Cell was used for the PSTA conceptual design.

4.3.7.2 Total Phosphorus Load Reduction

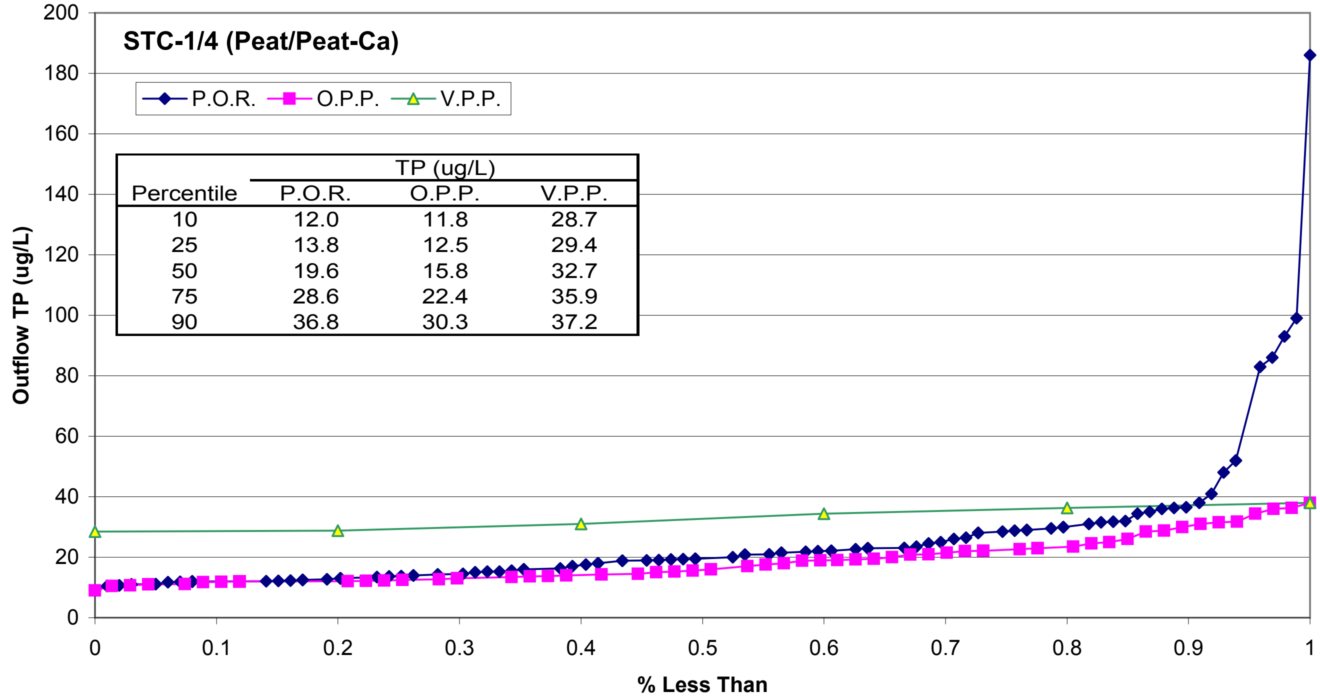
TP removal efficiencies shown in Exhibit 4-37 have been calculated on a mass basis. This approach is preferable to calculation of concentration-based reduction efficiencies unless the concentrations are flow-weighted means, in which case the two methods are identical. Based on the data summarized for all of the performance periods, the PSTA Test Cells produced the following ranges of TP mass removals:

- STC-1/4 (peat, constant water depth): -31 to 25 percent
- STC-2/5 (shellrock, constant water depth): 35 to 46 percent

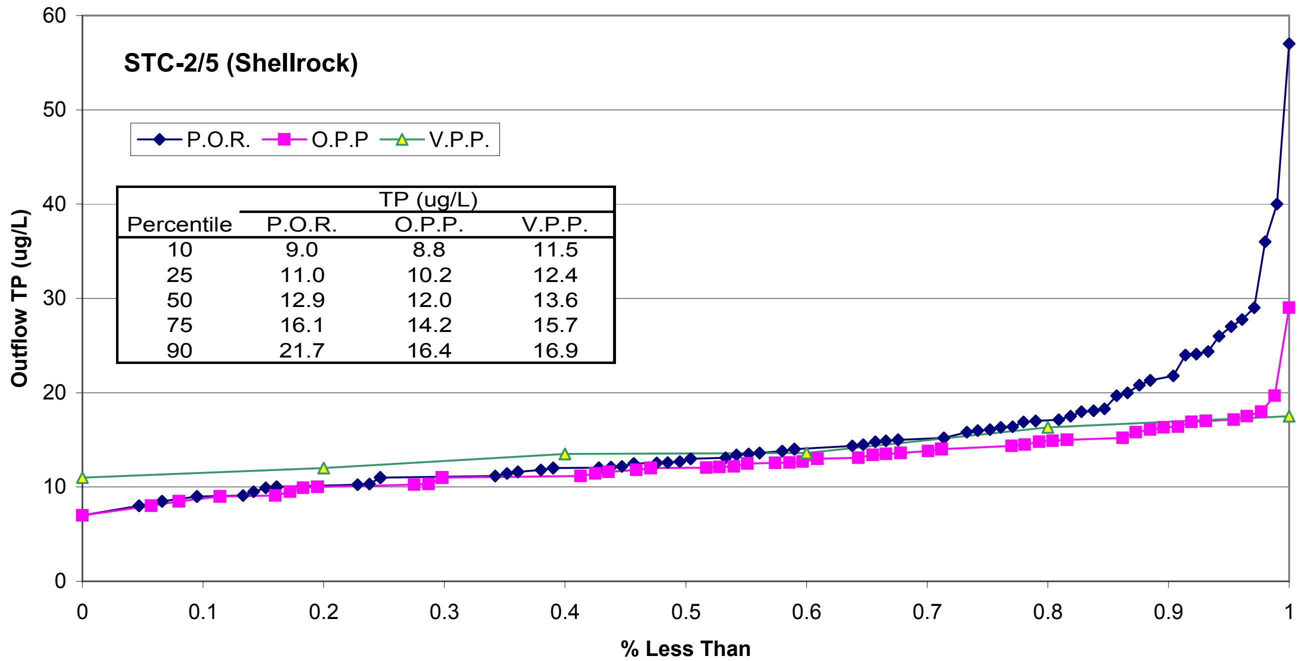
There are many factors that can affect TP removal in natural treatment systems. Key independent variables are evaluated in Exhibits 4-39 to 4-43 using monthly averages. The relationships developed in these regressions are tentative in nature but can provide some idea of possible causal relationships.

Exhibit 4-39 illustrates the observed relationships between TP inflow concentration and TP mass removal efficiency. TP mass removal efficiency for each of the PSTA Test Cells was positively correlated with inflow concentration. The fact that the highest mass removal efficiencies were observed in conjunction with the highest inflow concentrations indicates that these systems might perform even better (based on mass of TP removed) if tested at higher TP loads.

EXHIBIT 4-38
PSTA Test Cell STSOC Summary of TP Concentration Percentile Distributions



Percentile	TP (ug/L) P.O.R.	O.P.P.	V.P.P.
10	12.0	11.8	28.7
25	13.8	12.5	29.4
50	19.6	15.8	32.7
75	28.6	22.4	35.9
90	36.8	30.3	37.2



Percentile	TP (ug/L) P.O.R.	O.P.P.	V.P.P.
10	9.0	8.8	11.5
25	11.0	10.2	12.4
50	12.9	12.0	13.6
75	16.1	14.2	15.7
90	21.7	16.4	16.9

Note(s):
POR = Entire Period-of-Record
OPP = Optimal Performance Period
VPP = Verification Performance Period
Percentiles based on weekly averages.

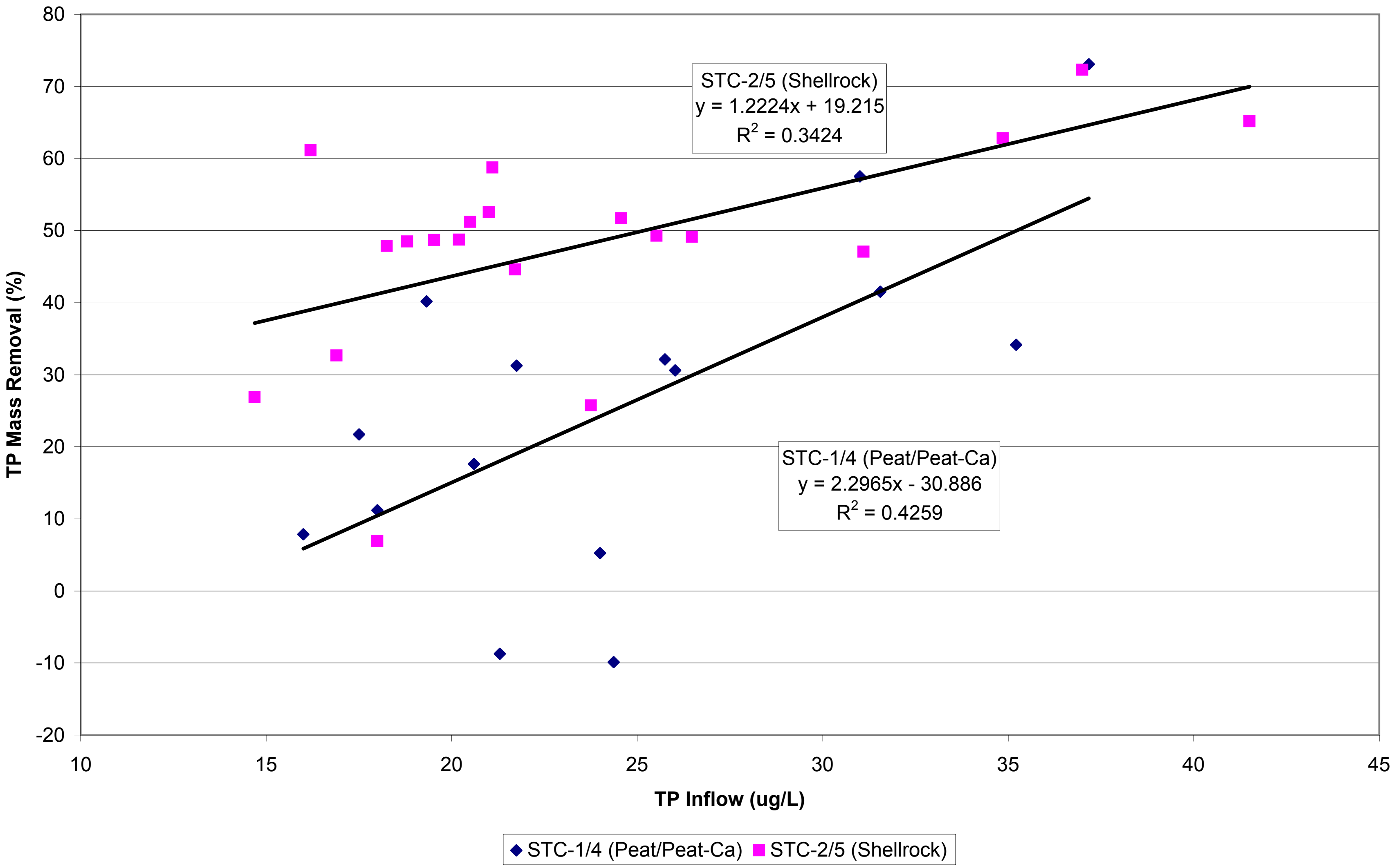


EXHIBIT 4-39

Observed Relationship Between Average Monthly Inlet TP Concentration and TP Mass Removal Efficiency in PSTA Test Cells during the OPP

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For the peat-based cell, very little mass removal occurred when inflow concentrations were less than approximately 25 µg/L. Monthly average mass removals were always positive for the shellrock-based Test Cell.

TP mass removal efficiency was also higher at higher TP inflow loads (see Exhibit 4-40). Approximately 36 percent of the variability in mass removal efficiency was explained by TP mass loading rate for both PSTA treatment regressions.

The PSTA Test Cells were not tested over a wide range of HLR. There was a very slight positive relationship between HLR and mass removal efficiency for the shellrock-based cell and a negative relationship for the peat-based PSTA cell (Exhibit 4-41). The regression coefficient for the peat-based Test Cell was 0.29 and for the shellrock-based Test Cell was 0.02.

Mass removal efficiency for TP was positively correlated with HRT in both PSTA Test Cell treatments (Exhibit 4-42). This relationship was more significant for the peat-based cell (R^2 = 0.35) than for the shellrock-based cell (R^2 = 0.040).

The relationship between water depth and TP mass removal efficiency in the PSTA Test Cells is illustrated in Exhibit 4-43. Removal efficiency was positively correlated with water depth for the peat-based treatment (R^2 = 0.35), but there was no observed effect of water depth on TP mass removal efficiency for the shellrock-based treatment cell (R^2 = 0.02).

4.3.7.3 Compliance with Water Quality Criteria

Any PSTA that is built will discharge to classified waters of Florida and the U.S. These water bodies have protective criteria that cannot be exceeded. Discharge permits define the actual allowable discharge water quality levels, but for the purposes of this STSOC assessment of compatibility with downstream receiving waters, it is assumed that the PSTA outflow must not exceed applicable Class III water quality standards. Exhibit 4-20 provided a summary of the data collected during the VPP. Of the parameters measured, only DO does not meet the criterion for freshwaters. Since DO is naturally depressed in the Everglades, the observation that the PSTA cells do not generally meet the 5.0 mg/L Class III standard appears moot. However, some form of discharge permit regulatory relief might be required.

Exhibit 4-44 provides a summary of the results of the biomonitoring of the PSTA Test Cells conducted by the FDEP during the STSOC VPP. These results are not easily interpreted. Sporadic survival of fish and water fleas in the control samples (laboratory dilution water) was observed during both sets of tests. When control survival was within acceptable limits, sporadic apparent toxicity to water fleas or minnows was observed for the head cell (inflow) water or for one or the other of the PSTA Test Cell outflows. FDEP indicated that some of the samples had detectable and possibly toxic levels of several pesticides, including atrazine and chlorpyrifos-ethyl. There were more tests without apparent effects than tests with negative results. There was never any detrimental effect noted in the algal toxicity test.

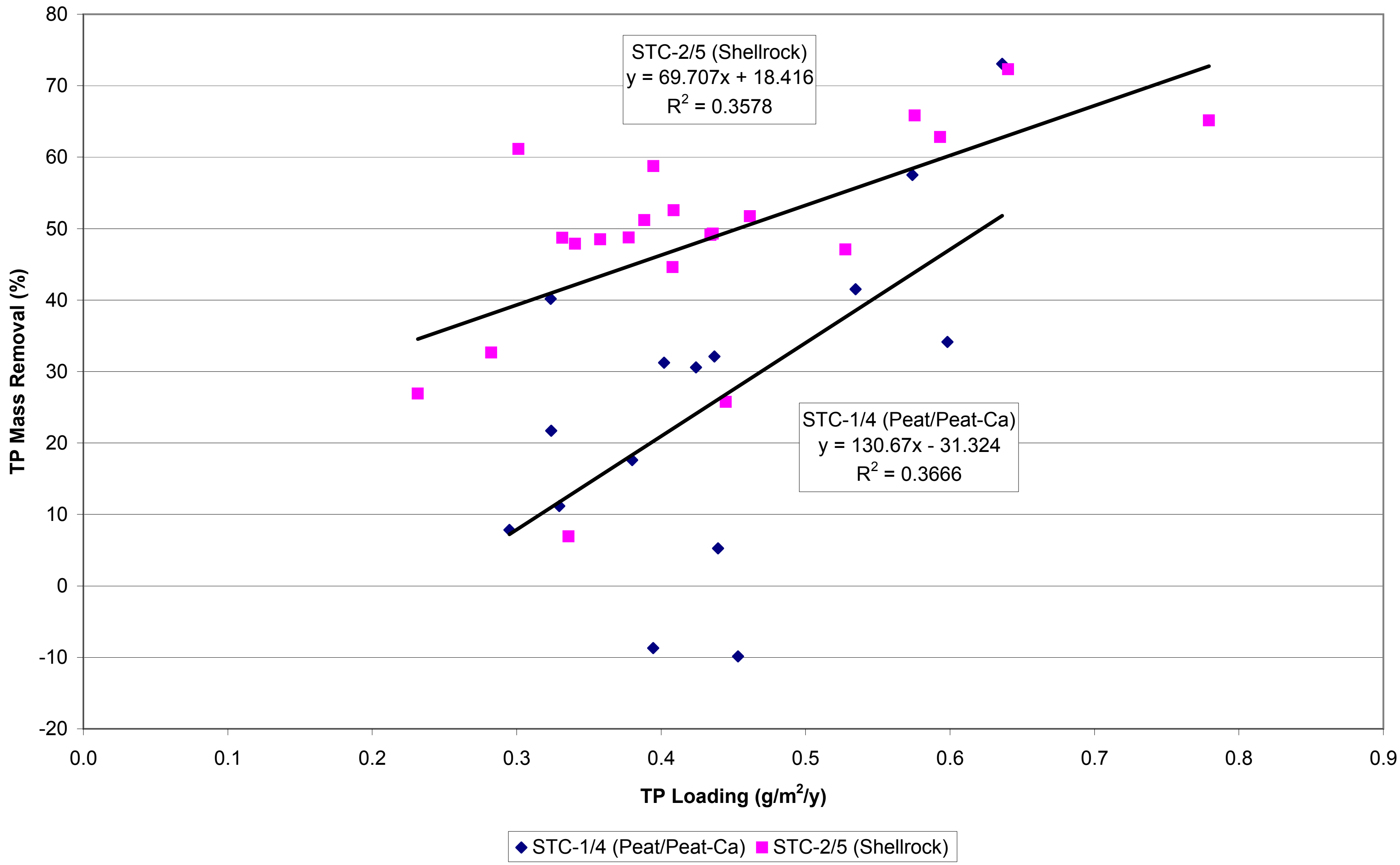

EXHIBIT 4-40

Observed Relationship Between Average Monthly TP Loading Rate and TP Mass Removal Efficiency in PSTA Test Cells during the OPP

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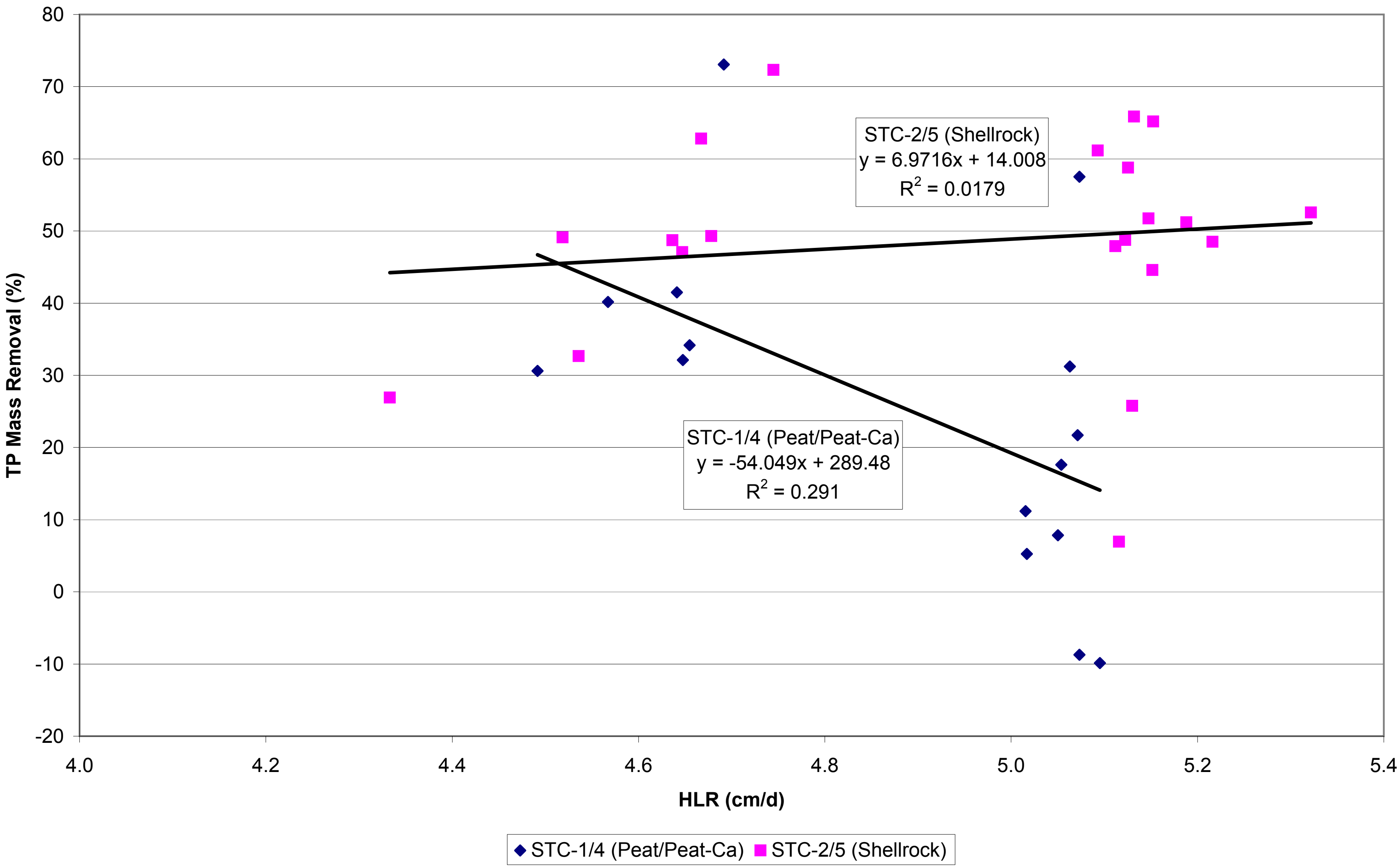

EXHIBIT 4-41

Observed Relationship Between Average Monthly HLR and TP Mass Removal Efficiency in PSTA Test Cells during the OPP

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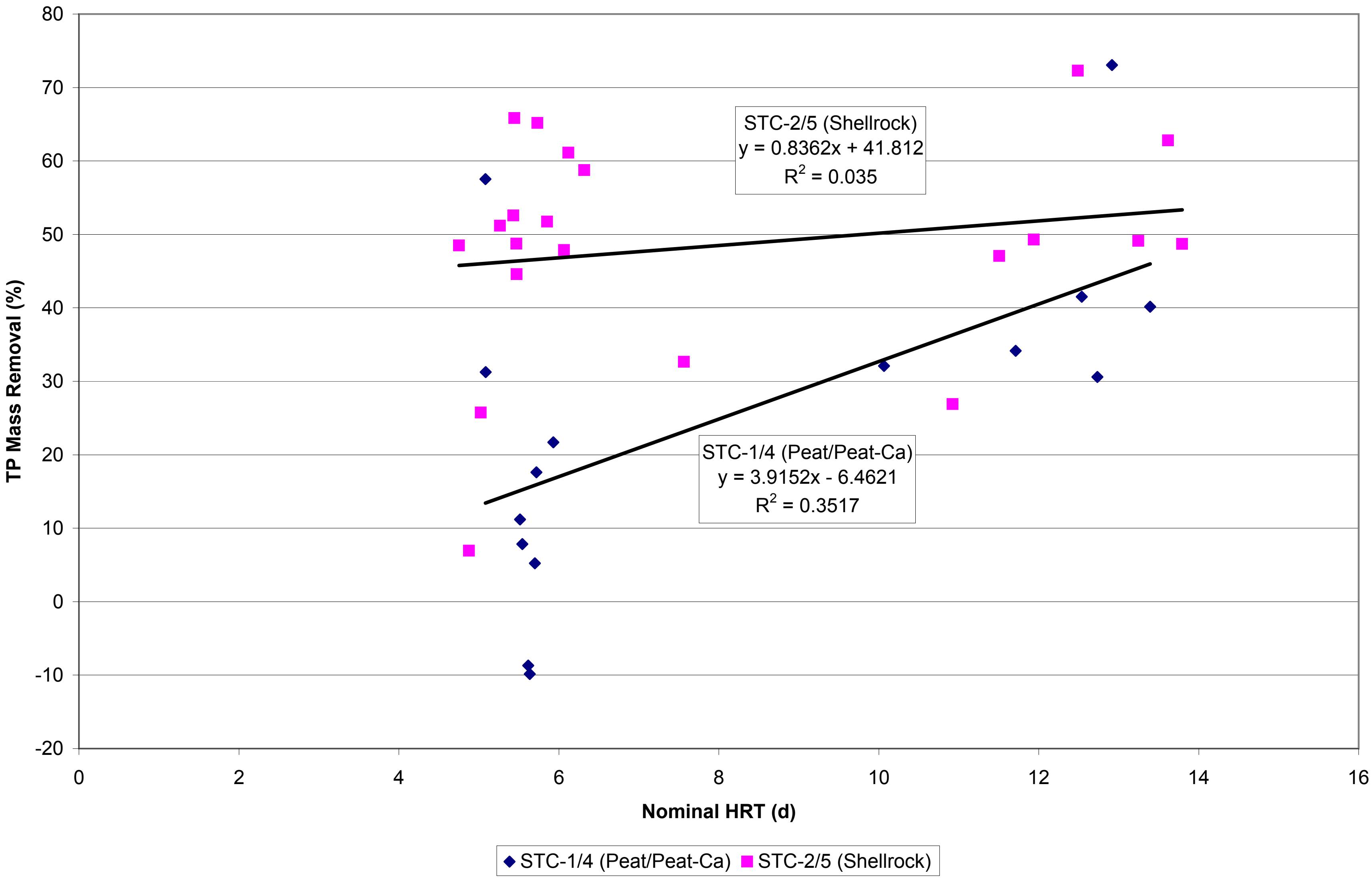

EXHIBIT 4-42

Observed Relationship Between Average Monthly Nominal HRT and TP Mass Removal Efficiency in PSTA Test Cells during the OPP

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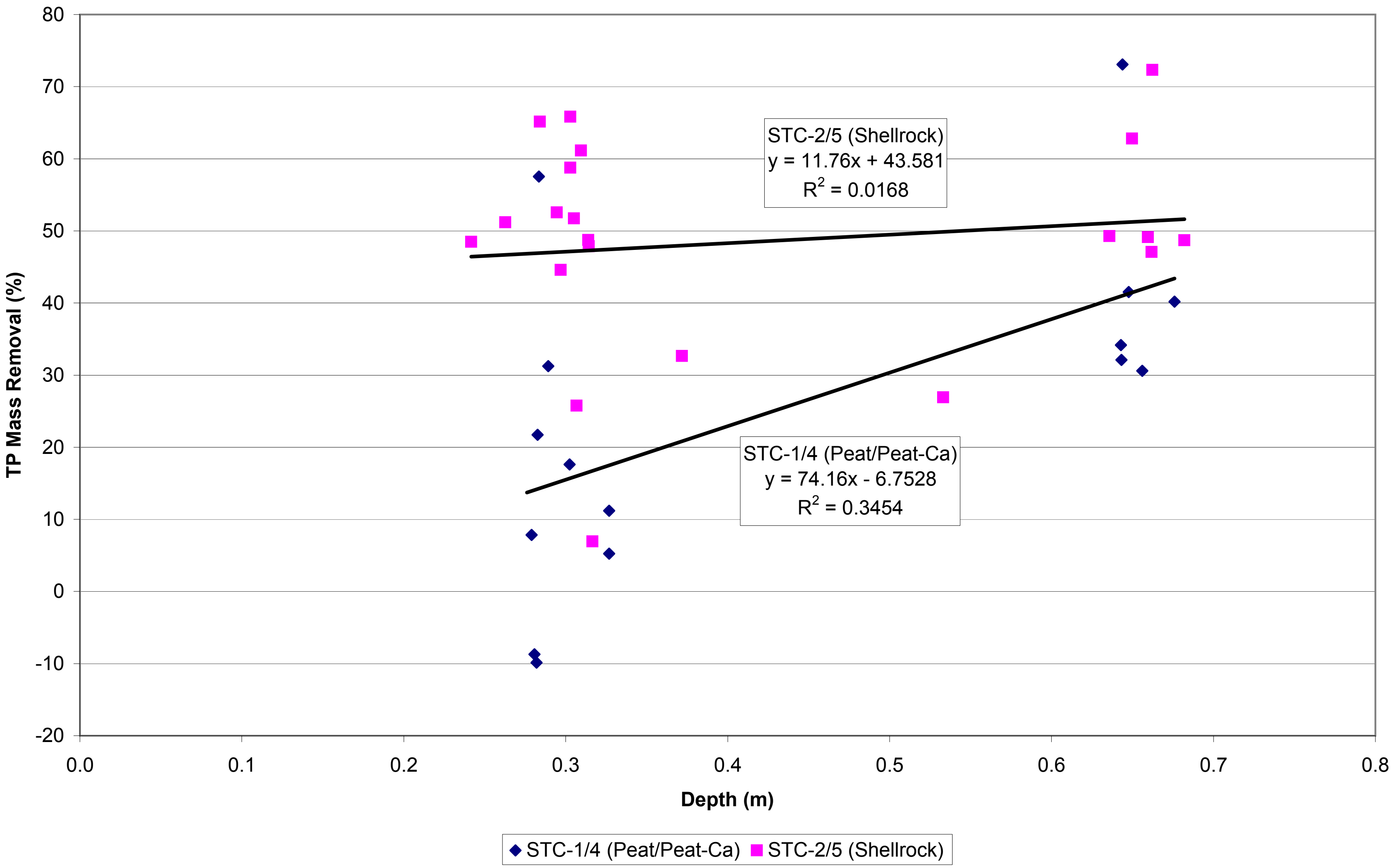

EXHIBIT 4-43
Observed Relationship Between Average Monthly Water Depth and TP Mass Removal Efficiency in PSTA Test Cells during the OPP

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EXHIBIT 4-44
Biomonitoring Results for the PSTA STSOC Verification Period

Sample	Test Start Date	Test Organism	Units	Control Result	Sample Result	Significant Effect
Head Cell	03/05/2001	waterflea	neonates/adult	23	27.4	no
Head Cell	03/05/2001	waterflea	total neonates	230	274	no
Head Cell	03/05/2001	waterflea	% survival	90	90	no
Head Cell	03/05/2001	minnow	% survival	72.5	65	invalid due to control mortality
Head Cell	03/05/2001	minnow	mg/larva	0.2813	0.2829	invalid due to control mortality
Head Cell	03/07/2001	green algae	cells/ml	380153	1795747	no
Shellrock PSTA	03/05/2001	waterflea	neonates/adult	23.1	8.4	yes
Shellrock PSTA	03/05/2001	waterflea	total neonates	208	76	yes
Shellrock PSTA	03/05/2001	waterflea	% survival	100	0	yes
Shellrock PSTA	03/05/2001	minnow	% survival	92.5	50	yes
Shellrock PSTA	03/05/2001	minnow	mg/larva	0.3203	0.1858	yes
Shellrock PSTA	03/07/2001	green algae	cells/ml	360693	2099393	no
Peat PSTA	03/05/2001	waterflea	neonates/adult	26.8	30.8	no
Peat PSTA	03/05/2001	waterflea	total neonates	268	277	no
Peat PSTA	03/05/2001	waterflea	% survival	100	100	no
Peat PSTA	03/05/2001	minnow	% survival	90	62.5	yes
Peat PSTA	03/05/2001	minnow	mg/larva	0.2551	0.206	no
Peat PSTA	03/07/2001	green algae	cells/ml	501533	1960933	no
Head Cell	04/23/2001	waterflea	neonates/adult	21.1	31.9	no
Head Cell	04/23/2001	waterflea	total neonates	169	319	no
Head Cell	04/23/2001	waterflea	% survival	80	100	no
Head Cell	04/23/2001	minnow	% survival	100	72.5	yes
Head Cell	04/23/2001	minnow	mg/larva	0.2878	0.274	no
Head Cell	04/25/2001	green algae	cells/ml	908833	2096213	no
Shellrock PSTA	04/23/2001	waterflea	neonates/adult	26.5	34.4	no
Shellrock PSTA	04/23/2001	waterflea	total neonates	265	344	no
Shellrock PSTA	04/23/2001	waterflea	% survival	100	100	no
Shellrock PSTA	04/25/2001	minnow	% survival	90	52.5	yes
Shellrock PSTA	04/25/2001	minnow	mg/larva	0.2638	0.3297	no
Shellrock PSTA	04/25/2001	green algae	cells/ml	913693	2037800	no
Peat PSTA	04/23/2001	waterflea	neonates/adult	6.4	33.6	no
Peat PSTA	04/23/2001	waterflea	total neonates	51	336	no
Peat PSTA	04/23/2001	waterflea	% survival	80	100	no
Peat PSTA	04/23/2001	minnow	% survival	87.5	95	no
Peat PSTA	04/23/2001	minnow	mg/larva	0.2796	0.3633	no
Peat PSTA	04/25/2001	green algae	cells/ml	874313	2294027	no

The Algal Growth Potential Test was also conducted by FDEP on samples collected from the PSTA Test Cells in March 2001. Insignificant algal growth was measured in the head cell and PSTA Test Cell outlets. The measured algal growth potential was 0.132 mg dry weight/L for the head cell sample and less (<0.100 mg dry weight/L) in the outflow samples from the peat and shellrock PSTA Test Cells. Limiting nutrient algal growth potential tests were not performed on these samples.

Based on existing information, there does not appear to be an adequate basis to determine if a full-scale PSTA would result in an environmental imbalance in downstream waters.

4.3.7.4 Cost-Effectiveness of Technology

Costs for the full-scale PSTA scenarios were summarized in Exhibit 4-33. Based on the conservative sizing and design criteria used in this analysis, and omitting the STA-2 costs, the 50-year present worth cost for a PSTA treating the post STA-2 flow to 20 µg/L with 0 bypass would be approximately $455,000,000, with a unit cost of approximately $700/lb of TP removed. To attain 12 µg/L, the estimated present worth cost is approximately $889,000,000, with an estimated unit cost of $1,080/lb TP removed.

These estimated costs are very sensitive to a number of factors including:

- Presence and thickness of a limerock or lime soil amendment
- The PSTA footprint area as affected by the hydraulic TIS model used for simulation
- The effects of deep percolation
- Actual inflow TP loads
- The target TP outflow concentration
- The quantity of inflow water that bypasses the PSTA

All of these variables create significant uncertainty related to the estimated costs in this STSOC. As currently evaluated, the base costs summarized in Exhibit 4-33 for 0-percent bypass are conservative. Additional information that might relax the stated design assumptions and requirements for soil amendment and that increase hydraulic efficiency are likely to result in significant cost estimate reductions.

4.3.7.5 Implementation Schedule

The startup period for PSTA was assessed in a total of 27 mesocosm studies (Test Cells and Porta-PSTAs). While there was some variability between treatments, the typical time from commencement of inflows to stable performance was from 3 to 6 months. The optimal seasons for startup were spring and summer. It is likely that startup through the fall and winter months would require a longer stabilization period.

The time needed for implementation of a full-scale PSTA is dependent on the treatment alternative selected, the site selection and acquisition process, preliminary and final engineering and design completion, bidding and contractor selection, construction completion, and startup. The time required for each of these components is estimated based on observations from prior District projects, such as the implementation of STA-3/4, the largest of the existing STAs. Based on the presumed start date of January 1, 1999 (as stipulated by the District's STSOC guidelines), the estimated time required for final completion and compliance with water quality standards is December 2004 (72 months), as itemized below and illustrated in Exhibit 4-45:

- Alternative analysis, site selection, and land acquisition – 24 months
- Preliminary engineering, including site-specific studies – 6 months
- Final engineering and preparation of design drawings and specifications – 6 months
- Bidding and contractor selection – 4 months
- Construction – 20 months
- Startup and compliance with water quality standards – 12 months

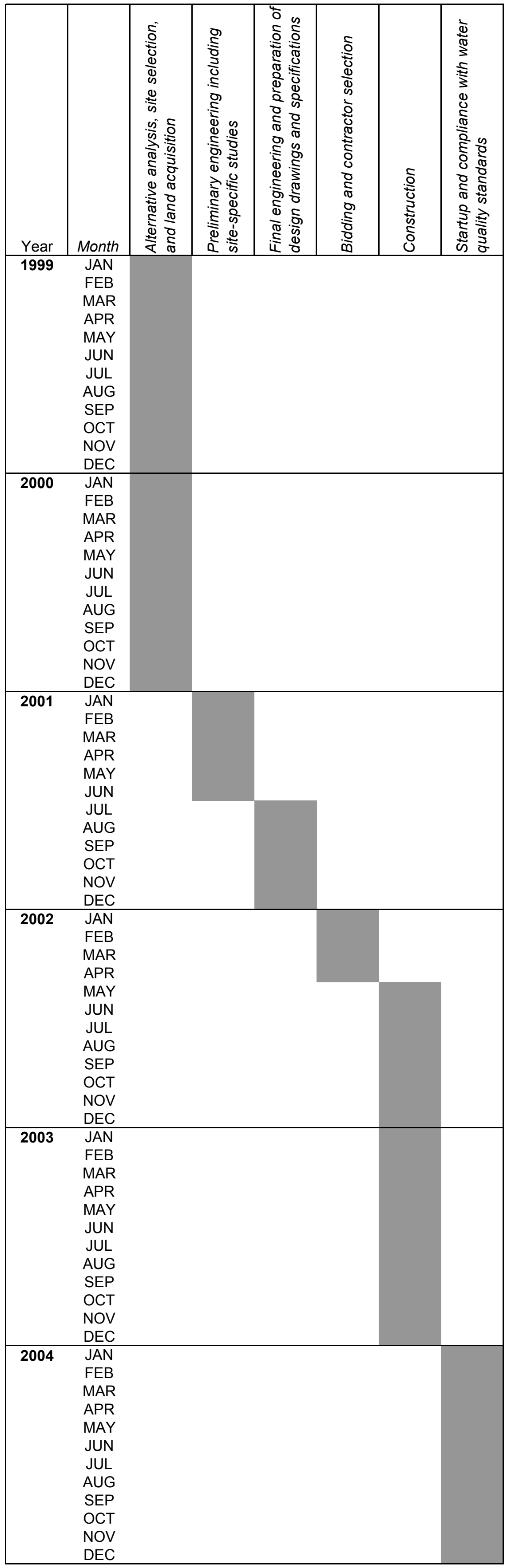
4.3.7.6 Feasibility and Functionality of Full-Scale Design

In some ways, PSTA is the least developed of the supplemental technologies. Significant research on design and performance of PSTAs has only been underway for approximately 3 years. No full-scale PSTA systems have been designed, constructed, or operated, nor are any of the existing PSTA systems operated to meet specific outflow discharge permit requirements. For these reasons, the feasibility, costs, and reliability of full-scale PSTA implementation should be evaluated cautiously.

On the other hand, large-scale, periphyton-dominated areas have been providing water with a low TP concentration for decades. The southern area of WCA 2A is dominated by a mixture of calcareous periphyton and sawgrass plant communities. This area has produced a long-term average TP concentration of approximately 14.3 μg/L (arithmetic average) or 10.5 μg/L (geometric mean) (Kadlec, 1999). Further downstream in WCA-2A, annual average TP concentrations range between 5 and 12 μg/L. Payne et al. (2001) reported the median annual TP geometric mean as 8.5 μg/L at the reference stations located in WCA-2A. Wet prairie and slough areas of WCA-1 had a median geometric mean TP concentration of approximately 9.1 μg/L (Payne et al., 2001). Areas of the Everglades National Park are also dominated by calcareous periphyton plant communities and have low ambient concentrations of TP. It is important to note that none of these existing full-scale systems were specifically designed to optimize TP removal and, therefore, their greater- or lesser-performance in relation to an engineered PSTA is not known.

There are many potential research issues that could provide additional certainty prior to full-scale PSTA design and implementation. These items have been

EXHIBIT 4-45
Implementation Schedule of a Full-scale PSTA



previously summarized as part of ongoing ATT team meetings. Critical research topics related to PSTA implementation include:

- Response of the PSTA periphyton and sparse macrophyte plant communities to a range of inlet TP concentrations and flow rates
- Management issues related to maintaining periphyton dominance over emergent and submerged aquatic macrophytes
- Soil pre-treatment options and effectiveness
- Effects/benefits of placing multiple PSTA cells in series
- Benefits/liabilities of high current velocities and winds on PSTAs
- Effects of long-term soil accretion on PSTA performance and engineering design

Additional information related to some of these topics has been gathered from the District's Field-Scale PSTA demonstration project currently underway. A plan to use the District's STA 1-W Test Cells to quantify the effects of cells-in-series, pulsed inlet loading, and combination of PSTA with other natural wetland treatment technologies (emergent and submerged macrophytes) was recently developed and should be re-considered for funding.

4.3.7.7 Operational Flexibility and Sensitivity to Fire, Flood, Drought, and Hurricane

As a land-intensive treatment option, the PSTA technology offers a potentially high level of operational flexibility and resilience to natural perturbations. Large water volumes can be stored within the footprint of the proposed PSTA during high rainfall events. Effects of this storage on performance are not known. Higher input TP loads can be assimilated to some extent due to relatively long residence times, and response to low TP loads is not expected to be a problem. Unlike other supplemental technologies, such as emergent and submerged macrophyte dominated STAs, the PSTA system is currently expected to recover relatively quickly from dessication occurring from drought. Fairly rapid recovery (approximately 2 weeks) was demonstrated during an early summer dry-out test and reflects the possible ability of the periphyton to be fully dessicated and recover its P-removal ability within a period of hours or days following rewetting. While this P uptake may start rapidly upon rewetting, optimal treatment performance of the PSTA will likely require an initial period of holding water without release.

Because they have less potential fuel, PSTAs are not as likely to carry a wildfire as are macrophyte-dominated STAs following a drought. High winds are known to mobilize some periphyton, resulting in the apparent potential for movement and washout of periphyton biomass during extreme weather events. However, periphyton growing in an open matrix of sparse macrophytes appears to be relatively immune to high biomass export.

4.3.7.8 Residual Solids Management

Forecast modeling described in the final PSTA report indicated that periphyton/ accreted solids harvesting was unlikely to contribute to a significant increase in TP load reduction. Periphyton harvesting would also result in an unmanageable amount of wet biomass needing disposal. For this reason, there is no side stream or residual management envisioned for this technology. The PSTA sizing and costs estimated in this report are based on no biomass harvesting and export.

4.3.8 Summary of Full-Scale PSTA Implementation Issues

Engineered PSTAs have been studied only during a 4-year research and demonstration period and only at a relatively small scale (mesocosms and Test Cells with areas ranging from 6 m^2 to 2,000 m^2 [65 ft^2 to 22,000 ft^2]). Larger-scale (20,000 m^2 [5 acre]) PSTA demonstration cells are in an early operational stage, and were ongoing at the time of the STSOC analysis. Assessment of the cost and reliability of full-scale PSTAs intended to treat very large volumes of stormwater runoff is based on these existing databases, model simulations, and cost and construction assumptions described in this report. These estimates of system design and performance are subject to considerable uncertainty until additional information is gathered and analyzed. Thus, while the information generated during the study period has dramatically increased our understanding of the engineerability of PSTAs, and the data have supported the preliminary STSOC analysis, it is premature to conclude that sufficient information is in hand to support detailed design and technology application full-scale.

Results to date for performance of PSTAs for post-STA TP load reduction are promising. TP mass reduction rates are dependent on TP load and are as high as or higher than removal rates of other natural wetland-based technologies. In addition, PSTAs offer the potential to achieve lower TP outflow concentrations than emergent macrophyte STAs and wetlands dominated by SAV and have the ability to recover relatively quickly following drought. They are not subject to fire or significant impairment from hurricanes or other foreseeable natural disasters. They are not likely to create an ecological imbalance in adjacent aquatic environments.

PSTAs do have limitations for full-scale application for TP load reduction. Land area requirements estimated by the STSOC analysis are large, requiring many thousands of acres to meet low TP concentration targets downstream from the existing STAs. Area estimates for PSTAs are subject to the uncertainty described above, and additional research on effects of pulsing, infiltration, cells-in-series design, and antecedent soil conditions on TP-removal performance is sorely needed.

In addition to their relatively large footprint, PSTAs will require an undetermined amount of plant management and/or alteration of pre-existing soil conditions. Placement of relatively inert soils to cover agricultural lands with high antecedent concentrations of available P may not be practical on a large scale. However, it is clear from the existing research that, at least during the early operational phase, relatively small amounts of available soil P will offset P-removal potential of any of the natural wetland treatment technologies near background TP concentrations. An additional effect of these elevated soil TP levels for PSTA is their apparent stimulatory effect on colonization and growth of emergent macrophytes that may out-compete the desired calcareous periphyton plant communities. While we have not yet identified how to optimize PSTA design and operations on peat substrates, the reality is that this is the system that prevails in the natural Everglades. Further research on peat-based PSTAs is strongly recommended in spite of the early results obtained to date.

Because there are few potential tools available to the regulator who wishes to achieve very low TP standards and Everglades protection, it is prudent to continue to refine knowledge of PSTA design and the potential of PSTAs for TP control. Their best use might be in conjunction with other "pre-treatment" technologies, such as emergent macrophyte STAs or SAV wetlands. Whether as standalone or integrated treatment units, PSTAs offer the potential to help achieve the environmental goals in the Everglades of South Florida.

4.4 Summary of PSTA Sustainability

A 2-year period of operation cannot fully evaluate PSTA sustainability. The PSTA Forecast Model provides a tool to predict future performance beyond the research timeframe; however, the accuracy of such predictions is significantly limited by the operational data. Based on the model, the ability of PSTA to provide removal of TP from agricultural drainage waters does not improve or decline with system age. The PSTA Forecast Model predicts a background TP concentration of approximately 3 to 5 µg/L based on rainfall inputs alone. The model extrapolates that 10 µg/L outflow concentrations can be achieved under some loading conditions and based on relatively large footprint areas. The estimated PSTA area needed to achieve 10 µg/L or lower concentrations is still under evaluation.

Macrophytes will likely need management in a full-scale PSTA. The amount of macrophyte management will depend on the range of inflow TP concentrations. More management will be needed with high inflow TP and less with low inflow TP. Macrophyte management is most likely to be in the form of herbicide application, water level control, and system dryout.

The biological community is expected to continue to capture, cycle, and accrete P as long as there is volume in a treatment cell for sediment accretion. The current research project did not accurately define that net accretion rate, but it appears to be less than an average of approximately 5 cm/yr. Assuming a conservative accretion rate of 2.5 cm/yr (see Section 3.5.3 for measured accretion rates), this would result in the accumulation of approximately 1.25 m of new soils in a 50-year project life. This rate of soil formation will require inclusion of a comparable embankment height to contain water during the project's life.

There is considerable uncertainty concerning the actual rate of soil accumulation in a PSTA undergoing periodic dry outs.

Finally, a PSTA *per se* is not expected to create unfavorable water quality conditions in downstream waters. Water quality changes, such as reduction of TP concentrations and slight shifts in concentrations of calcium, alkalinity, color, DO, and pH, are not likely to cause any harm to adjacent Everglades ecosystems. However, because of the large footprint of this technology, harmful anthropogenic chemicals (potentially including herbicides, metals, and TP), if present in pre-existing soils, could leach into the water column of a PSTA or any other "green" technology and create water quality problems. Site selection and preliminary soil sampling to quantify antecedent conditions will be a key factor in implementation and sustainability of a full-scale PSTA.

SECTION 5

Remaining PSTA Research Issues

5.1 Introduction

From 1998 to 2002, the PSTA Research and Demonstration Project has identified a number of key issues related to determining the feasibility of full-scale PSTA design and performance, and has addressed those issues within the practical limitations of allocated time and funding. That research agenda was constantly updated throughout the multi-year project with consultation from the District's scientific and engineering staff and based on detailed review of experimental treatments and data by a distinguished outside Scientific Review Panel (SRP).

At the time of this report, research is ongoing at a larger, field-scale site with four 5-acre PSTA cells located near STA-2. These are the largest constructed PSTAs that have been studied. Continued efforts by the District staff at this site could help to better answer remaining design questions related to alternative soil preparation techniques, groundwater exchange rates, and increased flow velocities in large-scale PSTA systems.

This section describes key remaining PSTA research issues that should be further evaluated if the District elects to better define PSTA long-term performance and costs for TP control.

5.2 Status of Field-Scale PSTA Testing

The Field-Scale PSTAs were operated under the contract between the District and CH2M HILL through December 30, 2002. Beginning in early 2003, District staff assumed the responsibility of Field-Scale PSTA operations. These operations will be extended for approximately 1 year at a minimal level of research activity.

Some of the following topics could be investigated as elements of further Field-Scale PSTA studies.

5.3 PSTA Plant Community Establishment and Control

A key issue is the most effective means of controlling establishment and succession of the periphyton-dominated plant community in a PSTA. While it is clear that it is not feasible to control specific algal species in the periphyton, a desire may exist to control the periphyton community type (e.g., blue-green calcitic-dominated rather than green filamentous). At this point, which type of periphyton assemblage is best for P removal and over what water P concentration range is not known with certainty. It is also not known how to manage the plant community so one type of periphyton dominates the community biomass. Studies by others have suggested the potential benefits of iterative dryout periods as a means of encouraging dominance by calcitic algal forms, but no definitive, experimentally based demonstration of this approach has been published.

A related issue is the effect of macrophytes on TP removal performance and periphyton dominance. The effect of different macrophyte groups (e.g., submerged versus emergent), macrophyte species (e.g., spikerush versus cattails), and macrophyte biomass density and shading on long-term TP removal performance has not been fully documented by the research to-date. A better understanding of how to control the densities of these various macrophyte assemblages to provide optimal cover so that periphyton dominance is maintained would be helpful.

Many large and small-scale research efforts could be designed and undertaken to investigate PSTA plant community management thoroughly. The list of ideas below is provided to identify other prospective study topics that would have value for better understanding PSTA design and operations issues.

- Porta-PSTA research platform
  - Combined effects of TP, DRP, and calcium on periphyton community structure (e.g., effects of P fractions and loads as well as total calcium)
  - Effects of flow velocity on periphyton community structure and export (e.g., variable speed re-circulation pumps to regulate flow velocities)
  - Effects of different macrophyte groups and species on periphyton biomass (e.g., test major SAV and emergent species including hydrilla, southern naiad, chara, bladderwort, spikerush, sawgrass, and cattails)
  - Effects of differing soil types on macrophyte and periphyton colonization (e.g., various sources of peat and sand soils)
  - Methods for controlling macrophyte colonization and succession (e.g., pre-emergent herbicides, herbicide application rates, mechanical harvesting, water depth control, soil seed bank sterilization, etc.)

- Test Cell and Field-Scale research platforms
  - Synoptic community structure sampling from inlet to outlet to relate community succession and structure to the gradient of P concentrations and forms
  - Macrophyte management at a larger scale (e.g., herbicide application techniques, both pre-emergent and post-emergent)

5.4 PSTA Optimization on Soils with High Antecedent P Levels

The PSTA research conducted to-date has illustrated the consequences of labile P in antecedent soils. It is clear that antecedent soil TP availability affects performance and attainable background TP concentrations (C^*_{TP}). It also appears likely that soils providing a source of available P will impair PSTA performance during a significant startup period. In addition, antecedent storages of available P in soils promote the colonization of macrophytes that compete with periphyton for available sunlight. It may be impractical to establish a PSTA on peat-based soils without amending those soils in some way to sequester any existing labile P. Several such soil amendments/pre-treatments tested in the PSTA Research and Demonstration Project included:

- Covering peat soils with shellrock, sand, and limerock
- Adding chemical amendments, such as aluminum, iron, or calcium to peat soils to bind with available P
- Rinsing sand soils with a dilute solution of hydrochloric acid to remove available P

While some form of these treatments might be technically feasible on a larger scale, it is not clear at this time that any of these treatments will be cost-effective. Additional research should be conducted at the Porta-PSTA or Test Cell scales to more fully evaluate the effectiveness and cost of various types of soil amendments on PSTA performance. Suggested Porta-PSTA research efforts are outlined below:

- Further testing of various forms of calcium (lime, hydrated lime, crushed limestone, etc.), lime addition rates, and methods for lime addition (broadcast, flood, roto-till, etc.)
- Test different depths of limerock and shellrock addition over peat soils
- Test various types of native soils (farmed versus non-farmed soils; soils from areas adjacent to existing cattail-based STAs, etc.)
- Test various types of sandy soils and methods of trapping antecedent labile P concentrations

These studies are recommended as a follow-on to the Field-Scale soil amendment study completed in Phase 3.

5.5 PSTA Cells in Series

Multiple cells-in-series or high length-to-width ratios may enhance treatment performance of any type of wetland plant community treatment system (Kadlec, 2001b). Enhanced performance results from improved hydraulics that better simulate plug-flow conditions and the optimization of first-order removal processes that depend on concentration. The PSTA mesocosms have hydraulics between plug flow and completely mixed, and on the basis of tracer studies conducted as part of this study may be described hydraulically as from 1.2 to 2.7 TIS during Phase 1, 3.8 to 4.1 TIS during Phase 2, and 9 to 25 TIS in Phase 3 Field-Scale PSTAs (see Kadlec, 2001a and Appendix G).

The cells-in-series concept could be tested in the ENRP Test Cells as part of a second phase of testing of integrated treatment processes. Alternatively, this concept could be easily tested on a smaller scale by linking a number of Porta-PSTA tanks in series and documenting performance.

5.6 PSTA Performance at High Inlet P Loads

Because natural calcareous periphyton communities are known to occur at low P water concentrations, the PSTA concept has been considered only as a final polishing step (post-STA application) and not for use at the front-end of a P management project. While this concept may be logical, it has not been thoroughly tested in the EAA. Algal-turf scrubber technology has been shown to be effective for trapping P at much higher inlet concentrations and loads than those tested as part of this program (Adey et al., 1993; Craggs, 2000; Hydromentia, 2000). Even if PSTAs will not find use at the beginning of a treatment train, it would be helpful to understand their performance response along a more complete gradient of P concentrations and loads.

5.7 PSTA Performance under Variable Hydraulic Loads

Hydraulic theory and wetland data analysis indicate that average treatment performance may be altered under variable inlet loads compared to steady operation (Kadlec, 2001c). Performance may be reduced under highly variable loads, such as those resulting from stormwater inputs. The PSTA concept has not been tested under a regime of widely variable loads, both from varying inlet concentrations and flows.

Both the Test Cells and the FSCs could be effectively used to provide a test of the effect of variable loading on PSTA performance.

5.8 Review of Long-Term PSTA Datasets

The District's PSTA Research and Demonstration Project conducted operational monitoring of tank and Test Cell systems for 2 years, which is the longest time span of any PSTA research effort to-date. However, water flow and quality data exist from other periphyton-dominated sites, such as the Water Conservation Areas, the C-111 Basin, and ENP. All of these locations existed for many more years than the District's PSTA research systems. Some of the data from these periphyton-dominated ecosystems could be examined to estimate PSTA performance in a mature plant community and for a longer time period. Also, ecological data exist for some of these systems that may provide insight into the natural periphyton and macrophyte succession in these areas and how that plant community development relates to soil chemistry and P loads.

5.9 Summary of PSTA Research Needs

While considerable knowledge has been gained as a result of the District's PSTA Research and Demonstration Project, much remains to be learned. This section highlighted some of the most important unresolved research topics. Answers to these questions would help optimize PSTA design and increase the cost-effectiveness of this technology.

Key remaining PSTA research issues include:

- Factors that affect plant community establishment and management
- Available options and effects of soil amendments and effects of antecedent soil P on C^*_{TP}
- Benefits of placing PSTA cells in series
- PSTA performance as a function of high inlet TP concentrations and loads
- PSTA performance under highly variable hydraulic loads

These potential field research efforts should be combined with a thorough literature and data review relevant to P removal performance and ecological development of naturally occurring periphyton-dominated plant communities in the greater Everglades area.

PSTAs appear to have substantive potential for being a part of the approach for modifying the existing STAs to achieve compliance with the anticipated TP criterion of 10 ppb. Additional investigations are needed to better address sustainability issues, and refine how to apply the cumulative PSTA knowledgebase toward full-scale design and optimization.

SECTION 6

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APPENDIX A

Field Methods and Operational Summary

APPENDIX A.1

Methods Summary

APPENDIX A.1

Methods Summary

Before commencing the PSTA Research and Demonstration Project, CH2M HILL prepared a research plan (CH2M HILL, 1999; 2000; 2001) and submitted a Quality Assurance Project Plan (QAPP) to FDEP for review (CH2M HILL, 1999; 2000; 2001). The QAPP details sampling procedures, analytical methods, and quality control samples used during the PSTA project. This section provides an overview of the sampling methods and laboratory analyses that were used for the PSTA Research and Demonstration Project. All of these methods are addressed in greater detail in the latest copy of the *PSTA Research Plan* (CH2M HILL, 2001). Detailed Standard Operating Procedures (SOPs) for site maintenance, operation, and sample collection are provided in Appendix A.2. A summary of key project activities from January 1999 to September 2002 is provided in Appendix A.3.

A.1.1 Quality Assurance/Quality Control

Laboratory personnel follow procedures outlined in the laboratory's Comprehensive Quality Assurance Plan (CompQAP) for sample kit preparation, tracking and analysis of samples, and data validation. CH2M HILL field personnel follow procedures outlined in CH2M HILL's CompQAP for the execution of field activities, proper completion of chain-of-custody forms, sample preservation requirements, and proper handling of samples. Strict adherence of holding times for all parameters is observed. CH2M HILL's SOPs for sample collection and preparation are summarized in Appendix A.2.

Field meters were calibrated by the field team in accordance with the manufacturer's recommendations and consistent with standard procedures outlined in CH2M HILL's CompQAP. Calibration results were recorded in the field notebook.

During each sampling event, the following field quality assurance/quality control (QA/QC) samples were collected as follows:

- Duplicate samples at a rate of 10 percent of total samples
- Equipment blanks at a rate of 5 percent of total samples

A.1.2 Meteorological Measurements

The District maintains a number of weather stations throughout the ENR. Data from these installations were used when necessary to fill the information needs described in this section.

A.1.2.1 Incoming Solar Radiation

Total insolation and photosynthetically active radiation (PAR) were measured continuously during the period of all mesocosm experiments at the south ENR advanced treatment technology site and at the Field-Scale Cell PSTA project site.

PAR was measured continuously using special sensors above the water surface, and periodically with depth in each mesocosm. Periodic measurements were taken in representative test systems to determine the variation in total PAR and light extinction as a function of water depth, side-to-side variation, and longitudinal variation. A light extinction coefficient was calculated for each mesocosm for all sampling events.

A.1.2.2 Precipitation

The District routinely records precipitation in the vicinity of the ENR project (STA-1W). These data were used for the ENR PSTA Test Cell and Porta-PSTA water balances. Precipitation records from S7-R were used for the Field-Scale Cell water balances.

A.1.2.3 Pan Evaporation

The District records pan evaporation in the vicinity of the ENR project. These data were used for the ENR PSTA Test Cell, Porta-PSTA and Field-Scale Cell water balances. PSTA evapotranspiration (ET) was estimated as 0.77 times pan evaporation.

A.1.2.4 Air Temperature

Air temperature was continuously recorded at the south technology research site in the ENR and at the Field-Scale PSTA project site.

A.1.3 Physical Measurements

A.1.3.1 Water Depth

Staff gauges were installed in all test systems to provide a convenient means of measuring water depth during routine field visits. Water level recorders were installed in the three ENR PSTA Test Cells by the District and in the Field-Scale Cells by CH2M HILL.

A.1.3.2 Water Temperature

Submersible thermistors were used to record temperature in each mesocosm on a rotating basis, and in FSC-3 on a continuous basis.

A.1.3.3 Water Flow Rates

Inflows to the PSTA Test Cells were estimated based on head cell stage and inlet orifice diameter using rating curves developed by the District. Head cell water stage was recorded every 0.5 hours and reported by the District. PSTA Test Cell outflows were estimated by visually measuring the water height over 90-degree v-notch weirs. Water stage was measured intermittently using staff gauges and continuously by water upstream and downstream level recorders in each cell by the District.

Inflow rates to the Porta-PSTAs were routinely checked for accuracy (at least twice per week) by measuring the time required to fill a sample container with known volume. Outflow rates from the Porta-PSTAs were measured by use of a graduated cylinder and a stopwatch at least weekly from all Porta-PSTA mesocosms.

Inflows to the Field-Scale Cells were monitored beginning on November 8, 2001, when ultrasonic flow meters were installed on all four inflow manifolds. Prior to November 8, inflow were estimated based on water level records, which indicated when the pumps were running and the average pumping rate. Some inflow measurement problems continued to arise because of low water levels in the inflow canal. Inflow numbers were estimated for a few limited periods when water level records indicated that the inflow meters were not accurately recording flows. Outflows were estimated through use of a recording water level sensor and a weir equation for flow over a 24-inch horizontal weir (Agri-drain stoplug) with end constrictions.

A.1.4 Water Quality Measurements

PSTA water samples were collected at a variety of sample points and with different methods. Some samples were collected from inflow and outflow lines, others were collected as grab samples below the water surface, and others were collected by use of compositing samplers. This section briefly describes the water quality analyses that were routinely made during the PSTA Research and Demonstration Project. Parameters and sampling frequencies are outlined in Exhibit A.1-1 (Test Cells), Exhibit A.1-2 (Porta-PSTAs) and Exhibit A.1-3 (Field-Scale Cells).

A.1.4.1 Field Parameters

Dissolved Oxygen. Dissolved oxygen (DO) was routinely measured in the PSTA mesocosms using a Hydrolab Minisonde Multiprobe. Diel DO profiles were measured with the same instrument outfitted with a data logger for continuous operation.

Hydrogen Ion. Hydrogen ion (pH) was measured using a Hydrolab Minisonde Multiprobe. Diel pH profiles were measured with a recording instrument intended for continuous operation.

Specific Conductance. Specific conductance was measured using a Hydrolab Minisonde Multiprobe. Diel conductivity profiles were measured with a recording instrument intended for continuous operation.

A.1.4.2 Laboratory Parameters

Water samples were routinely collected as grabs from the mesocosms for analysis of P and nitrogen (N) forms, total organic carbon (TOC), total suspended solids (TSS), calcium, and alkalinity.

P Speciation. Exhibit A.1-4 illustrates the analytical procedures that were used to speciate the various forms of P in water samples for the PSTA project. Water samples were collected in clean sample containers in the field, with 250 milliliters (mL) being filtered through a 0.45 micrometer (μm) filter for measurement of total dissolved P (TDP) and dissolved reactive P (DRP). TP and TDP fractions were acidified with ultra-pure sulfuric acid. The two filtrate samples were digested (standard persulfate digestion) in the laboratory to estimate TDP, and directly measured without digestion for DRP. The unfiltered sample was digested (persulfate digestion) with perchloric acid and analyzed for TP. The difference

EXHIBIT A.1-1

Phase 2 PSTA Test Cell Sampling Plan (November 2000 - March 2001) - SRP Workshop

		Sample Frequency				Number of Samples		
Parameter	**Sampling Period (months)**	**Combined Inflow**	**Inflow**	**2/3**	**Outflow**	**Field**	**QC**	**Total**
Field Sampling								
Flow	5	C(I)	W	NS	W	126	0	126
Water temperature	5	C(I)	W	M	W	141	0	141
Dissolved oxygen	5	C(I)	W	M	W	141	0	141
pH	5	C(I)	W	M	W	141	0	141
Conductivity	5	C(I)	W	M	W	141	0	141
PAR	5	NS	NS	M	NS	15	0	15
Water Quality Analyses								
Phosphorus (P) Series								
Total P	5	W	M	Q	W	102	20	122
Dissolved Reactive P	5	M	M	Q	M	38	8	46
Total Dissolved P	5	W	M	Q	W	102	20	122
Nitrogen (N) Series								
Total N	5	M	Q	Q	M	26	5	31
Ammonia N	5	M	Q	Q	M	26	5	31
Total kjeldahl N	5	M	Q	Q	M	26	5	31
Nitrate+nitrite N	5	M	Q	Q	M	26	5	31
Total organic carbon	5	M	Q	Q	M	26	5	31
Total suspended solids	5	M	Q	Q	M	26	5	31
Calcium	5	M	Q	Q	M	26	5	31
Alkalinity	5	M	Q	Q	M	26	5	31
Biological Analyses								
Periphyton Cover	5	NS		M		15	0	15
Macrophyte Cover	5	NS		M		15	0	15
Periphyton Dominant Species	5	NS	NS	Q	NS	3	0	3
Biomass (AFDW)	5	NS	NS	M	NS	15	3	18
Calcium	5	NS	NS	M	NS	15	3	18
Cholorophyll a, b,c, phaeophytin	5	NS	NS	M	NS	15	3	18
Phosphorus (P) Series								
Total P	5	NS	NS	M	NS	15	3	18
Total Inorganic P	5	NS	NS	M	NS	15	3	18
Non-reactive P	5	NS	NS	Q	NS	3	1	4
Total kjeldahl N	5	NS	NS	Q	NS	3	1	4
Sediments								
Phosphorus (P) Series								
Total P	5	NS	NS	E	NS	3	1	4
Total Inorganic P	5	NS	NS	E	NS	3	1	4
Non-reactive P	5	NS	NS	E	NS	3	1	4
Phosphorus Sorption/Desorption	5	NS		E		0	0	0
Total kjeldahl N	5	NS	NS	E	NS	3	1	4
Total organic carbon	5	NS	NS	E	NS	3	1	4
Bulk density	5	NS	NS	E	NS	3	1	4
Solids (percent)	5	NS	NS	E	NS	3	1	4
Accretion	5	NS	NS	Q	NS	3	0	3
System-Level Parameters								
Gross primary productivity	5	NS		Q		3	0	3
Net primary productivity	5	NS		Q		3	0	3
Community respiration	5	NS		Q		3	0	3
Standard of Comparison Sampling (Shifted Over From Field Scale)								
Sulfate	1	NS	5X	NS	5X	90	18	108
Dissolved ions/metals (Al, Fe, Ca, Mg, K, Si, Na, Cl)	0	NS	5X	NS	5X	90	18	108
Turbidity	0	NS	5X	NS	5X	90	18	108
Mercury (methylated)	0	NS	(D)	NS	(D)	60	12	72
Algal growth potential and chronic toxicity - *Selenastrum*	0	NS	5X	NS	5X	30	6	36
Chronic toxicity - *Cyprinella*	0	NS	5X	NS	5X	30	6	36
Chronic toxicity - *Ceriodaphnia*	0	NS	5X	NS	5X	30	6	36

Notes:

Assumes number of mesocosms = 3

W = weekly

M = monthly

Q = quarterly

A = annually

(D) = sampled by District

C(I) = continuous with instrument

NS = not sampled

na = not applicable

E = End of study phanse

EXHIBIT A.1-2
Phase 2 PSTA Porta-PSTA Sampling Plan (April 2000 - October 2000)

Parameter	Sampling Period (years)	Sample Frequency: Combined Inflow	Inflow	1/2	Outflow	Number of Samples: Field	QC	Total
Field Sampling								
Flow	0.5	NS	C(I)	NS	W	624	0	624
Water temperature	0.5	C(I)	W	M	W	1392	0	1392
Dissolved oxygen	0.5	C(I)	W	M	W	1392	0	1392
pH	0.5	C(I)	W	M	W	1392	0	1392
Conductivity	0.5	C(I)	W	M	W	1392	0	1392
PAR	0.5	NS	NS	M	NS	144	0	144
Water Quality Analyses								
Phosphorus (P) Series								
Total P	0.5	W	M	Q	W	842	168	1010
Dissolved Reactive P	0.5	W	M	Q	M	362	72	434
Total Dissolved P	0.5	W	M	Q	W	842	168	1010
Nitrogen (N) Series								
Total N	0.5	M	Q	Q	M	246	49	295
Ammonia N	0.5	M	Q	Q	Q	150	30	180
Total kjeldahl N	0.5	M	Q	Q	M	246	49	295
Nitrate+nitrite N	0.5	M	Q	Q	M	246	49	295
Total organic carbon	0.5	M	Q	Q	M	246	49	295
Total suspended solids	0.5	M	Q	Q	M	246	49	295
Calcium	0.5	M	Q	Q	M	246	49	295
Alkalinity	0.5	M	Q	Q	M	246	49	295
Biological Analyses								
Periphyton Cover	0.5	NS		M		144	0	144
Macrophyte Stem Count	0.5	NS		M		144	0	144
Periphyton Dominant Species	0.5	NS		M		144	0	144
Biomass (AFDW)	0.5	NS		M		144	29	173
Calcium	0.5	NS		M		144	29	173
Chlorophyll a, b,c, phaeophytin	0.5	NS		M		144	29	173
Phosphorus (P) Series								
Total P	0.5	NS		M		144	29	173
Total Inorganic P	0.5	NS		M		144	29	173
Non-reactive P	0.5	NS		Q		24	5	29
Total kjeldahl N	0.5	NS		Q		48	10	58
Sediments								
Phosphorus (P) Series								
Total P	0.5	NS		M		144	29	173
Total Inorganic P	0.5	NS		M		144	29	173
Non-reactive P	0.5	NS		Q		24	5	29
Phosphorus Sorption/Desorption	0.5	NS		A		12	0	12
Total kjeldahl N	0.5	NS		Q		48	10	58
Total organic carbon	0.5	NS		Q		48	10	58
Bulk density	0.5	NS		M		144	29	173
Solids (percent)	0.5	NS		M		144	29	173
Accretion	0.5	NS		A		12	0	12
System-Level Parameters								
Gross primary productivity	0.5	NS		Q		48	0	48
Net primary productivity	0.5	NS		Q		48	0	48
Community respiration	0.5	NS		Q		48	0	48
Totals						**12342**	**1081**	**13423**

Notes:

Assumes number of mesocosms = 24
W = weekly
M = monthly
Q = quarterly
A = annually

(D) = sampled by District
C(I) = continuous with instrument
NS = not sampled

EXHIBIT A.1-3
Field-Scale Cell Sampling Plan (August 2001 - Septemer 2002

	Sampling Locations and Frequency					
Parameter	**Piezometers**	**Inflow Canal**	**Inflow**	**1/2**	**Outflow**	**Outflow Canal**
Field Meter Readings						
Flow	NA	NA	Pump	NA	calc	NA
Water Stage	W	C(I)	W	C(I)	W	C(I)
Water temperature	M	W	W	C(I)	W	NA
Dissolved oxygen	NA	W	W	C(I)	W	NA
pH	M	W	W	C(I)	W	NA
Conductivity	M	W	W	C(I)	W	NA
Total Dissolved Solids	M	W	W	C(I)	W	NA
Turbidity	M	W	W	C(I)	W	NA
PAR	NA	NA	NA	M	NA	NA
Water Quality Analyses						
Phosphorus (P) Series						
Total P	M	W	M	M	W	NS
Dissolved Reactive P	NS	W	M	M	W	NS
Total Dissolved P	NS	W	M	M	W	NS
Nitrogen Series						
Total N	NS	NS	M	M	M	NS
Ammonia N	NS	NS	M	M	M	NS
TKN	NS	NS	M	M	M	NS
Nitrate+nitrite N	NS	NS	M	M	M	NS
Total Suspended Solids	NS	NS	M	M	M	NS
Total Organic carbon	NS	NS	M	M	M	NS
Calcium	NS	NS	M	M	M	NS
Alkalinity	NS	NS	M	M	M	NS
Chlorides	M	NS	M	M	M	NS
Biological Analyses						
Periphyton Cover	NS	NS	NS	M	NS	NS
Macrophyte Cover	NS	NS	NS	M	NS	NS
Periphyton Dominant Species	NS	NS	NS	Q (a)	NS	NS
Biomass (AFDW)	NS	NS	NS	Q (a)	NS	NS
Calcium	NS	NS	NS	Q (a)	NS	NS
Chlorophyll *a, b, c,* phaeophytin	NS	NS	NS	Q (a)	NS	NS
Phosphorus (P) Series						
Total P	NS	NS	NS	Q (a)	NS	NS
Total Inorganic P	NS	NS	NS	Q (a)	NS	NS
Non-reactive P (fractionation)	NS	NS	NS	Q (a)	NS	NS
TKN	NS	NS	NS	Q (a)	NS	NS
Accretion (Net Organic/Inorganic)	NS	NS	NS	Q (a)	NS	NS
Sediments (Start and End)						
Phosphorus (P) Series						
Total P	NS	NS	NS	S/M/E	NS	NS
Total Inorganic P	NS	NS	NS	S/M/E	NS	NS
Non-reactive P (fractionation)	NS	NS	NS	S/M/E	NS	NS
Phosphorus Sorption/Desorption	NS	NS		S/M/E		NS
Total Kjeldahl N	NS	NS	NS	S/M/E	NS	NS
Total Organic Carbon	NS	NS	NS	S/M/E	NS	NS
Bulk density	NS	NS	NS	S/M/E	NS	NS
Solids (percent)	NS	NS	NS	S/M/E	NS	NS
System-Level Parameters						
Gross primary productivity	NS	NS		C(I)		NS
Net primary productivity	NS	NS		C(I)		NS
Community respiration	NS	NS		C(I)		NS

Notes:

(a) Three replicate samples taken along the boardwalk of each cell.
W = weekly
M = monthly
Q = quarterly
(D) = sampled by District
C(I) = continuous with instrument

NS = not sampled
S/M/E = start, mid-point and end of study phase
NA = not applicable

between TP and TDP is equal to total particulate P (TPP). The difference between TDP and DRP is equal to dissolved organic P (DOP).

Nitrogen Series. Surface water N concentrations were determined at a reduced schedule compared to P. The full N series was analyzed to allow calculation of total nitrogen (TN). These analyses included: total Kjeldahl nitrogen (TKN) (organic + ammonia N), total ammonia N (inorganic reduced N), and nitrate + nitrite N (inorganic oxidized N).

TOC. TOC was measured to provide additional information on carbon transfer into and out of the experimental mesocosms.

TSS. TSS integrates most of the particulates in the water column. Because P is easily transported in a particulate form, TSS provides an important confirmatory estimate of the particulate TP fraction that is entering and exiting the mesocosms.

Calcium and Alkalinity. Co-precipitation of P with calcium carbonate is hypothesized to be an important process in PSTA TP retention. Calcium availability is directly measured as total calcium, while carbonate alkalinity is measured to document the amount of dissolved inorganic carbon available for this chemical precipitation pathway.

A.1.5 Sediment Analyses

Sediment samples were collected from the 0 to 10 cm depth interval, using plastic coring tubes (approximately 5 cm inside diameter) driven by hand into sediments or by directly filling sample containers from the surface layer. Roots and rhizomes were analyzed as part of the sediments.

A.1.5.1 P Sorption/Desorption Isotherms

P sorption and desorption were initially measured on the limerock, shellrock, sand, and peat substrates that were used in the PSTA test systems. Sorption/desorption experiments were conducted by exposing each substrate type to a range of P concentrations from 0 to 1.0 mg TP/L. These samples were purged with N_2 gas to create anaerobic conditions and placed on a mechanical shaker for 24 hours. After equilibration, the solution phase was analyzed to determine how much P had been sorbed in the solid phase. These soil samples were in turn exposed to water containing no spiked P, and the change in TP concentration after 24 hours was used to estimate their potential for TP desorption.

A.1.5.2 Dry Weight and Bulk Density

A sub-sample of each sediment sample of known volume was weighed, dried at 105°C for 72 hours, and re-weighed to determine percentage dry weight, water content, and bulk density.

A.1.5.3 Accretion Rate

Sediment accretion rate was estimated in the test systems by placement of horizon markers (feldspar) at the beginning of each Porta-PSTA and Test Cell experiment. Horizon markers were not evident by the end of the experiments and could not be used to assess accretion.

Accretion was estimated using sediment traps placed in the Porta-PSTAs and along the walkways in the Test Cells and Field-Scale Cells.

A.1.5.4 Sediment Chemistry

Sediments were routinely sampled and analyzed for various P fractions and for N and TOC. P was routinely fractionated using the scheme illustrated in Exhibit A.1-4, which divides this element into total inorganic P (TIP) and TP. Total organic P (TOP) was determined by difference. A more detailed fractionation scheme was also employed on a subset of the sediment core samples. This fractionation method is illustrated in Exhibit A.1-5 and identifies how much of the TP is in unavailable organic forms. Sediments were also routinely analyzed for TKN and TOC. Sediment sample fractions were compositedbetween Porta-PSTA treatments and internal stations of each ENR South Test Cell and Field-Scale Cell for the analysis of non-reactive P.

A.1.6 Biological Measurements

A.1.6.1 Population Sampling

Periphyton. Periphyton was sampled as a component of the whole water-column biotic community. A floating ring (approximately 250 cm^2) was placed on the water surface at a stratified random location. If present, the periphyton floating mat was clipped along the inside edge of the ring, removed, and transferred to the sample container. A plastic coring tube was placed through this ring and vertically lowered to the sediment surface and rotated to cut any plants or filamentous algae on the surface of the sediments. All macrophyte plant material was collected within this column and transferred to a Ziploc® bag for dry weight analysis. All benthic, metaphyton, and epiphyton within the coring tube were collected in a decontaminated bucket. The total volume was measured and recorded, and the periphyton sample was blended with deionized water for laboratory analysis. If no periphyton mat was evident, a clear PVC corer was used to collect 3 to 6 benthic algae cores within the larger plastic coring tube. This benthic algae corer has an inside diameter of approximately 3.8 cm and a sampling area of approximately 11.4 cm^2. A stop ring is attached to the outside of the tube so that it only penetrates the sediments to a depth of 1 cm or less. The entire water column and benthic layer in each of these three to six samples was composited for laboratory analysis.

Macrophytes. Macrophytes occurring in all three test systems types were identified to species, and their emergent stems were counted (Porta-PSTAs) and/or their percent cover estimated. Total macrophyte biomass was measured through a limited amount of destructive sampling at the end of the Porta-PSTA experiments.

A.1.6.2 Community Biomass

The total biomass in the water column was sampled and analyzed as described previously. Biomass samples were weighed wet, and then dried at 104°C for 72 hours to obtain a dry weight. Samples were ashed at 500°C in a muffle furnace for 1 hour, allowed to cool in a dis-sector, and reweighed to get an ash-free dry weight (AFDW) and an ash weight. Percent

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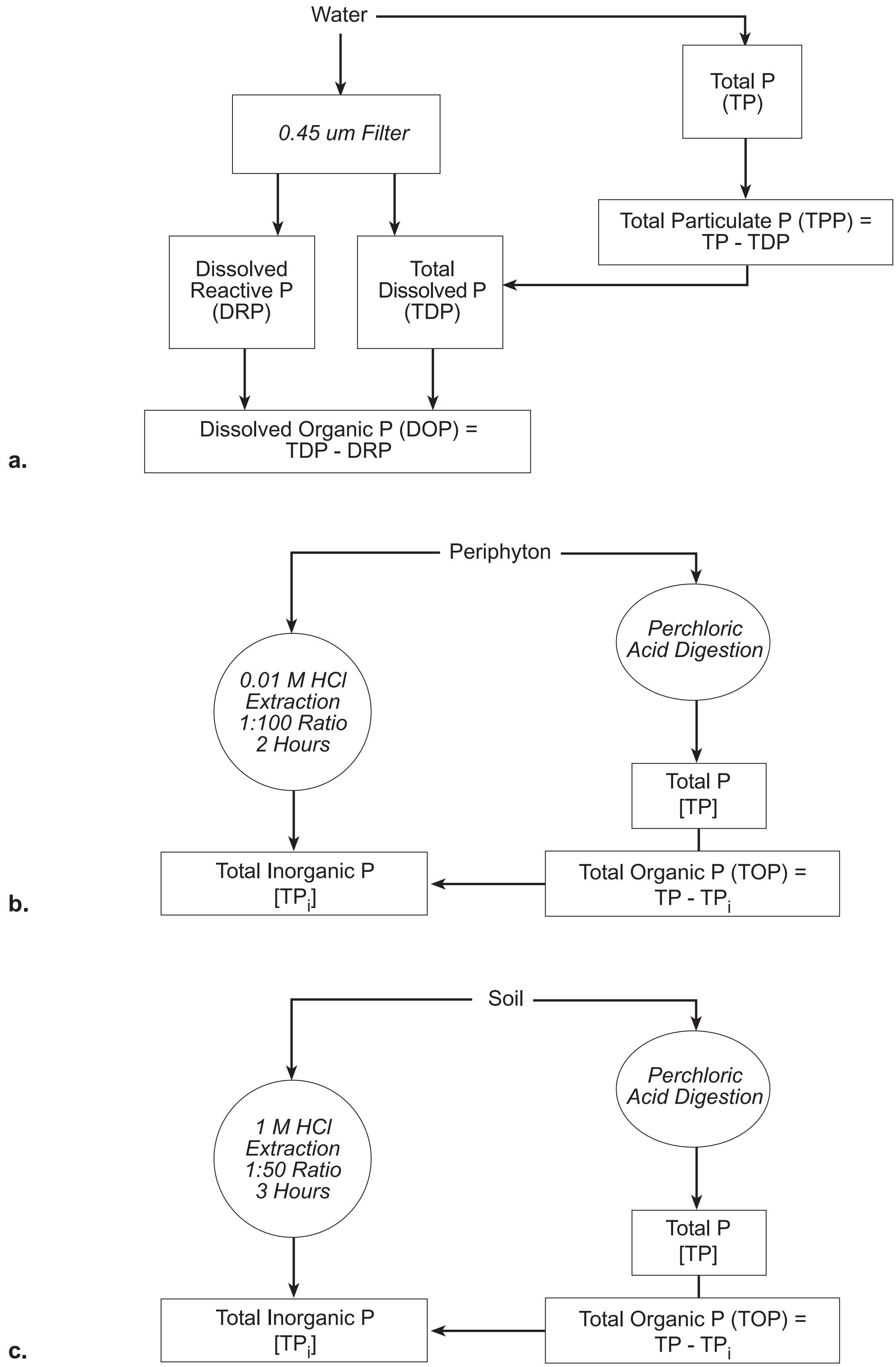

Exhibit A.1-4. Routine Phosphorus Fractionation Methods for a. Water Samples, b. Periphyton Samples, and c. Sediment Samples

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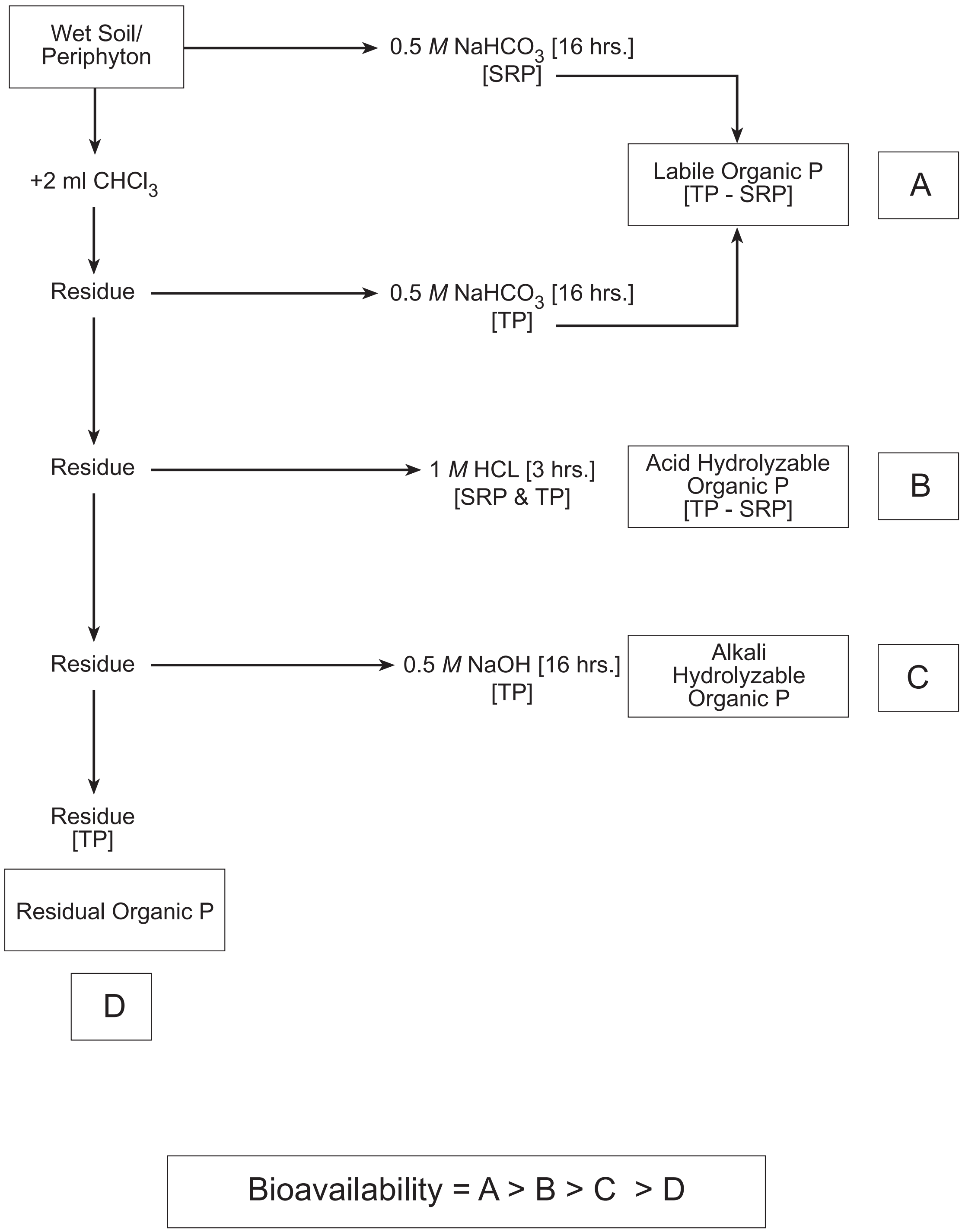

Exhibit A.1-5. Detailed Phosphorus Fractionation Scheme for Selected Periphyton and Sediment Samples solids were calculated as the dry weight divided by the wet weight. AFDW was calculated subtracting the ash weight from the dry weight. All biomass results are expressed on an area basis equal to the sampling area of the acrylic cylinder.

A.1.6.3 Plant Growth Pigments

A subsample of the periphyton biomass sample was analyzed for chlorophyll *a*, *b*, and *c*, and for the chlorophyll breakdown product phaeophytin. These pigments help to characterize the overall proportion of the periphytic algal community in classes including green (chlorophyta) versus non-green algae (such as blue-greens). Phaeophytin content is a sensitive indicator of algal population health and decomposition.

A.1.6.4 P Fractionation

Exhibit A.1-4 illustrates the routine P fractionation scheme that was used for periphyton samples. These methods allowed determination of TIP, TP, and TOP by difference. A more detailed P fractionation scheme was used for a limited subset of representative periphyton samples (Exhibit A.1-5). This procedure separated the bioavailable organic P from the truly unavailable organic P. Periphyton sample fractions were composited between Porta-PSTA treatments and internal stations of each ENR South Test Cell and Field-Scale cell for the analysis of non-reactive P.

A.1.6.5 Nitrogen

The organic N content of the periphyton was determined by measuring TKN.

A.1.7 System-Level Parameters

A.1.7.1 Community Metabolism

Community metabolism can be expressed as gross primary productivity (GPP) or as community respiration (CR). These two parameters are generally similar in magnitude in adapted ecosystems (GPP:CR ratio is equal to 1). Both parameters as well as net primary productivity (NPP) were measured in the experimental PSTA systems.

Upstream/Downstream Oxygen Method. A modified upstream-downstream oxygen rate-of-change method of Odum (1956) and Odum and Hoskins (1957) was used for measurement of community metabolism. Given the low flow rates in the mesocosms, a modified method similar to the dawn-dusk method was used. Diel oxygen concentration profiles were measured at the one- and two-third walkways in the Test Cells and at the center point of the Porta-PSTAs. Water inflow and outflow at these stations were assumed to be negligible, and oxygen rate-of-change was determined for successive measurements at the one station rather than as the difference between upstream and downstream measurements.

Oxygen rate-of-change curves were calculated at each station and corrected for estimated diffusion. Solar radiation (PAR) was measured at the water surface during diel oxygen studies and converted to incident energy by multiplying photons (Einsteins) by a conversion factor of 52.27 Cal/Einstein calculated for sun and sky radiation (McCree, 1972).

Community Respiration. The value of the nighttime oxygen rate-of-change curve, corrected for diffusion (if necessary), provides an estimate of CR (oxygen consumption in g $O_2/m^3/hr$). Nighttime values were averaged, multiplied by 24 hours, and multiplied by the average water depth to estimate the 24-hour community respiration in g $O_2/m^2/d$. This calculation is based on the generally accepted assumption that daytime respiration is the same as nighttime respiration.

Net Primary Production. The integrated area under the daytime oxygen rate-of-change curve, corrected for diffusion (if necessary), provides an estimate of NPP. The positive area under the daylight rate-of-change curve was measured and multiplied by the average water depth to get the average daily NPP in g $O_2/m^2/d$. NPP was also estimated from water-column sampling and changes in biomass summed with community export and sediment accretion.

Gross Primary Productivity. GPP was estimated as the sum of NPP and CR.

Production:Respiration Ratio. The production:respiration ratio was calculated as GPP/CR.

A.1.7.2 Community Export

Community export was measured directly by filtering the outflow from each type of mesocosm and determining TSS. TSS in g/m^3 was multiplied by water outflow in m^3/d and divided by mesocosm area in m^2 to get community export in g dry weight/m^2/d.

A.1.7.3 Periphyton Decomposition

The periphyton community decomposition rate was measured in the Porta-PSTA mesocosms and ENR Test Cells during the study period using samples of periphyton collected by core sampling, subsampling known volumes (with measured dry weight, AFDW, and P fractions), placing these subsamples in screened acrylic cylinders, and incubating these cylinders in the mesocosms for a 1-week or longer period before collection, drying, biomass determination, and P fractionation. Biomass-specific decomposition rates were estimated from these determinations.

A.1.8 Laboratory Analytical Procedures

Exhibit A.1-6 summarizes the analytical methods and target reporting limits for parameters monitored in the ENR Test Cells, the Porta-PSTAs mesocosms and Field-Scale Cells during Phases 1, 2 and 3 of the PSTA Research and Demonstration Project.

EXHIBIT A.1-6
Summary of Analytical Methods

Parameter	Analytical Method	Method Detection Limit	Units	Analytical Laboratory
Water Analyses				
Phosphorus (P) Series				
Total P	EPA 365.4	1.0	µg/L	IFAS
Total Dissolved F	EPA 365.1	1.0	µg/L	IFAS
Dissolved Reactive F	EPA 365.1	0.8	µg/L	IFAS
Nitrogen (N) Series				
Ammonia N	EPA 350.1/EPA 3503	0.003	mg/L	PPB/XENCO
Total kjeldahl N	EPA 351.2/EPA 3513	0.040	mg/L	PPB/XENCO
Nitrate+nitrite N	EPA 353.2/EPA 3533	0.050	mg/L	PPB/XENCO
Total organic carbor	EPA 415.1	0.030	mg/L	PPB/Columbia
Total suspended solids	EPA 160.2	4.00	mg/L	PPB/XENCO
Alkalinity	EPA 310.1	0.010	mg/L	PPB/XENCO
Calcium	EPA 160.0/E{A 6020)	0.050	mg/L	PPB
Color	EPA 110.2	5.000	pcu	PPB
Turbidity	EPA 180.1	0.5	NTU	PPB
Sulfate	EPA 375.4	2.00	mg/L	PPB
Total dissolved solids	EPA 160.1	3.00	mg/L	PPB/XENCO
Chloride	EPA 325.2/EPA 3253	0.20	mg/L	PPB
Dissolved aluminum	EPA 202.2	0.00	µg/L	PPB
Dissolved magnesium	EPA 258.1	0.050	mg/L	PPB
Dissolved potassium	EPA 200.7	0.500	mg/L	PPB
Dissolved sodium	EPA 200.7	0.500	mg/L	PPB
Dissolved iror	EPA 200.7	0.010	mg/L	PPB
Dissolved silica	EPA 370.1	0.50	mg/L	PPB
Selanastrum Tests	EPA 609/9-78-018 or FDEP SOP #TA 3.3	-	mg dry weight per L	Hydrosphere
Cyprinella Tests	EPA 600-4-91-002	-	NOEC	Hydrosphere
Ceriodaphnia Tests	EPA 600-4-91-002	-	NOEC	Hydrosphere
Periphyton Analyses				
Phosphorus (P) Series				
Total P	Kuo (1996) and Anderson (1976	23	µg/g	IFAS
Total Inorganic F	Scinto, L. J, and K. R. Reddy. 1997	2.3	µg/g	IFAS
Non-reactive F	Ivanoff et al. 1998	2.3	µg/g	IFAS
Biomass (AFDW)	SM10200I(5)	12.0	mg/L	PPB/Columbia
Chlorophyll a, b,c, phaeophytin	SM10200H(1,2)	<1.0	mg/m^3	PPB/Columbia
Total Kjeldahl N	EPA 351.4/E{A 351.3	1.00	µg/g	PPB/XENCO
Calcium	EPA 200.7/EPA 6020	0.10	mg/L	PPB/XENCO
Sediment Analyses				
Phosphorus (P) Series				
Total P	Kuo (1996) and Anderson (1976	23	µg/g	IFAS
Total Inorganic F	Ivanoff et al. 1998	2.3	µg/g	IFAS
Non-reactive F	Ivanoff et al. 1998	2.3	µg/g	IFAS
Bulk density	ASTM D2957	--	g/cc	Law Engineering
Percent solids	ASTM D2937	--	%	Law Engineering
Total Kjeldahl N	COE P #3-201-3-204/EPA 351.3	10.00	mg/kg	PPB/XENCO
Total organic carbor	CE-81-1-9060/ASTM D4129-82M	1.00	mg/kg	ENCO/Columbia

IFAS = University of Florida Institute of Food and Agricultural Science
NOEC = No observable effect concentration

APPENDIX A.2

PSTA Standard Operating Procedure Manual

APPENDIX A.2

PSTA Standard Operating Procedure Manual

The following standard operating procedures (SOPs) were followed for fieldwork at the Porta-PSTA mesocosms and ENR South Test Cells from February 1999 to April 2001 and at the Field Scale Cells from July 2001 through September 2002.

Standard Operating Procedure **Page**

Porta-PSTA Inflow/Outflow Calibration and System Flushing

Equipment Required

500 mL graduated cylinders, stopwatch

Monday Calibrations

1. Record start time and staff gauge reading in spaces provided on *Inflow Calibration and Outflow Log* fieldsheet for the Porta-PSTA that is being calibrated.
2. Using a graduated cylinder, collect outflow of the tank for 30 seconds. Double this value to obtain flow in milliliter per minute (mL/min). Record value on fieldsheet.
3. Repeat at tank inflow. Record inflow value in mL/min in appropriate space provided on fieldsheet.
4. Open inflow valve to flush line. Wearing latex glove, manually remove any excess algal growth from spigot opening. Reduce flow and calibrate in same manner with graduated cylinder and stopwatch to prescribed flow rate. Final inflows may vary by +/-20% from prescribed flow rate. Record time at which final inflow was calibrated and recorded.
5. Repeat steps 1–4 for all tanks.
6. Final outflow readings are taken a minimum of 1 hour after final inflow calibrations are made. Final outflow readings are preferentially taken the longest feasible time in the day after final inflow calibrations are made. Record time at which final outflow was recorded.

Thursday Calibrations and System Flushing

1. Follow steps 1–3 as for Monday Calibrations. Perform outflow recordings and initial inflow recordings on all Porta-PSTAs without performing final inflow flushing and calibration.
2. After completing initial outflow/inflow readings, flush the main line along fence that carries water in from the canal. Open the valve to allow water to flow to slough outside fence then immediately close the valve to prevent water flow to the Head Tank. Allow water to flow freely until the water clears. Open valve to Head Tank, then close valve to slough.
3. Open valve under Head Tank to flush accumulated sediments. Allow water to drain until water clears. Close valve. Open valve of pipe leading from Head Tank to Porta-PSTAs. Allow water to run freely until clears. Close valve.
4. Flush the lines (2) that run along the ground at Porta-PSTA inflows. Allow water to run freely until water clears. Close valves.
5. After all system lines have been flushed, begin again with Step 4 as in Monday Calibrations, flushing the Porta-PSTA inflow valve and calibrating to required flow rate. It may be necessary at times to remove valve and clean with a brush.
6. Perform final outflow readings as in Monday Calibrations.

Porta-PSTA Water Quality Sampling

Equipment Required

Appropriate sample bottles 0.45 µm filters, sulfuric acid, de-ionized water

1. Complete inflow/outflow calibration for all tanks to be sampled that day, minimize contact with inflow and outflow pipes before sampling to avoid dislodging particles.
2. Rinse outflow tube with deionized (DI) water (Zephyrhills brand) to dislodge any loose particles.
3. Sampling schedule is as follows:

	Weekly Event	Monthly Event	Quarterly Event
Inflow	-	TP, TDP, DRP	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
Center	-	-	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
Outflow	TP, TDP, DRP	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS

4. *Note*: Dissolved Reactive Phosphorus is sampled only at the Head Tank. Field duplicates are taken at a rate of 1 per 10 samples; equipment blanks are taken at a rate of 1 per 20 samples. When taking a field duplicate, note sampling location and time in space provided on the fieldsheet pertaining to that Porta-PSTA. Do not note location on field duplicate bottles. Note time of collection of equipment blank(s) on Head Tank fieldsheet.
5. All sample bottles need to be completed with the following information: initials of sample team, date, and time. Collection time is the same for all bottles filled at a particular sampling station.
6. Take outflow sample first. Do not allow blue outflow tube to come in contact with sample bottle. For those sample bottles that come pre-preserved, take care not to overflow the sample bottle and dilute the preservative. Contrarily, the water sample may be collected in a large bottle containing no preservative and aliquotted into the smaller sample bottles.
7. When applicable, collect samples from center locations next. To collect these samples, place inverted bottle under the water. At mid-depth, slowly turn the bottle upright to allow water to enter, making an effort to cause as little disturbance as possible. At center sample locations, it will be necessary to pour water from one of the bottles containing no preservative into the pre-preserved bottles.

8. Inflow samples should be collected last. Do not allow sample bottles to come in contact with the inflow pipe.
9. Add 1 mL of H_2SO_4 to **TP** sample bottles as a preservative after sample collection. Cap and invert bottles after acid addition to mix thoroughly.
10. Filter **TDP** samples prior to shipping. Filters are one-time use filters. Verify that the Porta-PSTA number of the bottle being filtered from corresponds to the Porta-PSTA number of the bottle being filtered into. After filtering, add 1 mL of H_2SO_4 to preserve. Cap and invert bottles after acid addition to mix thoroughly. Water samples being analyzed for **DRP** do not receive any preservative.
11. Write collection times from sample bottles on corresponding field collection sheets and Chain of Custody sheets prior to shipping.
12. Place bottles in coolers lined with large garbage bags. Keep samples on ice until they are ready to be shipped. Prior to shipping, add two bags of ice to each cooler, knot bags. Tape chain of custody to inside lid of cooler. Tape cooler closed before shipping to laboratory.

Porta-PSTA Periphyton and Sediment Collection Techniques

Equipment Required

Standardized plastic sample ring, scissors, Ziplock bags (1 gallon), decontaminated buckets, plexi-glass cylinder (0.53-foot diameter), pocket staff gauge, small cylinder (0.13-foot diameter) with cap, appropriate sample collection bottles.

1. Determine a sample location using the random number tables that have already been generated. The 'X' value for the tank is the tank width (1 meter) and the 'Y' value for the tank is the tank length (6 meters). The sample location on the random number table is written as an X/Y coordinate. The 0,0 coordinate is at the southwest corner of the tank. Note the sample time on the data sheet.

2. Place the circle of plastic tubing on the water surface at the determined location. Using scissors, cut all aquatic vegetation that falls inside the cylindrical plane created by the plastic circle (plane extends above and below surface of the water). Place vegetation in a plastic Ziplock bag, labeled with Porta-PSTA number, to be sent to the lab for dry weight analysis. Note on data sheet if macrophytes were collected.

3. If a floating periphyton mat falls within the sample location, skim it off the water with your hand and place it in decontaminated plastic bucket marked for that station. Note on data sheet that floating mat was collected.

4. Take large plexi-glass cylinder and push it into the sediment at the same location where vegetation was just cleared. Once water has cleared, determine if a periphyton benthic mat exists. Measure water depth with pocket staff gauge and record on data sheet.

5. If a benthic mat exists, use your hand to skim mat off of the sediment. Try to get the entire mat in one piece if possible, disturbing as little of the sediment as possible. If shells or rocks are on bottom of the collected mat, remove them and place mat in decontaminated bucket. If the mat cannot be collected in one piece, continue collecting all other pieces until the entire mat is collected, again being careful to disturb as little sediment as possible.

6. If no benthic mat is present or appears that it is not possible to collect mat by hand, use the small cylinder cores to collect sample as follows. Place the small cylinder within the large cylinder. Place the red cap on top of the small cylinder and tighten down, making sure to only press the small cylinders approximately 2 centimeters (cm) into the sediment. Slowly lift small cylinder off the bottom while placing your hand over the bottom of the cylinder to keep sample from running out. Place contents of small cylinder into decontaminated bucket. If small cores are used multiple times, place them in a different area within the large cylinder each time (i.e., 12 o'clock, 3 o'clock, 6 o'clock, 9 o'clock). Record on data sheet the number of small cylinder cores collected.

7. After periphyton mat has been collected reach down with inverted sediment jar and scoop sediment into the pre-labeled jar, making sure to only collect the top 10 cm of sediment. After jar is filled, rinse it in the water within the large cylinder to send a "clean" sample jar to the lab.

8. Determine volume of periphyton collected as follows. In lab/trailer, place periphyton into blender. Using a known volume of lab grade DI water, dilute sample up to a measurable volume. Volume of periphyton sample is determined by subtracting amount of water added to the blender from total measurable volume in the blender. After volume of periphyton has been calculated, dilute sample to approximately 1,750 mL to have sufficient sample to fill all six specimen bottles. Re-suspend sample before aliquotting to specimen bottles.

Porta-PSTA Stem Count

Equipment Required

Hand counter, ¼ square meter (m^2) quadrat, PP-PAR, Stems, Cover Fieldsheet

Emergent stems are counted as part of the monthly sampling event in all Porta-PSTAs.

1. Each Porta-PSTA is effectively divided into thirds by two evenly spaced fiberglass cross pieces that support the tank. Stems are counted in each third of the tank created by these divisions. The fieldsheet notes Porta-PSTA thirds as North, Center, and South.
2. Count only live emergent stems. Record on fieldsheet species and number of stems per species for each third of Porta-PSTA tank being examined. Use hand counter/clicker to maintain an accurate count.
3. When stems are too dense to count visually, place the ¼ m^2 quadrat over a representative area. Count stems contained within the quadrat. Record raw number with the notation of “x32” to indicate the quadrat was used for the count. Multiplying the raw number by 32 will give the count equivalent to stems in the one-third-tank division in Porta-PSTAs 1–22. Porta-PSTAs 23 and 24 are 18 m^2 and, therefore, need to be multiplied by a factor of 96 to achieve equivalence of one third of the tank when employing the quadrat.

Porta-PSTA Sediment Trap Collection Technique

Equipment Required

Sediment trap lids, graduated cylinders (10, 100, 250, and 1,000 mL), sediment sample bottles.

1. Place lid on sediment trap while trap is submerged.
2. If several sediment traps are collected at a time, keep those not being immediately processed cold until they can be processed.
3. Wearing gloves, open container (some water may be lost, but little to no sediment will be lost, <1%). Decant off as much water as possible without losing any sediment.
4. Leave a little water in the container to allow washers (weights) to be rinsed off.
5. Remove any extraneous debris, such as snails, rocks, shells, or large pieces of plant material. Rinse any associated sediment from debris back into container.
6. Quantitatively transfer sediment/water slurry into graduated cylinder, scraping any sediment adhering to bottom or sides of container into cylinder.
7. Let settle 10–20 minutes.
8. Make note of total volume in cylinder (water plus sediment) and volume of the settled sediment only.
9. Decant off as much water as possible from cylinder and then let settle another 5-10 minutes (repeat this step if necessary).
10. Record final total volume and sediment volume in cylinder on data sheet.
11. Quantitatively transfer sediment/water slurry into 250 mL jar. If necessary, use squeeze bottle of lab grade DI water to rinse any material adhering to cylinder into specimen jar.
12. Place sample into cooler and keep on ice until all samples are ready to be shipped.
13. Items recorded on data sheet include: date, start time, PSTA number, sediment volume, total volume, and stop time.

Test Cell Water Quality Sampling

Equipment Required

10-foot PVC pole with Velcro tape, appropriate sample bottles, filters, sulfuric acid, DI water

All sample bottles need to be completed with the following information: initials of sample team, date, and time. Collection time is the same for all bottles filled at a particular sampling station.

Head Cell

1. Use pocket staff gauge to obtain a total depth. Water samples are collected at mid-depth. Take a sample bottle containing no preservative and secure it to the PVC sampling pole using the Velcro tape. Plunge the bottle down to mid-depth level and allow it to fill. Fill other sample bottles from the one secured to the pole; plunge as many times as necessary to fill all bottles. Avoid overfilling pre-preserved bottles to prevent loss of preservative.

Test Cells

1. Proceed to outflow of Test Cell. Secure labeled bottle to the PVC sample pole and lower to collect water over the weir 'v-notch'. Fill remaining bottles from one secured to the pole.
2. Sampling schedule is as follows:

	Weekly Event	Monthly Event	Quarterly Event
Inflow	-	TP, TDP, DRP	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
1/3 Walkway	-	-	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
2/3 Walkway	-	-	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
Outflow	TP, TDP, DRP	TP, TDP, DRP, Total N, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS
Head Cell	TP, TDP, DRP	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS

3. *Note*: Field duplicates are taken at a rate of 1 per 10 samples; equipment blanks are taken at a rate of 1 per 20 samples. When taking a field duplicate, note sampling location and time in space provided on the fieldsheet pertaining to that Test Cell. Do not note location on field duplicate bottles. Note time of collection of equipment blank(s) on Head Cell fieldsheet.

4. To collect water from the walkways, lower inverted bottle (containing no preservative) into water column to mid-depth. Slowly turn bottle upright allowing water to enter bottle, being careful to cause as little disturbance as possible. Fill preserved bottles from water sample collected in bottle containing no preservative.
5. To sample inflow water, remove black plastic inflow pipe from brass orifice. Hold bottle in front of outflow stream until full. The inflow water stream flows at a high rate, therefore bottles containing preservative should be filled from bottles containing no preservative.
6. Add 1 mL of H_2SO_4 to **TP** sample bottles as a preservative after sample collection. Cap and invert bottles after acid addition to mix thoroughly.
7. Filter **TDP** samples prior to shipping. Filters are one-time use filters. Verify that the Test Cell number of the bottle being filtered from corresponds to the Test Cell number of the bottle being filtered into. After filtering, add 1 mL of H_2SO_4 to preserve. Cap and invert bottles after acid addition to mix thoroughly. Water samples being analyzed for **DRP** do not receive any preservative.
8. Write collection times from sample bottles on corresponding field collection sheets and Chain of Custody sheets prior to shipping.
9. Place bottles in coolers lined with large garbage bags. Keep samples on ice until they are ready to be shipped. Prior to shipping, add two bags of ice to each cooler, knot bags. Tape chain of custody to inside lid of cooler. Tape cooler closed before shipping to laboratory for analysis.

Test Cell Water Level Recordings

Equipment Required

Pocket staff gauge, Test Cell Water Elevation Data fieldsheet

Head Cell

1. Read the staff gauge located on north edge of cell, and record value on Test Cell Water Elevation Data fieldsheet along with date and time.

Test Cells

1. Water level recorders are located at ends of east and west walkways of Test Cells in housing boxes. Read the value from tape in housing box (marked in 0.01-foot increments) at both the east and the west recorders; record time and values in appropriate slots of data sheet.
2. At the weir outflow box, read the weir height from the white PVC pole, marked in 0.1-foot increments. Use staff gauge to record in 0.01-foot increments. Record on Test Cell Water Elevation Data fieldsheet.
3. The weir box staff gauge is attached to the wall below the grate inside the weir box. Read the weir box staff gauge (it may be necessary to climb down into weir box to clean algae off gauge), marked in 0.01-foot increments. Record value on fieldsheet.
4. Use the pocket staff gauge to measure the height of the white PVC pole above the metal grate; record value on data sheet.
5. Read the volume of water moving over the v-notch denoted by the rubber stopper within the clear tube above the white PVC pole. The value is read at the bottom of the rubber indicator and must be read directly at eye level for an accurate measurement. Record value on data sheet.
6. Read staff gauge located at west end of Test Cells. Read and record staff gauge in 0.01-foot increments.
7. Repeat Test Cell recording procedures 1–5 at all Test Cells.

Test Cell Periphyton and Sediment Sampling

Equipment Required

Standardized plastic sample ring, scissors, Ziplock bags (1 gallon), decontaminated buckets, plexi-glass cylinder (0.53-foot diameter), pocket staff gauge, small cylinder (0.13-foot diameter) with cap, soil corer auger, appropriate sample collection bottles.

1. Sampling location along walkway is determined using random number tables. The distal end of the walkway is the random unit of '50'; each walkway division is considered a unit of '10.' Periphyton samples are collected on the east side of the walkway, and soil samples are collected on the west side of the walkway. Record start time on the data sheet.

2. Once a sample location has been selected, place the circle of plastic tubing on the surface of the water. Place the circle of plastic tubing on the water surface at the determined location. Using scissors, cut all aquatic vegetation that falls inside the cylindrical plane created by the plastic circle (plane extends above and below surface of the water). Place vegetation in a plastic Ziplock bag, labeled with Test Cell number, to be sent to the lab for dry weight analysis. Note on data sheet if macrophytes were collected.

3. If a floating periphyton mat falls within the sample location, skim it off the water with your hand and place it in decontaminated plastic bucket marked for that station. Note on data sheet that floating mat was collected. A small piece of floating mat needs to be placed in a labeled sample jar for taxonomy identification (no preservative added).

4. Take large plexi-glass cylinder and push it into the sediment at the same location where vegetation was just cleared. Once water has cleared, determine if a periphyton benthic mat exists. Measure water depth with pocket staff gauge and record on data sheet.

5. If a benthic mat exists, use your hand to skim mat off of the sediment. Try to get the entire mat in one piece if possible, disturbing as little of the sediment as possible. If shells or rocks are on bottom of the collected mat, remove them and place mat in decontaminated bucket. If the mat cannot be collected in one piece, continue collecting all other pieces until the entire mat is collected, again being careful to disturb as little sediment as possible.

6. If no benthic mat is present or appears that it is not possible to collect mat by hand, use the small cylinder cores to collect sample as follows. Place the small cylinder within the large cylinder. Place the red cap on top of the small cylinder and tighten down, making sure to only press the small cylinders approximately 2 cm into the sediment. Slowly lift small cylinder off the bottom while placing your hand over the bottom of the cylinder to keep sample from running out. Place contents of small cylinder into decontaminated bucket. If small cores are used multiple times, place them in a different area within the large cylinder each time (i.e., 12 o'clock, 3 o'clock, 6 o'clock, 9 o'clock). Record on data sheet the number of small cylinder cores collected.

7. Determine volume of periphyton collected as follows. In lab/trailer, place periphyton into blender. Using a known volume of lab grade DI water, dilute sample up to a measurable volume. Volume of periphyton sample is determined by subtracting amount

of water added to the blender from total measurable volume in the blender. After volume of periphyton has been calculated, dilute sample to approximately 1,750 mL to have sufficient sample to fill all six specimen bottles. Re-suspend sample before aliquotting to specimen bottles.

8. Sediment sample locations are also determined using random number tables and are collected on the west side of the walkway. Sediment samples are collected using the soil corer auger. The auger is rotated 10 cm deep into the sediments. The sediment is then removed from the auger, using a plastic spoon if necessary, and placed in a decontaminated bucket. Multiple cores may need to be collected to provide sufficient volume for all sampling jars. Before aliquotting sediment to respective labeled jars, blend cores for an even mixture. Record number of cores collected at each station on the data sheet. Record location of any field duplicates on data sheet pertaining to that Test Cell (do not write Test Cell location on field duplicate jars).

Field Scale Cell Water Quality Sampling

Equipment Required

Isco Auto-Sampler, 2.5 Gallon composite sample jug, hydrochloric acid, 10-foot PVC pole with velcro tape, appropriate sample bottles, filters, sulfuric acid, DI water

All sample bottles need to be completed with the following information: initials of sample team, date, and time. Collection time is the same for all bottles filled at a particular sampling station.

Inflow Canal

1. To collect TP composite samples, decon the 2.5 gallon Isco composite jug with 10% hydrochloric acid and a triple rinse of store bought DI water. Set Isco sampler to collect 125 mL of sample every two hours starting at 10:00 am the day before the field team is to be on-site to collect samples. On the day of sample collection remove composite sample jug from Isco, gently swirl jug to ensure water is well mixed and fill TP bottle only. Fill TP bottle slowly to ensure that no particulate matter which may be in the composite jug is poured into TP sample. Decon jug and reset Isco for the following week's samples.
2. To collect TDP and DRP samples take a sample bottle containing no preservative and secure it to the PVC sampling pole using the Velcro tape. Plunge the bottle down to mid-depth level and allow it to fill. Fill other sample bottles from the one secured to the pole; plunge as many times as necessary to fill all bottles.

Field Scale Cells

1. Sampling schedule is as follows:

	Weekly Event	Monthly Event	Quarterly Event
Inflow	-	TP, TDP, DRP, Total N, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides
Center Walkway	-	TP, TDP, DRP, Total N, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides
Outflow	TP, TDP, DRP	TP, TDP, DRP, Total N, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides	TP, TDP, DRP, Total N, NH_3, TKN, NO_3/NO_2, TOC, Ca^{++}, Alkalinity, TSS, Chlorides

Note: Field duplicates are taken at a rate of 1 per 10 samples; equipment blanks are taken at a rate of 1 per 20 samples. When taking a field duplicate, note sampling location and time in space provided on the fieldsheet pertaining to that Field Scale Cell. Do not note location on field duplicate bottles. Note time of collection of equipment blank(s) on Head Cell fieldsheet.

2. To collect outflow TP composite samples, decon the 2.5 gallon Isco composite jug with 10%hydrochloric acid and a triple rinse of store bought DI water. Set Isco sampler to collect 125 mL of sample every two hours starting at 10:00 am the day before the field team is to be on-site to collect samples. On the day of sample collection remove composite sample jug from Isco, gently swirl jug to ensure water is well mixed and fill TP bottle only. Fill TP bottle slowly to ensure that no particulate matter which may be in the composite jug is poured into TP sample. Decon jug and reset Isco for the following week's samples.
3. To collect all other sample parameters from the inflow, center walkway, and outflow secure un-preserved sample bottle to the PVC sampling pole using the Velcro tape. Plunge the bottle down to mid-depth level and allow it to fill. Fill other sample bottles from the one secured to the pole; plunge as many times as necessary to fill all bottles. Avoid overfilling pre-preserved bottles to prevent loss of preservative.
4. Add 1 mL of H_2SO_4 to **TP** sample bottles as a preservative after sample collection. Cap and invert bottles after acid addition to mix thoroughly.
5. Filter **TDP** and **DRP** samples prior to shipping. Filters are one-time use filters. Verify that the Field Scale Cell number of the bottle being filtered from corresponds to the Field Scale Cell number of the bottle being filtered into. After filtering, add 1 mL of H_2SO_4 to preserve **TDP** samples. Cap and invert bottles after acid addition to mix thoroughly. Water samples being analyzed for **DRP** do not receive any preservative.
6. Write collection times from sample bottles on corresponding field collection sheets and Chain of Custody sheets prior to shipping.
7. Place bottles in coolers lined with large garbage bags. Keep samples on ice until they are ready to be shipped. Prior to shipping, add two bags of ice to each cooler, knot bags. Tape chain of custody to inside lid of cooler. Tape cooler closed before shipping to laboratory for analysis.

Field Scale Cell Water Level Recordings

Equipment Required

Pocket staff gauge, Field Scale Cell Water Elevation Data fieldsheet, HP 48 calculator, data transfer cord.

1. At the weir outflow box, use the pocket staff gauge to record the distance from the top of the concrete weir box to the surface of the water in the cell. Record on Field Scale Cell Water Elevation Data fieldsheet.
2. Remove the top from the outflow agri-drain. Use the pocket staff gauge to measure the distance from the top of the agri-drain box to the surface of the water within the agri-drain box at the upstream (southern) most point. Record value on data sheet
3. Use the pocket staff gauge to measure the distance from the top of the agri-drain western channel to the top of the stop logs in the agri-drain. Record value on data sheet.
4. Read staff gauge located at center walkway of Field Scale Cells. Read and record staff gauge in 0.01-foot increments. Record time of sampling.
5. Digital Water Level Recorders are located at the outflow of each Field Scale Cell and in the inflow canal. Once a month, use the HP 48 calculator and data transfer cord to download the data from each water level recorder. Upon connecting to water level recorder the HP 48 calculator will automatically recognize which station is being downloaded and append the data to the appropriate file.
6. Repeat Test Cell recording procedures 1–5 at all Field Scale Cells.

Field Scale Cell Periphyton Sampling

Equipment Required

Standardized plastic sample ring, scissors, ziplock bags (1 gallon), decontaminated 2.5 gallon buckets, plexi-glass cylinder (16.15 cm diameter) , pocket staff gauge, appropriate sample collection bottles.

1. Periphyton sampling at the PSTA Field Scale cells will be conducted during quarterly sampling events.
2. Periphyton sampling transects will be located at three locations within each cell: at the mid-point of the inflow, center and outflow cell thirds.
3. Along a transect a total of 10 replicate samples will be collected, with all replicates composited into one transect sample. Replicates are collected within a known circular surface area of 204.7 cm^2 .
4. Once a representative sample location has been selected, place the circle of plastic tubing on the surface of the water. Using scissors, proceed to cut all aquatic vegetation that falls inside the cylindrical plane created by the plastic circle (plane extends above and below surface of the water). Place vegetation in a plastic ziplock bag, labeled with Field Scale Cell and transect number, to be sent to the lab for dry weight analysis. All macrophytes from replicate samples along a transect will be composited. Note on data sheet that macrophytes were collected and identify plant species.
5. If a floating periphyton mat falls within the sample location, skim it off the water with your hand and place it in decontaminated plastic bucket marked for that station. Note on data sheet that floating mat was collected. A small piece of floating mat needs to be placed in a labeled sample jar for taxonomy identification (no preservative added).
6. Take large plexi-glass cylinder and push it down into the sediment at the same location where vegetation was just cleared. Once water has cleared determine if a periphyton benthic mat exists. Measure water depth with pocket staff gauge and record on data sheet. Record presence of floating mat on data sheet.
7. If a benthic mat exists then reach down with your hand and skim mat off of the sediment. Make an effort to get the entire mat in one piece if possible, disturbing as little of the sediment as possible. If shells or rocks are on bottom of the collected mat then remove them and place mat in decontaminated bucket. If the mat cannot be collected in one piece, continue collecting all other pieces until the entire mat is collected, again being careful to disturb as little sediment as possible. Record presence of benthic mat on data sheet.
8. If no benthic mat is present record as such on data sheet and move on to next representative sample location.
9. Repeat steps 4 through 8 at all ten replicate sample locations along each transect and composite all sub-samples for each transect in 2 ½ gallon decontaminated bucket.

10. Place composited periphyton sample into graduated container. Fill 1 L graduated cylinder with lab grade de-ionized (DI) water. Add DI water to periphyton in graduated container until total volume in container is 1,000 ml. Volume of periphyton sample is determined by subtracting amount of water added to the container from total volume in the container. Determine the total amount of sample volume needed to fill all sample bottles. Place periphyton and DI water into composite bucket and dilute up to appropriate volume necessary to fill all sample bottles. Suspend periphyton through out sample using hand blender before aliquotting sample to specimen bottles. Record total periphyton volume, total volume of DI water, total blended volume and total number of collected cores on data sheet.
11. Save approximately 50 ml of blended sample from each transect. Composite 50 ml from each transect into one "cell composite" sample. Aliquot this composite to sample bottles to be sent to laboratory for taxonomy analysis.
12. When collecting periphyton for NP samples take small amount of representative periphyton mat from near location of each replicate sample along each transect (30 total locations per cell). Sample will be a "cell composite" of periphyton mat, with no blending or dilution of sample.

Field Scale Cell Sediment Sampling

Equipment Required

Decontaminated 2.5 gallon buckets, shovel, pocket staff gauge, 1 gallon ziplock bags, appropriate sample bottles

1. Sediment sampling transects will be located at three stations within each cell: at the mid-point of the inflow, center, and outflow cell thirds.
2. Using the shovel, sediment will be collected at three replicate sampling points along each transect, use the pocket staff gage to record the depth at each sample point.
3. Remove any periphyton or algal mat and macrophytes from the sample location. Fill the decontaminated bucket approximately one third full of sediment from the upper 0 to 10 cm at each of the replicate sampling points. Make an effort to collect only fine sediment and smaller rocks that can easily be ground and processed at the laboratory. Avoid collecting larger rocks and periphyton mat. If possible a sediment sampling location can be located at a periphyton sampling station where mat has already been removed.
4. Throughly mix full sample bucket and fill sample bottles. This sample is for total and total inorganic P analyses. Save extra sample material from transect for P fractionation composite.
5. Repeat sampling procedure at additional two transects for the cell and process samples as above, again saving sampling material from each transect for P fractionation composite.
6. Combine extra sample material from three transects into one cell composite sample. Throughly mix material in bucket and fill gallon ziplock bag with sediment. Mark bag for Phosphorus Fractionation Analysis.

Field Scale Cell Sediment Trap Collection Technique

Equipment Required

Accretion traps, lids, pocket staff gauge, graduated cylinders,appropriate sample bottles

1. Eight accretion traps were deployed in each PSTA Field Scale Cell in January 2002
2. In April 2002, locate two accretion traps within each cell to be collected.
3. Place lid on plastic container under water, record depth of trap location.
4. If more samples are collected than can be immediately processed make sure to keep extras cold.
5. Wearing gloves, open container (water usually spills out but very little sediment is lost <1%). Decant off as much water as possible while holding your hand on the side of the container, to make sure no sediment accidentally spills out (change gloves between decanting each sample).
6. Leave a little water in the container to allow you to rinse the sediment and periphyton mat off the sides of the trap.
7. Snails, rocks, shells, or large pieces of plant material should be removed from container, making sure to rinse off any sediment.
8. Make notes of dominant material in trap (periphyton mat, peat, snail droppings, etc.)
9. Pour remaining water, along with sediment into a graduated cylinder (when necessary scrape sediment or periphyton off the bottom/inside of the container during pouring and add to sample).
10. Combine the two replicate traps from each cell into one composite sample.
11. Let settle between 10-20 minutes (If initial settling seems insufficient, decant some water and let sample settle again).
12. Record final total volume and sediment volume in cylinder.
13. Decant off water and pour sample material into sample bottle, making sure to get as much material as possible out of cylinder (it may be necessary to tap graduated cylinder on the side of the sample bottle to get any material sticking to the sides of the cylinder, or a light DI water rinse may be used if necessary).
14. Place sample into cooler and keep on ice until all samples are ready to be shipped.
15. Items to be recorded on data sheet include: date, start time, PSTA number, sediment volume, total volume, and stop time.
16. Decontaminate accretion traps removed from cell and re-deploy into cell. Clearly mark location of re-deployed traps.
17. During July 2002 quarterly sampling event 2 traps from each cell will be collected: one that was deployed in January 2002 and one that was re-deployed after the April 2002

sampling event. The traps from each time period will be processed following the above described steps.

18. Two traps for each cell will be decontaminated and re-deployed in each cell, with locations being clearly marked.
19. During the October 2002 quarterly sampling events the process of collecting a trap that was deployed in January 2002 and trap that was re-deployed after the previous quarterly event will be repeated.

Field Readings

Equipment Required

Surveyor 4 unit, connecting cable, Sonde calibration supplies

1. Retrieve Sonde from Porta-PSTA or Test Cell. Record time and date that Sonde was retrieved for field readings on the meter rotation log.
2. Calibrate Sonde following standard field procedures.
3. Field readings are taken on water sampling days. See table below for meter reading schedule. Field readings are also taken at both the Head Cell and Head Tank with each event.

Meter Reading Location Per Sampling Event

	Weekly Event	Monthly Event	Quarterly Event
Porta-PSTAs	Inflow Outflow	Inflow Center Outflow	Inflow Center Outflow
Test Cells	Inflow Outflow	Inflow 1/3 walkway 2/3 walkway Outflow	Inflow 1/3 walkway 2/3 walkway Outflow
Field Scale Cells	Inflow Outflow	Inflow Center walkway Outflow	Inflow Center walkway Outflow

4. Field readings are most accurately taken beginning at the outflow and proceeding 'upstream.' Place the meter into the water at approximately mid-depth at each station.
5. Allow meter to stabilize for approximately 1 minute before taking reading.
6. Record appropriate information from the Surveyor 4 unit onto data sheet and proceed to next station.
7. Upon completion of all field readings, replace Sonde back in its appropriate tank according to the meter rotation. Record time and date of deployment on the meter rotation log.

Quarterly Non-Reactive Phosphorus Testing of Periphyton and Sediments

Materials Required

Decontaminated buckets, 250 mL widemouth sediment packer jar, spoon, 10% HCl, Publix-grade DI water, aluminum foil.

To decontaminate buckets, rinse with dilute (10% HCl). Triple rinse buckets with Publix-grade de-ionized water. Allow to air dry and cover with aluminum foil.

Sediment Composite Sampling

1. Collect a sediment sample from designated sampling location of Porta-PSTA mesocosm (or Test Cell) and place in decontaminated bucket. Sampling locations for the Porta-PSTAs are determined from the random number tables that have already been generated. The 'X' value for the tank represents width (1 meter) and the 'Y' value for the tank is length (6 meters). The sample location on the random number table is written as an X/Y coordinate. The 0,0 coordinate is the southwest corner of the tank. The random number for the Test Cells sampling location represents location along the walkway, 50 denoting distal end of walkway. Periphyton samples are taken on the east side of the walkway, soil samples on the west side of the walkway. Note the sample time on the data sheet.
2. Collect approximately equivalent amounts of sediment from each of the Porta-PSTA mesocosms (or Test Cells, if applicable) comprising same treatment regime.
3. Thoroughly mix composite sample either by swirling or with a spoon if necessary.
4. Remove sample to be sent for testing from this mixed composite and place in labeled sediment packer jar. Note time collected on appropriate datasheet.
5. Ship to appropriate testing facility.

Periphyton Composite Sampling

1. Collect a small amount (up to 70 mL) of periphyton from Porta-PSTA mesocosm (or Test Cell). Note on datasheet pertaining to that mesocosm (Test Cell or Field Scale Cell) if sampled periphyton is floating, benthic, or if both are sampled. Place periphyton specimen(s) in labeled sediment packer jar.
2. Note: Unlike periphyton sampling for monthly events, sampling periphyton for the composite NRP analysis is not limited to the area designated by the random number X/Y coordinate. Obtain a small sample of periphyton from any available location within the Porta-PSTAs for each treatment. Note on fieldsheet whether periphyton is benthic, floating, or epiphytic.
3. Collect periphyton from other mesocosms (or Test Cells or Field Scale Cells), if applicable) within the same treatment protocol and add to the labeled jar. Note final time on appropriate datasheet.
4. Ship to appropriate facility.

Sonde Calibration

Equipment Required

Lab-grade deionized DI water; drinking water, pH standards 7 and 10, specific conductivity buffer standard, Hydrolab Surveyor 4 unit.

1. Retrieve Sonde from Test Cell or Porta-PSTA (if this Sonde is to be used for field measurements, mark Sonde ID number and time retrieved on Field Rotation Sheet). For all Sonde Meter Rotation and calibration events, note Sonde number and location from which Sonde was retrieved on Calibration datasheet.
2. Attach cable connecting Sonde to Surveyor 4; make sure all connections are tight.

Dissolved Oxygen Calibration

1. Unscrew weighted cap protecting sensors and replace with a MiniSonde cup, with lid in place, filled halfway with drinking water. The appropriate amount of water is such that, with the Sonde vertically oriented with the sensors pointing up, the water line should be just level with the O-ring that secures the Dissolved Oxygen (DO) membrane.
2. With the Sonde in the upright position, loosen cap completely. Check that no water droplets are present on the DO membrane; if droplets are present, blot gently with a clean cloth and replace cap loosely.
3. From the Surveyor 4 unit, record DO (in milligrams per liter [mg/L]), DO %, and temperature pre-calibration readings.
4. Select Sonde.
5. From the displayed menu, highlight DO % and press Select.
6. Verify, or enter the current value as 760 mm Hg and press Done.
7. The Surveyor 4 unit should beep and give the message, "Calibration Successful!" and prompt to press any key to return. The "Go Back" key must then next be depressed to return the field displaying all parameters being measured.
8. Re-read DO, % DO, and temperature, and note in post-calibration section of the Meter Calibration sheet.
9. Tighten cap on MiniSonde cup and remove cup from probe.

Specific Conductivity

1. Rinse probe with DI water and place in Specific Conductivity buffer. Record pre-calibration reading.
2. Select Sonde.
3. From the displayed menu, highlight SpCond mS/cm and press Select.
4. Verify, or enter calibration units to 1.00 and select Done.
5. The Surveyor 4 unit should beep and give the message, "Calibration Successful!" and prompt to press any key to return. The "Go Back" key must then next be depressed to return the field displaying all parameters being measured.

6. Re-read Specific Conductivity and note in post-calibration section of the Meter Calibration sheet along with temperature.

pH Calibration

1. Rinse MiniSonde probe with DI water and place in pH buffer standard 10; record pre-calibration reading.
2. Rinse probe with DI water and place in pH buffer standard 7; record pre-calibration reading.
3. Select Sonde.
4. From the displayed menu, highlight pH: Units and press Select.
5. Verify, or enter calibration units to 7.00 and select Done.
6. The Surveyor 4 unit should beep and give the message, "Calibration Successful!" and prompt to press any key to return. The "Go Back" key must then next be depressed to return the field displaying all parameters being measured.
7. Re-read pH and note in post-calibration section of the Meter Calibration sheet.
8. Rinse probe with DI water and place in pH buffer standard 10.
9. Select Sonde.
10. From the displayed menu, highlight pH: Units and press Select.
11. Verify, or enter calibration units to 10.00 and select Done.
12. The Surveyor 4 unit should beep and give the message, "Calibration Successful!" and prompt to press any key to return. The "Go Back" key must then next be depressed to return the field displaying all parameters being measured.
13. Re-read pH and temperature and note in post-calibration section of the Meter Calibration sheet along with time.
14. Rinse probe with DI water after all calibrations are complete.

Data Download, Meter Rotation, Programming and Maintenance

Equipment Required

Laptop computer, Surveyor 4 unit, connector cables, recharged batteries, allen wrench (9/64 in), paper towels, and any other material necessary to clean Sonde.

Head Cell Sonde with Internal Data Logger

1. Remove Sonde from Head Cell. Visually inspect Sonde, checking that the dissolved oxygen (DO) membrane is intact, the circulator free of algae and sensors clean; clean gently as necessary per instructions in Minisonde User's Manual. Loosen screws holding battery cap on either side of the Sonde with allen wrench.
2. Pull off battery cap and replace with charged batteries before attempting Data Download Calibration and Programming. Replace battery cap and screws.
3. Connect Sonde to laptop computer. From the desktop menu, select Shortcut to Series 4.
4. From the Menu bar, select the pull down menu Connect; choose Capture Data to a File.
5. Select *Unattended log file*.
6. Select the file to download from the scroll menu. Go to *Transfer file*.
7. Select *Do Transfer* (verify data are downloading to the appropriate file).
8. After transferring the data, select *Done* (there is a computer prompt when the file has finished transferring).
9. Open transferred file to verify all data downloaded properly.

Programming the Sonde with Surveyor 4

1. From the main menu in Surveyor 4 go to *Files* and select *Create*. Delete old files as necessary to create memory space.
2. When prompted for a name, enter the name of the new file.
3. Enter the start time in the format mm/dd/yy.
4. Enter the stop time in the format mm/dd/yy.
5. Enter Data to be sampled every 65 seconds.
6. Enter sensor cycle of 120.
7. Enter parameters to be added (temperature, TSS, pH, Conductivity, DO %, DO [mg/L]).
8. Enter audio *Off* (0 = off).
9. The surveyor will prompt for new file information.

Programming the Sonde with Laptop Computer

1. From the File menu go to *Create File*. Name the new file.
2. Add parameters (temperature, TSS, pH, Conductivity, DO %, DO [mg/L].)
3. Add sensors cycle of 120.
4. Sample time every 65 seconds.
5. Enter Audio *Off* (0 = off).
6. Enable the file.
7. Click done.

Downloading Data from Sonde with External Data Logger

1. Retrieve Sonde and data logger from Test Cell or Porta-PSTA; record time and date of retrieval on meter rotation fieldsheet.
2. Calibrate Sonde following standard field procedures.
3. Connect laptop to white data logger box using cable.
4. Open PC208w 3.0 program on the computer.
5. Select the menu item *Connect.*
6. Make sure the "Prompt for data file name" box is checked and select C*ollect All.*
7. Message box will appear with the path the file will be saved as. Select *Browse* and note saving location. Name the file in the format using Test Cell number or Porta-PSTA and download date (e.g. TC8W0309.dat or PP030900.dat).
8. Select the file name and path then press "*OK.*" A status bar will appear displaying percent downloaded as the file is recorded.
9. When the status bar shows 100% collected, disconnect and open the file in Notepad. Verify data downloaded successfully. Record name of file along with time and date of download onto the meter rotation log.
10. Rotate Sonde into next Test Cell or Porta-PSTA. Sondes move in an ascending rotation in Test Cells (TC3, TC8 to TC13 then back to TC3). Keep Sonde with the proper data logger (i.e., Sonde 4 stays with data logger 1). Record the time and date of deployment as well as depth on the meter rotation fieldsheet. Sondes are deployed at mid-water depth in the Test Cell and Porta-PSTAs. Record depth from the surface of the sediment (bottom) to the location of the Sonde sensors.
11. Each of the three Porta-PSTA Sondes is assigned to a rotation of eight tanks. Make sure to keep the proper Sonde rotating in an ascending order though its assigned tanks. Also keep the proper sonde with the proper data cable (data cables are marked with zipties corresponding to the Sonde ID number). Record the time and date of deployment as well as the depth on the meter rotation log.

12. Temperature probes and the photosynthetically active radiation (PAR) meter are rotated on the same designated days with the Sondes at the Porta-PSTAs. These meters move though the 24 tanks in a descending rotation (PP24, PP23, etc.).
13. Record the time and date of retrieval, move the meter to the next tank in the rotation and record the time and date of deployment as well as the depth onto the meter rotation fieldsheet.

Percent Cover

Equipment Required

Fieldsheet for Percent Cover for Porta-PSTA, Test Cells or Field Scale Cells

Percent cover estimates are performed as part of the monthly sampling event.

1a. Each Porta-PSTA is effectively divided into thirds by two evenly spaced fiberglass cross pieces that support the tank. Percent cover is estimated in each third of the tank created by these divisions. The fieldsheet notes Porta-PSTA thirds as North, Center, and South.

1b. Each Test Cell is also effectively divided into thirds by the metal walkways. East of the eastern walkway is Zone A, between the two walkways is Zone B, and west of the west walkway is Zone C.

1c. Each Field Scale Cell is divided into two zones a South Inflow zone and a North Outflow zone. Field Scale Cell 2 is the sinuous cell and is divided into three zone of Inflow, Center and Outflow.

2. Characterize each third individually. Percent cover is estimated by visually assessing total surface area comprised of plant material compared with the entire third. Plant shading does not enter into the estimate, only that percent physically assumed by the plant.

3. Each third is assessed for Blue-Green Algal Mat, Green Algal Mat, Floating Aquatic Plants, Submerged Aquatic Plants, and Emergent Macrophytes. An "Other" column is provided for any additional observations.

4. Each assessment is keyed with the following values to represent percent coverage:

    1= <1%
    2= 1-5%
    3= 5-10%
    4= 10-25%
    5= 25-50%
    6= 50-75%
    7= 75-90%
    8= 90-95%
    9= 95-99%
    10= >99%

5. A list of plant types making up the percent cover is written in space provided on the fieldsheet corresponding to each percent cover assessment.

Snail Count

Equipment required

Ziploc bags, hand counter, permanent marker

1. For each Porta-PSTA, remove all snails seen.
2. Place snails in Ziploc bag labeled with Porta-PSTA number and date.
3. Record number and snail type on sheet of paper and in Field Notebook. Snails are typically of two types: *Helisoma*, with spiral round shell, and *Physa*, a smaller snail with conically shaped shell and spirals more noticeable toward tip of shell.
4. Double-bag snails particularly if a large amount have been collected.
5. Place snails in freezer until can be shipped for analysis.

APPENDIX A.3

Key Date Summary

APPENDIX A.3

Key Date Summary

Dates of key activities conducted at the Porta-PSTAs, PSTA Test Cells, and PSTA Field-Scale Cells are provided below for the study period from January 1999 to September 2002.

January 1999

- **01-05-99:** Filled Porta-PSTAs with soils. Planted *Eleocharis cellulosa* into Porta-PSTAs (two to three plant clumps per square meter).
- **01-06-99:** Placed WCA-2A periphyton/bladderwort mix in all Test Cells and in all Porta-PSTA tanks except PP-21 and 22.
- **01-07-99:** Installed aluminum scaffold boardwalks in Test Cells.
- **01-08-99:** Porta-PSTAs filled to 50 cm.
- **01-12-99:** Valves opened at Test Cells. Weirs raised to 15.5 ft. national geodetic vertical datum (NGVD).
- **01-13-99:** Porta-PSTAs 1, 4, 9, 10, 23, and 24 drained and repaired for leaks.
- **01-14-99:** Water turned on at Porta-PSTAs 1, 4, 10, 12, 23, and 24 to bring up water level. Water to all Porta PSTAs turned off at end of day. Test Cell weirs adjusted to 16.0 ft. NGVD.
- **01-20-99:** Staff gauges installed in Porta-PSTAs. Porta-PSTAs filled and flows turned off at end of day for leak testing. Weir heights of all Test Cells raised to 16.5 ft. NGVD.
- **01-27-99:** Test Cell weir heights lowered to 15.5 ft. NGVD. Flow to Porta-PSTA 7 turned on for preliminary tracer study (250 mL/min).

February 1999

- **02-20-99:** Plant material and substrate removed from Porta-PSTAs 16, 19, 20, and 21 for leak repairs.
- **02-12-99:** All Test Cell weir heights raised to 16.5 ft. NGVD.
- **02-17-99:** Weir height in Test Cell 8 lowered to 16.2 ft. NGVD for feldspar deployment.
- **02-18-99:** Weir height in Test Cell 8 raised to 16.5 ft. NGVD. Fiberglass repair crew replaced Porta-PSTAs 20 and 21; inflows to these tanks began. Porta-PSTAs 16 and 19 removed for repair by fiberglass repair crew.
- **02-22-99:** Adjusted Test Cell weir heights to 16.05 ft. NGVD in TC-3, 16.12 ft. NGVD in TC-8, and 16.3 ft. NGVD in TC-13 to try to reach goal of 16.5 ft. on staff gauge.

March 1999

- **03-03-99:** Substrate removed from Porta-PSTA 2 for leak repair. Porta-PSTAs 1, 3, 16,19, and 22 filled. Inflow to Head Tank stopped because of canal treatment.
- **03-17-99:** Flow to Head Tank resumed. All Porta-PSTAs filled.
- **03-18-99:** All Porta-PSTAs filled and valves then closed except PP-23.
- **03-19-99:** Porta-PSTA 23 and Head Tank flows stopped. Feldspar deployed at end of east walkway in TC-13.
- **03-23-99:** Porta-PSTAs 19 and 20 drained and sand substrate added, then macrophytes planted. Tanks refilled. Porta-PSTAs 16, 21, 23 and 24 drained.
- **03-24-99:** Shellrock added to Porta-PSTA 16, peat added to Porta-PSTA 21. Macrophytes planted in Porta-PSTA 16 and water levels increased in both tanks.
- **03-25-99:** Shellrock added to Porta-PSTA 23. Plants added and flow restarted. Test Cell 3 weir lowered to 16.0 ft. NGVD.
- **03-29-99:** Water not flowing from Head Cell to Test Cells; sampling event postponed until next day.

April 1999

- **04-01-99:** Porta-PSTA 2 replaced with new tank. Supplemental Braces installed on PP-23 and 24; PP-7, 10, 11, 13, and 14 re-glassed with new braces along rib. Shellrock substrate added to PP 2 and replanted with spike rush.
- **04-02-99:** Outflow pipes on PP-3 and 7 changed to 30 cm height. Outflow pipe missing from PP-1 so pipe from PP 23 moved to PP 11. Silicon cement used to fix leaking outflow points on PP-12, 13, and 14.
- **04-03-99:** Added outflow pipe to PP-23 and started inflow. Reduced inflows on Porta-PSTAs 1–22 to the 45 setting on the inflow valve; PP-24 flow reduced. Inflow to Head Tank reduced to avoid overflow. Cleaned outflow tube on PP-3 to keep tank from overfilling.
- **04-07-99:** Lowered water in PP-4 for leak repair.
- **04-08-99:** Raised outflow point on PP-11 and 18 to the 60-cm level.
- **04-09-99:** Turned off flows to PP-4, 7, 11, 18, and 20 for leak test. Lowered weir in TC-3 by 1.875 in., TC-8 by 1 in., and TC-13 by 1 in.
- **04-12-99:** Restarted flows to tanks 4, 7, 11, 18, and 20 after leak test.
- **04-17-99:** Changed outflow level in PP-1, 6, and 15 from 60 cm to 30 cm and flows reduced to 170 mL/min.
- **04-19-99:** Lowered outflow point in PP-18 to 30 cm. Lowered weir in TC-3 to 15.3 ft. NGVD.

- **04-22-99:** Lowered weir in TC-3 to a height above grate of 10.5 in.
- **04-23-99:** Drained PP-18 for repairs.
- **04-24-99:** Flow shut off and water level dropped in PP-4 to fix leak.
- **04-27-99:** Lowered weirs in TC-8 and 13 by 0.10 ft.
- **04-30-99:** Set weir for TC-3 to 15.3 ft. NGVD.

May 1999

- **05-04-99**: Raised weir in TC-8 from 15.70 ft to 15.75 ft. NGVD.
- **05-05-99:** Raised weir in TC-3 by 0.3 tenths and in TC-8 by 0.5 tenths.
- **05-17-99:** Pump transporting water to Head Tank at Porta-PSTAs stopped.
- **05-18-99:** Repaired pump to Head Tank at Porta-PSTAs, flow resumed.
- **05-24-99:** Leak in PP-11 caused water levels to drop, no sample collected.
- **05-27-99:** Raised weir in TC-13 to 16.2 ft. NGVD in an attempt to reach cell water depth of 16.5 ft. NGVD. All Porta-PSTAs except PP-23 and 24 partially drained for repairs and feldspar addition.
- **05-29-99:** Replaced drain plugs and outflow drains in all Porta-PSTAs, then filled all tanks back to operational level. Flow to TC-3 shut off for approximately 2 hours for repairs.

June 1999

- **06-01-99:** Lowered water level in PP-22 to repair leak.
- **06-02-99:** Repaired leak in PP-22.
- **06-03-99:** Raised outflow points in PP-1, 6, and 15 to 60 cm level and set flows to 320 mL/min.
- **06-09-99:** Flow to Porta-PSTA Head Tank stopped between 15:00 to 15:30, Head Tank dry.
- **06-10-99:** Raised outflow levels of tanks 1, 6, and 15 to 70 cm. Pump to Porta-PSTA Head Tank still not operational.
- **06-11-99:** Set up temporary pump and garden hose to supply water to Porta-PSTA Head Tank over the weekend.
- **06-17-99:** Installed new larger temporary pump to supply water to Porta-PSTA Head Tank. District pumps still not operational.
- **06-18-99:** Flow to Head Tank from temporary pump too low. Assembled new inflow tube for hose to keep it from clogging. Flow to Head Tank via temporary pump restored.

- **06-21-99:** Temporary pump to Head Tank lost prime over the weekend. Re-established flow to Head Tank at 08:45.
- **06-22-99:** District pumps that supply water to Porta-PSTA Head Tank back online.
- **06-28-99:** District pumps to Porta-PSTA Head Tank not functioning. Temporary pump still working, Head Tank has water, all Porta-PSTAs have flow.

July 1999

- **07-01-99:** Increased flows in PP-1, 6, and 15 to 370 mL/min. District pump started up and began adding water to Head Tank.
- **07-15-99:** District pump to Porta-PSTA Head Tank not running. Temporary pump running fine, Head Tank full.
- **07-21-99:** District pump to Porta-PSTA Head Tank not running.
- **07-26-99:** District pump to Porta-PSTA Head Tank still not running.
- **07-29-99:** District pump to Porta-PSTA Head Tank ran on and off during the day.

August 1999

- **08-02-99**: District pump to Porta-PSTA Head Tank up and running.
- **08-03-99**: Removed small temporary Porta-PSTA Head Tank pump from canal since district pump is online.
- **08-05-99**: District pump down for repairs, back online at 12:45. Set inflows for tanks 1, 6, and 15 to 430 mL/min. Pulled 11 cattail seedlings from PP-11.

September 1999

- **09-02-99:** Raise weir in TC-3 from 16.65 ft. NGVD to new height of 16.8 ft. NGVD.
- **09-10-99:** Changed orifice on TC-3 to 1.5 in.

October 1999

- **10-01-99:** Adjusted inflow pipe on TC-13 because it had been leaking water. Repaired it so that water is flowing through distribution pipe once again.
- **10-07-99:** Increased flows in Porta-PSTAs to 1,200 mL/min in tanks 23 and 24, 800 mL/min in tanks 2, 13, and 16, and 400 mL/min in all other tanks in an attempt to keep flows from stopping between calibration days. Removed screens from inflow manifold line. Changed orifice in TC-3 from 1.5 in to 1 in.

November 1999

- **11-04-99:** Lowered weir in TC-3 to 16.00 ft. NGVD, orifice changed to 0.75 in. Lowered outflow point on Porta-PSTAs 1, 6, and 15 to 30 cm.
- **11-23-99:** Outflow valve on Porta-PSTA NE line was changed out; water to Porta-PSTAs was shut off for 1 hr.

December 1999

- **12-02-99:** Lowered weir in TC-3 to 15.3 ft. NGVD. Lowered flow in Porta-PSTAs 1, 6, and 15 to 80 mL/min.

January 2000

- **01-06-00:** Lowered weir for TC-3 to 14.8 ft. NGVD, changed orifice to 1.00 in. Lowered outflow point on Porta-PSTAs 1, 6, and 15 to 10 cm and increased flows to 260 mL/min.
- **01-13-00:** Used siphon to lower water levels in tanks 2, 13, and 16 to 30 cm and set flows to 800 mL/min. Lowered weir in TC-8 by 12 in. and shut off flow to TC-13. Shut off flows in Porta-PSTAs 4, 7, 8, 9, 11, 18, and 20 to begin batch experiment.
- **01-27-00:** Re-circulation pumps were added to tanks 4, 7, 8, 9, 11, 18, and 20 as part of the batch experiment.

February 2000

- **02-03-00:** Lowered weir in TC-3 by 0.1 ft. NGVD. Set flows in Porta-PSTAs 1, 6, and 15 to 205 mL/min.
- **02-14-00:** Lowered weir in TC-3 by 0.75 ft. in an attempt to reach target water depth of 0.2 ft. Lowered weir in TC-8 by 0.4 ft. in an attempt to reach target water depth of 1.0 ft.

March 2000

- **03-06-00:** Shut of inflow and lowered weir in TC-3 to 14.2 ft. NGVD to drain cell for dry down experiment.
- **03-07-00:** Lowered weir in TC-13 to 14.5 ft. NGVD to drain cell.
- **03-14-00:** Cleared vegetation and dug a hole near TC-13 outflow pipe to facilitate drying of the cell.
- **03-16-00:** Re-circulation pumps removed from PP-4, 7, 8, 9, 11, 18 and 20. Shut off inflows to PP-1, 6, 15, 21, and 22. Used siphon to drain water from PP-4, 7, 8, 9, 11, 18, 20, 21, and 22. Set flows for all remaining PP to 250 mL/min and 750 mL/min for 23 and 24.
- **03-20-00:** Harvested spikerush from PP-9, 11, and 18 and save to replant tanks later. Harvested periphyton mat from PP-4, 7, 8, and 20 and save to restock PP later. Drained PP-4, 7, 8, 20, 21, and 22. Removed sediment from PP-4, 7, and 8.
- **03-21-00:** Removed sediment from PP-21 and 22. Rinse PP-4, 7, 8, 20, 21, and 22 with HCl. Counted and removed snails from PP-1, 2, 6, 10, 12, 13, 14, 17, 23, and 24.
- **03-22-00:** Loaded limerock sediment into PP-4, 7, and 8 and rinsed limerock three times before bringing water levels up to just above the sediment. Brought water level in PP-20 up to just above sediment. Planted spike rush in PP-1, 4, 6, 7, 8, 19, and 20. Added approximately 1.5 gallons of periphyton to PP-4, 7, 8, 20, 21, and 22. Installed re-circulation pumps on tanks 2, 13, and 16. Pulled cattail seedlings: PP-3 (1), PP-6 (8), and PP-13 (2). Loosened lowest outlet point on PP-1, 6, and 15 to allow them to dry out. Herbicide applied to vegetation in TC-13.

- **03-27-00:** Installed Aquamat in PP-22. Applied approximately 9 lbs. of hydrated lime to PP-9, 11, and 18. Dug trench and cleaned out screen over outflow pipe in weir box in TC-13 to facilitate drying of cell.

April 2000

- **04-03-00:** Installed screen over intake of re-circulation pumps in PP-2, 13, and to keep them from clogging with snails. Added water to tanks 4, 7, 8, 6, and 15 to keep plants alive.
- **04-07-00:** Raised weir to 14.8 ft in TC-13. Clear all dead vegetation from TC-13 and turned on water with 1-inch orifice.
- **04-10-00:** Turned off water to TC-13, cell had approximately 3 inches of water. Added hydrated lime to 1/3 of TC-13. Added water to tanks 1, 6, and 15 to keep plants alive.
- **04-11-00:** Added lime to final 2/3 of TC-13 (sixty-eight 50-lb. bags were spread evenly throughout the cell for a total of 3,400 lbs.)
- **04-12-00:** Raised weir to 15.0 ft and turned on water. Planted spikerush in TC-13. Broadcast approximately 126 gallons of periphyton into TC-13.
- **04-13-00:** Lowered outflow point of PP-21 and 22 to 10-cm level. The 10-cm level accounts for the lack of sediment in the tanks. Because the tanks have no sediment, there is approximately 30 cm of water in the tanks. All other tanks have outflow points at 30-cm level. Turned on inflows to tanks 4, 7, 8, 9, 11, 18, 20, 21, & 22. Planted six clumps of *Eleocharis* each into PP-9, 11, and 18.
- **04-17-00:** Adjusted outflow point of PP 20 to 30cm level.
- **04/27/00:** Notice to proceed issued by the District to Team Land Development (TLD) for construction of four PSTA Field-Scale Cells west of STA-2

May 2000

- **05-01-00:** Re-circulation pump in PP-2 not functioning properly; removed to exchange for a new one. Drew down water with siphon in PP-11 and 20 to level below that of metal support brackets to allow for leak repair.
- **05-02-00:** Fixed leaks with epoxy in PP-11 and 20; brought water levels back up to 30-cm level. Mobilization of heavy equipment to the PSTA FSC project site.
- **05-04-00:** Installed new re-circulation pump on PP-2.
- **05/10/00:** TLD determines that there is a large "muck hole" in the southern one-fifth of FSC-3, and estimates muck hole to be 3 to 4 feet deep.
- **05/11/00:** Removal of muck from floor of FSC-3 (excluding hole at southwest corner) and excavation of inflow canal are complete. Weir box locations are excavated to depth equal to that of inflow canal.
- **05-15-00:** Water in PP-1, 6, and 15 turned on and set to 350 mL/min.

- **05-18-00:** Turned on water in TC-3 with 1-inch orifice. Replaced bucket and black plastic tube back in outflow pipe; raised weir to 15.5 ft. Removed one cattail plant each from PP-6, 16, and 19. District and CH2M HILL decide that the “hole” in FSC-3 should be filled in with caprock and that the height of perimeter levees needs to be raised by 1 foot.
- **05-19-00:** Raised outflow pipe on PP-1, 6, and 15 to 30-cm level.
- **05-25-00:** Aquamat in PP-22 had drifted out of place. Moved it back into its original position. Flows in Porta-PSTA were increased from 350 mL/min (750 mL/min for PP-23 and 24) to 400 mL/min (1,200 mL/min for PP-23 and 24) to keep flows from stopping between calibration days. Completed depth survey at TC-3, 8, and 13 consisting of 40 depth measurements for each cell (10 measurements along each side of the 1/3 and 2/3 walkways). Used average depth from survey to make adjustments to weirs in an attempt to reach target water depth of 1.0 ft in each Test Cell. For TC-3 average depth was 1.192 ft, and the water was still ~0.1 ft below the V-notch. Weir was lowered by 0.3 ft to a new height of 15.2 ft. For TC-8 the average depth was 0.798 ft. Weir was raised by 0.2 ft to a new height of 15.0 ft. For TC-13 the average depth was 0.84 ft. Weir was raised by 0.16 ft to a new height of 15.15 ft.

June 2000

- **06-05-00:** Aquamat in PP-22 drifted out of place; moved back to its original position. Drew down water in PP-11 to repair a leak in tank.
- **06-08-00:** Aquamat in PP-22 drifted out of place; moved back to its original position. Changed orifice in TC-3 from 1 inch to 1.5 inches.
- **06/14/00:** Muck removal in FSC-3 completed.
- **06/21/00:** Graded access roads around the site. Surveyors set benchmarks for the installation of the pipes and structures.
- **06/23/00:** Outflow weir structures set for FSC-2 and –3.
- **06/26/00:** Outflow weir structure set for FSC-1.
- **06/28/00:** Inflow weir structure set for FSC-3.

July 2000

- **07/05/00:** FSC-2 inflow weir structure damaged; needed to be removed and repaired.
- **07/06/00:** Repair of FSC-2 inflow weir structure completed, and structure was reset in place. Filling of FSC-1 and -2 with cap rock completed.
- **07-12-00:** Aquamat in PP-22 drifted out of place; moved back to its original position. Collected snails from PP-1 and 10.
- **07-13-00:** Collected snails from PP-2 through 9 and 11 through 15.

- **07/20/00:** West perimeter and the seepage canal levees completed.
- **07/26/00:** Hole in FSC-3 filled, and grading of cell floor completed.
- **07-24-00:** Added ~ ½ gallon of *Utricularia* to PP-21. *Utricularia* was taken from west walkway of TC-3 and added to PP-21 in approximately 2 gallons of water.
- **07-27-00:** Used sprinkler head weights with zip ties to hold down Aquamat in its proper position. Collected snails from PP-16 through 21. Removed blue outflow tube from PP-21 and replaced with a more flexible tubing to fix problem with higher "recorded" outflows.
- **07-31-00:** Deployed larger sediment traps in Porta-PSTAs (one in each tank) and Test Cells (three along each walkway).

August 2000

- **08-03-00:** Cut a notch in outflow collection pipe in front of PP-21 (outflow tube was being pushed up by outflow collection pipe, causing water to pool up, which in turn altered our outflow measurements).
- **08/04/00:** Hauling of fill for east perimeter levee completed.
- **08/08/00:** Hauling of fill for internal levees completed.
- **08-10-00:** Entered TC-3 to clear snails, vegetation, and algae from holes in outflow stand pipes because water level was becoming too deep. Repaired hole in inflow tube for TC-13.
- **08/14/00:** Project trailer arrives onsite.
- **08/15/00:** All fill for levees onsite.
- **08/17/00:** Excavated culvert connections at inflow canal, seepage canal, and alternate water supply.
- **08/24/00:** All level roads graded and rolled. Completed grading of FSC-1 floor. Removed rock piles from FSC-2 to allow completion of cell floor grading.
- **08-28-00:** Installed new re-circulation pumps on PP-13 and 16.
- **08-31-00:** Entered TC-3 to clear holes in outflow stand pipes (water levels too deep). District met with TLD and declared FSC project complete.

September 2000

- **09-06-00:** Installed water level recorders onto outflow boxes of Field-Scale (FS) Cells 1, 2, and 3. Pumps delivered to FSC site by Moving Water Industries (MWI). Inflow pumps for FSC-1, 2, and 3 set in place and started. CH2M HILL installed water level recorders at outflow weir boxes of FSC-1, 2, and 3. Walk through by District and CH2M HILL determines that floor of FSC- 1 requires additional grading to even out high and low spots. Installed water level recorders at outflow boxes of FSC- 1, 2, and 3.

- **09-07-00:** Added five bags of dried periphyton to PP-21 and 22 each for decomposition study. Made cement bucket weights to use in FSCs to hold hose from inflow pumps in place. Made cement bucket weights to use in FSCs to hold hose from inflow pumps in place.

- **09-08-00:** Installed one water level recorder in FS inflow canal and one in outflow canal. Placed a PVC 'T' on end of FS pump hose to disperse flow so it would not be as erosive and added bucket weights to end of hose. Installed water level recorders in the FS inflow and outflow canals. Installed PVC 'T' diffusers on discharge pump hoses entering FSCs. Inflow pump of FSC-2 shut down because of hydraulic fluid leakage.

- **09-13-00:** Inflow to TC-3 turned off to change orifice from 1.5-in to 1-in. Lowered weir to 14.95 ft to reach target water level elevation of 15.0 ft. Could not get water turned back on; SFWMD to fix. Coastal Revegetation was on site to herbicide cattails along bank of TC-3, 8, and 13 (Coastal staff did not enter cell—only what they could reach from the bank) and also vegetation around inflow pipes, weir boxes, and walkways to allow for clear paths when taking field readings.

- **09-15-00:** Weir heights in Field-Scale Cells raised to 3 ft. Increased weir heights in FSCs to 3 ft.

- **09-18-00:** Power outage at Porta-PSTA site. Head tank emptied. Temporary pumps installed to supply head tank with water from canal. Flow to Porta-PSTAs resumed. Recirculation pumps in PP-2 and PP-16 off because of power outage; recirculation pump in PP-13 working. Water to TC-3 still not on. Final grading of FSC-1 and FSC-2 floors and north entrance completed. Pumps repaired and re-started.

- **09-19-00:** Power restored to Porta-PSTA site. Re-set weir height in FSCs to 2 ft. Determined that bringing in fill for FSC-4 from offsite is too expensive. Explored option of blasting a borrow pit area immediately west of site.

- **09-25-00:** Rain gauge installed at Field-Scale site. Water at TC-3 still slightly overflowing weir.

- **09-27-00:** Significant amount of leakage observed through inflow (south) berm of FSCs.

- **09-28-00:** Coastal Revegetation on site at Test Cells for second herbicide application. Weir in TC-3 lowered as much as possible to help cell to dry; decision made to enter dry-out phase.

October 2000

- **10-02-00 through 10-04-00:** Final Porta-PSTA quarterly event.

- **10-10-00:** Sediment traps collected at Porta-PSTAs and Test Cells.

- **10-12-00:** Met with Bagley Environmental and Planting Services to discuss *Eleocharis* planting. Decomposition study employing 1¼-inch PVC tubes, 15-cm length, begun at Porta-PSTA site. Tubes all deployed at 2/3 point in PP-21.

- **10-14-00:** Second set of water collected at Field-Scale site for phosphorus background levels.
- **10-24-00:** Sediment traps re-deployed in Test Cells. Final decomposition bag retrieved from Porta-PSTAs.
- **10/26/00:** FSC-4 pre-construction walk through to determine size and placement of borrow area.

November 2000

- **11-01-00:** Oxygen diffusion study performed in TC-8 and PP-3. First set of five periphyton decomposition study tubes retrieved from PP-21.
- **11/02/00:** Removal of muck from borrow area completed.
- **11/06/00:** Removal of muck from inflow canal extension to FSC-4 completed. Mowed internal area of FSC-4 and removed large Brazilian Pepper bushes.
- **11-07-00:** Oxygen diffusion study performed at PP-16.
- **11-14-00:** Oxygen diffusion study performed in PP-23. Final set of tubes removed for decomposition study.
- **11-28-00:** Photos taken at Test Cells. Stakes placed along TC3 walkways to photo-document re-wetting of periphyton mat in anticipation of water being turned back on. Valve at this point still not operational.

December 2000

- **12-05-00:** Diffusion study conducted in TC-13. Finished staking TC-8 and 13 for control photos, documenting re-wetting of periphyton mat of TC-3.
- **12-06-00:** Water level recorders removed from FS site to prevent damage they might incur from scheduled blasting (for fill for FS4). All pumps off for blasting event.
- **12/13/00:** Successful blasting of borrow area, insignificant amount of flying debris.
- **12-18-00:** Test Cell Quarterly sampling..
- **12-20-00:** Begin installing boardwalks in Field-Scale Cells. Meeting between District and CH2M HILL to finalize design of water supply pipe from STA 2 Cell 3 to inflow canal.
- **12-27-00:** Oxygen diffusion study conducted in PP-10.

January 2001

- **01-03-01:** Oxygen diffusion study conducted in PP-13. Completed removal of blasted material from borrow area, material determined to be of excellent construction quality.
- **01-09-01:** Oxygen diffusion study conducted in PP-24.
- **01-10-01:** District replaced butterfly value in TC-3. Turned water to cell on at 10:43 a.m. with 0.75-inch-diameter orifice.

- **01-12-01:** Set up ISCO auto-samplers in TC-3 for re-wetting study.
- **01-18-01:** Water observed flowing over weir in TC-3. Collected periphyton decomposition tubes from TC-8.
- **01-23-01:** Began periphyton decomposition study in TC-8. Deployed 22 periphyton decomposition tubes (18 with periphyton and 4 controls). Four periphyton decomposition tubes (3 with periphyton and 1 control) collected after being in place for 4 hours.
- **01/24/01:** Completed re-filling and re-grading of inflow levee along FSC-1 and 2 to reduce leakage from cells.
- **01-29-01:** Set up ISCO auto-samples for lithium tracer study (TC-3, -8, and -13; PP-16). Set up RDS units in weir boxes of TC-3, -8, and -13 to monitor water levels during lithium tracer study.
- **01-30-01:** Begin lithium tracer study in TC-3, -8, and -13.

February 2001

- **02-08-01:** Baseline sediment sampling at the Field-Scale Cells.
- **02-12-01:** Destructive sampling at Porta-PSTAs.
- **02-13-01:** Destructive sampling at Porta-PSTAs.
- **02-14-01:** Destructive sampling at Porta-PSTAs.
- **02-15-01:** Destructive sampling at Porta-PSTAs.
- **02/16/01:** All fill necessary to build FSC-4 levees in place.
- **02-20-01:** Collected 6 periphyton decomposition tubes (5 with periphyton and 1 control) from TC-8; tubes had been in cell for 30 days.
- **02-26-01:** Set up ISCO auto-samplers in the Head Cell, TC-8, and TC-13 for STSOC sampling event.
- **02-27-01:** Final lithium tracer test samples collected. STSOC samples collected (P samples and metals).

March 2001

- **03-01-01:** Samples collected for STSOC event.
- **03-05-01:** Samples collected for STSOC event. Water collected from the Head Cell, TC-8, and TC-13 for toxicity testing. Connected the agricultural ditch west of FSC-4 to the blasted borrow area.
- **03-06-01:** Completed boardwalk assembly at Field-Scale Cells.
- **03-07-01:** Samples collected for STSOC event. Water collected from the Head Cell, TC-8, and TC-13 for toxicity testing. FSC-4 inflow weir box set in place.

- **03-09-01:** Samples collected for STSOC event. Water collected from the Head Cell, TC-8, and TC-13 for toxicity testing. Grading of levees and discharge canal roads around FSC-4 completed.
- **03/12/01:** FSC-4 outflow weir box set in place.
- **03-13-01:** Test Cell weekly sampling event; STSOC samples collected. *Eleocharis cellulosa* planted in Field-Scale Cells (FSC) 1 and 2.
- **03-15-01:** Samples collected for STSOC event. Installed Agri-drain and 18-inch pipe at FSC-4outflow.
- **03-20-01:** Final Test Cell quarterly monitoring event. Six periphyton decomposition tubes collected from TC-8 (in place for 60 days).
- **03/21/01:** Complete widening of inflow canal around FSC-4 inflow weir box.
- **03-22-01:** Water level recorder moved from effluent canal at Field-Scale site to outflow weir box of FSC-4.
- **03-27-01:** Final Test Cell weekly monitoring event; STSOC samples collected. Majority of FSC-4 work completed. Walk through determined that grates need to be added to top of inflow and outflow weir boxes, all roads around cell need a final grading and rolling, and a 2-foot extension to top of inflow weir box should be added.
- **03-28-01:** Samples collected for STSOC event.
- **03-29-01:** Samples collected for STSOC event.

April 2001

- **04-03-01:** Final STSOC samples collected.
- **04-19-01:** Installed PVC 'T' on discharge pump hoses for FS Cell 4 and FS Cell 3 out. Stop logs added to Agri-drains in FSC-1 and FSC-2 in attempt to reach target cell water depth of 1.0 ft.
- **04-23-01:** Collected toxicity samples and retrieved sondes from TC-3 and TC-8. Prep for trailer removal from Porta-PSTA project site.
- **04/24/01:** Installed additional 2-foot section to top of FSC-4 inflow weir box.
- **04-25-01:** All pumps at Field-Scale Cells shut down because of drought
- **04-25-01:** Collected toxicity samples and sediment traps from TC-8 and TC-13. Prep for trailer removal from Porta-PSTA project site.
- **04-26-01:** Inventory equipment that will be used at Field-Scale office. Completed sealing of new top section to the original bottom section of FSC-4 inflow weir box.
- **04-27-01:** Collect toxicity samples from Test Cells. Prep for trailer removal from Porta-PSTA project site. Pilings to support pipeline from STA-2 Cell 3 set into ground; pilings were too long and required trimming.

- **04-30-01:** Collected toxicity samples from Test Cells. Returned field equipment from Porta-PSTA trailer to the District. Removed CR10X data logger from Porta-PSTA head tank and transported to Field-Scale office.

May 2001

- **05-02-01:** Removed five sections of boardwalk walkway from north and south Test Cells to be used at Field-Scale Cells. Trailer removed from Porta-PSTA field site by William-Scotsman.
- **05/09/01:** Western piling trimmed to proper length.
- **05/10/01:** Begin installation of water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal.
- **05/11/01:** Completed cutting levees to place pipe for PSTA inflow canal. Completed back filling of inflow pipe.
- **05/14/01:** Pipe on STA-2 Cell 3 side completed; still need one more section of pipe on PSTA side.
- **05-30-01:** Water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal completed.

June 2001

- **06-07-01:** GPS survey conducted at Field-Scale Cells by District.
- **06-14-01:** Agri-drain stop logs removed to allow flow through water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal.
- **06-20-01:** Herbicide application to cattails in Field-Scale Cells.
- **06-21-01:** Survey conducted of STA-2 Cell 3 water supply pipe and Agri-drain elevations.
- **06-28-01:** All inflow pumps started at Field-Scale Cells.
- **06-29-01:** FS-4 sprayed with herbicide by helicopter.

July 2001

- **07-05-01:** Survey conducted by District on structure elevations at Field-Scale Cells.
- **07-10-01:** Second application of herbicide on cattails at FSC-1, -2, and -3.
- **07-30-01:** ISCO samplers tested and deployed at Field-Scale Cells. Two stop logs removed from STA-2 Cell 3 water supply pipe Agri-drain.
- **07/31/01:** First 24-hour composite samples collected at FSC-1 and FSC-3 and inflow canal. Because of threat of hurricane, all samplers and meters secured in trailer at direction of the District.

August 2001

- **08/06/01:** Deployed and programmed ISCO samplers to collect 24-hour composite samples.
- **08/07/01:** Collected 24-hour composite samples at FSC-1 and FSC-3 and inflow canal.
- **08/09/01:** Collected 24-hour composite samples at FSC-1 and FSC-3 and inflow canal. Shut down pumps and removed stop logs to facilitate drying out of cells for well installation during the week of August 13, 2001. Added stop logs to STA-2 Cell 3 water supply pipe Agri-drain to stop flow into inflow canal.
- **08/14/01:** Begin installation of 10 groundwater wells at Field-Scale Site.
- **08/17/01:** Complete well installation at FS Cells 1 and 3. Turned on pumps 1 and 3 and added stop logs to FSC-1 and FSC-3 outflow Agri-drains to set cell target water levels at 1 ft.
- **08/23/01:** Started pump at inflow of FSC-4.
- **08/24/01:** Removed all stop logs from STA-2 Cell water supply pipe Agri-drain.
- **08/25/01:** Deployed data logger with photosynthetically active radiation (PAR) and temperature probes in FSC-3.
- **08/28/01:** Monthly sampling event conducted at Field-Scale Cells.
- **08/30/01:** Collected 24-hour composite samples at FSC-1 and FSC-3 and inflow canal. Collected grab samples at FSC-2.

September 2001

- **09/04/01:** Collected 24-hour composite samples at FSC-2, FSC-3 and inflow canal. Grab sample collected at FSC-1 after composite sampler malfunctioned.
- **09/11/01:** PVC 'T' diffuser noted off end of discharge pump hose at inflow tube. Agri-drain at STA-2 Cell 3 water supply pipe cleared after being clogged with SAV.
- **09/25/01:** Groundwater samples collected for first time at Field-Scale Site wells.
- **09/26/01:** Installation of boardwalk extensions completed at all cells for groundwater sampling. PVC 'T' diffuser replaced on FSC-3 pump hose.
- **09/27/01:** Monthly sampling of groundwater wells and periphyton.

October 2001

- **10/03/01:** Pump at FSC-1 inflow replaced. Groundwater well sampling conducted. Three (7-inch) stoplogs removed from Agri-drain between STA-2 seepage canal and PSTA inflow canal. Two (5 inch) stoplogs remain.
- **10/04/01:** Pump at FSC-4 increased from 1300 to 1600 rpm to achieve outflow.
- **10/09/01:** Sediment traps deployed in all cells.

- **10/16/01:** One (7-inch) stoplog added to Agri-drain from STA-2 seepage canal to PSTA inflow canal to stop backflow of water into seepage canal. Stakes placed in Field-Scale Cells for field flow measurements ('orange method').
- **10/23/01:** AMJ onsite to begin installation of flow meters.
- **10/24/01:** PAR bulb cleaned off. Periphyton sampling for quarterly event.

November 2001

- **11/1/01:** Photos taken of Field-Scale Cells. Tropical storm warning; ISCO samplers, sondes, and Infinities water level recorders removed.
- **11/2/01:** Staff gauges installed in Field-Scale Cells.
- **11/6/01:** ISCO samplers, sondes, and Infinities re-deployed.
- **11/29/01:** Pumps shut down and five (7 inch) stoplogs added to STA-2 Cell 3 water supply pipe Agridrain to dry cells for vegetation maintenance. MWI onsite to replace discharge hose on FSC 3 pump; leak noted on November 13, 2001. Monthly sampling event.

December 2001

- **12/5/01:** Surveyors onsite to perform elevation survey. Survey completed with the exception of tying into an existing benchmark.
- **12/10/01:** Removed all stoplogs (five 7 inch) from STA-2 Cell 3 water supply pipe Agridrain. Removed one (7 inch) and one (5 inch) stoplog from STA-2 Seepage Canal Agridrain.
- **12/13/01:** One (5 inch) stoplog added to FS Cell 1 Agridrain.
- **12/18/01:** Monthly sampling event.

January 2002

- **1/8/02:** Pump at FSC-4 slowed down to 1200 rpm to achieve proper flow.
- **1/10/02:** Deployed 8 sediment traps along center walkways of each FSC.
- **1/15/02:** Water depth in inflow canal extremely low, 0.55ft. Water flowing in from STA-2 Cell 3 and STA-2 Seepage Canal, all stoplogs removed for maximum inflow. At FSC-3 Outflow box, 13 dead fish were observed.
- **1/17/02:** Complete collection of periphyton samples from all cells.
- **1/22/02:** Monthly sampling event.
- **1/24/02:** Took pictures along the walkways of FSC-1 and FSC-2. Installed ¼" mesh screen on the inflow culverts to FSC-3 and FSC-4 inflow weir boxes.
- **1/29/02:** Removed bottom stoplog from agri-drain on inflow pipe from STA-2 seepage canal.

February 2002

- **2/07/02:** Was able to removed jammed stoplog from the bottom of agri-drain on inflow pipe from STA-2 Cell 3. Increased pump at FSC-3 from 1000 to 1600 rpm. Installed fence/screen around inflow culverts for FSC-3 and FSC-4. Flow meter main control panel board reading off for FSC-3.
- **2/12/02:** Two large leaks visible at upstream end of the seepage canal between FS-2 and FS-3.
- **2/22/02:** Field pictures taken.
- **2/26/02:** Monthly sampling event.

March 2002

- **3/11/02:** Tracer study started for FSC-2 and FSC-4. Deployed lithium and rhodamine WT.
- **3/26/02:** Monthly sampling event.

April 2002

- **4/09/02:** Collected sediment samples and also collected and processed sediment accretion trap samples; re-deployed sediment traps. MWI onsite to change pump in FSC-3.
- **4/11/02:** Add one (5-inch) stoplog to agri-drain on STA-2 seepage canal to increase depth in the FSC inflow canal. Pump at FSC-4 lowered to 1100 rpm; flow was too high.
- **4/15/02:** Quarterly sampling event. No samples taken at FSC-4 (pump off).
- **4/17/02:** Tracer study completed for FSC-2 and FSC-4.
- **4/22/02:** Removed all stoplogs from STA-2 seepage canal agri-drain.
- **4/30/02:** Pumps at all cells turned off because of insufficient water supply; cells begin dryout mode.

May 2002

- **5/13/02:** Pulled cattails from FSC-1.
- **5/27/02:** Puled cattails from FSC-1 and FSC-3.
- **5/29/02:** Well sampling (only monitoring conducted this month because cells in dry-out)

June 2002

- **6/13/02:** Well sampling (only monitoring conducted this month because cells in dryout)
- **6/17/02**: Applied 300 gallons of bentonite slurry to FSC-1 inflow deep zone wall.
- **6/19/02:** Applied bentonite slurry to FSC-1 inflow deep zone wall.

July 2002

- **7/03/02:** Started FSC inflow pumps.
- **7/15/02:** Herbicide applied to kill vegetation in FSC-2 and FSC-4

- **7/23/02:** Resume weekly water sample collection. Adjusted Pump at FSC-3 from 900 to 1100 rpm.
- **7/25/02:** Well sampling. Slowed pump at FSC-4 to 1100 rpm, reduced amount of air in line.
- **7/30/02:** Monthly sampling event.

August 2002

- **8/28/02:** Quarterly water quality and periphyton sampling event.
- **8/29/02:** Well sampling, complete quarterly periphyton sampling.

September 2002

- **9/11/02:** Monthly sampling event. Collected and processed sediment accretion trap samples; re-deployed sediment traps.
- **9/18/02:** Well sampling.
- **9/25/02:** Monthly sampling (second monthly event to make up for missed samples during dry-out in June 2002).

APPENDIX A.4

Quality Assurance/Quality Control

APPENDIX A.4

Quality Assurance/Quality Control

Quality Assurance (QA) is defined as those established protocols that provide adequate confidence that field activities are planned and performed in accordance with accepted standards and practices to ensure the resulting data are valid. Quality Control (QC) is an integral part of the overall QA function and is comprised of all actions necessary to control and verify that project activities and resulting data meet established requirements.

To ensure that a minimum level of data quality is achieved, the following activities are conducted:

- Field operations are conducted in accordance with written Standard Operating Procedures (SOPs) (refer to Appendix A.2).
- Project staff are provided with appropriate training to ensure familiarity with the SOPs. Senior staff members routinely observe field activities and refine methods, as needed.
- Field QC samples are collected to monitor the quality of field and laboratory data. Under the PSTA project, the following field control samples are collected: field duplicates and equipment blanks. Field duplicates are used to check repeatability or precision of the data; these samples are collected for all matrices at a rate of 10 percent of total samples. Equipment blanks are used to detect contamination of samples resulting from contaminated field equipment and are collected at a rate of 5 percent of total samples.

Exhibits A.4-1, A.4-2, A.4-3, A.4-4, and A.4-5 summarize field duplicate results for the PSTA project collected during Phases 1, 2, and 3 of the study for Test Cells, Porta-PSTAs, and FSCs, respectively. In accordance with District protocol, a relative standard deviation (RSD) between each duplicate sample and the corresponding native sample is calculated; RSD results are also summarized in the referenced exhibits. The target RSD for duplicate samples is less than 10 percent based on District standards.

Exhibits A.4-6, A.4-7, A.4-8, A.4-9 and A.4-10 summarize the equipment blank results for the PSTA project collected during Phases 1, 2, and 3 of the study for Test Cells, Porta-PSTAs, and FSCs, respectively. Equipment blank results were evaluated with respect to the analytical method detection limit (MDL), and those that are equal to or less than twice the MDL are acceptable, per District standards.

EXHIBIT A.4-1
Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
Water	PPB	12/27/99	13	1/3	N_TOT	mg/L	1.98	2.31	10.9
		01/24/00	HC	Outflow	N_TOT	mg/L	2.17	1.92	8.6
		02/22/00	HC	Outflow	N_TOT	mg/L	2.01	2.02	0.4
		02/22/00	HC	Outflow	N_TOT	mg/L	2.01	2.02	0.4
		03/06/00	HC	Outflow	N_TOT	mg/L	1.91	1.87	1.5
		12/27/99	13	1/3	NH_3	mg/L	< 0.00	< 0.00	0.0
		01/24/00	HC	Outflow	NH_3	mg/L	0.03	0.01	60.6
		02/22/00	HC	Outflow	NH_3	mg/L	0.10	0.10	1.5
		02/22/00	HC	Outflow	NH_3	mg/L	0.10	0.10	1.5
		03/06/00	HC	Outflow	NH_3	mg/L	0.09	0.13	23.8
		12/27/99	13	1/3	NO_2NO_3	mg/L	0.02	0.03	5.9
		01/24/00	HC	Outflow	NO_2NO_3	mg/L	0.09	< 0.00	130 [a]
		02/22/00	HC	Outflow	NO_2NO_3	mg/L	0.07	0.07	4.2
		02/22/00	HC	Outflow	NO_2NO_3	mg/L	0.07	0.07	4.2
		03/06/00	HC	Outflow	NO_2NO_3	mg/L	0.08	0.08	0.0
		12/27/99	13	1/3	TKN	mg/L	1.96	2.28	10.7
		01/24/00	HC	Outflow	TKN	mg/L	2.08	1.92	5.7
		02/22/00	HC	Outflow	TKN	mg/L	1.94	1.95	0.4
		02/22/00	HC	Outflow	TKN	mg/L	1.94	1.95	0.4
		03/06/00	HC	Outflow	TKN	mg/L	1.83	1.79	1.6
		12/27/99	13	1/3	TOC	mg/L	41	44	6.2
		01/24/00	HC	Outflow	TOC	mg/L	35	34	2.0
		02/22/00	HC	Outflow	TOC	mg/L	33	34	1.9
		02/22/00	HC	Outflow	TOC	mg/L	33	34	1.9
		03/06/00	HC	Outflow	TOC	mg/L	34	33	2.1
	TOXIKON	03/31/99	3	2/3	ALKAL	mg/L	273	287	3.5
		03/31/99	13	1/3	ALKAL	mg/L	259	268	2.4
		04/12/99	13	Outflow	ALKAL	mg/L	223	223	0.0
		05/21/99	8	2/3	ALKAL	mg/L	162	163	0.4
		06/14/99	8	Outflow	ALKAL	mg/L	125	121	2.3
		07/14/99	13	Inflow	ALKAL	mg/L	226	229	0.9
		08/16/99	8	Inflow	ALKAL	mg/L	255	259	1.1
		09/29/99	8	1/3	ALKAL	mg/L	258	254	1.1
		09/29/99	13	1/3	ALKAL	mg/L	194	214	6.9
		10/25/99	3	Outflow	ALKAL	mg/L	195	197	0.7
		11/29/99	8	Outflow	ALKAL	mg/L	240	245	1.5
		12/27/99	13	1/3	ALKAL	mg/L	240	240	0.0
		01/24/00	HC	Outflow	ALKAL	mg/L	260	230	8.7
		01/24/00	HC	Outflow	ALKAL	mg/L	260	230	8.7
		02/22/00	HC	Outflow	ALKAL	mg/L	260	260	0.0
		03/06/00	HC	Outflow	ALKAL	mg/L	260	260	0.0
		03/31/99	3	2/3	CA	mg/L	57	54	2.9
		03/31/99	13	1/3	CA	mg/L	50	46	5.3
		04/12/99	13	Outflow	CA	mg/L	42	41	2.1
		05/21/99	8	2/3	CA	mg/L	34	34	0.0
		06/14/99	8	Outflow	CA	mg/L	30	30	0.0
		07/14/99	13	Inflow	CA	mg/L	56	55	1.5
		08/16/99	8	Inflow	CA	mg/L	58	60	2.4
		09/29/99	8	1/3	CA	mg/L	76	72	3.8
		09/29/99	13	1/3	CA	mg/L	50	47	4.4
		10/25/99	3	Outflow	CA	mg/L	60	58	2.4
		11/29/99	8	Outflow	CA	mg/L	64	66	2.2
		12/27/99	13	1/3	CA	mg/L	60	66	6.7
		01/24/00	HC	Outflow	CA	mg/L	76	66	10.0
		01/24/00	HC	Outflow	CA	mg/L	76	66	10.0
		02/22/00	HC	Outflow	CA	mg/L	66	66	0.0
		03/06/00	HC	Outflow	CA	mg/L	65	71	6.2
		03/31/99	3	2/3	N_TOT	mg/L	1.06	< 0.09	119 [a]
		03/31/99	13	1/3	N_TOT	mg/L	0.61	0.10	101
		04/12/99	13	Outflow	N_TOT	mg/L	1.3	1.2	4.6
		05/21/99	8	2/3	N_TOT	mg/L	1.3	69	136 [a]
		06/14/99	8	Outflow	N_TOT	mg/L	1.0	1.0	0.7
		07/14/99	13	Inflow	N_TOT	mg/L	0.66	1.04	31.2
		08/16/99	8	Inflow	N_TOT	mg/L	2.40	1.50	32.6
		09/29/99	8	1/3	N_TOT	mg/L	0.78	1.10	24.1
		09/29/99	13	1/3	N_TOT	mg/L	1.10	1.60	26.2
		10/25/99	3	Outflow	N_TOT	mg/L	0.93	0.90	2.3
		11/29/99	8	Outflow	N_TOT	mg/L	1.40	1.50	4.9
		03/31/99	3	2/3	NH_3	mg/L	< 0.040	< 0.040	0.0
		03/31/99	13	1/3	NH_3	mg/L	< 0.040	< 0.040	0.0
		04/12/99	13	Outflow	NH_3	mg/L	< 0.040	< 0.040	0.0
		05/21/99	8	2/3	NH_3	mg/L	0.072	0.064	8.3
		06/14/99	8	Outflow	NH_3	mg/L	< 0.040	< 0.040	0.0
		07/14/99	13	Inflow	NH_3	mg/L	0.063	0.053	12.2
		08/16/99	8	Inflow	NH_3	mg/L	0.220	0.130	36.4
		09/29/99	8	1/3	NH_3	mg/L	< 0.040	< 0.040	0.0
		09/29/99	13	1/3	NH_3	mg/L	< 0.040	< 0.040	0.0

EXHIBIT A.4-1

Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		10/25/99	3	Outflow	NH_3	mg/L	< 0.040	< 0.040	0.0
		11/29/99	8	Outflow	NH_3	mg/L	< 0.040	< 0.040	0.0
		03/31/99	13	1/3	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		03/31/99	3	2/3	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		04/12/99	13	Outflow	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		05/21/99	8	2/3	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		06/14/99	8	Outflow	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		07/14/99	13	Inflow	NO_2NO_3	mg/L	0.054	< 0.050	5.4
		08/16/99	8	Inflow	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		09/29/99	8	1/3	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		09/29/99	13	1/3	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		10/25/99	3	Outflow	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		11/29/99	8	Outflow	NO_2NO_3	mg/L	< 0.050	< 0.050	0.0
		03/31/99	3	2/3	TKN	mg/L	1.06	< 0.04	131 [a]
		03/31/99	13	1/3	TKN	mg/L	0.61	0.10	101 [a]
		04/12/99	13	Outflow	TKN	mg/L	1.27	1.19	4.6
		05/21/99	8	2/3	TKN	mg/L	1.33	69.20	136 [a]
		06/14/99	8	Outflow	TKN	mg/L	1.00	0.99	0.7
		07/14/99	13	Inflow	TKN	mg/L	0.61	1.04	36.9
		08/16/99	8	Inflow	TKN	mg/L	2.40	1.50	32.6
		09/29/99	13	1/3	TKN	mg/L	1.10	1.60	26.2
		09/29/99	8	1/3	TKN	mg/L	0.78	1.10	24.1
		10/25/99	3	Outflow	TKN	mg/L	0.93	0.90	2.3
		11/29/99	8	Outflow	TKN	mg/L	1.40	1.50	4.9
		03/31/99	13	1/3	TOC	mg/L	35.2	37.4	4.3
		03/31/99	3	2/3	TOC	mg/L	35.0	35.4	0.8
		04/12/99	13	Outflow	TOC	mg/L	41.4	41.1	0.5
		05/21/99	8	2/3	TOC	mg/L	32.4	30.7	3.8
		06/14/99	8	Outflow	TOC	mg/L	23.2	23.7	1.5
		07/14/99	13	Inflow	TOC	mg/L	30.0	30.3	0.7
		08/16/99	8	Inflow	TOC	mg/L	32.6	32.0	1.3
		09/29/99	8	1/3	TOC	mg/L	39.5	70.0	39.4
		09/29/99	13	1/3	TOC	mg/L	74.7	74.6	0.1
		10/25/99	3	Outflow	TOC	mg/L	32.0	32.0	0.0
		11/29/99	8	Outflow	TOC	mg/L	40.0	41.0	1.7
		03/31/99	3	2/3	TSS	mg/L	< 4.0	< 4.0	0.0
		03/31/99	13	1/3	TSS	mg/L	6.0	8.0	20.2
		04/12/99	13	Outflow	TSS	mg/L	12.0	< 4.0	70.7
		05/21/99	8	2/3	TSS	mg/L	14.0	< 4.0	78.6
		06/14/99	8	Outflow	TSS	mg/L	< 4.0	< 4.0	0.0
		07/14/99	13	Inflow	TSS	mg/L	< 4.0	< 4.0	0.0
		08/16/99	8	Inflow	TSS	mg/L	< 2.0	< 2.0	0.0
		09/29/99	8	1/3	TSS	mg/L	2.0	1.8	9.4
		09/29/99	13	1/3	TSS	mg/L	12.0	6.0	47.1
		10/25/99	3	Outflow	TSS	mg/L	2.8	2.8	0.0
		11/29/99	8	Outflow	TSS	mg/L	1.0	< 1.0	0.0
		12/27/99	13	1/3	TSS	mg/L	28.0	30.0	4.9
		01/24/00	HC	Outflow	TSS	mg/L	2.0	< 1.0	47.1
		01/24/00	HC	Outflow	TSS	mg/L	2.0	< 1.0	47.1
		02/22/00	HC	Outflow	TSS	mg/L	2.6	2.0	18.4
		03/06/00	HC	Outflow	TSS	mg/L	4.0	1.6	60.6
	IFAS	02/23/99	8	Outflow	DRP	mg/L	0.0030	0.0020	28.3
		03/03/99	13	Outflow	DRP	mg/L	0.0030	0.0040	20.2
		03/08/99	3	Outflow	DRP	mg/L	0.0030	0.0030	0.0
		03/15/99	8	Outflow	DRP	mg/L	0.0020	0.0030	28.3
		03/23/99	13	Outflow	DRP	mg/L	0.0040	0.0030	20.2
		03/29/99	13	1/3	DRP	mg/L	0.0100	0.0090	7.4
		03/29/99	3	2/3	DRP	mg/L	0.0050	0.0090	40.4
		04/03/99	8	Outflow	DRP	mg/L	0.0030	0.0020	28.3
		04/12/99	13	Outflow	DRP	mg/L	0.0030	0.0030	0.0
		04/27/99	13	Outflow	DRP	mg/L	0.0040	0.0050	15.7
		05/03/99	3	Outflow	DRP	mg/L	0.0031	0.0039	16.2
		05/10/99	13	Outflow	DRP	mg/L	0.0026	0.0026	0.0
		05/20/99	8	2/3	DRP	mg/L	0.0142	0.0206	26.0
		05/25/99	3	Outflow	DRP	mg/L	0.0022	0.0013	36.4
		06/01/99	13	Outflow	DRP	mg/L	0.0002	0.0002	0.0
		06/09/99	8	Outflow	DRP	mg/L	0.0029	0.0030	2.4
		06/14/99	8	Outflow	DRP	mg/L	0.0024	0.0025	2.9
		06/21/99	3	Outflow	DRP	mg/L	0.0011	< 0.0001	118
		06/28/99	13	Outflow	DRP	mg/L	0.0027	0.0023	11.3
		07/06/99	13	Outflow	DRP	mg/L	0.0025	0.0038	29.2
		07/14/99	13	Inflow	DRP	mg/L	0.0064	0.0052	14.6
		07/19/99	13	Outflow	DRP	mg/L	0.0022	0.0064	69.1
		07/26/99	3	Outflow	DRP	mg/L	0.0010	0.0013	18.4
		08/02/99	13	Outflow	DRP	mg/L	0.0010	0.0008	15.7
		08/09/99	3	Outflow	DRP	mg/L	0.0010	0.0009	7.4
		08/31/99	13	Outflow	DRP	mg/L	0.0027	0.0022	14.4
		09/29/99	8	1/3	DRP	mg/L	0.0030	0.0022	21.8

EXHIBIT A.4-1
Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		09/29/99	13	1/3	DRP	mg/L	0.0016	0.0014	9.4
		10/18/99	8	Outflow	DRP	mg/L	0.0015	0.0016	4.6
		10/25/99	3	Outflow	DRP	mg/L	0.0015	0.0014	4.9
		11/29/99	8	Outflow	DRP	mg/L	0.0016	0.0025	31.0
		12/27/99	13	1/3	DRP	mg/L	0.0014	0.0023	34.4
		01/18/00	HC	Outflow	DRP	mg/L	0.0050	0.0022	55.0
		01/18/00	HC	Outflow	DRP	mg/L	0.0022	0.0022	0.0
		01/24/00	HC	Outflow	DRP	mg/L	0.0071	0.0069	2.0
		02/16/00	HC	Outflow	DRP	mg/L	0.0020	0.0020	0.0
		02/22/00	HC	Outflow	DRP	mg/L	0.0060	0.0060	0.0
		02/28/00	HC	Outflow	DRP	mg/L	0.0030	0.0030	0.0
		03/06/00	HC	Outflow	DRP	mg/L	0.0012	0.0012	0.0
		03/14/00	HC	Outflow	DRP	mg/L	0.0012	0.0015	15.7
		03/20/00	HC	Outflow	DRP	mg/L	0.0028	0.0028	0.0
		03/27/00	HC	Outflow	DRP	mg/L	0.0020	0.0020	0.0
		02/23/99	8	Outflow	TDP	mg/L	0.0250	0.0100	60.6
		03/03/99	13	Outflow	TDP	mg/L	0.0100	0.0090	7.4
		03/08/99	3	Outflow	TDP	mg/L	0.0100	0.0100	0.0
		03/15/99	8	Outflow	TDP	mg/L	0.0110	0.0130	11.8
		03/23/99	13	Outflow	TDP	mg/L	0.0100	0.0130	18.4
		03/29/99	13	1/3	TDP	mg/L	0.0110	0.0110	0.0
		03/29/99	3	2/3	TDP	mg/L	0.0180	0.0100	40.4
		04/03/99	8	Outflow	TDP	mg/L	0.0110	0.0110	0.0
		04/12/99	13	Outflow	TDP	mg/L	0.0170	0.0190	7.9
		04/27/99	13	Outflow	TDP	mg/L	0.0180	0.0200	7.4
		05/03/99	3	Outflow	TDP	mg/L	0.0189	0.0228	13.2
		05/10/99	13	Outflow	TDP	mg/L	0.0155	0.0145	4.7
		05/20/99	8	2/3	TDP	mg/L	0.0168	0.0241	25.2
		05/25/99	3	Outflow	TDP	mg/L	0.0122	0.0131	5.0
		06/01/99	13	Outflow	TDP	mg/L	0.0138	0.0185	20.6
		06/09/99	8	Outflow	TDP	mg/L	0.0114	0.0117	1.8
		06/14/99	8	Outflow	TDP	mg/L	0.0108	0.0108	0.0
		06/21/99	3	Outflow	TDP	mg/L	0.0081	0.0099	14.1
		06/28/99	13	Outflow	TDP	mg/L	0.0087	0.0087	0.0
		07/06/99	13	Outflow	TDP	mg/L	0.0071	0.0103	26.0
		07/14/99	13	Inflow	TDP	mg/L	0.0126	0.0135	4.9
		07/19/99	13	Outflow	TDP	mg/L	0.0101	0.0091	7.4
		07/26/99	3	Outflow	TDP	mg/L	0.0071	0.0071	0.0
		08/02/99	13	Outflow	TDP	mg/L	0.0106	0.0106	0.0
		08/09/99	3	Outflow	TDP	mg/L	0.0143	0.0125	9.5
		08/16/99	13	Inflow	TDP	mg/L	0.0134	0.0125	4.9
		08/25/99	8	Outflow	TDP	mg/L	0.0086	0.0086	0.0
		08/31/99	13	Outflow	TDP	mg/L	0.0086	0.0104	13.4
		09/07/99	3	Outflow	TDP	mg/L	0.0086	0.0086	0.0
		09/29/99	8	1/3	TDP	mg/L	0.0120	0.0103	10.8
		09/29/99	13	1/3	TDP	mg/L	0.0112	0.0147	19.1
		10/04/99	3	Outflow	TDP	mg/L	0.0085	0.0103	13.5
		10/18/99	8	Outflow	TDP	mg/L	0.0063	0.0063	0.0
		10/25/99	3	Outflow	TDP	mg/L	0.0086	0.0077	7.8
		11/01/99	8	Outflow	TDP	mg/L	0.0063	0.0055	9.6
		11/08/99	13	Outflow	TDP	mg/L	0.0074	0.0074	0.0
		11/15/99	8	Outflow	TDP	mg/L	0.0074	0.0074	0.0
		11/22/99	8	Outflow	TDP	mg/L	0.0052	0.0052	0.0
		11/29/99	8	Outflow	TDP	mg/L	0.0070	0.0080	9.4
		12/06/99	3	Outflow	TDP	mg/L	0.0083	0.0074	8.1
		12/15/99	13	Outflow	TDP	mg/L	0.0095	0.0095	0.0
		12/20/99	3	Outflow	TDP	mg/L	0.0073	0.0056	18.6
		12/27/99	13	1/3	TDP	mg/L	0.0081	0.0081	0.0
		01/04/00	13	Outflow	TDP	mg/L	0.0064	0.0073	9.3
		01/10/00	3	Outflow	TDP	mg/L	0.0079	0.0079	0.0
		01/18/00	HC	Outflow	TDP	mg/L	0.0134	0.0081	34.9
		01/24/00	HC	Outflow	TDP	mg/L	0.0127	0.0134	3.8
		01/31/00	HC	Outflow	TDP	mg/L	0.0108	0.0099	6.1
		02/07/00	8	Outflow	TDP	mg/L	0.0060	0.0060	0.0
		02/16/00	HC	Outflow	TDP	mg/L	0.0120	0.0120	0.0
		02/22/00	HC	Outflow	TDP	mg/L	0.0120	0.0130	5.7
		02/28/00	HC	Outflow	TDP	mg/L	0.0150	0.0130	10.1
		03/06/00	HC	Outflow	TDP	mg/L	0.0130	0.0130	0.0
		03/14/00	HC	Outflow	TDP	mg/L	0.0141	0.0150	4.3
		03/20/00	HC	Outflow	TDP	mg/L	0.0162	0.0153	4.1
		03/27/00	HC	Outflow	TDP	mg/L	0.0144	0.0126	9.5
		02/12/99	8	Outflow	TP	mg/L	0.0280	0.0210	20.2
		02/19/99	3	Outflow	TP	mg/L	0.0280	0.0280	0.0
		02/23/99	8	Outflow	TP	mg/L	0.0250	0.0270	5.4
		03/03/99	13	Outflow	TP	mg/L	0.0310	0.0330	4.4
		03/08/99	3	Outflow	TP	mg/L	0.0260	0.0300	10.1
		03/15/99	8	Outflow	TP	mg/L	0.0120	0.0200	35.4
		03/23/99	13	Outflow	TP	mg/L	0.0610	0.0430	24.5
		03/29/99	13	1/3	TP	mg/L	0.0330	0.0400	13.6

EXHIBIT A.4-1
Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		03/29/99	3	2/3	TP	mg/L	0.0230	0.0280	13.9
		04/03/99	8	Outflow	TP	mg/L	0.0310	0.0340	6.5
		04/12/99	13	Outflow	TP	mg/L	0.0350	0.0380	5.8
		04/27/99	13	Outflow	TP	mg/L	0.0270	0.0320	12.0
		05/03/99	3	Outflow	TP	mg/L	0.0256	0.0266	2.7
		05/10/99	13	Outflow	TP	mg/L	0.0260	0.0202	17.8
		05/20/99	8	2/3	TP	mg/L	0.0250	0.0204	14.3
		05/25/99	3	Outflow	TP	mg/L	0.0269	0.0305	8.9
		06/01/99	13	Outflow	TP	mg/L	0.0194	0.0194	0.0
		06/09/99	8	Outflow	TP	mg/L	0.0242	0.0245	0.9
		06/14/99	8	Outflow	TP	mg/L	0.0208	0.0208	0.0
		06/21/99	3	Outflow	TP	mg/L	0.0199	0.0181	6.7
		06/28/99	13	Outflow	TP	mg/L	0.0161	0.0143	8.4
		07/06/99	13	Outflow	TP	mg/L	0.0122	0.0122	0.0
		07/14/99	13	Inflow	TP	mg/L	0.0181	0.0199	6.7
		07/19/99	13	Outflow	TP	mg/L	0.0138	0.0138	0.0
		07/26/99	3	Outflow	TP	mg/L	0.0173	0.0173	0.0
		08/09/99	3	Outflow	TP	mg/L	0.0197	0.0207	3.5
		08/16/99	13	Inflow	TP	mg/L	0.0429	0.0328	18.9
		08/25/99	8	Outflow	TP	mg/L	0.0167	0.0176	3.7
		08/31/99	13	Outflow	TP	mg/L	0.0176	0.0176	0.0
		09/07/99	3	Outflow	TP	mg/L	0.0193	0.0157	14.5
		09/29/99	8	1/3	TP	mg/L	0.0161	0.0173	5.1
		09/29/99	13	1/3	TP	mg/L	0.0231	0.0385	35.4
		10/04/99	3	Outflow	TP	mg/L	0.0173	0.0164	3.8
		10/11/99	8	Outflow	TP	mg/L	0.0169	0.0169	0.0
		10/18/99	8	Outflow	TP	mg/L	0.0153	0.0145	3.8
		10/25/99	3	Outflow	TP	mg/L	0.0153	0.0132	10.4
		11/01/99	8	Outflow	TP	mg/L	0.0116	0.0125	5.3
		11/08/99	13	Outflow	TP	mg/L	0.0111	0.0111	0.0
		11/15/99	8	Outflow	TP	mg/L	0.0111	0.0121	6.1
		11/22/99	8	Outflow	TP	mg/L	0.0107	0.0098	6.2
		11/29/99	8	Outflow	TP	mg/L	0.0116	0.0107	5.7
		12/06/99	3	Outflow	TP	mg/L	0.0144	0.0127	8.9
		12/15/99	13	Outflow	TP	mg/L	0.0157	0.0148	4.2
		12/20/99	3	Outflow	TP	mg/L	0.0152	0.0126	13.2
		12/27/99	13	1/3	TP	mg/L	0.0187	0.0312	35.4
		01/04/00	13	Outflow	TP	mg/L	0.0100	0.0136	21.6
		01/10/00	3	Outflow	TP	mg/L	0.0156	0.0156	0.0
		01/18/00	HC	Outflow	TP	mg/L	0.0150	0.0109	22.4
		01/18/00	HC	Outflow	TP	mg/L	0.0146	0.0109	20.5
		01/24/00	HC	Outflow	TP	mg/L	0.0191	0.0182	3.4
		01/31/00	HC	Outflow	TP	mg/L	0.0125	0.0125	0.0
		02/07/00	8	Outflow	TP	mg/L	0.0090	0.0080	8.3
		02/16/00	HC	Outflow	TP	mg/L	0.0160	0.0160	0.0
		02/22/00	HC	Outflow	TP	mg/L	0.0230	0.0230	0.0
		02/28/00	HC	Outflow	TP	mg/L	0.0170	0.0210	14.9
		03/06/00	HC	Outflow	TP	mg/L	0.0166	0.0184	7.2
		03/14/00	HC	Outflow	TP	mg/L	0.0177	0.0177	0.0
		03/20/00	HC	Outflow	TP	mg/L	0.0207	0.0189	6.5
		03/27/00	HC	Outflow	TP	mg/L	0.0171	0.0234	22.1
Sediment	**TOXIKON**	02/25/99	8	2/3	DENSIT	g/cm3	1.86	1.94	3.0
		02/25/99	8	2/3	DENSIT	g/cm3	1.93	1.84	3.4
		04/14/99	3	2/3	DENSIT	g/cm3	1.89	1.89	0.0
		05/20/99	3	1/3	DENSIT	g/cm3	1.88	1.89	0.4
		06/15/99	8	1/3	DENSIT	g/cm3	1.99	2.03	1.4
		07/12/99	8	2/3	DENSIT	g/cm3	2.00	2.10	3.4
		08/17/99	3	2/3	DENSIT	g/cm3	1.77	1.66	4.5
		11/30/99	3	1/3	DENSIT	g/cm3	1.84	1.86	0.8
		12/28/99	8	2/3	DENSIT	g/cm3	1.90	1.90	0.0
		01/25/00	3	2/3	DENSIT	g/cm3	1.90	1.90	0.0
		01/25/00	3	2/3	DENSIT	g/cm3	1.90	1.90	0.0
		02/22/00	8	1/3	DENSIT	g/cm3	2.00	2.10	3.4
		03/06/00	8	1/3	DENSIT	g/cm3	2.00	1.90	3.6
		02/25/99	8	2/3	SOLID	%	78	72	5.7
		02/25/99	8	2/3	SOLID	%	69	67	2.8
		04/14/99	3	2/3	SOLID	%	72	70	1.7
		05/20/99	3	1/3	SOLID	%	69	73	4.0
		06/15/99	8	1/3	SOLID	%	80	80	0.0
		07/12/99	8	2/3	SOLID	%	80	77	2.7
		08/17/99	3	2/3	SOLID	%	70	66	4.2
		11/30/99	3	1/3	SOLID	%	78	77	1.3
		11/30/99	3	1/3	SOLID	%	80	77	2.5
		12/28/99	8	2/3	SOLID	%	61	75	14.6
		01/25/00	3	2/3	SOLID	%	76	70	5.8
		01/25/00	3	2/3	SOLID	%	76	70	5.8
		02/22/00	8	1/3	SOLID	%	71	77	5.7
		03/06/00	8	1/3	SOLID	%	72	76	3.8

EXHIBIT A.4-1
Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/20/99	3	1/3	TKN	mg/kg	47	38	15.2
		09/30/99	13	1/3	TKN	mg/kg	5100	170	132 [a]
		12/28/99	8	2/3	TKN	mg/kg	220	140	31.4
		05/20/99	3	1/3	TOC	mg/kg	3370	5430	33.1
		09/30/99	13	1/3	TOC	mg/kg	46000	2600	126 [a]
		12/28/99	8	2/3	TOC	mg/kg	6100	6900	8.7
		06/15/99	8	1/3	VS	%	3	9	69.0
	IFAS	02/25/99	8	2/3	TIP	mg/kg	952	853	7.7
		02/25/99	8	2/3	TIP	mg/kg	812	788	2.2
		05/20/99	8	2/3	TIP	mg/kg	873	761	9.6
		06/15/99	8	1/3	TIP	mg/kg	688	745	5.7
		07/12/99	8	2/3	TIP	mg/kg	661	665	0.4
		09/30/99	8	1/3	TIP	mg/kg	695	725	3.0
		10/26/99	8	1/3	TIP	mg/kg	573	592	2.3
		11/30/99	3	1/3	TIP	mg/kg	958	1046	6.2
		12/28/99	8	2/3	TIP	mg/kg	848	889	3.4
		01/25/00	3	2/3	TIP	mg/kg	975	962	1.0
		02/22/00	8	1/3	TIP	mg/kg	748	654	9.5
		02/25/99	8	2/3	TP	mg/kg	935	883	4.1
		02/25/99	8	2/3	TP	mg/kg	828	783	3.9
		04/14/99	3	2/3	TP	mg/kg	793	810	1.5
		05/20/99	8	2/3	TP	mg/kg	924	832	7.4
		06/15/99	8	1/3	TP	mg/kg	783	827	3.8
		07/12/99	8	2/3	TP	mg/kg	767	775	0.8
		09/30/99	8	1/3	TP	mg/kg	704	789	8.0
		10/26/99	8	1/3	TP	mg/kg	675	699	2.5
		11/30/99	3	1/3	TP	mg/kg	970	1103	9.1
		12/28/99	8	2/3	TP	mg/kg	899	837	5.1
		01/25/00	3	2/3	TP	mg/kg	948	982	2.5
		02/22/00	8	1/3	TP	mg/kg	674	658	1.8
Periphyton	Mote Marine	02/24/99	3	2/3	ASH WT	mg/L	362	375	2.5
		02/24/99	3	2/3	ASH WT	mg/L	362	445	14.6
		02/24/99	3	2/3	ASH-FREE DRY	mg/L	65	70	5.1
		02/24/99	3	2/3	ASH-FREE DRY	mg/L	65	70	5.1
		02/24/99	3	2/3	ASH-FREE DRY	mg/L	65	59	7.2
		02/24/99	3	2/3	ASH-FREE DRY	mg/L	65	59	7.2
		02/24/99	3	2/3	DRY WT	mg/L	427	445	2.9
		02/24/99	3	2/3	DRY WT	mg/L	427	503	11.7
	PPB	04/14/99	3	2/3	ASH WT	mg/L	736	753	1.6
		05/24/99	8	1/3	ASH WT	mg/L	2010	2110	3.4
		06/15/99	8	1/3	ASH WT	mg/L	856	837	1.6
		07/12/99	8	1/3	ASH WT	mg/L	421	604	25.2
		08/31/99	3	1/3	ASH WT	mg/L	512	512	0.0
		09/30/99	13	2/3	ASH WT	mg/L	1460	1450	0.5
		10/25/99	8	2/3	ASH WT	mg/L	720	732	1.2
		11/29/99	13	1/3	ASH WT	mg/L	696	716	2.0
		12/28/99	8	2/3	ASH WT	mg/L	2510	6570	63 [a]
		04/14/99	3	2/3	ASH-FREE DRY	mg/L	199	187	4.4
		05/24/99	8	1/3	ASH-FREE DRY	mg/L	510	550	5.3
		06/15/99	8	1/3	ASH-FREE DRY	mg/L	244	233	3.3
		07/12/99	8	1/3	ASH-FREE DRY	mg/L	156	217	23.1
		08/31/99	3	1/3	ASH-FREE DRY	mg/L	125	133	4.4
		09/30/99	13	2/3	ASH-FREE DRY	mg/L	640	590	5.7
		10/25/99	8	2/3	ASH-FREE DRY	mg/L	278	348	15.8
		11/29/99	13	1/3	ASH-FREE DRY	mg/L	304	294	2.4
		12/28/99	8	2/3	ASH-FREE DRY	mg/L	660	1420	51.7
		04/14/99	3	2/3	CHL_A	µg/L	8	8	3.5
		05/24/99	8	1/3	CHL_A	µg/L	76	153	47.7
		06/15/99	8	1/3	CHL_A	µg/L	47	37	16.5
		07/12/99	8	1/3	CHL_A	µg/L	36	44	13.9
		08/31/99	3	1/3	CHL_A	µg/L	35	31	7.9
		09/30/99	13	2/3	CHL_A	µg/L	981	624	31.5
		10/25/99	8	2/3	CHL_A	µg/L	30	22	22.6
		11/29/99	13	1/3	CHL_A	µg/L	189	198	3.3
		12/28/99	8	2/3	CHL_A	µg/L	1300	2840	52.6
		04/14/99	3	2/3	CHL_A corr	µg/L	4	5	19.8
		05/24/99	8	1/3	CHL_A corr	µg/L	66	88	20.5
		06/15/99	8	1/3	CHL_A corr	µg/L	29	27	4.5
		07/12/99	8	1/3	CHL_A corr	µg/L	30	31	4.2
		08/31/99	3	1/3	CHL_A corr	µg/L	33	27	13.6
		09/30/99	13	2/3	CHL_A corr	µg/L	538	405	19.9
		10/25/99	8	2/3	CHL_A corr	µg/L	16	14	6.6
		11/29/99	13	1/3	CHL_A corr	µg/L	155	158	1.4
		12/28/99	8	2/3	CHL_A corr	µg/L	1140	2560	54.3
		05/24/99	8	1/3	CHL_A Mono	µg/L	48	43	8.4
		04/14/99	3	2/3	CHL_B	µg/L	3.6	1.7	50.7
		05/24/99	8	1/3	CHL_B	µg/L	6.8	37.4	97.9
		06/15/99	8	1/3	CHL_B	µg/L	7.9	1.7	91.3

EXHIBIT A.4-1
Field Duplicate Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		07/12/99	8	1/3	CHL_B	µg/L	1.6	7.9	93.8
		08/31/99	3	1/3	CHL_B	µg/L	< 1.0	1.0	0.0
		09/30/99	13	2/3	CHL_B	µg/L	257.0	135.0	44.0
		10/25/99	8	2/3	CHL_B	µg/L	7.0	2.2	73.8
		11/29/99	13	1/3	CHL_B	µg/L	41.3	28.5	25.9
		12/28/99	8	2/3	CHL_B	µg/L	110.0	480.0	88.7
		04/14/99	3	2/3	CHL_C	µg/L	3.0	3.9	18.4
		05/24/99	8	1/3	CHL_C	µg/L	9.4	61.1	104
		06/15/99	8	1/3	CHL_C	µg/L	16.0	9.5	36.0
		07/12/99	8	1/3	CHL_C	µg/L	< 1.0	5.8	99.8
		08/31/99	3	1/3	CHL_C	µg/L	3.8	2.9	19.0
		09/30/99	13	2/3	CHL_C	µg/L	419.0	211.0	46.7
		10/25/99	8	2/3	CHL_C	µg/L	10.2	3.0	77.1
		11/29/99	13	1/3	CHL_C	µg/L	69.9	58.1	13.0
		12/28/99	8	2/3	CHL_C	µg/L	196.0	241.0	14.6
		04/14/99	3	2/3	DRY WT	mg/L	935	940	0.4
		05/24/99	8	1/3	DRY WT	mg/L	2520	2660	3.8
		06/15/99	8	1/3	DRY WT	mg/L	1100	1070	2.0
		07/12/99	8	1/3	DRY WT	mg/L	577	821	24.7
		08/31/99	3	1/3	DRY WT	mg/L	637	645	0.9
		09/30/99	13	2/3	DRY WT	mg/L	2100	2040	2.0
		10/25/99	8	2/3	DRY WT	mg/L	998	1080	5.6
		11/29/99	13	1/3	DRY WT	mg/L	1000	1010	0.7
		12/28/99	8	2/3	DRY WT	mg/L	3170	7990	61.1
		04/14/99	3	2/3	PHEO_A	µg/L	7	4	40.4
		05/24/99	8	1/3	PHEO_A	µg/L	27	77	68.5
		06/15/99	8	1/3	PHEO_A	µg/L	3	9	64.1
		07/12/99	8	1/3	PHEO_A	µg/L	3	< 1	74.1
		08/31/99	3	1/3	PHEO_A	µg/L	4	4	5.1
		09/30/99	13	2/3	PHEO_A	µg/L	105	50	50.4
		10/25/99	8	2/3	PHEO_A	µg/L	5	4	17.1
		11/29/99	13	1/3	PHEO_A	µg/L	62	8	111.0
		12/28/99	8	2/3	PHEO_A	µg/L	1830	493	81.4
	TOXIKON	04/14/99	3	2/3	CA	mg/L	84	189	54.6
		05/24/99	8	1/3	CA	mg/L	487	529	5.8
		06/15/99	8	1/3	CA	mg/L	190	180	3.8
		07/12/99	8	1/3	CA	mg/L	149	145	1.9
		08/17/99	8	2/3	CA	mg/L	158	189	12.6
		08/31/99	3	1/3	CA	mg/L	56	56	0.0
		09/30/99	13	2/3	CA	mg/L	270	300	7.4
		10/25/99	8	2/3	CA	mg/L	67	68	1.0
		11/29/99	13	1/3	CA	mg/L	160	140	9.4
		12/28/99	8	2/3	CA	mg/L	600	1700	67 [a]
		01/24/00	8	1/3	CA	mg/L	270	320	12.0
		05/24/99	8	1/3	TKN	mg/L	4	4	9.5
		09/30/99	13	2/3	TKN	mg/L	20	15	20.2
		12/28/99	8	2/3	TKN	mg/L	31	55	39.5
	IFAS	05/24/99	8	1/3	TIP	mg/L	1.07	1.30	14.2
		06/15/99	8	1/3	TIP	mg/L	0.37	0.38	1.9
		07/12/99	8	1/3	TIP	mg/L	0.24	0.25	0.7
		08/31/99	3	1/3	TIP	mg/L	0.02	0.02	8.4
		09/30/99	13	2/3	TIP	mg/L	0.32	0.08	86.1
		10/25/99	8	2/3	TIP	mg/L	0.02	0.02	10.1
		11/29/99	13	1/3	TIP	mg/L	0.02	0.02	3.1
		12/28/99	8	2/3	TIP	mg/L	1.31	2.70	49.1
		01/24/00	8	1/3	TIP	mg/L	0.19	0.26	21.0
		03/06/00	8	2/3	TIP	mg/kg	1.27	789	141
		03/06/00	8	2/3	TIP	mg/L	1.27	0.94	21.2
		05/24/99	8	1/3	TP	mg/L	1.91	2.48	18.4
		06/15/99	8	1/3	TP	mg/L	0.78	0.70	6.8
		07/12/99	8	1/3	TP	mg/L	0.48	0.43	7.4
		08/31/99	3	1/3	TP	mg/L	0.05	0.05	0.0
		09/30/99	13	2/3	TP	mg/L	0.84	0.35	58.5
		10/25/99	8	2/3	TP	mg/L	0.07	0.07	0.0
		11/29/99	13	1/3	TP	mg/L	0.26	0.36	22.0
		12/28/99	8	2/3	TP	mg/L	5.74	12.09	50.3
		01/24/00	8	1/3	TP	mg/L	0.80	1.55	45.2
		03/06/00	8	2/3	TP	mg/kg	4.96	772	140
		03/06/00	8	2/3	TP	mg/L	4.96	2.68	42.1

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
Water	PPB	12/13/1999	10	Outflow	N_TOT	mg/L	2.28	2.06	7.2
		12/13/1999	19	stn 1/2	N_TOT	mg/L	1.88	2.04	5.8
		12/14/1999	23	Outflow	N_TOT	mg/L	1.89	1.81	3.1
		12/15/1999	11	Outflow	N_TOT	mg/L	1.06	1.78	35.9
		12/15/1999	9	stn 1/2	N_TOT	mg/L	1.69	1.82	5.2
		01/17/2000	22	Outflow	N_TOT	mg/L	1.71	1.68	1.3
		01/18/2000	23	Outflow	N_TOT	mg/L	1.73	1.72	0.4
		01/19/2000	24	Outflow	N_TOT	mg/L	1.64	1.62	0.9
		02/14/2000	HC	Outflow	N_TOT	mg/L	1.34	1.28	3.2
		02/15/2000	HC	Outflow	N_TOT	mg/L	1.34	1.28	3.2
		02/16/2000	24	Outflow	N_TOT	mg/L	1.30	1.57	13.3
		02/16/2000	24	Outflow	N_TOT	mg/L	1.30	1.57	13.3
		03/13/2000	19	stn 1/2	N_TOT	mg/L	1.62	1.79	7.1
		03/15/2000	9b	stn 1/3	N_TOT	mg/L	2.48	2.48	0.0
		03/15/2000	12	stn 1/2	N_TOT	mg/L	1.96	1.92	1.5
		12/13/1999	19	stn 1/2	NH_3	mg/L	0.066	0.047	23.8
		12/13/1999	10	Outflow	NH_3	mg/L	0.030	0.033	6.7
		12/14/1999	23	Outflow	NH_3	mg/L	0.033	0.040	13.6
		12/15/1999	11	Outflow	NH_3	mg/L	0.038	0.034	7.9
		12/15/1999	9	stn 1/2	NH_3	mg/L	0.044	0.047	4.7
		02/14/2000	HC	Outflow	NH_3	mg/L	0.031	0.028	7.2
		02/15/2000	HC	Outflow	NH_3	mg/L	0.031	0.028	7.2
		12/13/1999	19	stn 1/2	NO_2NO_3	mg/L	0.010	< 0.004	60.6
		12/13/1999	10	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		12/14/1999	23	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		12/15/1999	11	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		12/15/1999	9	stn 1/2	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		01/17/2000	22	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		01/18/2000	23	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		01/19/2000	24	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		02/14/2000	HC	Outflow	NO_2NO_3	mg/L	0.048	0.056	10.9
		02/15/2000	HC	Outflow	NO_2NO_3	mg/L	0.048	0.056	10.9
		02/16/2000	24	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		02/16/2000	24	Outflow	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		03/13/2000	19	stn 1/2	NO_2NO_3	mg/L	0.009	0.004	54.4
		03/15/2000	12	stn 1/2	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		03/15/2000	9b	stn 1/3	NO_2NO_3	mg/L	< 0.004	< 0.004	0.0
		12/13/1999	10	Outflow	TKN	mg/L	2.28	2.06	7.2
		12/13/1999	19	stn 1/2	TKN	mg/L	1.87	2.04	6.1
		12/14/1999	23	Outflow	TKN	mg/L	1.89	1.81	3.1
		12/15/1999	11	Outflow	TKN	mg/L	1.06	1.78	35.9
		12/15/1999	9	stn 1/2	TKN	mg/L	1.69	1.82	5.2
		01/17/2000	22	Outflow	TKN	mg/L	1.71	1.68	1.3
		01/18/2000	23	Outflow	TKN	mg/L	1.73	1.72	0.4
		01/19/2000	24	Outflow	TKN	mg/L	1.64	1.62	0.9
		02/14/2000	HC	Outflow	TKN	mg/L	1.29	1.22	3.9
		02/15/2000	HC	Outflow	TKN	mg/L	1.29	1.22	3.9
		02/16/2000	24	Outflow	TKN	mg/L	1.30	1.57	13.3
		02/16/2000	24	Outflow	TKN	mg/L	1.30	1.57	13.3
		03/13/2000	19	stn 1/2	TKN	mg/L	1.61	1.79	7.5
		03/15/2000	12	stn 1/2	TKN	mg/L	1.96	1.92	1.5
		03/15/2000	9b	stn 1/3	TKN	mg/L	2.48	2.48	0.0
		12/13/1999	10	Outflow	TOC	mg/L	29.6	34.8	11.4
		12/13/1999	19	stn 1/2	TOC	mg/L	30.9	30.1	1.9
		12/14/1999	23	Outflow	TOC	mg/L	30.2	29.3	2.1
		12/15/1999	11	Outflow	TOC	mg/L	29.3	30.0	1.7
		12/15/1999	9	stn 1/2	TOC	mg/L	31.0	33.0	4.4
		01/17/2000	22	Outflow	TOC	mg/L	29.0	30.0	2.4
		01/18/2000	23	Outflow	TOC	mg/L	29.0	29.0	0.0
		01/19/2000	24	Outflow	TOC	mg/L	47.0	45.0	3.1
		02/14/2000	HC	Outflow	TOC	mg/L	25.0	25.0	0.0
		02/15/2000	HC	Outflow	TOC	mg/L	25.0	25.0	0.0
		02/16/2000	24	Outflow	TOC	mg/L	30.3	31.2	2.1
		02/16/2000	24	Outflow	TOC	mg/L	30.3	31.2	2.1
		03/13/2000	19	stn 1/2	TOC	mg/L	27.8	26.6	3.1
		03/15/2000	12	stn 1/2	TOC	mg/L	31.0	35.1	8.8
		03/15/2000	9b	stn 1/3	TOC	mg/L	37.8	39.3	2.8
	TOXIKON	04/26/1999	16	Outflow	ALKAL	mg/L	197	196	0.4
		04/26/1999	10	Outflow	ALKAL	mg/L	162	164	0.9
		04/26/1999	8	Outflow	ALKAL	mg/L	172	172	0.0
		04/27/1999	23	Outflow	ALKAL	mg/L	181	196	5.6
		05/17/1999	13	stn 1/2	ALKAL	mg/L	124	124	0.0
		05/17/1999	7	stn 1/2	ALKAL	mg/L	129	132	1.6
		05/17/1999	10	Outflow	ALKAL	mg/L	117	117	0.0
		05/17/1999	5	stn 1/2	ALKAL	mg/L	114	135	11.9

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/17/1999	2	Outflow	ALKAL	mg/L	146	146	0.0
		05/19/1999	20	stn 1/2	ALKAL	mg/L	144	158	6.6
		05/19/1999	16	Outflow	ALKAL	mg/L	160	156	1.8
		05/19/1999	24	stn 1/2	ALKAL	mg/L	169	171	0.8
		06/23/1999	24	Outflow	ALKAL	mg/L	169	168	0.4
		06/23/1999	12	Outflow	ALKAL	mg/L	170	161	3.8
		07/19/1999	24	Outflow	ALKAL	mg/L	220	218	0.6
		07/20/1999	15	Outflow	ALKAL	mg/L	159	< 1	139.7 [a]
		08/24/1999	22	Outflow	ALKAL	mg/L	186	189	1.1
		08/25/1999	24	Outflow	ALKAL	mg/L	202	198	1.4
		09/20/1999	1	Inflow	ALKAL	mg/L	290	274	4.0
		09/20/1999	10	Outflow	ALKAL	mg/L	176	174	0.8
		09/27/1999	23	stn 1/2	ALKAL	mg/L	188	184	1.5
		09/27/1999	HC	Outflow	ALKAL	mg/L	280	276	1.0
		09/27/1999	23	Outflow	ALKAL	mg/L	190	192	0.7
		09/27/1999	7	Inflow	ALKAL	mg/L	280	278	0.5
		09/27/1999	24	Outflow	ALKAL	mg/L	248	252	1.1
		10/18/1999	15	Outflow	ALKAL	mg/L	132	152	10.0
		10/18/1999	19	Outflow	ALKAL	mg/L	132	132	0.0
		10/20/1999	24	Outflow	ALKAL	mg/L	205	206	0.3
		11/15/1999	10	Outflow	ALKAL	mg/L	268	198	21.2
		11/17/1999	24	Outflow	ALKAL	mg/L	233	235	0.6
		12/13/1999	19	stn 1/2	ALKAL	mg/L	213	213	0.0
		12/13/1999	10	Outflow	ALKAL	mg/L	212	215	1.0
		12/14/1999	23	Outflow	ALKAL	mg/L	215	211	1.3
		12/15/1999	11	Outflow	ALKAL	mg/L	229	240	3.3
		12/15/1999	9	stn 1/2	ALKAL	mg/L	232	233	0.3
		01/17/2000	22	Outflow	ALKAL	mg/L	210	210	0.0
		01/18/2000	23	Outflow	ALKAL	mg/L	190	190	0.0
		01/19/2000	24	Outflow	ALKAL	mg/L	210	220	3.3
		02/14/2000	HC	Outflow	ALKAL	mg/L	190	190	0.0
		02/16/2000	24	Outflow	ALKAL	mg/L	200	200	0.0
		03/13/2000	19	stn 1/2	ALKAL	mg/L	180	170	4.0
		03/14/2000	HC	Outflow	ALKAL	mg/L	180	170	4.0
		03/15/2000	9b	stn 1/3	ALKAL	mg/L	170	170	0.0
		03/15/2000	12	stn 1/2	ALKAL	mg/L	200	200	0.0
		04/26/1999	10	Outflow	CA	mg/L	35.3	34.1	2.4
		04/26/1999	16	Outflow	CA	mg/L	44.6	45.4	1.3
		04/26/1999	8	Outflow	CA	mg/L	34.4	31.5	6.2
		04/27/1999	23	Outflow	CA	mg/L	42.0	46.6	7.3
		05/17/1999	10	Outflow	CA	mg/L	28.4	27.5	2.3
		05/17/1999	13	stn 1/2	CA	mg/L	28.7	26.9	4.6
		05/17/1999	7	stn 1/2	CA	mg/L	30.0	27.7	5.6
		05/17/1999	5	stn 1/2	CA	mg/L	28.0	25.8	5.8
		05/17/1999	2	Outflow	CA	mg/L	37.8	35.5	4.4
		05/19/1999	20	stn 1/2	CA	mg/L	30.1	29.3	1.9
		05/19/1999	16	Outflow	CA	mg/L	39.9	39.0	1.6
		05/19/1999	24	stn 1/2	CA	mg/L	37.8	36.9	1.7
		06/23/1999	12	Outflow	CA	mg/L	47.0	46.3	1.1
		06/23/1999	24	Outflow	CA	mg/L	46.6	47.3	1.1
		07/19/1999	24	Outflow	CA	mg/L	58.0	68.0	11.2
		07/20/1999	15	Outflow	CA	mg/L	37.4	39.2	3.3
		08/24/1999	22	Outflow	CA	mg/L	45.9	47.1	1.8
		08/25/1999	24	Outflow	CA	mg/L	53.4	52.5	1.2
		09/20/1999	1	Inflow	CA	mg/L	84.6	72.8	10.6
		09/20/1999	10	Outflow	CA	mg/L	42.2	40.2	3.4
		09/27/1999	23	stn 1/2	CA	mg/L	53.6	49.9	5.1
		09/27/1999	23	Outflow	CA	mg/L	52.8	49.5	4.6
		09/27/1999	HC	Outflow	CA	mg/L	83.9	73.7	9.2
		09/27/1999	7	Inflow	CA	mg/L	77.8	77.9	0.1
		09/27/1999	24	Outflow	CA	mg/L	68.7	68.6	0.1
		10/18/1999	19	Outflow	CA	mg/L	32.0	33.0	2.2
		10/18/1999	15	Outflow	CA	mg/L	36.0	39.0	5.7
		10/20/1999	24	Outflow	CA	mg/L	53.0	55.0	2.6
		11/15/1999	10	Outflow	CA	mg/L	57.0	57.0	0.0
		11/17/1999	24	Outflow	CA	mg/L	75.0	75.0	0.0
		12/13/1999	19	stn 1/2	CA	mg/L	55.0	58.0	3.8
		12/13/1999	10	Outflow	CA	mg/L	60.0	59.0	1.2
		12/14/1999	23	Outflow	CA	mg/L	63.5	64.5	1.1
		12/15/1999	11	Outflow	CA	mg/L	63.2	63.1	0.1
		12/15/1999	9	stn 1/2	CA	mg/L	64.5	58.4	7.0
		01/17/2000	22	Outflow	CA	mg/L	55.0	56.0	1.3
		01/18/2000	23	Outflow	CA	mg/L	50.0	46.0	5.9
		01/19/2000	24	Outflow	CA	mg/L	58.0	58.0	0.0
		02/14/2000	HC	Outflow	CA	mg/L	56.0	58.0	2.5
		02/16/2000	24	Outflow	CA	mg/L	57.0	56.0	1.3
		03/13/2000	19	stn 1/2	CA	mg/L	47.0	45.0	3.1
		03/14/2000	HC	Outflow	CA	mg/L	48.0	47.0	1.5

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		03/15/2000	9b	stn 1/3	CA	mg/L	38.0	40.0	3.6
		03/15/2000	12	stn 1/2	CA	mg/L	56.0	53.0	3.9
		04/26/1999	10	Outflow	N_TOT	mg/L	0.71	1.37	44.6
		04/26/1999	16	Outflow	N_TOT	mg/L	0.96	1.19	15.3
		04/26/1999	8	Outflow	N_TOT	mg/L	1.12	1.40	15.7
		04/27/1999	23	Outflow	N_TOT	mg/L	1.38	1.81	19.1
		05/17/1999	10	Outflow	N_TOT	mg/L	1.96	1.68	10.9
		05/17/1999	5	stn 1/2	N_TOT	mg/L	1.28	0.94	21.7
		05/17/1999	7	stn 1/2	N_TOT	mg/L	1.120	1.180	3.7
		05/17/1999	13	stn 1/2	N_TOT	mg/L	0.953	0.940	1.0
		05/17/1999	2	Outflow	N_TOT	mg/L	0.802	0.670	12.7
		05/19/1999	16	Outflow	N_TOT	mg/L	0.867	0.673	17.8
		05/19/1999	24	stn 1/2	N_TOT	mg/L	0.830	0.885	4.5
		05/19/1999	20	stn 1/2	N_TOT	mg/L	0.876	0.867	0.7
		06/23/1999	12	Outflow	N_TOT	mg/L	0.450	0.832	42.1
		06/23/1999	24	Outflow	N_TOT	mg/L	0.804	0.695	10.3
		07/19/1999	24	Outflow	N_TOT	mg/L	0.500	0.470	4.4
		07/20/1999	15	Outflow	N_TOT	mg/L	0.464	0.437	4.2
		08/24/1999	22	Outflow	N_TOT	mg/L	1.380	1.440	3.0
		08/25/1999	24	Outflow	N_TOT	mg/L	1.150	1.380	12.9
		09/20/1999	1	Inflow	N_TOT	mg/L	1.300	1.160	8.0
		09/20/1999	10	Outflow	N_TOT	mg/L	1.540	1.190	18.1
		09/27/1999	7	Inflow	N_TOT	mg/L	1.480	1.750	11.8
		09/27/1999	23	stn 1/2	N_TOT	mg/L	1.860	1.670	7.6
		09/27/1999	23	Outflow	N_TOT	mg/L	1.960	1.800	6.0
		09/27/1999	HC	Outflow	N_TOT	mg/L	2.210	2.030	6.0
		09/27/1999	24	Outflow	N_TOT	mg/L	1.560	1.520	1.8
		10/18/1999	15	Outflow	N_TOT	mg/L	0.740	1.200	33.5
		10/18/1999	19	Outflow	N_TOT	mg/L	0.320	0.740	56.0
		10/20/1999	24	Outflow	N_TOT	mg/L	0.690	1.200	38.2
		11/15/1999	10	Outflow	N_TOT	mg/L	1.300	1.200	5.7
		11/17/1999	24	Outflow	N_TOT	mg/L	1.600	< 0.050	132.8 [a]
		04/26/1999	10	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		04/26/1999	16	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		04/26/1999	8	Outflow	NH_3	mg/L	0.04	< 0.04	0.0
		04/27/1999	23	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/17/1999	13	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/17/1999	7	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/17/1999	10	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/17/1999	5	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/17/1999	2	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/19/1999	20	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/19/1999	16	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		05/19/1999	24	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		06/23/1999	12	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		06/23/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		07/19/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		07/20/1999	15	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		08/24/1999	22	Outflow	NH_3	mg/L	0.05	0.06	10.7
		08/25/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/20/1999	1	Inflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/20/1999	10	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/27/1999	23	stn 1/2	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/27/1999	HC	Outflow	NH_3	mg/L	< 0.04	0.16	84 [a]
		09/27/1999	23	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/27/1999	7	Inflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		09/27/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		10/18/1999	15	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		10/18/1999	19	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		10/20/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		11/15/1999	10	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		11/17/1999	24	Outflow	NH_3	mg/L	< 0.04	< 0.04	0.0
		04/26/1999	10	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		04/26/1999	16	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		04/26/1999	8	Outflow	NO_2NO_3	mg/L	0.05	< 0.05	0.0
		04/27/1999	23	Outflow	NO_2NO_3	mg/L	< 0.05	0.54	117.6 [a]
		05/17/1999	7	stn 1/2	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		05/17/1999	5	stn 1/2	NO_2NO_3	mg/L	0.08	< 0.05	29.2
		05/17/1999	10	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		05/17/1999	13	stn 1/2	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		05/17/1999	2	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		05/19/1999	16	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/19/1999	20	stn 1/2	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		05/19/1999	24	stn 1/2	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		06/23/1999	12	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		06/23/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		07/19/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		07/20/1999	15	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		08/24/1999	22	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		08/25/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/20/1999	1	Inflow	NO_2NO_3	mg/L	0.06	< 0.05	8.0
		09/20/1999	10	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/27/1999	23	stn 1/2	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/27/1999	23	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/27/1999	7	Inflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/27/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		09/27/1999	HC	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		10/18/1999	15	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		10/18/1999	19	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		10/20/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		11/15/1999	10	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		11/17/1999	24	Outflow	NO_2NO_3	mg/L	< 0.05	< 0.05	0.0
		04/26/1999	10	Outflow	TKN	mg/L	0.71	1.37	44.6
		04/26/1999	16	Outflow	TKN	mg/L	0.96	1.19	15.3
		04/26/1999	8	Outflow	TKN	mg/L	1.12	1.40	15.7
		04/27/1999	23	Outflow	TKN	mg/L	1.38	1.27	5.9
		05/17/1999	13	stn 1/2	TKN	mg/L	0.95	0.94	1.0
		05/17/1999	5	stn 1/2	TKN	mg/L	1.20	0.94	17.2
		05/17/1999	10	Outflow	TKN	mg/L	1.96	1.68	10.9
		05/17/1999	7	stn 1/2	TKN	mg/L	1.12	1.18	3.7
		05/17/1999	2	Outflow	TKN	mg/L	0.80	0.67	12.7
		05/19/1999	16	Outflow	TKN	mg/L	0.87	0.67	17.8
		05/19/1999	20	stn 1/2	TKN	mg/L	0.88	0.87	0.7
		05/19/1999	24	stn 1/2	TKN	mg/L	0.83	0.89	4.5
		06/23/1999	24	Outflow	TKN	mg/L	0.80	0.70	10.3
		06/23/1999	12	Outflow	TKN	mg/L	0.45	0.83	42.1
		07/19/1999	24	Outflow	TKN	mg/L	0.50	0.47	4.4
		07/20/1999	15	Outflow	TKN	mg/L	0.46	0.44	4.2
		08/24/1999	22	Outflow	TKN	mg/L	1.38	1.44	3.0
		08/25/1999	24	Outflow	TKN	mg/L	1.15	1.38	12.9
		09/20/1999	1	Inflow	TKN	mg/L	1.24	1.16	4.7
		09/20/1999	10	Outflow	TKN	mg/L	1.54	1.19	18.1
		09/27/1999	23	stn 1/2	TKN	mg/L	1.86	1.67	7.6
		09/27/1999	23	Outflow	TKN	mg/L	1.96	1.80	6.0
		09/27/1999	HC	Outflow	TKN	mg/L	2.21	2.03	6.0
		09/27/1999	7	Inflow	TKN	mg/L	1.48	1.75	11.8
		09/27/1999	24	Outflow	TKN	mg/L	1.56	1.52	1.8
		10/18/1999	15	Outflow	TKN	mg/L	0.74	1.20	33.5
		10/18/1999	19	Outflow	TKN	mg/L	0.32	0.74	56.0
		10/20/1999	24	Outflow	TKN	mg/L	0.69	1.20	38.2
		11/15/1999	10	Outflow	TKN	mg/L	1.30	1.20	5.7
		11/17/1999	24	Outflow	TKN	mg/L	1.60	< 0.10	124.8 [a]
		04/26/1999	10	Outflow	TOC	mg/L	32.6	31.9	1.5
		04/26/1999	16	Outflow	TOC	mg/L	27.7	28.8	2.8
		04/26/1999	8	Outflow	TOC	mg/L	36.2	36.2	0.0
		04/27/1999	23	Outflow	TOC	mg/L	28.8	29.5	1.7
		05/17/1999	10	Outflow	TOC	mg/L	30.3	28.8	3.6
		05/17/1999	5	stn 1/2	TOC	mg/L	29.1	28.3	2.0
		05/17/1999	7	stn 1/2	TOC	mg/L	28.4	27.9	1.3
		05/17/1999	13	stn 1/2	TOC	mg/L	27.0	25.7	3.5
		05/17/1999	2	Outflow	TOC	mg/L	22.6	22.9	0.9
		05/19/1999	16	Outflow	TOC	mg/L	25.4	22.9	7.3
		05/19/1999	24	stn 1/2	TOC	mg/L	23.0	22.8	0.6
		05/19/1999	20	stn 1/2	TOC	mg/L	24.7	24.6	0.3
		06/23/1999	12	Outflow	TOC	mg/L	20.0	19.3	2.5
		06/23/1999	24	Outflow	TOC	mg/L	18.6	18.7	0.4
		07/19/1999	24	Outflow	TOC	mg/L	31.5	31.0	1.1
		07/20/1999	15	Outflow	TOC	mg/L	30.5	25.0	14.0
		08/24/1999	22	Outflow	TOC	mg/L	32.0	31.2	1.8
		08/25/1999	24	Outflow	TOC	mg/L	29.5	29.7	0.5
		09/20/1999	10	Outflow	TOC	mg/L	35.4	37.2	3.5
		09/20/1999	1	Inflow	TOC	mg/L	37.6	43.0	9.5
		09/27/1999	7	Inflow	TOC	mg/L	40.2	40.2	0.0
		09/27/1999	23	stn 1/2	TOC	mg/L	36.1	36.6	1.0
		09/27/1999	23	Outflow	TOC	mg/L	36.4	37.0	1.2
		09/27/1999	24	Outflow	TOC	mg/L	37.2	36.0	2.3
		09/27/1999	HC	Outflow	TOC	mg/L	39.5	38.9	1.1

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		10/18/1999	19	Outflow	TOC	mg/L	26.0	26.0	0.0
		10/18/1999	15	Outflow	TOC	mg/L	31.0	32.0	2.2
		10/20/1999	24	Outflow	TOC	mg/L	32.0	32.0	0.0
		11/15/1999	10	Outflow	TOC	mg/L	37.0	34.0	6.0
		11/17/1999	24	Outflow	TOC	mg/L	36.0	36.0	0.0
		04/26/1999	10	Outflow	TSS	mg/L	< 4.0	4.0	0.0
		04/26/1999	16	Outflow	TSS	mg/L	< 4.0	4.0	0.0
		04/27/1999	23	Outflow	TSS	mg/L	20.0	22.0	6.7
		05/17/1999	10	Outflow	TSS	mg/L	< 4.0	< 4.0	0.0
		05/17/1999	5	stn 1/2	TSS	mg/L	< 4.0	< 4.0	0.0
		05/17/1999	7	stn 1/2	TSS	mg/L	< 4.0	< 4.0	0.0
		05/17/1999	13	stn 1/2	TSS	mg/L	< 4.0	< 4.0	0.0
		05/17/1999	2	Outflow	TSS	mg/L	< 4.0	< 4.0	0.0
		05/19/1999	16	Outflow	TSS	mg/L	14.0	8.0	38.6
		05/19/1999	24	stn 1/2	TSS	mg/L	6.0	16.0	64.3
		05/19/1999	20	stn 1/2	TSS	mg/L	4.0	7.0	38.6
		06/23/1999	12	Outflow	TSS	mg/L	< 4.0	< 4.0	0.0
		06/23/1999	24	Outflow	TSS	mg/L	< 4.0	8.0	47.1
		07/19/1999	24	Outflow	TSS	mg/L	4.0	< 4.0	0.0
		07/20/1999	15	Outflow	TSS	mg/L	< 4.0	< 4.0	0.0
		08/24/1999	22	Outflow	TSS	mg/L	2.0	2.0	0.0
		08/25/1999	24	Outflow	TSS	mg/L	2.4	3.0	15.7
		09/20/1999	10	Outflow	TSS	mg/L	4.0	4.0	0.0
		09/20/1999	1	Inflow	TSS	mg/L	3.8	1.8	51.4
		09/27/1999	23	stn 1/2	TSS	mg/L	2.8	2.0	22.3
		09/27/1999	7	Inflow	TSS	mg/L	3.0	2.3	20.2
		09/27/1999	HC	Outflow	TSS	mg/L	3.3	3.8	10.1
		09/27/1999	24	Outflow	TSS	mg/L	1.5	1.8	10.9
		09/27/1999	23	Outflow	TSS	mg/L	3.0	2.0	28.3
		10/18/1999	15	Outflow	TSS	mg/L	1.8	1.2	28.3
		10/18/1999	19	Outflow	TSS	mg/L	1.0	< 1.0	0.0
		10/20/1999	24	Outflow	TSS	mg/L	1.4	1.2	10.9
		11/15/1999	10	Outflow	TSS	mg/L	1.2	1.2	0.0
		11/17/1999	24	Outflow	TSS	mg/L	1.2	1.4	10.9
		12/13/1999	19	stn 1/2	TSS	mg/L	1.4	9.0	103.3
		12/13/1999	10	Outflow	TSS	mg/L	1.0	9.0	113.1
		12/14/1999	23	Outflow	TSS	mg/L	< 1.0	< 1.0	0.0
		12/15/1999	11	Outflow	TSS	mg/L	< 1.0	< 1.0	0.0
		12/15/1999	9	stn 1/2	TSS	mg/L	< 1.0	3.0	70.7
		01/17/2000	22	Outflow	TSS	mg/L	< 1.0	< 1.0	0.0
		01/18/2000	23	Outflow	TSS	mg/L	1.2	< 1.0	12.9
		01/19/2000	24	Outflow	TSS	mg/L	< 1.0	< 1.0	0.0
		02/14/2000	HC	Outflow	TSS	mg/L	2.4	3.2	20.2
		02/16/2000	24	Outflow	TSS	mg/L	1.4	2.2	31.4
		03/13/2000	19	stn 1/2	TSS	mg/L	1.8	1.4	17.7
		03/14/2000	HC	Outflow	TSS	mg/L	1.4	1.2	10.9
		03/15/2000	12	stn 1/2	TSS	mg/L	4.4	1.0	89.0
		03/15/2000	9b	stn 1/3	TSS	mg/L	< 2.0	1.0	47.1
	IFAS	04/13/1999	21	Outflow	DRP	mg/L	0.007	0.005	23.6
		04/13/1999	14	Outflow	DRP	mg/L	0.004	0.007	38.6
		04/13/1999	7	Outflow	DRP	mg/L	0.005	0.006	12.9
		04/19/1999	23	Outflow	DRP	mg/L	0.002	0.002	0.0
		04/19/1999	8	Outflow	DRP	mg/L	0.001	0.003	70.7
		04/19/1999	14	Outflow	DRP	mg/L	0.001	0.001	0.0
		04/26/1999	10	Outflow	DRP	mg/L	0.002	0.004	47.1
		04/26/1999	8	Inflow	DRP	mg/L	0.003	0.004	20.2
		04/26/1999	16	Outflow	DRP	mg/L	0.002	0.004	47.1
		04/27/1999	23	Outflow	DRP	mg/L	0.003	0.002	28.3
		05/03/1999	24	Outflow	DRP	mg/L	0.003	0.003	2.4
		05/03/1999	17	Outflow	DRP	mg/L	0.003	0.003	2.8
		05/03/1999	9	Outflow	DRP	mg/L	0.003	0.003	2.3
		05/10/1999	13	Outflow	DRP	mg/L	0.003	0.003	0.0
		05/10/1999	19	Outflow	DRP	mg/L	0.003	0.002	9.0
		05/17/1999	13	stn 1/2	DRP	mg/L	0.003	0.003	2.3
		05/17/1999	10	Outflow	DRP	mg/L	0.003	0.004	10.9
		05/17/1999	7	stn 1/2	DRP	mg/L	0.002	0.004	57.1
		05/17/1999	5	stn 1/3	DRP	mg/L	0.003	0.003	18.9
		05/17/1999	2	Outflow	DRP	mg/L	0.003	0.003	12.4
		05/19/1999	13	Outflow	DRP	mg/L	0.004	0.003	12.9
		05/19/1999	20	stn 1/2	DRP	mg/L	0.003	0.004	21.4
		05/19/1999	24	stn 1/2	DRP	mg/L	0.003	0.003	13.7
		05/25/1999	1	Outflow	DRP	mg/L	0.003	0.004	23.6
		05/25/1999	13	Outflow	DRP	mg/L	0.002	0.002	21.2
		05/25/1999	23	Outflow	DRP	mg/L	0.002	0.003	18.7
		06/01/1999	14	Outflow	DRP	mg/L	0.000	0.000	28.3
		06/09/1999	6	Outflow	DRP	mg/L	0.003	0.004	32.3
		06/09/1999	16	Outflow	DRP	mg/L	0.002	0.003	15.0
		06/23/1999	8	Outflow	DRP	mg/L	0.019	0.004	94.9

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		06/23/1999	4	Outflow	DRP	mg/L	0.003	0.004	26.5
		06/23/1999	20	Outflow	DRP	mg/L	0.002	0.002	0.0
		06/23/1999	24	Outflow	DRP	mg/L	0.002	0.002	0.0
		06/28/1999	4	Outflow	DRP	mg/L	0.003	0.002	11.3
		06/28/1999	16	Outflow	DRP	mg/L	0.003	0.003	2.8
		07/06/1999	12	Outflow	DRP	mg/L	0.004	0.003	20.9
		07/06/1999	24	Outflow	DRP	mg/L	0.004	0.002	31.2
		07/14/1999	23	Outflow	DRP	mg/L	0.005	0.003	40.9
		07/14/1999	19	Outflow	DRP	mg/L	0.002	0.003	45.3
		07/19/1999	24	Inflow	DRP	mg/L	0.004	0.005	12.9
		07/19/1999	24	Outflow	DRP	mg/L	0.003	0.003	4.7
		07/20/1999	1	Inflow	DRP	mg/L	0.004	0.004	10.3
		07/20/1999	15	Outflow	DRP	mg/L	0.003	0.002	11.8
		07/21/1999	2	Inflow	DRP	mg/L	0.003	0.004	12.9
		07/26/1999	16	Outflow	DRP	mg/L	0.001	0.001	17.0
		07/26/1999	24	Outflow	DRP	mg/L	0.002	0.002	7.4
		08/02/1999	13	Outflow	DRP	mg/L	0.001	0.001	25.7
		08/02/1999	24	Outflow	DRP	mg/L	0.002	0.002	32.6
		08/09/1999	23	Outflow	DRP	mg/L	0.001	0.002	4.9
		08/09/1999	1	Outflow	DRP	mg/L	0.001	0.001	25.7
		08/24/1999	23	Outflow	DRP	mg/L	0.002	0.002	10.9
		08/24/1999	22	Outflow	DRP	mg/L	0.001	0.001	25.7
		08/24/1999	1	Inflow	DRP	mg/L	0.002	0.007	65.1
		08/25/1999	24	Inflow	DRP	mg/L	0.007	0.004	35.7
		08/25/1999	24	Outflow	DRP	mg/L	0.002	0.002	29.8
		08/30/1999	18	Outflow	DRP	mg/L	0.001	0.002	10.1
		08/30/1999	11	Outflow	DRP	mg/L	0.001	0.002	89.0
		09/20/1999	1	Inflow	DRP	mg/L	0.006	0.008	15.3
		09/20/1999	3	Outflow	DRP	mg/L	0.001	0.001	7.4
		09/27/1999	23	Outflow	DRP	mg/L	0.002	0.001	70.7
		09/27/1999	7	Inflow	DRP	mg/L	0.008	0.009	7.2
		09/27/1999	23	stn 1/2	DRP	mg/L	0.001	0.001	23.6
		09/27/1999	24	Outflow	DRP	mg/L	0.003	0.001	57.9
		09/27/1999	HC	Outflow	DRP	mg/L	0.009	0.010	4.5
		10/18/1999	19	Outflow	DRP	mg/L	0.001	0.001	0.0
		10/18/1999	15	Outflow	DRP	mg/L	0.001	0.001	15.7
		10/19/1999	23	Inflow	DRP	mg/L	0.005	0.005	2.9
		10/20/1999	24	Outflow	DRP	mg/L	0.001	0.002	31.9
		10/20/1999	24	Inflow	DRP	mg/L	0.004	0.006	22.9
		11/15/1999	10	Outflow	DRP	mg/L	0.000	0.001	76.1
		11/15/1999	19	Inflow	DRP	mg/L	0.004	0.005	6.6
		11/16/1999	2	Inflow	DRP	mg/L	0.005	0.005	7.3
		11/17/1999	14	Inflow	DRP	mg/L	0.004	0.005	12.9
		11/17/1999	24	Outflow	DRP	mg/L	0.001	0.001	0.0
		12/13/1999	10	Outflow	DRP	mg/L	0.001	0.002	28.3
		12/13/1999	19	stn 1/2	DRP	mg/L	0.002	0.001	4.9
		12/14/1999	23	Outflow	DRP	mg/L	0.002	0.002	3.8
		12/15/1999	9	stn 1/2	DRP	mg/L	0.001	0.002	47.1
		12/15/1999	11	Outflow	DRP	mg/L	0.002	0.003	11.8
		01/19/2000	HC	Outflow	DRP	mg/L	0.007	0.007	2.1
		01/31/2000	HC	Outflow	DRP	mg/L	0.009	0.010	5.1
		02/16/2000	HC	Outflow	DRP	mg/L	0.011	0.011	0.0
		02/21/2000	HC	Outflow	DRP	mg/L	0.016	0.017	4.3
		02/28/2000	HC	Outflow	DRP	mg/L	0.012	0.011	6.1
		03/07/2000	HC	Outflow	DRP	mg/L	0.011	0.010	2.7
		03/14/2000	HC	Outflow	DRP	mg/L	0.012	0.012	0.0
		03/20/2000	HC	Outflow	DRP	mg/L	0.010	0.010	2.2
		03/27/2000	HC	Outflow	DRP	mg/L	0.003	0.003	8.0
		04/13/1999	21	Outflow	TDP	mg/L	0.0140	0.0140	0.0
		04/13/1999	14	Outflow	TDP	mg/L	0.0130	0.0140	5.2
		04/13/1999	7	Outflow	TDP	mg/L	0.0200	0.0140	25.0
		04/19/1999	14	Outflow	TDP	mg/L	0.0170	0.0140	13.7
		04/19/1999	23	Outflow	TDP	mg/L	0.0190	0.0160	12.1
		04/19/1999	8	Outflow	TDP	mg/L	0.0150	0.0120	15.7
		04/26/1999	16	Outflow	TDP	mg/L	0.0180	0.0200	7.4
		04/26/1999	10	Outflow	TDP	mg/L	0.0150	0.0200	20.2
		04/26/1999	8	Inflow	TDP	mg/L	0.0180	0.0180	0.0
		04/27/1999	23	Outflow	TDP	mg/L	0.0180	0.0150	12.9
		05/03/1999	9	Outflow	TDP	mg/L	0.0094	0.0180	44.4
		05/03/1999	24	Outflow	TDP	mg/L	0.0151	0.0107	24.1
		05/03/1999	17	Outflow	TDP	mg/L	0.0094	0.0107	9.1
		05/10/1999	13	Outflow	TDP	mg/L	0.0088	0.0088	0.0
		05/10/1999	19	Outflow	TDP	mg/L	0.0174	0.0078	53.9
		05/17/1999	2	Outflow	TDP	mg/L	0.0172	0.0111	30.5
		05/17/1999	13	stn 1/2	TDP	mg/L	0.0084	0.0153	41.2
		05/17/1999	10	Outflow	TDP	mg/L	0.0116	0.0172	27.5
		05/17/1999	5	stn 1/3	TDP	mg/L	0.0135	0.0163	13.3
		05/17/1999	7	stn 1/2	TDP	mg/L	0.0153	0.0153	0.0

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/19/1999	13	Outflow	TDP	mg/L	0.0129	0.0287	53.7
		05/19/1999	20	stn 1/2	TDP	mg/L	0.0101	0.0074	21.8
		05/19/1999	24	stn 1/2	TDP	mg/L	0.0101	0.0074	21.8
		05/25/1999	1	Outflow	TDP	mg/L	0.0113	0.0094	13.0
		05/25/1999	13	Outflow	TDP	mg/L	0.0057	0.0103	40.7
		05/25/1999	23	Outflow	TDP	mg/L	0.0094	0.0076	15.0
		06/01/1999	14	Outflow	TDP	mg/L	0.0100	0.0100	0.0
		06/09/1999	16	Outflow	TDP	mg/L	0.0136	0.0104	18.9
		06/09/1999	6	Outflow	TDP	mg/L	0.0086	0.0103	12.7
		06/23/1999	8	Outflow	TDP	mg/L	0.0317	0.0106	70.5
		06/23/1999	4	Outflow	TDP	mg/L	0.0108	0.0115	4.4
		06/23/1999	20	Outflow	TDP	mg/L	0.0097	0.0097	0.0
		06/23/1999	24	Outflow	TDP	mg/L	0.0106	0.0134	16.5
		06/28/1999	16	Outflow	TDP	mg/L	0.0078	0.0069	8.7
		06/28/1999	4	Outflow	TDP	mg/L	0.0078	0.0069	8.7
		07/06/1999	12	Outflow	TDP	mg/L	0.0066	0.0159	58.5
		07/06/1999	24	Outflow	TDP	mg/L	0.0131	0.0084	30.9
		07/14/1999	19	Outflow	TDP	mg/L	0.0062	0.0062	0.0
		07/14/1999	23	Outflow	TDP	mg/L	0.0062	0.0062	0.0
		07/19/1999	24	Inflow	TDP	mg/L	0.0082	0.0110	20.6
		07/19/1999	24	Outflow	TDP	mg/L	0.0082	0.0101	14.7
		07/20/1999	1	Inflow	TDP	mg/L	0.0091	0.0099	6.0
		07/20/1999	15	Outflow	TDP	mg/L	0.0071	0.0071	0.0
		07/21/1999	2	Inflow	TDP	mg/L	0.0080	0.0090	8.3
		07/26/1999	16	Outflow	TDP	mg/L	0.0080	0.0071	8.4
		07/26/1999	24	Outflow	TDP	mg/L	0.0080	0.0099	15.0
		08/02/1999	13	Outflow	TDP	mg/L	0.0087	0.0087	0.0
		08/02/1999	24	Outflow	TDP	mg/L	0.0097	0.0097	0.0
		08/09/1999	1	Outflow	TDP	mg/L	0.0115	0.0107	5.1
		08/09/1999	23	Outflow	TDP	mg/L	0.0116	0.0116	0.0
		08/16/1999	2	Outflow	TDP	mg/L	0.0088	0.0097	6.9
		08/16/1999	HC	Outflow	TDP	mg/L	0.0143	0.0125	9.5
		08/24/1999	23	Outflow	TDP	mg/L	0.0090	0.0090	0.0
		08/24/1999	1	Inflow	TDP	mg/L	0.0126	0.0126	0.0
		08/24/1999	22	Outflow	TDP	mg/L	0.0081	0.0090	7.4
		08/25/1999	24	Outflow	TDP	mg/L	0.0090	0.0077	11.0
		08/25/1999	24	Inflow	TDP	mg/L	0.0145	0.0145	0.0
		08/30/1999	11	Outflow	TDP	mg/L	0.0086	0.0068	16.5
		08/30/1999	18	Outflow	TDP	mg/L	0.0086	0.0086	0.0
		09/07/1999	23	Outflow	TDP	mg/L	0.0086	0.0086	0.0
		09/20/1999	1	Inflow	TDP	mg/L	0.0140	0.0132	4.2
		09/20/1999	3	Outflow	TDP	mg/L	0.0090	0.0070	17.7
		09/27/1999	HC	Outflow	TDP	mg/L	0.0125	0.0125	0.0
		09/27/1999	24	Outflow	TDP	mg/L	0.0099	0.0099	0.0
		09/27/1999	7	Inflow	TDP	mg/L	0.0132	0.0134	1.1
		09/27/1999	23	Outflow	TDP	mg/L	0.0082	0.0090	6.6
		09/27/1999	23	stn 1/2	TDP	mg/L	0.0082	0.0082	0.0
		10/04/1999	23	Outflow	TDP	mg/L	0.0059	0.0076	17.8
		10/04/1999	7	Outflow	TDP	mg/L	0.0103	0.0085	13.5
		10/11/1999	23	Outflow	TDP	mg/L	0.0081	0.0081	0.0
		10/11/1999	8	Outflow	TDP	mg/L	0.0072	0.0081	8.3
		10/18/1999	19	Outflow	TDP	mg/L	0.0072	0.0063	9.4
		10/18/1999	15	Outflow	TDP	mg/L	0.0077	0.0072	4.7
		10/19/1999	23	Inflow	TDP	mg/L	0.0171	0.0162	3.8
		10/20/1999	24	Inflow	TDP	mg/L	0.0162	0.0162	0.0
		10/20/1999	24	Outflow	TDP	mg/L	0.0109	0.0100	6.1
		10/26/1999	24	Outflow	TDP	mg/L	0.0050	0.0068	21.6
		10/26/1999	16	Outflow	TDP	mg/L	0.0050	0.0059	11.7
		11/01/1999	16	Outflow	TDP	mg/L	0.0081	0.0072	8.3
		11/01/1999	20	Outflow	TDP	mg/L	0.0090	0.0081	7.4
		11/08/1999	2	Outflow	TDP	mg/L	0.0063	0.0074	11.4
		11/08/1999	11	Outflow	TDP	mg/L	0.0072	0.0084	10.9
		11/15/1999	10	Outflow	TDP	mg/L	0.0084	0.0074	9.0
		11/15/1999	19	Inflow	TDP	mg/L	0.0149	0.0139	4.9
		11/16/1999	2	Inflow	TDP	mg/L	0.0158	0.0145	6.1
		11/17/1999	14	Inflow	TDP	mg/L	0.0145	0.0145	0.0
		11/17/1999	24	Outflow	TDP	mg/L	0.0109	0.0109	0.0
		11/22/1999	23	Outflow	TDP	mg/L	0.0070	0.0070	0.0
		11/22/1999	16	Outflow	TDP	mg/L	0.0144	0.0070	48.9
		11/30/1999	20	Outflow	TDP	mg/L	0.0061	0.0070	9.7
		11/30/1999	14	Outflow	TDP	mg/L	0.0061	0.0052	11.3
		12/06/1999	16	Outflow	TDP	mg/L	0.0101	0.0092	6.6
		12/06/1999	2	Outflow	TDP	mg/L	0.0101	0.0092	6.6
		12/13/1999	10	Outflow	TDP	mg/L	0.0073	0.0083	9.1
		12/13/1999	19	stn 1/2	TDP	mg/L	0.0083	0.0092	7.3
		12/14/1999	23	Outflow	TDP	mg/L	0.0087	0.0087	0.0
		12/15/1999	11	Outflow	TDP	mg/L	0.0087	0.0087	0.0
		12/15/1999	9	stn 1/2	TDP	mg/L	0.0091	0.0209	55.6

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		12/20/1999	16	Outflow	TDP	mg/L	0.0073	0.0082	8.2
		12/20/1999	19	Outflow	TDP	mg/L	0.0073	0.0117	32.7
		12/27/1999	12	Outflow	TDP	mg/L	0.0098	0.0134	21.9
		12/27/1999	11	Outflow	TDP	mg/L	0.0089	0.0152	37.0
		01/03/2000	20	Outflow	TDP	mg/L	0.0091	0.0082	7.4
		01/03/2000	9	Outflow	TDP	mg/L	0.0082	0.0073	8.2
		01/10/2000	16	Outflow	TDP	mg/L	0.0096	0.0105	6.3
		01/10/2000	3	Outflow	TDP	mg/L	0.0073	0.0105	25.4
		01/17/2000	22	Outflow	TDP	mg/L	0.0096	0.0096	0.0
		01/17/2000	22	Inflow	TDP	mg/L	0.0199	0.0208	3.1
		01/18/2000	23	Outflow	TDP	mg/L	0.0081	0.0091	8.2
		01/19/2000	24	Outflow	TDP	mg/L	0.0081	0.0091	8.2
		01/19/2000	HC	Outflow	TDP	mg/L	0.0198	0.0173	9.5
		01/25/2000	5	Outflow	TDP	mg/L	0.0080	0.0089	7.5
		01/25/2000	16	Outflow	TDP	mg/L	0.0098	0.0098	0.0
		01/31/2000	10	Outflow	TDP	mg/L	0.0099	0.0117	11.8
		01/31/2000	HC	Outflow	TDP	mg/L	0.0265	0.0257	2.2
		01/31/2000	HC	Outflow	TDP	mg/L	0.0257	0.0257	0.0
		01/31/2000	HC	Outflow	TDP	mg/L	0.0239	0.0257	5.1
		02/07/2000	HC	Outflow	TDP	mg/L	0.0260	0.0240	5.7
		02/07/2000	HC	Outflow	TDP	mg/L	0.0250	0.0240	2.9
		02/07/2000	HC	Outflow	TDP	mg/L	0.0240	0.0240	0.0
		02/07/2000	15	Outflow	TDP	mg/L	0.0080	0.0090	8.3
		02/14/2000	HC	Outflow	TDP	mg/L	0.0230	0.0250	5.9
		02/14/2000	19	Inflow	TDP	mg/L	0.0250	0.0270	5.4
		02/15/2000	16	Inflow	TDP	mg/L	0.0240	0.0270	8.3
		02/16/2000	24	Outflow	TDP	mg/L	0.0120	0.0120	0.0
		02/16/2000	HC	Outflow	TDP	mg/L	0.0270	0.0350	18.2
		02/21/2000	HC	Outflow	TDP	mg/L	0.0350	0.0370	3.9
		02/21/2000	HC	Outflow	TDP	mg/L	0.0350	0.0370	3.9
		02/21/2000	HC	Outflow	TDP	mg/L	0.0350	0.0370	3.9
		02/21/2000	19	Outflow	TDP	mg/L	0.0100	0.0140	23.6
		02/28/2000	HC	Outflow	TDP	mg/L	0.0380	0.0320	12.1
		02/28/2000	HC	Outflow	TDP	mg/L	0.0340	0.0320	4.3
		02/28/2000	HC	Outflow	TDP	mg/L	0.0320	0.0320	0.0
		02/28/2000	19	Outflow	TDP	mg/L	0.0160	0.0140	9.4
		03/07/2000	HC	Outflow	TDP	mg/L	0.0318	0.0282	8.4
		03/07/2000	HC	Outflow	TDP	mg/L	0.0300	0.0282	4.3
		03/07/2000	2	Outflow	TDP	mg/L	0.0207	0.0175	11.7
		03/07/2000	HC	Outflow	TDP	mg/L	0.0282	0.0282	0.0
		03/13/2000	3	Outflow	TDP	mg/L	0.0116	0.0261	54.4
		03/13/2000	19	stn 1/2	TDP	mg/L	0.0116	0.0125	5.3
		03/14/2000	HC	Outflow	TDP	mg/L	0.0360	0.0330	6.2
		03/15/2000	12	stn 1/2	TDP	mg/L	0.0150	0.0141	4.3
		03/15/2000	9b	stn 1/3	TDP	mg/L	0.0097	0.0070	22.9
		03/20/2000	HC	Outflow	TDP	mg/L	0.0222	0.0231	2.8
		03/20/2000	HC	Outflow	TDP	mg/L	0.0222	0.0231	2.8
		03/20/2000	HC	Outflow	TDP	mg/L	0.0222	0.0231	2.8
		03/20/2000	17	Outflow	TDP	mg/L	0.0097	0.0097	0.0
		03/27/2000	3	Outflow	TDP	mg/L	0.0126	0.0089	23.7
		03/27/2000	HC	Outflow	TDP	mg/L	0.0153	0.0162	4.1
		03/27/2000	HC	Outflow	TDP	mg/L	0.0135	0.0162	12.9
		03/27/2000	HC	Outflow	TDP	mg/L	0.0162	0.0162	0.0
		04/13/1999	7	Outflow	TP	mg/L	0.0250	0.0390	30.9
		04/13/1999	14	Outflow	TP	mg/L	0.0150	0.0220	26.8
		04/13/1999	21	Outflow	TP	mg/L	0.0230	0.0370	33.0
		04/19/1999	23	Outflow	TP	mg/L	0.0630	0.0550	9.6
		04/19/1999	14	Outflow	TP	mg/L	0.0310	0.0340	6.5
		04/19/1999	8	Outflow	TP	mg/L	0.0410	0.0380	5.4
		04/26/1999	16	Outflow	TP	mg/L	0.0270	0.0290	5.1
		04/26/1999	10	Outflow	TP	mg/L	0.0310	0.0260	12.4
		04/26/1999	8	Inflow	TP	mg/L	0.0350	0.0210	35.4
		04/27/1999	23	Outflow	TP	mg/L	0.0700	0.0550	17.0
		05/03/1999	9	Outflow	TP	mg/L	0.0161	0.0180	7.9
		05/03/1999	17	Outflow	TP	mg/L	0.0161	0.0161	0.0
		05/03/1999	24	Outflow	TP	mg/L	0.0228	0.0199	9.6
		05/10/1999	19	Outflow	TP	mg/L	0.0145	0.0126	9.9
		05/10/1999	13	Outflow	TP	mg/L	0.0183	0.0135	21.3
		05/17/1999	2	Outflow	TP	mg/L	0.0192	0.0148	18.3
		05/17/1999	5	stn 1/3	TP	mg/L	0.0192	0.0165	10.7
		05/17/1999	7	stn 1/2	TP	mg/L	0.0148	0.0148	0.0
		05/17/1999	10	Outflow	TP	mg/L	0.0192	0.0218	9.0
		05/17/1999	13	stn 1/2	TP	mg/L	0.0139	0.0209	28.4
		05/19/1999	24	stn 1/2	TP	mg/L	0.0172	0.0172	0.0
		05/19/1999	13	Outflow	TP	mg/L	0.0148	0.0394	64.2
		05/19/1999	20	stn 1/2	TP	mg/L	0.0181	0.0135	20.6
		05/25/1999	1	Outflow	TP	mg/L	0.0461	0.0516	8.0
		05/25/1999	13	Outflow	TP	mg/L	0.0168	0.0232	22.6

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/25/1999	23	Outflow	TP	mg/L	0.0461	0.0241	44.3
		06/01/1999	14	Outflow	TP	mg/L	0.0148	0.0165	7.7
		06/09/1999	16	Outflow	TP	mg/L	0.0147	0.0124	12.0
		06/09/1999	6	Outflow	TP	mg/L	0.0132	0.0150	9.0
		06/23/1999	4	Outflow	TP	mg/L	0.0190	0.0190	0.0
		06/23/1999	24	Outflow	TP	mg/L	0.0181	0.0172	3.6
		06/23/1999	20	Outflow	TP	mg/L	0.0126	0.0163	18.1
		06/23/1999	8	Outflow	TP	mg/L	0.0453	0.0489	5.4
		06/28/1999	16	Outflow	TP	mg/L	0.0161	0.0161	0.0
		06/28/1999	4	Outflow	TP	mg/L	0.0180	0.0152	11.9
		07/06/1999	12	Outflow	TP	mg/L	0.0131	0.0159	13.7
		07/06/1999	24	Outflow	TP	mg/L	0.0178	0.0178	0.0
		07/14/1999	19	Outflow	TP	mg/L	0.0117	0.0108	5.7
		07/14/1999	23	Outflow	TP	mg/L	0.0117	0.0108	5.7
		07/19/1999	24	Inflow	TP	mg/L	0.0110	0.0119	5.6
		07/19/1999	24	Outflow	TP	mg/L	0.0184	0.0166	7.3
		07/20/1999	15	Outflow	TP	mg/L	0.0128	0.0128	0.0
		07/20/1999	1	Inflow	TP	mg/L	0.0147	0.0128	9.8
		07/21/1999	2	Inflow	TP	mg/L	0.0117	0.0127	5.8
		07/26/1999	24	Outflow	TP	mg/L	0.0200	0.0182	6.7
		07/26/1999	16	Outflow	TP	mg/L	0.0117	0.0099	11.8
		08/02/1999	13	Outflow	TP	mg/L	0.0280	0.0142	46.2
		08/02/1999	24	Outflow	TP	mg/L	0.0690	0.0317	52.4
		08/09/1999	1	Outflow	TP	mg/L	0.0161	0.0161	0.0
		08/09/1999	23	Outflow	TP	mg/L	0.0216	0.0197	6.5
		08/16/1999	2	Outflow	TP	mg/L	0.0153	0.0143	4.8
		08/16/1999	HC	Outflow	TP	mg/L	0.0199	0.0180	7.1
		08/24/1999	23	Outflow	TP	mg/L	0.0154	0.0181	11.4
		08/24/1999	1	Inflow	TP	mg/L	0.0162	0.0163	0.4
		08/24/1999	22	Outflow	TP	mg/L	0.0117	0.0126	5.2
		08/25/1999	24	Inflow	TP	mg/L	0.0158	0.0158	0.0
		08/25/1999	24	Outflow	TP	mg/L	0.0158	0.0158	0.0
		08/30/1999	11	Outflow	TP	mg/L	0.0158	0.0167	3.9
		08/30/1999	18	Outflow	TP	mg/L	0.0284	0.0221	17.6
		09/07/1999	1	Outflow	TP	mg/L	0.0157	0.0175	7.7
		09/07/1999	23	Outflow	TP	mg/L	0.0175	0.0157	7.7
		09/20/1999	1	Inflow	TP	mg/L	0.0184	0.0167	6.8
		09/20/1999	3	Outflow	TP	mg/L	0.0167	0.0149	8.1
		09/27/1999	HC	Outflow	TP	mg/L	0.0187	0.0169	7.2
		09/27/1999	24	Outflow	TP	mg/L	0.0169	0.0169	0.0
		09/27/1999	23	stn 1/2	TP	mg/L	0.0125	0.0117	4.7
		09/27/1999	7	Inflow	TP	mg/L	0.0130	0.0143	6.7
		09/27/1999	23	Outflow	TP	mg/L	0.0108	0.0117	5.7
		10/04/1999	23	Outflow	TP	mg/L	0.0138	0.0147	4.5
		10/04/1999	7	Outflow	TP	mg/L	0.0156	0.0156	0.0
		10/11/1999	8	Outflow	TP	mg/L	0.0128	0.0133	2.7
		10/11/1999	23	Outflow	TP	mg/L	0.0142	0.0125	9.0
		10/18/1999	19	Outflow	TP	mg/L	0.0098	0.0133	21.4
		10/18/1999	15	Outflow	TP	mg/L	0.0089	0.0098	6.8
		10/19/1999	23	Inflow	TP	mg/L	0.0162	0.0162	0.0
		10/20/1999	24	Inflow	TP	mg/L	0.0162	0.0153	4.0
		10/20/1999	24	Outflow	TP	mg/L	0.0145	0.0145	0.0
		10/26/1999	16	Outflow	TP	mg/L	0.0127	0.0123	2.3
		10/26/1999	24	Outflow	TP	mg/L	0.0214	0.0141	29.1
		11/01/1999	16	Outflow	TP	mg/L	0.0143	0.0134	4.6
		11/01/1999	20	Outflow	TP	mg/L	0.0125	0.0125	0.0
		11/08/1999	11	Outflow	TP	mg/L	0.0143	0.0116	14.7
		11/08/1999	2	Outflow	TP	mg/L	0.0143	0.0125	9.5
		11/15/1999	10	Outflow	TP	mg/L	0.0121	0.0111	6.1
		11/15/1999	19	Inflow	TP	mg/L	0.0149	0.0158	4.1
		11/16/1999	2	Inflow	TP	mg/L	0.0186	0.0176	3.9
		11/17/1999	14	Inflow	TP	mg/L	0.0162	0.0153	4.0
		11/17/1999	24	Outflow	TP	mg/L	0.0136	0.0127	4.8
		11/22/1999	23	Outflow	TP	mg/L	0.0125	0.0107	11.0
		11/22/1999	16	Outflow	TP	mg/L	0.0107	0.0107	0.0
		11/30/1999	20	Outflow	TP	mg/L	0.0270	0.0162	35.4
		11/30/1999	14	Outflow	TP	mg/L	0.0089	0.0089	0.0
		12/06/1999	2	Outflow	TP	mg/L	0.0145	0.0101	25.3
		12/06/1999	16	Outflow	TP	mg/L	0.0110	0.0110	0.0
		12/13/1999	10	Outflow	TP	mg/L	0.0118	0.0127	5.2
		12/13/1999	19	stn 1/2	TP	mg/L	0.0118	0.0136	10.0
		12/14/1999	23	Outflow	TP	mg/L	0.0148	0.0148	0.0
		12/15/1999	9	stn 1/2	TP	mg/L	0.0117	0.0126	5.2
		12/15/1999	11	Outflow	TP	mg/L	0.0130	0.0126	2.2
		12/20/1999	16	Outflow	TP	mg/L	0.0152	0.0169	7.5
		12/20/1999	19	Outflow	TP	mg/L	0.0134	0.0178	19.9
		12/27/1999	12	Outflow	TP	mg/L	0.0160	0.0089	40.3
		12/27/1999	11	Outflow	TP	mg/L	0.0160	0.0134	12.5

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Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		01/03/2000	9	Outflow	TP	mg/L	0.0100	0.0100	0.0
		01/03/2000	20	Outflow	TP	mg/L	0.0118	0.0136	10.0
		01/10/2000	16	Outflow	TP	mg/L	0.0136	0.0136	0.0
		01/10/2000	3	Outflow	TP	mg/L	0.0118	0.0118	0.0
		01/17/2000	22	Outflow	TP	mg/L	0.0148	0.0131	8.6
		01/17/2000	22	Inflow	TP	mg/L	0.0233	0.0225	2.5
		01/18/2000	23	Outflow	TP	mg/L	0.0136	0.0136	0.0
		01/19/2000	24	Outflow	TP	mg/L	0.0146	0.0136	5.0
		01/19/2000	HC	Outflow	TP	mg/L	0.0219	0.0210	3.0
		01/25/2000	5	Outflow	TP	mg/L	0.0125	0.0134	4.9
		01/25/2000	16	Outflow	TP	mg/L	0.0160	0.0160	0.0
		01/31/2000	HC	Outflow	TP	mg/L	0.0309	0.0292	4.0
		01/31/2000	HC	Outflow	TP	mg/L	0.0309	0.0292	4.0
		01/31/2000	HC	Outflow	TP	mg/L	0.0292	0.0292	0.0
		01/31/2000	10	Outflow	TP	mg/L	0.0169	0.0178	3.7
		02/07/2000	15	Outflow	TP	mg/L	0.0130	0.0130	0.0
		02/07/2000	HC	Outflow	TP	mg/L	0.0270	0.0290	5.1
		02/07/2000	HC	Outflow	TP	mg/L	0.0290	0.0290	0.0
		02/07/2000	HC	Outflow	TP	mg/L	0.0290	0.0290	0.0
		02/14/2000	HC	Outflow	TP	mg/L	0.0290	0.0290	0.0
		02/14/2000	19	Inflow	TP	mg/L	0.0280	0.0280	0.0
		02/15/2000	16	Inflow	TP	mg/L	0.0310	0.0300	2.3
		02/16/2000	HC	Outflow	TP	mg/L	0.0320	0.0350	6.3
		02/16/2000	24	Outflow	TP	mg/L	0.0200	0.0210	3.4
		02/21/2000	HC	Outflow	TP	mg/L	0.0400	0.0410	1.7
		02/21/2000	HC	Outflow	TP	mg/L	0.0410	0.0410	0.0
		02/21/2000	19	Outflow	TP	mg/L	0.0200	0.0290	26.0
		02/21/2000	HC	Outflow	TP	mg/L	0.0400	0.0410	1.7
		02/28/2000	HC	Outflow	TP	mg/L	0.0380	0.0370	1.9
		02/28/2000	19	Outflow	TP	mg/L	0.0210	0.0210	0.0
		02/28/2000	HC	Outflow	TP	mg/L	0.0380	0.0370	1.9
		02/28/2000	HC	Outflow	TP	mg/L	0.0370	0.0370	0.0
		03/07/2000	HC	Outflow	TP	mg/L	0.0470	0.0461	1.4
		03/07/2000	HC	Outflow	TP	mg/L	0.0443	0.0461	2.8
		03/07/2000	HC	Outflow	TP	mg/L	0.0425	0.0461	5.7
		03/07/2000	2	Outflow	TP	mg/L	0.0237	0.0273	10.0
		03/13/2000	3	Inflow	TP	mg/L	0.0506	0.0324	31.0
		03/13/2000	19	stn 1/2	TP	mg/L	0.0170	0.0161	3.9
		03/14/2000	HC	Outflow	TP	mg/L	0.0423	0.0378	8.0
		03/15/2000	9b	stn 1/3	TP	mg/L	0.0106	0.0115	5.8
		03/15/2000	12	stn 1/2	TP	mg/L	0.0240	0.0240	0.0
		03/20/2000	17	Outflow	TP	mg/L	0.0189	0.0231	14.2
		03/20/2000	HC	Outflow	TP	mg/L	0.0306	0.0321	3.3
		03/20/2000	HC	Outflow	TP	mg/L	0.0303	0.0321	4.1
		03/20/2000	HC	Outflow	TP	mg/L	0.0294	0.0321	6.2
		03/27/2000	3	Outflow	TP	mg/L	0.0153	0.0171	7.9
		03/27/2000	HC	Outflow	TP	mg/L	0.0378	0.0369	1.7
		03/27/2000	HC	Outflow	TP	mg/L	0.0261	0.0369	24.3
		03/27/2000	HC	Outflow	TP	mg/L	0.0342	0.0369	5.4
Sediment	TOXIKON	04/28/1999	9		DENSIT	g/cm_3	1.11	1.92	37.8
		04/28/1999	24		DENSIT	g/cm_3	1.16	1.09	4.4
		04/28/1999	14		DENSIT	g/cm_3	1.20	1.11	5.5
		05/18/1999	20		DENSIT	g/cm_3	1.75	1.43	14.2
		05/18/1999	10		DENSIT	g/cm_3	1.87	1.62	10.1
		06/21/1999	3		DENSIT	g/cm_3	1.91	1.94	1.1
		06/24/1999	24		DENSIT	g/cm_3	1.03	1.06	2.0
		07/19/1999	24		DENSIT	g/cm_3	1.08	1.22	8.6
		07/20/1999	5		DENSIT	g/cm_3	1.10	1.92	38.4
		08/24/1999	10		DENSIT	g/cm_3	1.70	1.78	3.3
		08/25/1999	2		DENSIT	g/cm_3	1.81	1.05	37.6
		09/20/1999	3		DENSIT	g/cm_3	1.83	1.94	4.1
		09/28/1999	17		DENSIT	g/cm_3	1.12	1.08	2.6
		10/18/1999	22		DENSIT	g/cm_3	1.85	1.87	0.8
		10/20/1999	21		DENSIT	g/cm_3	1.07	1.16	5.7
		11/15/1999	22		DENSIT	g/cm_3	1.92	1.82	3.8
		11/17/1999	12		DENSIT	g/cm_3	1.07	1.08	0.7
		12/13/1999	3		DENSIT	g/cm_3	1.96	1.87	3.3
		12/13/1999	1		DENSIT	g/cm_3	1.94	2.02	2.9
		12/15/1999	24		DENSIT	g/cm_3	1.23	1.23	0.0
		01/17/2000	15		DENSIT	g/cm_3	1.70	2.10	14.9
		01/19/2000	17		DENSIT	g/cm_3	1.20	1.30	5.7
		02/14/2000	19		DENSIT	g/cm_3	1.70	1.90	7.9
		02/16/2000	21		DENSIT	g/cm_3	1.20	1.20	0.0
		04/28/1999	9		SOLID	%	35	67	44.4
		04/28/1999	24		SOLID	%	27	32	12.0

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Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		04/28/1999	14		SOLID	%	27	34	16.2
		05/18/1999	10		SOLID	%	61	77	16.4
		05/18/1999	20		SOLID	%	34	79	56.3
		06/21/1999	3		SOLID	%	76	75	0.9
		06/24/1999	24		SOLID	%	19	20	3.7
		07/19/1999	24		SOLID	%	27	32	12.6
		07/20/1999	5		SOLID	%	67	73	6.1
		08/24/1999	10		SOLID	%	77	76	0.9
		08/25/1999	2		SOLID	%	74	17	88.6
		09/20/1999	3		SOLID	%	77	84	6.2
		09/28/1999	17		SOLID	%	31	34	5.7
		10/18/1999	22		SOLID	%	73	73	0.4
		10/20/1999	21		SOLID	%	36	35	0.6
		11/15/1999	22		SOLID	%	75	74	0.9
		11/17/1999	12		SOLID	%	25	19	20.5
		12/13/1999	3		SOLID	%	79	74	4.6
		12/13/1999	1		SOLID	%	74	74	0.0
		12/15/1999	24		SOLID	%	44	12	80.8
		01/17/2000	15		SOLID	%	60	77	17.5
		01/19/2000	17		SOLID	%	15	20	20.2
		02/14/2000	19		SOLID	%	69	67	2.1
		02/16/2000	21		SOLID	%	20	29	26.0
		05/18/1999	20		TKN	mg/kg	< 4.0	< 4.0	0.0
		05/18/1999	10		TKN	mg/kg	15.9	38.0	58.0
		09/20/1999	3		TKN	mg/kg	74.3	112.0	28.6
		09/28/1999	17		TKN	mg/kg	12000	8500	24.1
		12/13/1999	3		TKN	mg/kg	51	53	2.7
		12/13/1999	1		TKN	mg/kg	42	48	9.4
		12/15/1999	24		TKN	mg/kg	9710	6220	31.0
		05/18/1999	10		TOC	mg/kg	2270	2110	5.2
		05/18/1999	20		TOC	mg/kg	1770	5980	76.8
		09/20/1999	3		TOC	mg/kg	3050	1540	46.5
		09/28/1999	17		TOC	mg/kg	46000	61000	19.8
		12/13/1999	3		TOC	mg/kg	2800	3000	4.9
		12/13/1999	1		TOC	mg/kg	3100	3400	6.5
		12/15/1999	24		TOC	mg/kg	105000	63800	34.5
		06/21/1999	3		VS	%	2	3	21.9
		06/24/1999	24		VS	%	61	69	8.9
	IFAS	04/28/1999	9		TIP	mg/kg	114.2	851.0	107.9
		04/28/1999	24		TIP	mg/kg	133.7	151.7	8.9
		04/28/1999	14		TIP	mg/kg	116.5	110.4	3.8
		05/18/1999	20		TIP	mg/kg	10.3	3.7	66.5
		05/18/1999	10		TIP	mg/kg	805.1	891.2	7.2
		06/21/1999	3		TIP	mg/kg	1055.6	809.3	18.7
		06/23/1999	24		TIP	mg/kg	107.5	136.2	16.7
		07/19/1999	24		TIP	mg/kg	124.4	162.8	18.9
		07/20/1999	5		TIP	mg/kg	921.3	999.0	5.7
		08/24/1999	10		TIP	mg/kg	995.3	930.3	4.8
		08/25/1999	11		TIP	mg/kg	100.7	104.4	2.6
		10/18/1999	22		TIP	mg/kg	943.6	956.5	1.0
		10/20/1999	21		TIP	mg/kg	98.9	108.9	6.8
		11/17/1999	12		TIP	mg/kg	86.8	78.4	7.2
		12/13/1999	1		TIP	mg/kg	1163.4	1173.4	0.6
		12/15/1999	24		TIP	mg/kg	121.6	95.3	17.1
		01/17/2000	15		TIP	mg/kg	970.5	959.8	0.8
		01/19/2000	17		TIP	mg/kg	129.3	100.4	17.8
		02/14/2000	19		TIP	mg/kg	19.4	19.8	1.4
		02/16/2000	24		TIP	mg/kg	122.5	104.5	11.2
		04/28/1999	9		TP	mg/kg	158.3	1006.9	103.0
		04/28/1999	14		TP	mg/kg	182.5	204.5	8.1
		04/28/1999	24		TP	mg/kg	219.2	230.1	3.4
		05/18/1999	20		TP	mg/kg	11.9	10.4	9.2
		05/18/1999	10		TP	mg/kg	913.8	993.3	5.9
		06/21/1999	3		TP	mg/kg	1221.6	996.5	14.4
		06/23/1999	24		TP	mg/kg	196.7	219.1	7.6
		07/19/1999	24		TP	mg/kg	138.6	177.4	17.4
		07/20/1999	5		TP	mg/kg	1017.1	1099.9	5.5
		08/24/1999	10		TP	mg/kg	1117.5	1036.7	5.3
		08/25/1999	11		TP	mg/kg	218.9	243.0	7.4
		10/18/1999	22		TP	mg/kg	994.6	948.8	3.3
		10/20/1999	21		TP	mg/kg	225.3	207.3	5.9
		11/17/1999	12		TP	mg/kg	195.7	115.8	36.3
		12/13/1999	1		TP	mg/kg	993.1	995.1	0.1
		12/15/1999	24		TP	mg/kg	366.2	170.4	51.6
		01/17/2000	15		TP	mg/kg	943.6	915.7	2.1
		01/19/2000	17		TP	mg/kg	62.8	96.3	29.8
		02/14/2000	19		TP	mg/kg	32.0	32.1	0.2
		02/16/2000	24		TP	mg/kg	197.8	210.5	4.4

EXHIBIT A.4-2

Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
Periphyton	PPB	04/29/1999	17		ASH WT	mg/L	990.0	830.0	12.4
		04/29/1999	24		ASH WT	mg/L	940.0	990.0	3.7
		04/29/1999	7		ASH WT	mg/L	244.0	244.0	0.0
		05/18/1999	20		ASH WT	mg/L	500.0	676.0	21.2
		05/18/1999	12		ASH WT	mg/L	1420.0	1400.0	1.0
		06/22/1999	2		ASH WT	mg/L	868.0	402.0	51.9
		06/22/1999	1		ASH WT	mg/L	1760.0	1960.0	7.6
		07/19/1999	18		ASH WT	mg/L	555.0	545.0	1.3
		07/20/1999	15		ASH WT	mg/L	1420.0	1490.0	3.4
		08/24/1999	6		ASH WT	mg/L	1250.0	1220.0	1.7
		08/25/1999	11		ASH WT	mg/L	1270.0	1290.0	1.1
		09/20/1999	6		ASH WT	mg/L	679.0	697.0	1.8
		09/28/1999	21		ASH WT	mg/L	1020.0	1140.0	7.9
		10/19/1999	13		ASH WT	mg/L	808.0	970.0	12.9
		10/20/1999	21		ASH WT	mg/L	1070.0	1740.0	33.7
		11/15/1999	15		ASH WT	mg/L	860.0	903.0	3.4
		11/17/1999	12		ASH WT	mg/L	751.0	1160.0	30.3
		12/14/1999	24		ASH WT	mg/L	< 10.0	< 10.0	0.0
		01/17/2000	10		ASH WT	mg/L	793.0	2460.0	72.5
		01/19/2000	17		ASH WT	mg/L	348.0	364.0	3.2
		02/14/2000	19		ASH WT	mg/L	2380.0	4960.0	49.7
		02/16/2000	21		ASH WT	mg/L	3420.0	2970.0	10.0
		04/29/1999	7		ASH-FREE DRY WT	mg/L	40.0	34.0	11.5
		04/29/1999	17		ASH-FREE DRY WT	mg/L	2010.0	1400.0	25.3
		04/29/1999	24		ASH-FREE DRY WT	mg/L	1640.0	1940.0	11.9
		05/18/1999	12		ASH-FREE DRY WT	mg/L	2330.0	2160.0	5.4
		06/22/1999	1		ASH-FREE DRY WT	mg/L	400.0	370.0	5.5
		06/22/1999	2		ASH-FREE DRY WT	mg/L	172.0	122.0	24.1
		07/19/1999	18		ASH-FREE DRY WT	mg/L	269.0	223.0	13.2
		07/20/1999	15		ASH-FREE DRY WT	mg/L	300.0	300.0	0.0
		08/24/1999	6		ASH-FREE DRY WT	mg/L	210.0	210.0	0.0
		08/25/1999	11		ASH-FREE DRY WT	mg/L	1500.0	200.0	108.1
		09/20/1999	6		ASH-FREE DRY WT	mg/L	145.0	150.0	2.4
		09/28/1999	21		ASH-FREE DRY WT	mg/L	730.0	1030.0	24.1
		10/19/1999	13		ASH-FREE DRY WT	mg/L	492.0	550.0	7.9
		10/20/1999	21		ASH-FREE DRY WT	mg/L	940.0	2440.0	62.8
		11/15/1999	15		ASH-FREE DRY WT	mg/L	260.0	257.0	0.8
		11/17/1999	12		ASH-FREE DRY WT	mg/L	639.0	1110.0	38.1
		12/14/1999	24		ASH-FREE DRY WT	mg/L	< 10.0	< 10.0	0.0
		01/17/2000	10		ASH-FREE DRY WT	mg/L	203.0	450.0	53.5
		01/19/2000	17		ASH-FREE DRY WT	mg/L	209.0	219.0	3.3
		02/14/2000	19		ASH-FREE DRY WT	mg/L	630.0	1240.0	46.1
		02/16/2000	21		ASH-FREE DRY WT	mg/L	4990.0	3670.0	21.6
		04/29/1999	24		CHL_A	µg/L	79.9	80.8	0.8
		04/29/1999	17		CHL_A	µg/L	67.9	84.0	15.0
		04/29/1999	7		CHL_A	µg/L	20.3	21.9	5.4
		05/18/1999	12		CHL_A	µg/L	485.0	463.0	3.3
		06/22/1999	2		CHL_A	µg/L	91.0	89.7	1.0
		06/22/1999	1		CHL_A	µg/L	193.0	519.0	64.8
		07/19/1999	18		CHL_A	µg/L	22.3	19.0	11.3
		07/20/1999	15		CHL_A	µg/L	192.0	175.0	6.6
		08/24/1999	6		CHL_A	µg/L	26.4	60.1	55.1
		08/25/1999	2		CHL_A	µg/L	127.0	112.0	8.9
		09/20/1999	6		CHL_A	µg/L	15.1	16.2	5.0
		09/28/1999	21		CHL_A	µg/L	168.0	544.0	74.7
		10/19/1999	22		CHL_A	µg/L	61.9	75.0	13.5
		10/20/1999	21		CHL_A	µg/L	184.0	257.0	23.4
		11/15/1999	15		CHL_A	µg/L	9.3	104.0	118.2
		11/17/1999	12		CHL_A	µg/L	216.0	332.0	29.9
		12/14/1999	24		CHL_A	µg/L	17.8	23.9	20.7
		01/17/2000	10		CHL_A	µg/L	563.0	1510.0	64.6
		01/19/2000	17		CHL_A	µg/L	84.4	141.0	35.5
		02/14/2000	19		CHL_A	µg/L	1140.0	1390.0	14.0
		02/16/2000	21		CHL_A	µg/L	2340.0	10600.0	90.3
		04/29/1999	7		CHL_A corr	µg/L	26.7	29.4	6.8
		04/29/1999	24		CHL_A corr	µg/L	66.8	80.1	12.8
		04/29/1999	17		CHL_A corr	µg/L	80.1	66.8	12.8
		05/18/1999	12		CHL_A corr	µg/L	280.0	268.0	3.1
		06/22/1999	2		CHL_A corr	µg/L	29.6	59.0	46.9
		06/22/1999	1		CHL_A corr	µg/L	132.0	263.0	46.9
		07/19/1999	18		CHL_A corr	µg/L	17.1	14.9	9.7
		07/20/1999	15		CHL_A corr	µg/L	107.0	99.7	5.0
		08/24/1999	6		CHL_A corr	µg/L	20.3	47.8	57.1
		08/25/1999	2		CHL_A corr	µg/L	60.2	37.3	33.2
		09/20/1999	6		CHL_A corr	µg/L	10.0	10.0	0.0
		09/28/1999	21		CHL_A corr	µg/L	90.8	202.0	53.7
		10/19/1999	22		CHL_A corr	µg/L	47.6	46.4	1.8
		10/20/1999	21		CHL_A corr	µg/L	98.4	122.0	15.1

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		11/15/1999	15		CHL_A corr	µg/L	7.7	83.5	117.5
		11/17/1999	12		CHL_A corr	µg/L	95.9	289.0	70.9
		12/14/1999	24		CHL_A corr	µg/L	11.6	16.2	23.4
		01/17/2000	10		CHL_A corr	µg/L	510.0	1270.0	60.4
		01/19/2000	17		CHL_A corr	µg/L	56.1	75.4	20.8
		02/14/2000	19		CHL_A corr	µg/L	1060.0	1180.0	7.6
		02/16/2000	21		CHL_A corr	µg/L	1070.0	480.0	53.8
		05/18/1999	12		CHL_A Mono	µg/L	214.0	214.0	0.0
		05/18/1999	20		CHL_A Mono	µg/L	69.4	40.8	36.7
		04/29/1999	24		CHL_B	µg/L	1.4	51.1	133.9
		04/29/1999	7		CHL_B	µg/L	1.0	9.3	114.0
		04/29/1999	17		CHL_B	µg/L	4.2	14.4	77.6
		05/18/1999	12		CHL_B	µg/L	50.6	53.4	3.8
		06/22/1999	2		CHL_B	µg/L	24.1	8.2	69.6
		06/22/1999	1		CHL_B	µg/L	19.5	106	97.5
		08/24/1999	6		CHL_B	µg/L	< 1.0	< 1.0	0.0
		08/25/1999	2		CHL_B	µg/L	21.3	4.6	91.2
		09/20/1999	6		CHL_B	µg/L	2.5	2.5	0.0
		09/28/1999	21		CHL_B	µg/L	110.0	266.0	58.7
		10/19/1999	22		CHL_B	µg/L	15.2	15.5	1.4
		10/20/1999	21		CHL_B	µg/L	103.0	146.0	24.4
		11/15/1999	15		CHL_B	µg/L	< 1.0	9.2	113.7
		11/17/1999	12		CHL_B	µg/L	34.2	20.1	36.7
		12/14/1999	24		CHL_B	µg/L	2.4	2.7	8.3
		01/17/2000	10		CHL_B	µg/L	< 1.0	20.7	128.4
		01/19/2000	17		CHL_B	µg/L	15.0	39.1	63.0
		02/14/2000	19		CHL_B	µg/L	< 1.0	2.3	55.7
		02/16/2000	21		CHL_B	µg/L	1360.0	571.0	57.8
		04/29/1999	7		CHL_C	µg/L	9.6	15.3	32.4
		04/29/1999	24		CHL_C	µg/L	< 1.0	72.1	137.6
		04/29/1999	17		CHL_C	µg/L	23.8	38.2	32.8
		05/18/1999	12		CHL_C	µg/L	103.0	129.0	15.8
		06/22/1999	1		CHL_C	µg/L	50.4	204.0	85.4
		06/22/1999	2		CHL_C	µg/L	42.4	25.1	36.2
		07/19/1999	18		CHL_B	µg/L	1.0	< 1.0	0.0
		07/20/1999	15		CHL_B	µg/L	34.1	31.6	5.4
		08/24/1999	6		CHL_C	µg/L	3.0	13.3	89.4
		08/25/1999	2		CHL_C	µg/L	78.4	33.9	56.0
		09/20/1999	6		CHL_C	µg/L	5.3	5.3	0.0
		09/28/1999	21		CHL_C	µg/L	293.0	514.0	38.7
		10/19/1999	22		CHL_C	µg/L	28.4	31.0	6.2
		10/20/1999	21		CHL_C	µg/L	267.0	347.0	18.4
		11/15/1999	15		CHL_C	µg/L	1.5	16.9	118.4
		11/17/1999	12		CHL_C	µg/L	43.7	< 1.0	135.1
		12/14/1999	24		CHL_C	µg/L	2.0	5.6	67.0
		01/17/2000	10		CHL_C	µg/L	110.0	321.0	69.2
		01/19/2000	17		CHL_C	µg/L	23.8	65.8	66.3
		02/14/2000	19		CHL_C	µg/L	138.0	187.0	21.3
		02/16/2000	21		CHL_C	µg/L	2630.0	1060.0	60.2
		04/29/1999	24		DRY WT	mg/L	2580	2930	9.0
		04/29/1999	17		DRY WT	mg/L	3000	2230	20.8
		04/29/1999	7		DRY WT	mg/L	284	278	1.5
		05/18/1999	12		DRY WT	mg/L	3750	3560	3.7
		06/22/1999	2		DRY WT	mg/L	1040	524	46.7
		06/22/1999	1		DRY WT	mg/L	2160	2320	5.1
		07/19/1999	18		DRY WT	mg/L	824	768	5.0
		07/20/1999	15		DRY WT	mg/L	1720	1790	2.8
		08/24/1999	6		DRY WT	mg/L	1460	1430	1.5
		08/25/1999	2		DRY WT	mg/L	1520	1490	1.4
		09/20/1999	6		DRY WT	mg/L	824	847	1.9
		09/28/1999	21		DRY WT	mg/L	1750	2170	15.2
		10/19/1999	22		DRY WT	mg/L	1520	1520	0.0
		10/20/1999	21		DRY WT	mg/L	2010	4180	49.6
		11/15/1999	15		DRY WT	mg/L	1120	1160	2.5
		11/17/1999	12		DRY WT	mg/L	1390	2270	34.0
		12/14/1999	24		DRY WT	mg/L	< 10	12	12.9
		01/17/2000	10		DRY WT	mg/L	996	2910	69.3
		01/19/2000	17		DRY WT	mg/L	557	583	3.2
		02/14/2000	19		DRY WT	mg/L	3010	6200	49.0
		02/16/2000	21		DRY WT	mg/L	8410	6640	16.6
		04/29/1999	7		PHEO_A	µg/L	< 1.0	< 1.0	0.0
		04/29/1999	17		PHEO_A	µg/L	< 1.0	8.0	110.0
		04/29/1999	24		PHEO_A	µg/L	17.4	4.0	88.6
		05/18/1999	12		PHEO_A	µg/L	104	85	14.2
		06/22/1999	2		PHEO_A	µg/L	< 1.0	< 1.0	0.0
		06/22/1999	1		PHEO_A	µg/L	< 1.0	40.0	134.5
		07/19/1999	18		PHEO_A	µg/L	5.3	1.6	75.8
		07/20/1999	15		PHEO_A	µg/L	< 1.0	73.3	137.6

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		08/24/1999	6		PHEO_A	µg/L	< 1.0	< 1.0	0.0
		08/25/1999	2		PHEO_A	µg/L	6.3	32.0	94.9
		09/20/1999	6		PHEO_A	µg/L	1.0	7.7	108.9
		09/28/1999	21		PHEO_A	µg/L	54.7	124.0	54.8
		10/19/1999	22		PHEO_A	µg/L	7.7	5.9	18.7
		10/20/1999	21		PHEO_A	µg/L	88.6	97.2	6.5
		11/15/1999	15		PHEO_A	µg/L	< 1.0	< 1.0	0.0
		11/17/1999	12		PHEO_A	µg/L	77.8	39.6	46.0
		12/14/1999	24		PHEO_A	µg/L	2.8	1.3	51.7
		01/17/2000	10		PHEO_A	µg/L	< 1.0	83.3	138.1
		01/19/2000	17		PHEO_A	µg/L	48.4	62.2	17.6
		02/14/2000	19		PHEO_A	µg/L	< 1.0	< 1.0	0.0
		02/16/2000	21		PHEO_A	µg/L	665.0	243.0	65.7
	TOXIKON	04/29/1999	24		CA	mg/L	354	329	5.2
		04/29/1999	17		CA	mg/L	333	317	3.5
		04/29/1999	7		CA	mg/L	195	147	19.8
		05/18/1999	12		CA	mg/L	238	328	22.5
		06/22/1999	2		CA	mg/L	270	280	2.6
		06/22/1999	1		CA	mg/L	260	550	50.6
		07/19/1999	18		CA	mg/L	66	71	5.2
		07/20/1999	15		CA	mg/L	374	354	3.9
		08/24/1999	6		CA	mg/L	256	314	14.4
		08/25/1999	2		CA	mg/L	266	299	8.3
		09/20/1999	6		CA	mg/L	61	67	6.9
		09/28/1999	21		CA	mg/L	240	280	10.9
		10/18/1999	22		CA	mg/L	88	86	1.6
		10/20/1999	21		CA	mg/L	200	290	26.0
		11/15/1999	15		CA	mg/L	190	300	31.7
		12/15/1999	24		CA	mg/L	1	< 1	1.4
		01/17/2000	10		CA	mg/L	210	810	83.2
		01/19/2000	17		CA	mg/L	54	57	3.8
		02/14/2000	19		CA	mg/L	730	1400	44.5
		02/16/2000	21		CA	mg/L	580	580	0.0
		05/18/1999	12		TKN	mg/L	10.4	17.2	34.8
		05/18/1999	20		TKN	mg/L	1.9	1.7	4.3
		09/20/1999	6		TKN	mg/L	1.2	1.3	7.4
		09/28/1999	21		TKN	mg/L	13.0	14.0	5.2
		12/13/1999	10		TKN	mg/L	12.0	9.6	15.7
		12/13/1999	5		TKN	mg/L	4.8	6.9	25.4
		12/13/1999	3		TKN	mg/L	7.9	4.7	35.9
		12/15/1999	24		TKN	mg/L	< 1.0	0.3	84.3
	IFAS	04/29/1999	7		TIP	mg/L	0.1654	0.1378	12.9
		04/29/1999	17		TIP	mg/L	0.3452	0.2877	12.8
		04/29/1999	24		TIP	mg/L	0.3261	0.4219	18.1
		05/18/1999	12		TIP	mg/L	0.2821	0.6370	54.6
		06/22/1999	1		TIP	mg/L	1.2356	1.2497	0.8
		06/22/1999	2		TIP	mg/L	0.1112	0.0998	7.6
		07/19/1999	18		TIP	mg/L	0.0243	0.0266	6.4
		07/20/1999	15		TIP	mg/L	0.0020	0.0015	20.2
		08/24/1999	6		TIP	mg/L	0.7024	0.1372	95.2
		08/25/1999	2		TIP	mg/L	0.6083	0.7376	13.6
		09/20/1999	6		TIP	mg/L	0.0927	0.0903	1.9
		09/29/1999	21		TIP	mg/L	0.2509	0.2696	5.1
		10/18/1999	22		TIP	mg/L	0.1387	0.1901	22.1
		10/20/1999	21		TIP	mg/L	0.1590	0.1339	12.1
		11/15/1999	15		TIP	mg/L	0.2900	0.3240	7.8
		11/17/1999	9		TIP	mg/L	0.0960	0.1970	48.7
		12/15/1999	24		TIP	mg/L	0.0030	0.0030	0.0
		01/17/2000	10		TIP	mg/L	0.2720	0.1670	33.8
		01/19/2000	17		TIP	mg/L	0.0480	0.0440	6.1
		02/14/2000	19		TIP	mg/L	0.2240	0.2530	8.6
		02/16/2000	21		TIP	mg/L	0.9020	0.6780	20.0
		04/29/1999	24		TP	mg/L	0.9635	0.8898	5.6
		04/29/1999	17		TP	mg/L	1.1356	0.9144	15.3
		04/29/1999	7		TP	mg/L	0.3957	0.4203	4.3
		05/18/1999	12		TP	mg/L	0.8259	1.3912	36.1
		06/22/1999	1		TP	mg/L	1.9546	2.0736	4.2
		06/22/1999	2		TP	mg/L	0.7886	0.9314	11.7
		07/19/1999	18		TP	mg/L	0.0731	0.0731	0.0
		07/20/1999	15		TP	mg/L	1.1932	1.1218	4.4
		08/24/1999	6		TP	mg/L	1.0158	1.0641	3.3
		08/25/1999	2		TP	mg/L	1.0641	1.1124	3.1
		09/20/1999	6		TP	mg/L	0.2498	0.2007	15.4
		09/29/1999	21		TP	mg/L	0.7410	0.8393	8.8
		10/18/1999	22		TP	mg/L	0.2617	0.3576	21.9
		10/20/1999	21		TP	mg/L	1.0767	1.1726	6.0
		11/15/1999	15		TP	mg/L	0.5490	0.4530	13.5
		11/17/1999	9		TP	mg/L	0.6930	0.7890	9.2

EXHIBIT A.4-2
Field Duplicate Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Cell	Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		12/15/1999	24		TP	mg/L	0.0240	0.0240	0.0
		01/17/2000	10		TP	mg/L	0.8040	4.1930	95.9
		01/19/2000	17		TP	mg/L	0.1960	0.2360	13.1
		02/14/2000	19		TP	mg/L	0.9010	1.3410	27.8
		02/16/2000	21		TP	mg/L	2.0250	1.5690	17.9

[a] Questionable value; high % RSD may be the result of an analytical outlier.

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
Water	PPB	03/07/2001	8	Outflow	AL_DIS	µg/L	4.5	4.5	0.0
		03/28/2001	13	Outflow	AL_DIS	µg/L	4.5	4.5	0.0
		05/22/2000	13	Outflow	ALKAL	mg/L	204	200	1.4
		06/27/2000	13	Outflow	ALKAL	mg/L	112	114	1.3
		06/27/2000	3	Inflow	ALKAL	mg/L	224	224	0.0
		07/17/2000	8	Outflow	ALKAL	mg/L	180	184	1.6
		08/14/2000	8	Outflow	ALKAL	mg/L	250	242	2.3
		10/24/2000	13	Outflow	ALKAL	mg/L	198	196	0.7
		11/28/2000	13	Outflow	ALKAL	mg/L	280	276	1.0
		12/18/2000	8	Outflow	ALKAL	mg/L	278	281	0.8
		01/23/2001	3	Outflow	ALKAL	mg/L	288	276	3.0
		02/20/2001	3	Outflow	ALKAL	mg/L	284	284	0.0
		03/07/2001	8	Outflow	ALKAL	mg/L	262	266	1.1
		03/20/2001	3	stn 2/3	ALKAL	mg/L	272	252	5.4
		03/28/2001	13	Outflow	ALKAL	mg/L	224	220	1.3
		05/22/2000	13	Outflow	CA	mg/L	51.9	52.6	0.9
		06/27/2000	3	Inflow	CA	mg/L	50.2	39.2	17.4
		06/27/2000	13	Outflow	CA	mg/L	18	17.9	0.4
		07/17/2000	8	Outflow	CA	mg/L	48.8	47.2	2.4
		08/14/2000	8	Outflow	CA	mg/L	64.5	65.6	1.2
		10/24/2000	13	Outflow	CA	mg/L	55.4	55.7	0.4
		11/28/2000	13	Outflow	CA	mg/L	63.8	62.6	1.3
		12/18/2000	8	Outflow	CA	mg/L	71.6	58.4	14.4
		01/23/2001	3	Outflow	CA	mg/L	106	106	0.0
		02/20/2001	3	Outflow	CA	mg/L	72.6	70.4	2.2
		03/20/2001	3	stn 2/3	CA	mg/L	70.9	65.2	5.9
		03/07/2001	8	Outflow	CA_DIS	mg/L	63.6	63.4	0.2
		03/28/2001	13	Outflow	CA_DIS	mg/L	39.6	67.6	36.9
		03/07/2001	8	Outflow	CL	mg/L	207	204	1.0
		03/28/2001	13	Outflow	CL	mg/L	233	232	0.3
		03/07/2001	8	Outflow	COLOR	cpu	180	200	7.4
		03/13/2001	HC	Outflow	COLOR	cpu	150	150	0.0
		03/28/2001	13	Outflow	COLOR	cpu	160	160	0.0
		04/03/2001	8	Outflow	COLOR	cpu	75	75	0.0
		03/07/2001	8	Outflow	FE_DIS	µg/L	6.4	6	4.6
		03/28/2001	13	Outflow	FE_DIS	µg/L	4.3	2.5	37.4
		03/07/2001	8	Outflow	K_DIS	mg/L	17.3	17.4	0.4
		03/28/2001	13	Outflow	K_DIS	mg/L	16	14.4	7.4
		03/07/2001	8	Outflow	MG_DIS	mg/L	32.5	32.3	0.4
		03/28/2001	13	Outflow	MG_DIS	mg/L	31.9	30.6	2.9
		05/22/2000	13	Outflow	N_TOT	mg/L	2.96	3.06	2.3
		06/27/2000	3	Inflow	N_TOT	mg/L	3.61	3.77	3.1
		06/27/2000	13	Outflow	N_TOT	mg/L	3.28	3.5	4.6
		07/17/2000	8	Outflow	N_TOT	mg/L	2.40	2.54	4.0
		08/14/2000	8	Outflow	N_TOT	mg/L	2.46	2.69	6.3
		09/19/2000	13	Inflow	N_TOT	mg/L	2.39	2.29	3.0
		09/19/2000	3	Outflow	N_TOT	mg/L	2.13	2.2	2.3
		09/19/2000	8	Outflow	N_TOT	mg/L	1.86	1.92	2.2
		10/24/2000	13	Outflow	N_TOT	mg/L	2.02	2.18	5.4
		11/28/2000	13	Outflow	N_TOT	mg/L	2.21	2.35	4.3
		12/18/2000	8	Outflow	N_TOT	mg/L	2.32	2.01	10.1
		01/23/2001	3	Outflow	N_TOT	mg/L	2.60	2.68	2.1
		02/20/2001	3	Outflow	N_TOT	mg/L	2.89	3.10	5.0
		03/20/2001	3	stn 2/3	N_TOT	mg/L	2.94	2.49	11.7
		03/07/2001	8	Outflow	NA_DIS	mg/L	154	153	0.5
		03/28/2001	13	Outflow	NA_DIS	mg/L	163	159	1.8
		05/22/2000	13	Outflow	NH_3	mg/L	0.039	0.042	5.2
		06/27/2000	3	Inflow	NH_3	mg/L	0.174	0.193	7.3
		06/27/2000	13	Outflow	NH_3	mg/L	0.005	0.008	32.6
		11/28/2000	13	Outflow	NH_3	mg/L	0.003	0.003	0.0
		12/18/2000	8	Outflow	NH_3	mg/L	0.004	0.004	0.0
		01/23/2001	3	Outflow	NH_3	mg/L	0.028	0.079	67.4
		02/20/2001	3	Outflow	NH_3	mg/L	0.03	0.071	57.4
		03/07/2001	8	Outflow	NH_3	mg/L	0.032	0.031	2.2
		03/20/2001	3	stn 2/3	NH_3	mg/L	0.042	0.015	67.0
		03/28/2001	13	Outflow	NH_3	mg/L	0.003	0.017	99.0

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/22/2000	13	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/27/2000	3	Inflow	NO_2NO_3	mg/L	0.038	0.033	10.0
		06/27/2000	13	Outflow	NO_2NO_3	mg/L	0.004	0.140	133.6
		07/17/2000	8	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		08/14/2000	8	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		09/19/2000	8	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		09/19/2000	3	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		09/19/2000	13	Inflow	NO_2NO_3	mg/L	0.006	0.008	20.2
		10/24/2000	13	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		11/28/2000	13	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		12/18/2000	8	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		01/23/2001	3	Outflow	NO_2NO_3	mg/L	0.005	0.004	15.7
		02/20/2001	3	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		03/07/2001	8	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		03/20/2001	3	stn 2/3	NO_2NO_3	mg/L	0.004	0.004	0.0
		03/28/2001	13	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		03/07/2001	8	Outflow	SI	mg/L	20.9	21.2	1.0
		03/28/2001	13	Outflow	SI	mg/L	22.6	22.1	1.6
		03/07/2001	8	Outflow	SO4	mg/L	55.2	58.2	3.7
		03/28/2001	13	Outflow	SO4	mg/L	49.0	48.4	0.9
		03/07/2001	8	Outflow	TDS	mg/L	777	779	0.2
		03/28/2001	13	Outflow	TDS	mg/L	733	745	1.1
		05/22/2000	13	Outflow	TKN	mg/L	2.96	3.06	2.3
		06/27/2000	13	Outflow	TKN	mg/L	3.28	3.36	1.7
		06/27/2000	3	Inflow	TKN	mg/L	3.57	3.74	3.3
		07/17/2000	8	Outflow	TKN	mg/L	2.40	2.54	4.0
		08/14/2000	8	Outflow	TKN	mg/L	2.46	2.69	6.3
		09/19/2000	8	Outflow	TKN	mg/L	1.86	1.92	2.2
		09/19/2000	3	Outflow	TKN	mg/L	2.13	2.2	2.3
		09/19/2000	13	Inflow	TKN	mg/L	2.38	2.28	3.0
		10/24/2000	13	Outflow	TKN	mg/L	2.02	2.18	5.4
		11/28/2000	13	Outflow	TKN	mg/L	2.21	2.35	4.3
		12/18/2000	8	Outflow	TKN	mg/L	2.32	2.01	10.1
		01/23/2001	3	Outflow	TKN	mg/L	2.6	2.68	2.1
		02/20/2001	3	Outflow	TKN	mg/L	2.89	3.1	5.0
		03/07/2001	8	Outflow	TKN	mg/L	2.13	2.14	0.3
		03/20/2001	3	stn 2/3	TKN	mg/L	2.94	2.49	11.7
		03/28/2001	13	Outflow	TKN	mg/L	2.72	2.79	1.8
		05/22/2000	13	Outflow	TOC	mg/L	55.0	53.0	2.6
		06/27/2000	3	Inflow	TOC	mg/L	45.0	43.0	3.2
		06/27/2000	13	Outflow	TOC	mg/L	42.0	43.0	1.7
		07/17/2000	8	Outflow	TOC	mg/L	38.0	37.0	1.9
		08/14/2000	8	Outflow	TOC	mg/L	43.0	44.0	1.6
		09/19/2000	8	Outflow	TOC	mg/L	43.0	36.0	12.5
		09/19/2000	13	Inflow	TOC	mg/L	47.0	49.0	2.9
		09/19/2000	3	Outflow	TOC	mg/L	46.0	38.0	13.5
		10/24/2000	13	Outflow	TOC	mg/L	35.0	35.0	0.0
		11/28/2000	13	Outflow	TOC	mg/L	36.0	35.0	2.0
		12/18/2000	8	Outflow	TOC	mg/L	41.0	40.0	1.7
		01/23/2001	3	Outflow	TOC	mg/L	46.3	44.0	3.6
		02/20/2001	3	Outflow	TOC	mg/L	51.0	49.6	2.0
		03/07/2001	8	Outflow	TOC	mg/L	45.0	44.3	1.1
		03/20/2001	3	stn 2/3	TOC	mg/L	46.9	45.1	2.8
		03/28/2001	13	Outflow	TOC	mg/L	50.8	48.3	3.6
		05/22/2000	13	Outflow	TSS	mg/L	4	7	38.6
		06/27/2000	13	Outflow	TSS	mg/L	3	2	28.3
		06/27/2000	3	Inflow	TSS	mg/L	2	2	0.0
		07/17/2000	8	Outflow	TSS	mg/L	4	4	0.0
		08/14/2000	8	Outflow	TSS	mg/L	6	5	12.9
		11/28/2000	13	Outflow	TSS	mg/L	12	2	101.0
		12/18/2000	8	Outflow	TSS	mg/L	4	2	47.1
		01/23/2001	3	Outflow	TSS	mg/L	4	4	0.0
		02/20/2001	3	Outflow	TSS	mg/L	4	2	47.1
		03/07/2001	8	Outflow	TSS	mg/L	5	3	35.4
		03/20/2001	3	stn 2/3	TSS	mg/L	4	10	60.6
		03/28/2001	13	Outflow	TSS	mg/L	2	3	28.3
		03/07/2001	8	Outflow	TURBIDITY	ntu	0.8	0.5	28.3
		03/13/2001	HC	Outflow	TURBIDITY	ntu	1.3	1.3	0.0
		03/28/2001	13	Outflow	TURBIDITY	ntu	1.7	1.8	4.0

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		04/03/2001	8	Outflow	TURBIDITY	ntu	1.3	1.2	5.7
	IFAS	04/03/2000	HC	Outflow	DRP	mg/L	0.002	0.003	13.3
		08/14/2000	8	Outflow	DRP	mg/L	0.002	0.002	0.0
		09/19/2000	3	Outflow	DRP	mg/L	0.001	0.001	0.0
		09/19/2000	8	Outflow	DRP	mg/L	0.003	0.001	70.7
		09/19/2000	13	Inflow	DRP	mg/L	0.003	0.004	20.2
		10/02/2000	HC	Outflow	DRP	mg/L	0.001	0.003	70.7
		10/24/2000	13	Outflow	DRP	mg/L	0.001	0.001	0.0
		10/24/2000	13	Outflow	DRP	mg/L	0.001	0.001	0.0
		10/24/2000	13	Outflow	DRP	mg/L	0.001	0.001	0.0
		10/24/2000	13	Outflow	DRP	mg/L	0.001	0.001	0.0
		11/28/2000	8	Outflow	DRP	mg/L	0.001	0.002	47.1
		11/28/2000	13	Outflow	DRP	mg/L	0.002	0.002	0.0
		11/28/2000	8	Outflow	DRP	mg/L	0.001	0.002	47.1
		11/28/2000	13	Outflow	DRP	mg/L	0.002	0.001	47.1
		11/28/2000	13	Outflow	DRP	mg/L	0.002	0.001	47.1
		11/28/2000	13	Outflow	DRP	mg/L	0.002	0.002	0.0
		12/18/2000	8	stn 2/3	DRP	mg/L	0.001	0.001	0.0
		12/18/2000	13	Outflow	DRP	mg/L	0.001	0.001	0.0
		01/23/2001	3	Outflow	DRP	mg/L	0.004	0.004	0.0
		02/20/2001	3	Inflow	DRP	mg/L	0.006	0.002	70.7
		03/05/2001	8	Outflow	DRP	mg/L	0.002	0.002	0.0
		03/05/2001	8	Outflow	DRP	mg/L	0.003	0.002	28.3
		03/05/2001	8	Outflow	DRP	mg/L	0.002	0.002	0.0
		03/13/2001	HC	Outflow	DRP	mg/L	0.002	0.003	28.3
		03/13/2001	HC	Outflow	DRP	mg/L	0.002	0.003	28.3
		03/13/2001	HC	Outflow	DRP	mg/L	0.002	0.003	28.3
		03/20/2001	3	stn 2/3	DRP	mg/L	0.001	0.002	47.1
		03/20/2001	3	stn 2/3	DRP	mg/L	0.001	0.002	47.1
		03/28/2001	13	Outflow	DRP	mg/L	0.003	0.002	28.3
		03/28/2001	13	Outflow	DRP	mg/L	0.002	0.002	0.0
		03/28/2001	13	Outflow	DRP	mg/L	0.002	0.002	0.0
		04/03/2000	HC	Outflow	TDP	mg/L	0.017	0.015	8.8
		04/10/2000	HC	Outflow	TDP	mg/L	0.011	0.010	6.7
		04/17/2000	8	Outflow	TDP	mg/L	0.010	0.011	6.7
		04/24/2000	13	Outflow	TDP	mg/L	0.038	0.043	8.7
		05/01/2000	HC	Outflow	TDP	mg/L	0.012	0.013	5.7
		05/08/2000	8	Outflow	TDP	mg/L	0.010	0.010	0.0
		05/22/2000	13	Outflow	TDP	mg/L	0.031	0.031	0.0
		05/30/2000	13	Outflow	TDP	mg/L	0.008	0.014	38.6
		06/12/2000	3	Outflow	TDP	mg/L	0.016	0.015	4.6
		06/19/2000	HC	Outflow	TDP	mg/L	0.017	0.015	8.8
		06/27/2000	13	Outflow	TDP	mg/L	0.016	0.016	0.0
		07/05/2000	8	Outflow	TDP	mg/L	0.008	0.008	0.0
		07/10/2000	HC	Outflow	TDP	mg/L	0.012	0.013	5.7
		07/17/2000	8	Outflow	TDP	mg/L	0.006	0.006	0.0
		07/24/2000	3	Outflow	TDP	mg/L	0.010	0.009	7.4
		07/24/2000	3	Outflow	TDP	mg/L	0.008	0.009	8.3
		07/24/2000	3	Outflow	TDP	mg/L	0.010	0.007	25.0
		07/24/2000	3	Outflow	TDP	mg/L	0.008	0.007	9.4
		07/31/2000	8	Outflow	TDP	mg/L	0.008	0.010	15.7
		08/07/2000	13	Outflow	TDP	mg/L	0.009	0.008	8.3
		08/14/2000	8	Outflow	TDP	mg/L	0.007	0.006	10.9
		08/21/2000	3	Outflow	TDP	mg/L	0.005	0.004	15.7
		08/28/2000	8	Outflow	TDP	mg/L	0.004	0.004	0.0
		09/05/2000	13	Outflow	TDP	mg/L	0.009	0.009	0.0
		09/13/2000	8	Outflow	TDP	mg/L	0.008	0.008	0.0
		09/19/2000	8	Outflow	TDP	mg/L	0.009	0.008	8.3
		09/19/2000	13	Inflow	TDP	mg/L	0.011	0.011	0.0
		09/19/2000	3	Outflow	TDP	mg/L	0.007	0.006	10.9
		09/25/2000	13	Outflow	TDP	mg/L	0.010	0.010	0.0
		10/02/2000	HC	Outflow	TDP	mg/L	0.009	0.010	7.4
		10/24/2000	13	Outflow	TDP	mg/L	0.008	0.008	0.0
		11/20/2000	13	Outflow	TDP	mg/L	0.011	0.010	6.7
		11/28/2000	8	Outflow	TDP	mg/L	0.007	0.010	25.0
		11/28/2000	13	Outflow	TDP	mg/L	0.013	0.012	5.7
		12/12/2000	13	Outflow	TDP	mg/L	0.017	0.011	30.3
		12/18/2000	8	stn 2/3	TDP	mg/L	0.006	0.007	10.9
		12/18/2000	13	Outflow	TDP	mg/L	0.010	0.011	6.7
		01/09/2001	13	Outflow	TDP	mg/L	0.020	0.020	0.0

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		01/23/2001	3	Outflow	TDP	mg/L	0.014	0.012	10.9
		02/06/2001	3	Outflow	TDP	mg/L	0.012	0.016	20.2
		02/13/2001	3	Outflow	TDP	mg/L	0.011	0.012	6.1
		02/13/2001	3	Outflow	TDP	mg/L	0.011	0.012	6.1
		02/13/2001	3	Outflow	TDP	mg/L	0.011	0.012	6.1
		02/13/2001	3	Outflow	TDP	mg/L	0.011	0.012	6.1
		02/20/2001	3	Inflow	TDP	mg/L	0.016	0.012	20.2
		02/27/2001	3	Outflow	TDP	mg/L	0.015	0.014	4.9
		03/05/2001	8	Outflow	TDP	mg/L	0.009	0.009	0.0
		03/05/2001	8	Outflow	TDP	mg/L	0.009	0.009	0.0
		03/13/2001	HC	Outflow	TDP	mg/L	0.011	0.014	17.0
		03/13/2001	HC	Outflow	TDP	mg/L	0.011	0.014	17.0
		03/13/2001	HC	Outflow	TDP	mg/L	0.011	0.015	21.8
		03/13/2001	HC	Outflow	TDP	mg/L	0.011	0.015	21.8
		03/20/2001	3	stn 2/3	TDP	mg/L	0.013	0.020	30.0
		03/20/2001	3	stn 2/3	TDP	mg/L	0.013	0.014	5.2
		03/28/2001	13	Outflow	TDP	mg/L	0.013	0.012	5.7
		04/03/2000	HC	Outflow	TP	mg/L	0.026	0.021	15.0
		04/10/2000	HC	Outflow	TP	mg/L	0.019	0.017	7.9
		04/17/2000	8	Outflow	TP	mg/L	0.012	0.012	0.0
		04/24/2000	13	Outflow	TP	mg/L	0.102	0.096	4.3
		05/01/2000	HC	Outflow	TP	mg/L	0.016	0.017	4.3
		05/08/2000	8	Outflow	TP	mg/L	0.013	0.012	5.7
		05/22/2000	13	Outflow	TP	mg/L	0.045	0.059	19.0
		05/30/2000	13	Outflow	TP	mg/L	0.036	0.007	95.4
		06/12/2000	3	Outflow	TP	mg/L	0.023	0.022	3.1
		06/19/2000	HC	Outflow	TP	mg/L	0.019	0.027	24.6
		06/27/2000	13	Outflow	TP	mg/L	0.021	0.025	12.3
		07/10/2000	HC	Outflow	TP	mg/L	0.031	0.033	4.4
		07/17/2000	8	Outflow	TP	mg/L	0.010	0.009	7.4
		07/24/2000	3	Outflow	TP	mg/L	0.013	0.016	14.6
		07/24/2000	3	Outflow	TP	mg/L	0.012	0.012	0.0
		07/24/2000	3	Outflow	TP	mg/L	0.012	0.016	20.2
		07/24/2000	3	Outflow	TP	mg/L	0.013	0.012	5.7
		07/31/2000	8	Outflow	TP	mg/L	0.010	0.010	0.0
		08/07/2000	13	Outflow	TP	mg/L	0.017	0.022	18.1
		08/14/2000	8	Outflow	TP	mg/L	0.009	0.009	0.0
		08/21/2000	3	Outflow	TP	mg/L	0.009	0.009	0.0
		08/28/2000	8	Outflow	TP	mg/L	0.011	0.011	0.0
		09/05/2000	13	Outflow	TP	mg/L	0.020	0.020	0.0
		09/13/2000	8	Outflow	TP	mg/L	0.012	0.013	5.7
		09/19/2000	3	Outflow	TP	mg/L	0.013	0.013	0.0
		09/19/2000	13	Inflow	TP	mg/L	0.019	0.019	0.0
		09/19/2000	8	Outflow	TP	mg/L	0.015	0.015	0.0
		09/25/2000	13	Outflow	TP	mg/L	0.020	0.023	9.9
		10/02/2000	HC	Outflow	TP	mg/L	0.018	0.022	14.1
		10/24/2000	13	Outflow	TP	mg/L	0.012	0.012	0.0
		11/20/2000	13	Outflow	TP	mg/L	0.023	0.023	0.0
		11/28/2000	13	Outflow	TP	mg/L	0.031	0.032	2.2
		11/28/2000	8	Outflow	TP	mg/L	0.010	0.007	25.0
		12/12/2000	13	Outflow	TP	mg/L	0.028	0.021	20.2
		12/18/2000	8	stn 2/3	TP	mg/L	0.021	0.018	10.9
		12/18/2000	13	Outflow	TP	mg/L	0.025	0.021	12.3
		01/09/2001	13	Outflow	TP	mg/L	0.026	0.026	0.0
		01/23/2001	3	Outflow	TP	mg/L	0.027	0.027	0.0
		02/06/2001	3	Outflow	TP	mg/L	0.024	0.025	2.9
		02/13/2001	3	Outflow	TP	mg/L	0.020	0.020	0.0
		02/20/2001	3	Inflow	TP	mg/L	0.025	0.021	12.3
		02/27/2001	3	Outflow	TP	mg/L	0.023	0.022	3.1
		03/01/2001	13	Outflow	TP	mg/L	0.033	0.034	2.1
		03/01/2001	13	Outflow	TP	mg/L	0.037	0.034	6.0
		03/05/2001	8	Outflow	TP	mg/L	0.015	0.015	0.0
		03/05/2001	8	Outflow	TP	mg/L	0.017	0.015	8.8
		03/13/2001	HC	Outflow	TP	mg/L	0.023	0.024	3.0
		03/13/2001	HC	Outflow	TP	mg/L	0.023	0.024	3.0
		03/13/2001	HC	Outflow	TP	mg/L	0.024	0.024	0.0
		03/13/2001	HC	Outflow	TP	mg/L	0.023	0.034	27.3
		03/13/2001	HC	Outflow	TP	mg/L	0.023	0.034	27.3
		03/13/2001	HC	Outflow	TP	mg/L	0.024	0.034	24.4
		03/20/2001	13	Outflow	TP	mg/L	0.034	0.036	4.0

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		03/20/2001	13	stn 2/3	TP	mg/L	0.073	0.056	18.6
		03/27/2001	HC	Outflow	TP	mg/L	0.025	0.027	5.4
		03/27/2001	HC	Outflow	TP	mg/L	0.023	0.027	11.3
		03/27/2001	HC	Outflow	TP	mg/L	0.022	0.027	14.4
		03/28/2001	13	Outflow	TP	mg/L	0.027	0.028	2.6
		04/03/2001	8	Outflow	TP	mg/L	0.018	0.017	4.0
Sediment	**PPB**	05/22/2000	8	stn 2/3	DENSIT	g/cm^3	1.49	1.50	0.5
		06/27/2000	8	stn 1/3	DENSIT	g/cm^3	1.61	1.56	2.2
		07/24/2000	8	stn 2/3	DENSIT	g/cm^3	1.66	1.64	0.9
		08/14/2000	3	stn 2/3	DENSIT	g/cm^3	1.76	1.69	2.9
		09/19/2000	8	stn 2/3	DENSIT	g/cm^3	1.74	1.80	2.4
		10/24/2000	13	stn 1/3	DENSIT	g/cm^3	0.61	0.63	2.3
		03/20/2001	3	stn 2/3	DENSIT	g/cm^3	1.60	1.66	2.6
		05/22/2000	8	stn 2/3	SOLID	%	78.4	63.9	14.4
		06/27/2000	8	stn 1/3	SOLID	%	83.5	83.6	0.1
		07/24/2000	8	stn 2/3	SOLID	%	81.3	81.7	0.3
		08/14/2000	3	stn 2/3	SOLID	%	71.6	72.2	0.6
		09/19/2000	8	stn 2/3	SOLID	%	74.9	73.8	1.0
		10/24/2000	13	stn 1/3	SOLID	%	46.3	48.0	2.5
		03/20/2001	3	stn 2/3	SOLID	%	74.4	75.7	1.2
		06/27/2000	8	stn 1/3	TIP	mg/kg	774	678	9.4
		07/24/2000	8	stn 2/3	TIP	mg/kg	1070	832	17.7
		08/14/2000	3	stn 2/3	TIP	mg/kg	826	568	26.2
		06/27/2000	8	stn 1/3	TKN	mg/kg	151	640	87.4
		09/19/2000	8	stn 2/3	TKN	mg/kg	147	151	1.9
		03/20/2001	3	stn 2/3	TKN	mg/kg	280	256	6.3
		06/27/2000	8	stn 1/3	TOC	mg/kg	51	28	41.2
		09/19/2000	8	stn 2/3	TOC	mg/kg	43	57	19.8
		06/27/2000	8	stn 1/3	TP	mg/kg	688	674	1.5
		07/24/2000	8	stn 2/3	TP	mg/kg	924	674	22.1
		08/14/2000	3	stn 2/3	TP	mg/kg	696	1360	45.7
	TOXIKON	04/24/2000	13	stn 2/3	DENSIT	g/cm3	1.4	1.2	10.9
		04/24/2000	13	stn 2/3	SOLID	%	38	36	3.8
	IFAS	04/24/2000	13	stn 2/3	TIP	mg/kg	250	206	13.8
		05/22/2000	8	stn 2/3	TIP	mg/kg	843	816	2.3
		09/19/2000	3	stn 1/3	TIP	mg/Kg	967	803	13.1
		10/24/2000	8	stn 2/3	TIP	mg/Kg	877	256	77.4
		03/20/2001	3	stn 2/3	TIP	mg/kg	828	817	1.0
		04/24/2000	13	stn 2/3	TP	mg/kg	270	236	9.5
		05/22/2000	8	stn 2/3	TP	mg/kg	818	817	0.0
		09/19/2000	3	stn 1/3	TP	mg/kg	1006	829	13.6
		10/24/2000	8	stn 2/3	TP	mg/kg	899	262	77.5
		03/20/2001	3	stn 2/3	TP	mg/kg	902	946	3.4
Periphyton	**PPB**	04/24/2000	3	stn 2/3	ASH WT	mg/L	2820	2990	4.1
		05/22/2000	3	stn 1/3	ASH WT	mg/L	1440	5	140.4
		07/17/2000	3	stn 2/3	ASH WT	mg/L	2815	2815	0.0
		08/14/2000	8	stn 2/3	ASH WT	mg/L	2940	2700	6.0
		09/19/2000	3	stn 1/3	ASH WT	mg/L	1537	1576	1.8
		10/24/2000	8	stn 2/3	ASH WT	mg/L	3460	3480	0.4
		11/28/2000	3	stn 2/3	ASH WT	mg/L	5080	4850	3.3
		12/18/2000	3	stn 2/3	ASH WT	mg/L	388	311	15.6
		01/23/2001	8	stn 2/3	ASH WT	mg/L	3130	3300	3.7
		02/20/2001	8	stn 2/3	ASH WT	mg/L	1780	2090	11.3
		03/20/2001	3	stn 2/3	ASH WT	mg/L	1260	1190	4.0
		04/24/2000	3	stn 2/3	ASH-FREE DRY WT	mg/L	1230	1540	15.8
		05/22/2000	3	stn 1/3	ASH-FREE DRY WT	mg/L	697	685	1.2
		07/17/2000	3	stn 2/3	ASH-FREE DRY WT	mg/L	925	925	0.0
		08/14/2000	8	stn 2/3	ASH-FREE DRY WT	mg/L	1400	1300	5.2
		09/19/2000	3	stn 1/3	ASH-FREE DRY WT	mg/L	943	984	3.0
		10/24/2000	8	stn 2/3	ASH-FREE DRY WT	mg/L	1450	1460	0.5
		11/28/2000	3	stn 2/3	ASH-FREE DRY WT	mg/L	2480	2340	4.1
		12/18/2000	3	stn 2/3	ASH-FREE DRY WT	mg/L	505	352	25.2
		01/23/2001	8	stn 2/3	ASH-FREE DRY WT	mg/L	1520	1620	4.5
		01/23/2001	8	stn 2/3	ASH-FREE DRY WT	mg/L	1520	1620	4.5
		01/23/2001	8	stn 2/3	ASH-FREE DRY WT	mg/L	1520	1620	4.5
		01/23/2001	8	stn 2/3	ASH-FREE DRY WT	mg/L	1520	1620	4.5
		02/20/2001	8	stn 2/3	ASH-FREE DRY WT	mg/L	1420	1630	9.7
		03/20/2001	3	stn 2/3	ASH-FREE DRY WT	mg/L	572	556	2.0

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point		Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
			Cell	Location					
		05/22/2000	3	stn 1/3	CA	mg/L	527	608	10.1
		06/27/2000	3	stn 2/3	CA	mg/L	352	532	28.8
		07/17/2000	3	stn 2/3	CA	mg/L	1820	2330	17.4
		08/14/2000	8	stn 2/3	CA	mg/L	1100	1320	12.9
		09/19/2000	3	stn 1/3	CA	mg/L	553	540	1.7
		10/24/2000	8	stn 2/3	CA	mg/L	1250	1410	8.5
		11/28/2000	3	stn 2/3	CA	mg/L	1470	1110	19.7
		12/18/2000	3	stn 2/3	CA	mg/L	194	120	33.3
		01/23/2001	8	stn 2/3	CA	mg/L	1430	1390	2.0
		02/20/2001	8	stn 2/3	CA	mg/L	796	760	3.3
		03/20/2001	3	stn 2/3	CA	mg/L	415	426	1.8
		04/24/2000	3	stn 2/3	CHL_A	µg/L	1100	949	10.4
		05/22/2000	3	stn 1/3	CHL_A	µg/L	432	550	17.0
		07/17/2000	3	stn 2/3	CHL_A	µg/L	3680	3360	6.4
		08/14/2000	8	stn 2/3	CHL_A	µg/L	1730	2490	25.5
		09/19/2000	3	stn 1/3	CHL_A	µg/L	1690	1470	9.8
		10/24/2000	8	stn 2/3	CHL_A	µg/L	3500	2950	12.1
		11/28/2000	3	stn 2/3	CHL_A	µg/L	3530	3780	4.8
		12/18/2000	3	stn 2/3	CHL_A	µg/L	778	513	29.0
		01/23/2001	8	stn 2/3	CHL_A	µg/L	3560	3770	4.1
		02/20/2001	8	stn 2/3	CHL_A	µg/L	4790	6450	20.9
		03/20/2001	3	stn 2/3	CHL_A	µg/L	880	754	10.9
		04/24/2000	3	stn 2/3	CHL_A corr	µg/L	913	897	1.3
		05/22/2000	3	stn 1/3	CHL_A corr	µg/L	380	499	19.1
		07/17/2000	3	stn 2/3	CHL_A corr	µg/L	2590	1940	20.3
		08/14/2000	8	stn 2/3	CHL_A corr	µg/L	1760	2170	14.8
		09/19/2000	3	stn 1/3	CHL_A corr	µg/L	1690	1520	7.5
		10/24/2000	8	stn 2/3	CHL_A corr	µg/L	3280	2830	10.4
		11/28/2000	3	stn 2/3	CHL_A corr	µg/L	3200	3490	6.1
		12/18/2000	3	stn 2/3	CHL_A corr	µg/L	615	452	21.6
		01/23/2001	8	stn 2/3	CHL_A corr	µg/L	3170	3140	0.7
		02/20/2001	8	stn 2/3	CHL_A corr	µg/L	4140	5410	18.8
		03/20/2001	3	stn 2/3	CHL_A corr	µg/L	645	555	10.6
		04/24/2000	3	stn 2/3	CHL_B	µg/L	1	33.2	133.1
		05/22/2000	3	stn 1/3	CHL_B	µg/L	21.6	31.6	26.6
		07/17/2000	3	stn 2/3	CHL_B	µg/L	305	415	21.6
		08/14/2000	8	stn 2/3	CHL_B	µg/L	220	255	10.4
		09/19/2000	3	stn 1/3	CHL_B	µg/L	157	98.7	32.2
		10/24/2000	8	stn 2/3	CHL_B	µg/L	82.7	50	34.8
		11/28/2000	3	stn 2/3	CHL_B	µg/L	191	210	6.7
		12/18/2000	3	stn 2/3	CHL_B	µg/L	16.7	55.9	76.4
		01/23/2001	8	stn 2/3	CHL_B	µg/L	1	1	0.0
		02/20/2001	8	stn 2/3	CHL_B	µg/L	50	50	0.0
		03/20/2001	3	stn 2/3	CHL_B	µg/L	50.2	34.5	26.2
		04/24/2000	3	stn 2/3	CHL_C	µg/L	141	78	40.7
		05/22/2000	3	stn 1/3	CHL_C	µg/L	27.9	5.7	93.4
		07/17/2000	3	stn 2/3	CHL_C	µg/L	562	635	8.6
		08/14/2000	8	stn 2/3	CHL_C	µg/L	297	389	19.0
		09/19/2000	3	stn 1/3	CHL_C	µg/L	156	106	27.0
		10/24/2000	8	stn 2/3	CHL_C	µg/L	173	49.8	78.2
		11/28/2000	3	stn 2/3	CHL_C	µg/L	414	384	5.3
		12/18/2000	3	stn 2/3	CHL_C	µg/L	33.4	23	26.1
		01/23/2001	8	stn 2/3	CHL_C	µg/L	209	212	1.0
		03/20/2001	3	stn 2/3	CHL_C	µg/L	128	128	0.0
		04/24/2000	3	stn 2/3	DRY WT	mg/L	4050	4530	7.9
		05/22/2000	3	stn 1/3	DRY WT	mg/L	2140	16	139.3
		07/17/2000	3	stn 2/3	DRY WT	mg/L	3740	3740	0.0
		08/14/2000	8	stn 2/3	DRY WT	mg/L	4340	4000	5.8
		09/19/2000	3	stn 1/3	DRY WT	mg/L	2480	2560	2.2
		10/24/2000	8	stn 2/3	DRY WT	mg/L	4910	4940	0.4
		11/28/2000	3	stn 2/3	DRY WT	mg/L	7560	7190	3.5
		12/18/2000	3	stn 2/3	DRY WT	mg/L	893	663	20.9
		01/23/2001	8	stn 2/3	DRY WT	mg/L	4660	4920	3.8
		02/20/2001	8	stn 2/3	DRY WT	mg/L	3190	3720	10.8
		03/20/2001	3	stn 2/3	DRY WT	mg/L	1830	1750	3.2
		04/24/2000	3	stn 2/3	PHEO_A	µg/L	1	1	0.0
		05/22/2000	3	stn 1/3	PHEO_A	µg/L	13.4	1.9	106.3
		07/17/2000	3	stn 2/3	PHEO_A	µg/L	200	200	0.0
		08/14/2000	8	stn 2/3	PHEO_A	µg/L	317	502	31.9
		09/19/2000	3	stn 1/3	PHEO_A	µg/L	50	144	68.5

EXHIBIT A.4-3
Field Duplicate Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point: Cell	Sampling Point: Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		10/24/2000	8	stn 2/3	PHEO_A	µg/L	344	641	42.6
		11/28/2000	3	stn 2/3	PHEO_A	µg/L	913	718	16.9
		12/18/2000	3	stn 2/3	PHEO_A	µg/L	102	112	6.6
		01/23/2001	8	stn 2/3	PHEO_A	mg/m^3	511	646	16.5
		02/20/2001	8	stn 2/3	PHEO_A	µg/L	347	171	48.1
		03/20/2001	3	stn 2/3	PHEO_A	mg/m^3	66.8	76.1	9.2
		07/17/2000	3	stn 2/3	TIP	mg/L	3.05	2.19	23.2
		08/14/2000	8	stn 2/3	TIP	mg/L	0.59	0.52	8.9
		06/27/2000	3	stn 2/3	TKN	mg/L	12.8	9.3	22.2
		09/19/2000	3	stn 1/3	TKN	mg/L	36.2	35.3	1.7
		12/18/2000	3	stn 2/3	TKN	mg/L	17.2	19.6	9.2
		01/23/2001	8	stn 2/3	TKN	mg/L	47.7	67.1	23.9
		02/20/2001	8	stn 2/3	TKN	mg/L	7.1	2.4	69.7
		03/20/2001	3	stn 2/3	TKN	mg/L	13.1	10.2	17.6
		07/17/2000	3	stn 2/3	TP	mg/L	8.44	5.98	24.1
		08/14/2000	8	stn 2/3	TP	mg/L	1.43	1.34	4.3
	TOXIKON	04/24/2000	3	stn 2/3	CA	mg/L	490	840	37.2
	IFAS	04/24/2000	3	stn 2/3	TIP	mg/L	0.410	0.055	108.0
		05/22/2000	3	stn 1/3	TIP	mg/L	0.490	0.798	33.8
		09/19/2000	3	stn 1/3	TIP	mg/L	0.192	0.116	34.9
		10/24/2000	8	stn 2/3	TIP	mg/L	0.671	0.598	8.1
		11/28/2000	3	stn 2/3	TIP	mg/L	0.982	1.148	11.0
		12/18/2000	3	stn 2/3	TIP	mg/L	0.108	0.111	1.9
		01/23/2001	8	stn 2/3	TIP	mg/L	0.212	0.251	11.9
		02/20/2001	8	stn 2/3	TIP	mg/L	0.256	0.253	0.8
		03/20/2001	3	stn 2/3	TIP	mg/L	0.486	0.366	19.9
		04/24/2000	3	stn 2/3	TP	mg/L	4.14	3.24	17.2
		05/22/2000	3	stn 1/3	TP	mg/L	1.63	2.06	16.7
		09/19/2000	3	stn 1/3	TP	mg/L	1.47	1.49	0.9
		10/24/2000	8	stn 2/3	TP	mg/L	2.04	2.11	2.2
		11/28/2000	3	stn 2/3	TP	mg/L	6.44	7.12	7.1
		12/18/2000	3	stn 2/3	TP	mg/L	1.18	1.45	14.5
		01/23/2001	8	stn 2/3	TP	mg/L	4.30	4.46	2.6
		02/20/2001	8	stn 2/3	TP	mg/L	5.45	5.37	1.0
		03/20/2001	3	stn 2/3	TP	mg/L	2.17	1.80	13.3

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point: Cell	Sampling Point: Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
Water	PPB	05/15/2000	16	Outflow	ALKAL	mg/L	204	204	0.0
		05/15/2000	22	Outflow	ALKAL	mg/L	148	148	0.0
		05/15/2000	24	Outflow	ALKAL	mg/L	222	220	0.6
		06/19/2000	17	Center	ALKAL	mg/L	188	184	1.5
		06/19/2000	24	Center	ALKAL	mg/L	184	184	0.0
		06/19/2000	2	Center	ALKAL	mg/L	200	196	1.4
		06/19/2000	12	Outflow	ALKAL	mg/L	192	188	1.5
		06/19/2000	8	Outflow	ALKAL	mg/L	148	144	1.9
		06/19/2000	10	Center	ALKAL	mg/L	160	156	1.8
		06/19/2000	22	Center	ALKAL	mg/L	144	148	1.9
		07/10/2000	HC	Outflow	ALKAL	mg/L	184	180	1.6
		07/10/2000	24	Outflow	ALKAL	mg/L	180	192	4.6
		08/21/2000	15	Outflow	ALKAL	mg/L	260	264	1.1
		08/21/2000	HC	Outflow	ALKAL	mg/L	260	262	0.5
		10/02/2000	18	Inflow	ALKAL	mg/L	300	296	0.9
		10/02/2000	20	Outflow	ALKAL	mg/L	256	260	1.1
		10/02/2000	6	Outflow	ALKAL	mg/L	276	280	1.0
		10/02/2000	23	Center	ALKAL	mg/L	272	272	0.0
		10/02/2000	7	Center	ALKAL	mg/L	242	240	0.6
		10/02/2000	1	Outflow	ALKAL	mg/L	280	280	0.0
		05/15/2000	24	Outflow	CA	mg/L	71.0	68.6	2.4
		05/15/2000	22	Outflow	CA	mg/L	40.5	43.1	4.4
		05/15/2000	16	Outflow	CA	mg/L	58.6	64.7	7.0
		06/19/2000	8	Outflow	CA	mg/L	41.4	37.7	6.6
		06/19/2000	2	Center	CA	mg/L	57.7	54.5	4.0
		06/19/2000	17	Center	CA	mg/L	52.8	51.7	1.5
		06/19/2000	12	Outflow	CA	mg/L	53.2	51.8	1.9
		06/19/2000	10	Center	CA	mg/L	40.4	39.9	0.9
		06/19/2000	24	Center	CA	mg/L	49.4	49.1	0.4
		06/19/2000	22	Center	CA	mg/L	36.3	36.0	0.6
		07/10/2000	HC	Outflow	CA	mg/L	55.6	53.5	2.7
		07/10/2000	24	Outflow	CA	mg/L	49.9	49.0	1.3
		08/21/2000	15	Outflow	CA	mg/L	76.5	80.6	3.7
		08/21/2000	HC	Outflow	CA	mg/L	78.4	75.7	2.5
		10/02/2000	18	Inflow	CA	mg/L	97.6	98.0	0.3
		10/02/2000	6	Outflow	CA	mg/L	83.7	89.7	4.9
		10/02/2000	15	Center	CA	mg/L	87.0	91.8	3.8
		10/02/2000	1	Outflow	CA	mg/L	86.7	94.4	6.0
		10/02/2000	20	Outflow	CA	mg/L	78.8	85.0	5.4
		10/02/2000	23	Center	CA	mg/L	83.5	84.5	0.8
		10/02/2000	7	Center	CA	mg/L	72.1	76.2	3.9
		04/17/2000	22	Outflow	N_TOT	mg/L	1.41	1.35	3.1
		04/18/2000	17	Outflow	N_TOT	mg/L	0.43	0.51	12.0
		05/15/2000	22	Outflow	N_TOT	mg/L	2.04	2.22	6.0
		05/15/2000	24	Outflow	N_TOT	mg/L	1.80	2.01	7.8
		05/15/2000	16	Outflow	N_TOT	mg/L	2.04	2.06	0.7
		06/19/2000	24	Center	N_TOT	mg/L	2.50	2.46	1.1
		06/19/2000	22	Center	N_TOT	mg/L	2.20	2.82	17.5
		06/19/2000	8	Outflow	N_TOT	mg/L	2.17	2.19	0.6
		06/19/2000	10	Center	N_TOT	mg/L	2.20	2.33	4.1
		06/19/2000	17	Center	N_TOT	mg/L	3.25	2.51	18.2
		06/19/2000	12	Outflow	N_TOT	mg/L	2.19	2.23	1.3
		06/19/2000	2	Center	N_TOT	mg/L	2.67	2.37	8.4
		07/10/2000	HC	Outflow	N_TOT	mg/L	2.36	2.29	2.1
		07/10/2000	24	Outflow	N_TOT	mg/L	2.35	2.44	2.7
		08/21/2000	15	Outflow	N_TOT	mg/L	2.53	2.49	1.1
		08/21/2000	HC	Outflow	N_TOT	mg/L	2.04	2.44	12.6
		10/02/2000	1	Outflow	N_TOT	mg/L	2.53	2.34	5.5
		10/02/2000	20	Outflow	N_TOT	mg/L	2.29	2.26	0.9
		10/02/2000	15	Center	N_TOT	mg/L	2.23	2.52	8.6
		10/02/2000	6	Outflow	N_TOT	mg/L	1.67	2.34	23.6
		10/02/2000	18	Inflow	N_TOT	mg/L	0.97	2.37	59.3
		10/02/2000	7	Center	N_TOT	mg/L	1.09	2.16	46.6
		10/02/2000	23	Center	N_TOT	mg/L	4.71	2.44	44.9

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		04/17/2000	22	Outflow	NH_3	mg/L	0.021	0.025	12.3
		05/15/2000	24	Outflow	NH_3	mg/L	0.005	0.004	15.7
		05/15/2000	16	Outflow	NH_3	mg/L	0.004	0.004	0.0
		05/15/2000	22	Outflow	NH_3	mg/L	0.011	0.015	21.8
		06/19/2000	8	Outflow	NH_3	mg/L	0.023	0.034	27.3
		06/19/2000	2	Center	NH_3	mg/L	0.042	0.059	23.8
		06/19/2000	10	Center	NH_3	mg/L	0.028	0.034	13.7
		06/19/2000	17	Center	NH_3	mg/L	0.038	0.044	10.3
		06/19/2000	12	Outflow	NH_3	mg/L	0.037	0.036	1.9
		06/19/2000	24	Center	NH_3	mg/L	0.063	0.043	26.7
		06/19/2000	22	Center	NH_3	mg/L	0.044	0.104	57.3
		07/10/2000	HC	Outflow	NH_3	mg/L	0.030	0.035	10.9
		08/21/2000	HC	Outflow	NH_3	mg/L	0.064	0.064	0.0
		04/17/2000	22	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		04/18/2000	17	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		05/15/2000	24	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		05/15/2000	16	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		05/15/2000	22	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	12	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	22	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	2	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	8	Outflow	NO_2NO_3	mg/L	0.020	0.017	11.5
		06/19/2000	10	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	24	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		06/19/2000	17	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		07/10/2000	HC	Outflow	NO_2NO_3	mg/L	0.023	0.030	18.7
		07/10/2000	24	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		08/21/2000	15	Outflow	NO_2NO_3	mg/L	0.008	0.010	15.7
		08/21/2000	HC	Outflow	NO_2NO_3	mg/L	0.025	0.024	2.9
		10/02/2000	20	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		10/02/2000	18	Inflow	NO_2NO_3	mg/L	0.009	0.010	7.4
		10/02/2000	1	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		10/02/2000	23	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		10/02/2000	6	Outflow	NO_2NO_3	mg/L	0.004	0.004	0.0
		10/02/2000	15	Center	NO_2NO_3	mg/L	0.004	0.004	0.0
		10/02/2000	7	Center	NO_2NO_3	mg/L	0.013	0.014	5.2
		04/17/2000	22	Outflow	TKN	mg/L	1.41	1.35	3.1
		04/18/2000	17	Outflow	TKN	mg/L	0.43	0.51	12.0
		05/15/2000	16	Outflow	TKN	mg/L	2.04	2.06	0.7
		05/15/2000	24	Outflow	TKN	mg/L	1.80	2.01	7.8
		05/15/2000	22	Outflow	TKN	mg/L	2.04	2.22	6.0
		06/19/2000	24	Center	TKN	mg/L	2.50	2.46	1.1
		06/19/2000	10	Center	TKN	mg/L	2.20	2.33	4.1
		06/19/2000	8	Outflow	TKN	mg/L	2.15	2.17	0.7
		06/19/2000	12	Outflow	TKN	mg/L	2.19	2.23	1.3
		06/19/2000	2	Center	TKN	mg/L	2.67	2.37	8.4
		06/19/2000	22	Center	TKN	mg/L	2.20	2.82	17.5
		06/19/2000	17	Center	TKN	mg/L	3.25	2.51	18.2
		07/10/2000	24	Outflow	TKN	mg/L	2.35	2.44	2.7
		07/10/2000	HC	Outflow	TKN	mg/L	2.34	2.26	2.5
		08/21/2000	15	Outflow	TKN	mg/L	2.52	2.48	1.1
		08/21/2000	HC	Outflow	TKN	mg/L	2.01	2.42	13.1
		10/02/2000	23	Center	TKN	mg/L	4.71	2.44	44.9
		10/02/2000	20	Outflow	TKN	mg/L	2.29	2.26	0.9
		10/02/2000	15	Center	TKN	mg/L	2.23	2.52	8.6
		10/02/2000	6	Outflow	TKN	mg/L	1.67	2.34	23.6
		10/02/2000	18	Inflow	TKN	mg/L	0.96	2.36	59.6
		10/02/2000	7	Center	TKN	mg/L	1.08	2.15	46.8
		10/02/2000	1	Outflow	TKN	mg/L	2.53	2.34	5.5
		04/17/2000	22	Outflow	TOC	mg/L	27	26	2.7
		04/18/2000	17	Outflow	TOC	mg/L	28	29	2.5
		05/15/2000	16	Outflow	TOC	mg/L	47	37	16.8
		05/15/2000	24	Outflow	TOC	mg/L	40	40	0.0
		05/15/2000	22	Outflow	TOC	mg/L	46	42	6.4
		06/19/2000	24	Center	TOC	mg/L	48	47	1.5
		06/19/2000	8	Outflow	TOC	mg/L	35	38	5.8
		06/19/2000	22	Center	TOC	mg/L	53	48	7.0
		06/19/2000	2	Center	TOC	mg/L	39	43	6.9

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		06/19/2000	12	Outflow	TOC	mg/L	46	38	13.5
		06/19/2000	10	Center	TOC	mg/L	38	40	3.6
		06/19/2000	17	Center	TOC	mg/L	48	44	6.1
		07/10/2000	HC	Outflow	TOC	mg/L	31	34	6.5
		07/10/2000	24	Outflow	TOC	mg/L	36	36	0.0
		08/21/2000	15	Outflow	TOC	mg/L	44	45	1.6
		08/21/2000	HC	Outflow	TOC	mg/L	42	43	1.7
		10/02/2000	7	Center	TOC	mg/L	71	55	18.0
		10/02/2000	1	Outflow	TOC	mg/L	42	60	25.0
		10/02/2000	18	Inflow	TOC	mg/L	99	63	31.4
		10/02/2000	6	Outflow	TOC	mg/L	42	61	26.1
		10/02/2000	15	Center	TOC	mg/L	79	61	18.2
		10/02/2000	20	Outflow	TOC	mg/L	45	59	19.0
		10/02/2000	23	Center	TOC	mg/L	72	60	12.9
		05/15/2000	16	Outflow	TSS	mg/L	3	3	0.0
		05/15/2000	22	Outflow	TSS	mg/L	4	27	104.9
		05/15/2000	24	Outflow	TSS	mg/L	4	4	0.0
		06/19/2000	24	Center	TSS	mg/L	2	2	0.0
		06/19/2000	10	Center	TSS	mg/L	2	2	0.0
		06/19/2000	2	Center	TSS	mg/L	3	2	28.3
		06/19/2000	8	Outflow	TSS	mg/L	2	2	0.0
		06/19/2000	22	Center	TSS	mg/L	2	2	0.0
		06/19/2000	12	Outflow	TSS	mg/L	2	2	0.0
		06/19/2000	17	Center	TSS	mg/L	2	2	0.0
		07/10/2000	HC	Outflow	TSS	mg/L	2	3	28.3
		07/10/2000	24	Outflow	TSS	mg/L	3	4	20.2
		08/21/2000	HC	Outflow	TSS	mg/L	4	2	47.1
		08/21/2000	15	Outflow	TSS	mg/L	2	3	28.3
		10/02/2000	6	Outflow	TSS	mg/L	2	8	84.9
		10/02/2000	23	Center	TSS	mg/L	9	12	20.2
		10/02/2000	18	Inflow	TSS	mg/L	2	7	78.6
		10/02/2000	7	Center	TSS	mg/L	3	5	35.4
		10/02/2000	1	Outflow	TSS	mg/L	3	3	0.0
		10/02/2000	20	Outflow	TSS	mg/L	11	9	14.1
	TOXIKON	04/17/2000	22	Outflow	ALKAL	mg/L	140	140	0.0
		04/18/2000	17	Outflow	ALKAL	mg/L	160	150	4.6
		04/17/2000	22	Outflow	CA	mg/L	42	41	1.7
		04/18/2000	17	Outflow	CA	mg/L	49	49	0.0
		04/17/2000	22	Outflow	TSS	mg/L	1.6	2	15.7
		04/18/2000	17	Outflow	TSS	mg/L	2.8	1.6	38.6
	IFAS	04/03/2000	HC	Outflow	DRP	mg/L	0.005	0.005	0.0
		05/01/2000	HC	Outflow	DRP	mg/L	0.005	0.004	4.9
		08/21/2000	15	Outflow	DRP	mg/L	0.002	0.001	47.1
		08/21/2000	HC	Outflow	DRP	mg/L	0.005	0.005	0.0
		08/21/2000	22	Outflow	DRP	mg/L	0.001	0.002	47.1
		08/21/2000	19	Outflow	DRP	mg/L	0.001	0.001	0.0
		08/21/2000	6	Inflow	DRP	mg/L	0.005	0.006	12.9
		09/25/2000	3	Outflow	DRP	mg/L	0.001	0.002	47.1
		09/25/2000	1	Outflow	DRP	mg/L	0.002	0.003	28.3
		10/02/2000	15	Center	DRP	mg/L	0.003	0.006	47.1
		10/02/2000	20	Outflow	DRP	mg/L	0.003	0.001	70.7
		10/02/2000	18	Inflow	DRP	mg/L	0.010	0.005	47.1
		10/02/2000	6	Outflow	DRP	mg/L	0.002	0.002	0.0
		10/02/2000	23	Center	DRP	mg/L	0.001	0.006	101.0
		10/02/2000	1	Outflow	DRP	mg/L	0.001	0.006	101.0
		10/02/2000	7	Center	DRP	mg/L	0.002	0.004	47.1
		04/03/2000	HC	Outflow	TDP	mg/L	0.020	0.021	3.4
		04/03/2000	19	Outflow	TDP	mg/L	0.011	0.009	14.1
		04/10/2000	3	Outflow	TDP	mg/L	0.018	0.017	4.0
		04/17/2000	22	Outflow	TDP	mg/L	0.012	0.015	15.7
		04/18/2000	23	Outflow	TDP	mg/L	0.017	0.013	18.9
		04/18/2000	17	Outflow	TDP	mg/L	0.014	0.016	9.4
		04/24/2000	5	Outflow	TDP	mg/L	0.010	0.010	0.0
		04/24/2000	21	Outflow	TDP	mg/L	0.010	0.011	6.7
		05/01/2000	HC	Outflow	TDP	mg/L	0.017	0.017	0.0
		05/08/2000	5	Outflow	TDP	mg/L	0.010	0.010	0.0
		05/08/2000	19	Outflow	TDP	mg/L	0.008	0.010	15.7
		05/15/2000	24	Outflow	TDP	mg/L	0.011	0.012	6.1
		05/15/2000	16	inflow	TDP	mg/L	0.018	0.017	4.0
		05/15/2000	22	Outflow	TDP	mg/L	0.015	0.013	10.1

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/15/2000	16	Outflow	TDP	mg/L	0.009	0.009	0.0
		05/15/2000	17	inflow	TDP	mg/L	0.017	0.018	4.0
		05/15/2000	20	inflow	TDP	mg/L	0.018	0.018	0.0
		05/22/2000	19	Outflow	TDP	mg/L	0.014	0.014	0.0
		05/22/2000	4	Outflow	TDP	mg/L	0.012	0.015	15.7
		05/30/2000	19	Outflow	TDP	mg/L	0.009	0.008	8.3
		05/30/2000	6	Outflow	TDP	mg/L	0.011	0.011	0.0
		06/05/2000	23	Outflow	TDP	mg/L	0.012	0.012	0.0
		06/05/2000	24	Outflow	TDP	mg/L	0.012	0.014	10.9
		06/12/2000	6	Outflow	TDP	mg/L	0.013	0.013	0.0
		06/12/2000	20	Outflow	TDP	mg/L	0.012	0.011	6.1
		06/19/2000	8	Outflow	TDP	mg/L	0.014	0.011	17.0
		06/19/2000	12	Outflow	TDP	mg/L	0.017	0.013	18.9
		06/26/2000	16	Outflow	TDP	mg/L	0.010	0.014	23.6
		06/26/2000	17	Outflow	TDP	mg/L	0.010	0.014	23.6
		07/05/2000	19	Outflow	TDP	mg/L	0.007	0.009	17.7
		07/05/2000	HC	Outflow	TDP	mg/L	0.018	0.017	4.0
		07/17/2000	1	Outflow	TDP	mg/L	0.007	0.009	17.7
		07/17/2000	24	Outflow	TDP	mg/L	0.008	0.007	9.4
		07/17/2000	16	Outflow	TDP	mg/L	0.010	0.006	35.4
		07/24/2000	1	Outflow	TDP	mg/L	0.008	0.006	20.2
		07/24/2000	HC	Outflow	TDP	mg/L	0.012	0.012	0.0
		07/31/2000	17	Outflow	TDP	mg/L	0.012	0.010	12.9
		07/31/2000	19	Outflow	TDP	mg/L	0.006	0.010	35.4
		08/07/2000	21	Outflow	TDP	mg/L	0.009	0.009	0.0
		08/07/2000	5	Outflow	TDP	mg/L	0.008	0.013	33.7
		08/14/2000	15	Outflow	TDP	mg/L	0.007	0.007	0.0
		08/14/2000	24	Outflow	TDP	mg/L	0.008	0.008	0.0
		08/21/2000	19	Outflow	TDP	mg/L	0.004	0.004	0.0
		08/21/2000	6	Inflow	TDP	mg/L	0.012	0.012	0.0
		08/21/2000	22	Outflow	TDP	mg/L	0.004	0.004	0.0
		08/21/2000	15	Outflow	TDP	mg/L	0.011	0.005	53.0
		08/21/2000	HC	Outflow	TDP	mg/L	0.013	0.012	5.7
		08/28/2000	24	Outflow	TDP	mg/L	0.007	0.007	0.0
		08/28/2000	23	Outflow	TDP	mg/L	0.007	0.008	9.4
		09/05/2000	18	Outflow	TDP	mg/L	0.009	0.008	8.3
		09/05/2000	9	Outflow	TDP	mg/L	0.009	0.009	0.0
		09/05/2000	2	Outflow	TDP	mg/L	0.009	0.009	0.0
		09/20/2000	22	Outflow	TDP	mg/L	0.005	0.010	47.1
		09/20/2000	24	Outflow	TDP	mg/L	0.007	0.006	10.9
		09/20/2000	22	Outflow	TDP	mg/L	0.005	0.005	0.0
		09/20/2000	23	Outflow	TDP	mg/L	0.006	0.006	0.0
		09/25/2000	1	Outflow	TDP	mg/L	0.010	0.011	6.7
		09/25/2000	3	Outflow	TDP	mg/L	0.010	0.007	25.0
		10/02/2000	23	Center	TDP	mg/L	0.007	0.007	0.0
		10/02/2000	15	Center	TDP	mg/L	0.007	0.007	0.0
		10/02/2000	6	Outflow	TDP	mg/L	0.005	0.009	40.4
		10/02/2000	18	Inflow	TDP	mg/L	0.012	0.012	0.0
		10/02/2000	20	Outflow	TDP	mg/L	0.007	0.007	0.0
		10/02/2000	1	Outflow	TDP	mg/L	0.007	0.008	9.4
		10/02/2000	7	Center	TDP	mg/L	0.004	0.005	15.7
		04/03/2000	HC	Outflow	TP	mg/L	0.040	0.033	13.6
		04/03/2000	19	Outflow	TP	mg/L	0.017	0.015	8.8
		04/10/2000	3	Outflow	TP	mg/L	0.024	0.024	0.0
		04/17/2000	22	Outflow	TP	mg/L	0.019	0.017	7.9
		04/18/2000	17	Outflow	TP	mg/L	0.026	0.020	18.4
		04/18/2000	23	Outflow	TP	mg/L	0.019	0.021	7.1
		04/24/2000	5	Outflow	TP	mg/L	0.020	0.014	25.0
		04/24/2000	21	Outflow	TP	mg/L	0.034	0.027	16.2
		05/01/2000	HC	Outflow	TP	mg/L	0.132	0.050	63.7
		05/01/2000	5	Outflow	TP	mg/L	0.016	0.017	4.3
		05/08/2000	5	Outflow	TP	mg/L	0.016	0.017	4.3
		05/08/2000	19	Outflow	TP	mg/L	0.017	0.020	11.5
		05/15/2000	24	Outflow	TP	mg/L	0.020	0.019	3.6
		05/15/2000	22	Outflow	TP	mg/L	0.016	0.016	0.0
		05/15/2000	20	inflow	TP	mg/L	0.015	0.025	35.4
		05/15/2000	16	inflow	TP	mg/L	0.026	0.025	2.8
		05/15/2000	16	Outflow	TP	mg/L	0.011	0.013	11.8
		05/15/2000	17	inflow	TP	mg/L	0.021	0.024	9.4
		05/22/2000	19	Outflow	TP	mg/L	0.025	0.016	31.0

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point: Cell	Sampling Point: Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/22/2000	4	Outflow	TP	mg/L	0.010	0.012	12.9
		05/30/2000	6	Outflow	TP	mg/L	0.020	0.017	11.5
		05/30/2000	19	Outflow	TP	mg/L	0.012	0.045	81.9
		06/05/2000	24	Outflow	TP	mg/L	0.024	0.022	6.1
		06/05/2000	23	Outflow	TP	mg/L	0.021	0.023	6.4
		06/12/2000	6	Outflow	TP	mg/L	0.019	0.023	13.5
		06/12/2000	20	Outflow	TP	mg/L	0.014	0.014	0.0
		06/19/2000	12	Outflow	TP	mg/L	0.022	0.074	76.6
		06/19/2000	8	Outflow	TP	mg/L	0.020	0.019	3.6
		06/26/2000	16	Outflow	TP	mg/L	0.013	0.014	5.2
		06/26/2000	17	Outflow	TP	mg/L	0.032	0.028	9.4
		07/17/2000	16	Outflow	TP	mg/L	0.014	0.012	10.9
		07/17/2000	1	Outflow	TP	mg/L	0.013	0.013	0.0
		07/17/2000	24	Outflow	TP	mg/L	0.017	0.017	0.0
		07/24/2000	HC	Outflow	TP	mg/L	0.018	0.018	0.0
		07/24/2000	1	Outflow	TP	mg/L	0.018	0.013	22.8
		07/31/2000	17	Outflow	TP	mg/L	0.021	0.016	19.1
		07/31/2000	19	Outflow	TP	mg/L	0.010	0.014	23.6
		08/07/2000	21	Outflow	TP	mg/L	0.012	0.012	0.0
		08/07/2000	5	Outflow	TP	mg/L	0.017	0.014	13.7
		08/14/2000	24	Outflow	TP	mg/L	0.014	0.018	17.7
		08/14/2000	15	Outflow	TP	mg/L	0.011	0.010	6.7
		08/21/2000	22	Outflow	TP	mg/L	0.009	0.008	8.3
		08/21/2000	6	Inflow	TP	mg/L	0.015	0.015	0.0
		08/21/2000	19	Outflow	TP	mg/L	0.010	0.009	7.4
		08/21/2000	15	Outflow	TP	mg/L	0.011	0.010	6.7
		08/21/2000	HC	Outflow	TP	mg/L	0.017	0.017	0.0
		08/28/2000	24	Outflow	TP	mg/L	0.014	0.014	0.0
		08/28/2000	23	Outflow	TP	mg/L	0.013	0.013	0.0
		09/05/2000	2	Outflow	TP	mg/L	0.012	0.014	10.9
		09/05/2000	18	Outflow	TP	mg/L	0.015	0.016	4.6
		09/05/2000	9	Outflow	TP	mg/L	0.015	0.016	4.6
		09/20/2000	23	Outflow	TP	mg/L	0.018	0.023	17.2
		09/20/2000	24	Outflow	TP	mg/L	0.015	0.015	0.0
		09/20/2000	23	Outflow	TP	mg/L	0.015	0.015	0.0
		09/20/2000	24	Outflow	TP	mg/L	0.016	0.015	4.6
		09/25/2000	1	Outflow	TP	mg/L	0.016	0.016	0.0
		09/25/2000	3	Outflow	TP	mg/L	0.013	0.013	0.0
		10/02/2000	7	Center	TP	mg/L	0.012	0.012	0.0
		10/02/2000	15	Center	TP	mg/L	0.011	0.009	14.1
		10/02/2000	6	Outflow	TP	mg/L	0.011	0.011	0.0
		10/02/2000	18	Inflow	TP	mg/L	0.015	0.016	4.6
		10/02/2000	23	Center	TP	mg/L	0.012	0.012	0.0
		10/02/2000	1	Outflow	TP	mg/L	0.012	0.012	0.0
		10/02/2000	20	Outflow	TP	mg/L	0.010	0.009	7.4
Sediment	**PPB**	05/17/2000	3		DENSIT	g/cm^3	1.7	0.91	42.8
		05/17/2000	3		DENSIT	g/cm^3	1.7	1.75	2.0
		06/20/2000	3		DENSIT	g/cm^3	1.58	1.64	2.6
		06/21/2000	2		DENSIT	g/cm^3	1.67	1.64	1.3
		07/11/2000	9		DENSIT	g/cm^3	0.47	0.78	35.1
		07/12/2000	18		DENSIT	g/cm^3	0.41	0.61	27.7
		08/22/2000	5		DENSIT	g/cm^3	1.45	1.79	14.8
		08/23/2000	15		DENSIT	g/cm^3	1.65	1.59	2.6
		10/03/2000	6		DENSIT	g/cm^3	1.74	1.77	1.2
		10/04/2000	14		DENSIT	g/cm^3	0.45	0.45	0.0
		05/17/2000	24		SOLID	%	34.6	34.2	0.8
		05/17/2000	24		SOLID	%	34.6	78.1	54.6
		06/20/2000	3		SOLID	%	81.4	78.9	2.2
		06/21/2000	2		SOLID	%	80.7	85.1	3.8
		07/11/2000	9		SOLID	%	31.6	41.0	18.3

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point: Cell	Sampling Point: Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		07/12/2000	18		SOLID	%	45.5	34.2	20.1
		08/22/2000	5		SOLID	%	75.7	80.2	4.1
		08/23/2000	15		SOLID	%	84.1	77.6	5.7
		10/03/2000	6		SOLID	%	83.4	83.7	0.3
		10/04/2000	14		SOLID	%	35.0	36.1	2.2
		06/20/2000	3		TIP	mg/kg	906	1310	25.8
		06/21/2000	2		TIP	mg/kg	1190	1080	6.9
		07/11/2000	9		TIP	mg/kg	101	74.8	21.1
		07/12/2000	18		TIP	mg/kg	99.9	106	4.2
		08/22/2000	5		TIP	mg/kg	731	552	19.7
		08/23/2000	15		TIP	mg/kg	811	677	12.7
		06/20/2000	3		TKN	mg/kg	62.4	50	15.6
		06/21/2000	2		TKN	mg/kg	50	61.3	14.4
		10/03/2000	6		TKN	mg/kg	43.3	48.3	7.7
		10/04/2000	14		TKN	mg/kg	399	445	7.7
		06/20/2000	3		TOC	mg/kg	55	25	53.0
		06/21/2000	2		TOC	mg/kg	43	42	1.7
		10/03/2000	6		TOC	mg/kg	36	30	12.9
		10/04/2000	14		TOC	mg/kg	150	180	12.9
		06/20/2000	3		TP	mg/kg	893	1200	20.7
		06/21/2000	2		TP	mg/kg	915	985	5.2
		07/11/2000	9		TP	mg/kg	91.7	42.1	52.4
		07/12/2000	18		TP	mg/kg	77.7	59.4	18.9
		08/22/2000	5		TP	mg/kg	661	630	3.4
	TOXIKON	04/17/2000	5		DENSIT	g/cm3	1.9	2.1	7.1
		04/25/2000	17		DENSIT	g/cm3	1.1	1.1	0.0
		04/17/2000	5		SOLID	%	71	70	1.0
		04/25/2000	17		SOLID	%	18	19	3.8
	IFAS	04/17/2000	5		TIP	mg/kg	980	982	0.1
		04/24/2000	17		TIP	mg/kg	73	64	9.5
		05/17/2000	24		TIP	mg/kg	111	984	112.8
		05/17/2000	3		TIP	mg/kg	987	100	115.5
		10/03/2000	6		TIP	mg/Kg	961	1001	2.9
		10/04/2000	14		TIP	mg/Kg	96	81	12.0
		04/17/2000	5		TP	mg/kg	941	953	0.9
		04/24/2000	17		TP	mg/kg	82	96	11.1
		05/17/2000	24		TP	mg/kg	117	983	111.4
		05/17/2000	3		TP	mg/kg	958	100	114.8
		10/03/2000	6		TP	mg/kg	985	1037	3.6
		10/04/2000	14		TP	mg/kg	159	128	15.3
Periphyton	**PPB**	04/17/2000	5		ASH WT	mg/L	6790	15300	54.5
		04/25/2000	17		ASH WT	mg/L	2980	2480	13.0
		05/17/2000	3		ASH WT	mg/L	3820	4480	11.2
		05/17/2000	24		ASH WT	mg/L	446	456	1.6
		06/20/2000	3		ASH WT	mg/L	2860	3440	13.0
		06/21/2000	15		ASH WT	mg/L	5240	6520	15.4
		07/11/2000	4		ASH WT	mg/L	5140	5310	2.3
		07/12/2000	19		ASH WT	mg/L	15010	20990	23.5
		08/22/2000	5		ASH WT	mg/L	6930	13360	44.8
		08/23/2000	15		ASH WT	mg/L	4050	4000	0.9
		10/03/2000	8		ASH WT	mg/L	3850	3050	16.4
		10/04/2000	11		ASH WT	mg/L	3090	3010	1.9
		04/17/2000	5		ASH-FREE DRY WT	mg/L	1650	3400	49.0
		04/25/2000	17		ASH-FREE DRY WT	mg/L	6380	4310	27.4
		05/17/2000	3		ASH-FREE DRY WT	mg/L	1130	1240	6.6
		05/17/2000	24		ASH-FREE DRY WT	mg/L	311	301	2.3
		06/20/2000	3		ASH-FREE DRY WT	mg/L	880	1040	11.8
		06/21/2000	15		ASH-FREE DRY WT	mg/L	1340	1400	3.1
		07/11/2000	4		ASH-FREE DRY WT	mg/L	1620	1620	0.0
		07/12/2000	19		ASH-FREE DRY WT	mg/L	3490	3910	8.0
		08/22/2000	5		ASH-FREE DRY WT	mg/L	1590	2740	37.6
		08/23/2000	15		ASH-FREE DRY WT	mg/L	1710	1710	0.0
		10/03/2000	8		ASH-FREE DRY WT	mg/L	1390	1440	2.5
		10/04/2000	11		ASH-FREE DRY WT	mg/L	2900	2870	0.7

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		05/17/2000	24		CA	mg/L	66.6	67.8	1.3
		05/17/2000	3		CA	mg/L	1500	752	47.0
		06/20/2000	3		CA	mg/L	1140	1030	7.2
		06/21/2000	2		CA	mg/L	848	2040	58.4
		07/11/2000	4		CA	mg/L	1240	1160	4.7
		07/12/2000	19		CA	mg/L	2450	2310	4.2
		08/22/2000	5		CA	mg/L	152	2830	127.0
		08/23/2000	15		CA	mg/L	1410	1280	6.8
		10/03/2000	8		CA	mg/L	1490	1260	11.8
		10/04/2000	11		CA	mg/L	1050	1000	3.4
		04/17/2000	5		CHL_A	µg/L	998	2140	51.5
		04/25/2000	17		CHL_A	µg/L	196	357	41.2
		05/17/2000	3		CHL_A	µg/L	1430	2310	33.3
		05/17/2000	24		CHL_A	µg/L	175	206	11.5
		06/20/2000	3		CHL_A	µg/L	1060	1510	24.8
		06/21/2000	15		CHL_A	µg/L	3400	2560	19.9
		07/11/2000	4		CHL_A	µg/L	1780	1870	3.5
		07/12/2000	19		CHL_A	µg/L	3790	4370	10.1
		08/22/2000	5		CHL_A	µg/L	1100	3020	65.9
		08/23/2000	15		CHL_A	µg/L	2820	2640	4.7
		10/03/2000	8		CHL_A	µg/L	1500	1930	17.7
		10/04/2000	11		CHL_A	µg/L	673	126	96.8
		04/17/2000	5		CHL_A corr	µg/L	896	2180	59.0
		04/25/2000	17		CHL_A corr	µg/L	150	275	41.6
		05/17/2000	3		CHL_A corr	µg/L	1350	2160	32.6
		05/17/2000	24		CHL_A corr	µg/L	152	154	0.9
		06/20/2000	3		CHL_A corr	µg/L	992	1130	9.2
		06/21/2000	15		CHL_A corr	µg/L	2020	2030	0.3
		07/11/2000	4		CHL_A corr	µg/L	1640	1620	0.9
		07/12/2000	19		CHL_A corr	µg/L	2750	3280	12.4
		08/22/2000	5		CHL_A corr	µg/L	955	3110	75.0
		08/23/2000	15		CHL_A corr	µg/L	2840	2750	2.3
		10/03/2000	8		CHL_A corr	µg/L	1740	2130	14.3
		10/04/2000	11		CHL_A corr	µg/L	561	113	94.0
		04/17/2000	5		CHL_B	µg/L	1	1	0.0
		04/25/2000	17		CHL_B	µg/L	1	1	0.0
		05/17/2000	24		CHL_B	µg/L	1	11.9	119.5
		05/17/2000	3		CHL_B	µg/L	1	1	0.0
		06/20/2000	3		CHL_B	µg/L	57.9	106	41.5
		06/21/2000	15		CHL_B	µg/L	570	186	71.8
		07/11/2000	4		CHL_B	µg/L	1	50.4	135.9
		07/12/2000	19		CHL_B	µg/L	87.9	2	135.1
		08/22/2000	5		CHL_B	µg/L	289	188	29.9
		08/23/2000	15		CHL_B	µg/L	91.8	135	26.9
		10/03/2000	8		CHL_B	µg/L	146	119	14.4
		10/04/2000	11		CHL_B	µg/L	115	17.5	104.1
		04/17/2000	5		CHL_C	µg/L	1	1	0.0
		04/25/2000	17		CHL_C	µg/L	1	1	0.0
		05/17/2000	24		CHL_C	µg/L	9.8	25.3	62.5
		05/17/2000	3		CHL_C	µg/L	152	284	42.8
		06/20/2000	3		CHL_C	µg/L	156	322	49.1
		06/21/2000	15		CHL_C	µg/L	1060	629	36.1
		07/11/2000	4		CHL_C	µg/L	373	334	7.8
		07/12/2000	19		CHL_C	µg/L	456	465	1.4
		08/22/2000	5		CHL_C	µg/L	337	304	7.3
		08/23/2000	15		CHL_C	µg/L	378	391	2.4
		10/03/2000	8		CHL_C	µg/L	378	358	3.8
		10/04/2000	11		CHL_C	µg/L	83.3	4.5	126.9
		04/17/2000	5		DRY WT	mg/L	8440	18700	53.5
		04/25/2000	17		DRY WT	mg/L	9360	6790	22.5
		05/17/2000	3		DRY WT	mg/L	4950	5720	10.2
		05/17/2000	24		DRY WT	mg/L	757	757	0.0
		06/20/2000	3		DRY WT	mg/L	3740	4480	12.7
		06/21/2000	15		DRY WT	mg/L	6580	7920	13.1
		07/11/2000	4		DRY WT	mg/L	6770	6920	1.5

EXHIBIT A.4-4
Field Duplicate Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	Units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		07/12/2000	19		DRY WT	mg/L	18500	24900	20.9
		08/22/2000	5		DRY WT	mg/L	8520	16100	43.5
		08/23/2000	15		DRY WT	mg/L	5760	5710	0.6
		10/03/2000	8		DRY WT	mg/L	5240	4490	10.9
		10/04/2000	11		DRY WT	mg/L	5990	5880	1.3
		04/17/2000	5		PHEO_A	µg/L	454	352	17.9
		04/25/2000	17		PHEO_A	µg/L	1	85.4	138.1
		05/17/2000	24		PHEO_A	µg/L	1	1	0.0
		05/17/2000	3		PHEO_A	µg/L	1	1	0.0
		06/20/2000	3		PHEO_A	µg/L	1	1	0.0
		06/21/2000	15		PHEO_A	µg/L	1	1	0.0
		07/11/2000	4		PHEO_A	µg/L	200	200	0.0
		07/12/2000	19		PHEO_A	µg/L	200	200	0.0
		08/22/2000	5		PHEO_A	µg/L	246	112	52.9
		08/23/2000	15		PHEO_A	µg/L	50	166	75.9
		10/03/2000	8		PHEO_A	µg/L	155	155	0.0
		10/04/2000	11		PHEO_A	µg/L	208	35.6	100.1
		06/21/2000	2		TIP	mg/L	295	239	14.8
		07/12/2000	19		TIP	mg/L	1.42	1.20	12.4
		08/22/2000	5		TIP	mg/L	2.57	1.26	48.1
		08/23/2000	15		TIP	mg/L	0.25	0.26	4.1
		06/20/2000	3		TKN	mg/L	13.5	14.4	4.6
		06/21/2000	2		TKN	mg/L	36	23.4	30.0
		10/03/2000	8		TKN	mg/L	6910	6500	4.3
		10/04/2000	11		TKN	mg/L	30.37	61.15	47.6
		06/20/2000	3		TP	mg/kg	155	212	22.0
		06/21/2000	2		TP	mg/L	1.12	2.07	42.0
		07/11/2000	4		TP	mg/L	2.19	2.27	2.4
		07/12/2000	19		TP	mg/L	0.83	2.56	72.1
		08/22/2000	5		TP	mg/L	2.65	1.54	37.5
		08/23/2000	15		TP	mg/L	0.65	0.63	2.6
	TOXIKON	04/17/2000	5		CA	mg/L	2600	8000	72.0
		04/25/2000	17		CA	mg/L	900	540	35.4
	IFAS	04/17/2000	5		TIP	mg/L	0.157	7.265	135.4
		04/25/2000	17		TIP	mg/L	1.515	0.821	42.0
		05/17/2000	24		TIP	mg/L	0.079	0.067	11.6
		05/17/2000	3		TIP	mg/L	1.22	2.26	42.4
		10/03/2000	8		TIP	mg/L	0.202	0.111	41.1
		10/04/2000	11		TIP	mg/L	0.600	0.648	5.4
		04/17/2000	5		TP	mg/L	6.6	13.9	50.4
		04/25/2000	17		TP	mg/L	8.3	2.6	72.8
		05/17/2000	3		TP	mg/L	2.14	5.99	66.9
		05/17/2000	24		TP	mg/L	0.23	0.23	0.0
		10/03/2000	8		TP	mg/L	0.79	0.80	1.1
		10/04/2000	11		TP	mg/L	1.84	2.15	11.2

EXHIBIT A.4-5

Field Duplicate Data for the Field-Scale Cells, Augsut 2001 to September 2002

Media	Laboratory	Date	Sampling Point		Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
			Cell	Location					
Water	Columbia	08/28/01	FSC-1	Outflow	TOC	mg/L	36	28	17.7
		09/25/01	FSC-2	Outflow	TOC	mg/L	41	41	0.0
		10/23/01	FSC-1	Inflow	TOC	mg/L	41	40	1.8
		11/29/01	FSC-3	Outflow	TOC	mg/L	39.7	40.2	0.9
		12/18/01	FSC-4	Outflow	TOC	mg/L	40	39	1.8
		03/26/02	FSC-3	Inflow	TOC	mg/L	37	44	12.2
		04/15/02	FSC-3	Outflow	TOC	mg/L	37	38	1.9
		07/30/02	FSC-1	Outflow	TOC	mg/L	39	32	13.9
		08/28/02	FSC-1	Outflow	TOC	mg/L	30	32	4.6
		09/11/02	FSC-1	Outflow	TOC	mg/L	35	36	2.0
	Sanders	08/28/01	FSC-1	Outflow	ALK	mg/L	190	185	1.9
		09/25/01	FSC-2	Inflow	ALK	mg/L	260	275	4.0
		10/23/01	FSC-1	Inflow	ALK	mg/L	320	270	12.0
		08/28/01	FSC-1	Outflow	CA	mg/L	43.6	43.4	0.3
		09/25/01	FSC-2	Inflow	CA	mg/L	79.9	78.4	1.3
		10/23/01	FSC-1	Inflow	CA	mg/L	55.5	51.4	5.4
		09/25/01	FSC-2	Inflow	CL	mg/L	157	153	1.8
		10/23/01	FSC-1	Inflow	CL	mg/L	162	171	3.8
		08/28/01	FSC-1	Outflow	NH3	mg/L	0.09	0.08	8.3
		09/25/01	FSC-2	Inflow	NH3	mg/L	0.11	0.09	14.1
		10/23/01	FSC-1	Inflow	NH3	mg/L	0.16	0.12	20.2
		08/28/01	FSC-1	Outflow	NO2NO3	mg/L	< 0.05	< 0.05	0.0
		09/25/01	FSC-2	Inflow	NO2NO3	mg/L	0.05	0.05	0.0
		10/23/01	FSC-1	Inflow	NO2NO3	mg/L	0.12	0.12	0.0
		08/28/01	FSC-1	Outflow	TKN	mg/L	2.74	2.98	5.9
		09/25/01	FSC-2	Inflow	TKN	mg/L	2.54	2.71	4.6
		10/23/01	FSC-1	Inflow	TKN	mg/L	3.26	3.01	5.6
		08/28/01	FSC-1	Outflow	TN	mg/L	2.74	2.98	5.9
		09/25/01	FSC-2	Inflow	TN	mg/L	2.6	2.76	4.2
		10/23/01	FSC-1	Inflow	TN	mg/L	3.38	3.13	5.4
		08/28/01	FSC-1	Outflow	TSS	mg/L	< 1.6	< 2.6	33.7
		09/25/01	FSC-2	Inflow	TSS	mg/L	6.5	8.5	18.9
		10/23/01	FSC-1	Inflow	TSS	mg/L	3.5	7.1	48.0
	STL	02/26/02	FSC-3	stn_1/2	NH3	mg/L	< 0.03	< 0.03	0.0
		02/26/02	FSC-3	stn_1/2	NO2NO3	mg/L	0.6	0.6	0.0
		02/26/02	FSC-3	stn_1/2	TKN	mg/L	2.3	2.1	6.4
		02/26/02	FSC-3	stn_1/2	TN	mg/L	2.9	2.7	5.1
		02/26/02	FSC-3	stn_1/2	TSS	mg/L	< 5	< 5	0.0
	IFAS	08/28/01	FSC-1	Outflow	SRP	mg/L	0.001	0.001	0.0
		09/11/01	FSC-3	Outflow	SRP	mg/L	0.002	0.002	0.0
		09/18/01	FSC-3	Outflow	SRP	mg/L	0.002	0.002	0.0
		09/25/01	FSC-2	Inflow	SRP	mg/L	0.003	0.002	28.3
		10/09/01	FSC-1	Outflow	SRP	mg/L	0.001	0.003	70.7
		10/16/01	FSC-INFCNL	Outflow	SRP	mg/L	0.002	0.003	28.3
		10/23/01	FSC-1	Inflow	SRP	mg/L	0.003	0.003	0.0
		11/13/01	FSC-2	Outflow	SRP	mg/L	0.001	0.001	0.0
		11/20/01	FSC-3	Outflow	SRP	mg/L	0.001	0.001	0.0
		11/29/01	FSC-3	Outflow	SRP	mg/L	0.001	0.001	0.0
		12/13/01	FSC-2	Outflow	SRP	mg/L	0.004	0.003	20.2
		12/18/01	FSC-4	Outflow	SRP	mg/L	0.001	0.002	47.1
		01/08/02	FSC-1	Outflow	SRP	mg/L	0.001	0.001	0.0
		01/15/02	FSC-1	Outflow	SRP	mg/L	0.001	0.002	47.1
		01/22/02	FSC-1	Inflow	SRP	mg/L	0.001	0.001	0.0
		01/29/02	FSC-1	Outflow	SRP	mg/L	0.001	0.003	70.7
		02/05/02	FSC-2	Outflow	SRP	mg/L	0.002	0.002	0.0
		02/19/02	FSC-4	Outflow	SRP	mg/L	0.001	0.003	70.7
		02/26/02	FSC-3	stn_1/2	SRP	mg/L	0.002	0.003	28.3
		03/05/02	FSC-2	Outflow	SRP	mg/L	0.004	0.003	20.2
		03/19/02	FSC-1	Outflow	SRP	mg/L	0.005	0.003	35.4
		03/26/02	FSC-3	Inflow	SRP	mg/L	0.011	0.003	80.8
		04/02/02	FSC-1	Outflow	SRP	mg/L	0.001	0.002	47.1
		04/15/02	FSC-3	Outflow	SRP	mg/L	0.008	0.003	64.3
		04/23/02	FSC-2	Outflow	SRP	mg/L	0.002	0.003	28.3
		07/30/02	FSC-1	Outflow	SRP	mg/L	0.001	0.001	0.0
		08/07/02	FSC-2	Outflow	SRP	mg/L	0.002	0.003	28.3

EXHIBIT A.4-5
Field Duplicate Data for the Field-Scale Cells, Augsut 2001 to September 2002

Media	Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		08/20/02	FSC-1	Outflow	SRP	mg/L	0.002	0.004	47.1
		08/28/02	FSC-1	Outflow	SRP	mg/L	0.001	0.001	0.0
		09/11/02	FSC-1	Outflow	SRP	mg/L	0.008	0.001	110.0
		09/25/02	FSC-1	stn_1/2	SRP	mg/L	0.001	0.002	47.1
		08/28/01	FSC-1	Outflow	TDP	mg/L	0.007	0.007	0.0
		09/11/01	FSC-3	Outflow	TDP	mg/L	0.004	0.005	15.7
		09/18/01	FSC-3	Outflow	TDP	mg/L	0.007	0.005	23.6
		09/25/01	FSC-2	Inflow	TDP	mg/L	0.007	0.007	0.0
		10/09/01	FSC-1	Outflow	TDP	mg/L	0.006	0.006	0.0
		10/16/01	FSC-INFCNL	Outflow	TDP	mg/L	0.01	0.008	15.7
		10/23/01	FSC-1	Inflow	TDP	mg/L	0.012	0.011	6.2
		11/13/01	FSC-2	Outflow	TDP	mg/L	0.004	0.005	15.7
		11/20/01	FSC-3	Outflow	TDP	mg/L	0.006	0.006	0.0
		11/29/01	FSC-3	Outflow	TDP	mg/L	0.007	0.007	0.0
		12/13/01	FSC-2	Outflow	TDP	mg/L	0.016	0.019	12.1
		12/18/01	FSC-4	Outflow	TDP	mg/L	0.01	0.01	0.0
		12/27/01	FSC-2	Outflow	TDP	mg/L	0.015	0.015	0.0
		01/08/02	FSC-1	Outflow	TDP	mg/L	0.006	0.006	0.0
		01/15/02	FSC-1	Outflow	TDP	mg/L	0.006	0.006	0.0
		01/22/02	FSC-1	Inflow	TDP	mg/L	0.007	0.008	9.4
		01/29/02	FSC-1	Outflow	TDP	mg/L	0.008	0.007	9.4
		02/05/02	FSC-2	Outflow	TDP	mg/L	0.007	0.007	0.0
		02/19/02	FSC-4	Outflow	TDP	mg/L	0.008	0.009	8.3
		02/26/02	FSC-3	stn_1/2	TDP	mg/L	0.006	0.006	0.0
		03/05/02	FSC-2	Outflow	TDP	mg/L	0.007	0.008	9.4
		03/19/02	FSC-1	Outflow	TDP	mg/L	0.008	0.01	15.7
		03/26/02	FSC-3	Inflow	TDP	mg/L	0.01	0.01	0.0
		04/02/02	FSC-1	Outflow	TDP	mg/L	0.01	0.011	6.7
		04/15/02	FSC-3	Outflow	TDP	mg/L	0.01	0.013	18.5
		04/23/02	FSC-2	Outflow	TDP	mg/L	0.01	0.01	0.0
		07/25/02	FSC-3	Outflow	TDP	mg/L	0.006	0.008	20.2
		07/30/02	FSC-1	Outflow	TDP	mg/L	0.009	0.005	40.4
		08/01/02	FSC-3	Outflow	TDP	mg/L	0.004	0.006	28.3
		08/07/02	FSC-2	Outflow	TDP	mg/L	0.009	0.012	20.2
		08/15/02	FSC-2	Outflow	TDP	mg/L	0.011	0.009	14.1
		08/20/02	FSC-1	Outflow	TDP	mg/L	0.008	0.006	20.2
		08/28/02	FSC-1	Outflow	TDP	mg/L	0.007	0.006	10.9
		09/06/02	FSC-4	Outflow	TDP	mg/L	0.018	0.017	0.0
		09/11/02	FSC-1	Outflow	TDP	mg/L	0.005	0.005	0.0
		09/25/02	FSC-1	stn_1/2	TDP	mg/L	0.014	0.007	47.1
		08/28/01	FSC-1	Outflow	TP	mg/L	0.02	0.021	3.5
		09/03/01	FSC-2	Outflow	TP	mg/L	0.018	0.021	10.9
		09/11/01	FSC-3	Outflow	TP	mg/L	0.012	0.013	5.7
		09/18/01	FSC-3	Outflow	TP	mg/L	0.012	0.011	6.2
		09/25/01	FSC-2	Inflow	TP	mg/L	0.017	0.018	4.0
		09/27/01	FSC-2	Outflow	TP	mg/L	0.014	0.014	0.0
		10/04/01	FSC-3	Outflow	TP	mg/L	0.009	0.012	20.2
		10/09/01	FSC-1	Outflow	TP	mg/L	0.012	0.014	10.9
		10/16/01	FSC-INFCNL	Outflow	TP	mg/L	0.016	0.016	0.0
		10/23/01	FSC-1	Inflow	TP	mg/L	0.024	0.028	10.9
		10/25/01	FSC-1	Outflow	TP	mg/L	0.015	0.015	0.0
		11/13/01	FSC-2	Outflow	TP	mg/L	0.009	0.009	0.0
		11/20/01	FSC-3	Outflow	TP	mg/L	0.011	0.009	14.1
		11/29/01	FSC-3	Outflow	TP	mg/L	0.012	0.012	0.0
		12/13/01	FSC-2	Outflow	TP	mg/L	0.037	0.034	6.0
		12/18/01	FSC-4	Outflow	TP	mg/L	0.028	0.027	2.6
		12/20/01	FSC-1	Outflow	TP	mg/L	0.041	0.048	11.1
		12/27/01	FSC-2	Outflow	TP	mg/L	0.015	0.016	4.6
		01/08/02	FSC-1	Outflow	TP	mg/L	0.019	0.018	3.8
		01/15/02	FSC-1	Outflow	TP	mg/L	0.018	0.021	10.9
		01/17/02	FSC-3	Outflow	TP	mg/L	0.015	0.021	23.6
		01/22/02	FSC-1	Inflow	TP	mg/L	0.02	0.023	9.9
		01/24/02	FSC-1	Outflow	TP	mg/L	0.017	0.015	8.8
		01/29/02	FSC-1	Outflow	TP	mg/L	0.017	0.017	0.0
		01/29/02	FSC-1	Outflow	TP	mg/L	0.019	0.017	7.9

EXHIBIT A.4-5

Field Duplicate Data for the Field-Scale Cells, Augsut 2001 to September 2002

Media	Laboratory	Date	Sampling Point Cell	Sampling Point Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		02/05/02	FSC-2	Outflow	TP	mg/L	0.013	0.013	0.0
		02/14/02	FSC-1	Outflow	TP	mg/L	0.018	0.019	3.8
		02/19/02	FSC-4	Outflow	TP	mg/L	0.021	0.022	3.3
		02/26/02	FSC-3	stn_1/2	TP	mg/L	0.014	0.013	5.2
		03/05/02	FSC-2	Outflow	TP	mg/L	0.021	0.017	14.9
		03/19/02	FSC-1	Outflow	TP	mg/L	0.019	0.019	0.0
		03/26/02	FSC-3	Inflow	TP	mg/L	0.022	0.025	9.0
		04/02/02	FSC-1	Outflow	TP	mg/L	0.027	0.028	2.6
		04/15/02	FSC-3	Outflow	TP	mg/L	0.021	0.021	0.0
		04/23/02	FSC-2	Outflow	TP	mg/L	0.022	0.022	0.0
		07/25/02	FSC-3	Outflow	TP	mg/L	0.019	0.018	3.82
		07/30/02	FSC-1	Outflow	TP	mg/L	0.023	0.024	3.01
		08/01/02	FSC-3	Outflow	TP	mg/L	0.015	0.012	15.7
		08/07/02	FSC-2	Outflow	TP	mg/L	0.021	0.024	9.4
		08/15/02	FSC-2	Outflow	TP	mg/L	0.023	0.019	13.5
		08/20/02	FSC-1	Outflow	TP	mg/L	0.025	0.017	26.9
		08/28/02	FSC-1	Outflow	TP	mg/L	0.008	0.015	43.0
		09/11/02	FSC-1	Outflow	TP	mg/L	0.1	0.01	0.0
		09/16/02	FSC-2	Outflow	TP	mg/L	0.01	0.01	0.0
		09/25/02	FSC-1	stn_1/2	TP	mg/L	0.018	0.015	12.9
	Xenco	11/29/01	FSC-3	Outflow	ALK	mg/L	242	232	3.0
		12/18/01	FSC-4	Outflow	ALK	mg/L	288	279	2.2
		01/22/02	FSC-1	Inflow	ALK	mg/L	282	276	1.5
		02/26/02	FSC-3	stn_1/2	ALK	mg/L	288	293	1.2
		03/26/02	FSC-3	Inflow	ALK	mg/L	260	268	2.1
		04/15/02	FSC-3	Outflow	ALK	mg/L	267	255	3.3
		07/30/02	FSC-1	Outflow	ALK	mg/L	263	255	2.2
		08/28/02	FSC-1	Outflow	ALK	mg/L	178	190	4.6
		09/11/02	FSC-1	Outflow	ALK	mg/L	238	210	8.8
		09/25/02	FSC-1	stn_1/2	ALK	mg/L	228	228	0.0
		11/29/01	FSC-3	Outflow	CA	mg/L	60.7	54	8.3
		12/18/01	FSC-4	Outflow	CA	mg/L	81.6	77	4.1
		01/22/02	FSC-1	Inflow	CA	mg/L	78.9	82	2.7
		02/26/02	FSC-3	stn_1/2	CA	mg/L	106	99	4.8
		03/26/02	FSC-3	Inflow	CA	mg/L	113	72.1	31.2
		04/15/02	FSC-3	Outflow	CA	mg/L	61.7	55.8	7.1
		07/30/02	FSC-1	Outflow	CA	mg/L	65	58.1	7.9
		08/28/02	FSC-1	Outflow	CA	mg/L	29.4	33.7	9.6
		09/11/02	FSC-1	Outflow	CA	mg/L	49	51.6	3.7
		09/25/02	FSC-1	stn_1/2	CA	mg/L	44.2	43.6	1.0
		12/18/01	FSC-4	Outflow	CL	mg/L	256	257	0.3
		01/22/02	FSC-1	Inflow	CL	mg/L	228	276	13.5
		02/26/02	FSC-3	stn_1/2	CL	mg/L	203	209	2.1
		03/26/02	FSC-3	Inflow	CL	mg/L	129	149	10.2
		04/15/02	FSC-3	Outflow	CL	mg/L	165	124	20.1
		07/30/02	FSC-1	Outflow	CL	mg/L	82.7	108	18.8
		08/28/02	FSC-1	Outflow	CL	mg/L	273	306	8.1
		09/11/02	FSC-1	Outflow	CL	mg/L	215	174	14.9
		09/25/02	FSC-1	stn_1/2	CL	mg/L	174	182	3.2
		02/26/02	FSC-3	stn_1/2	NH3	mg/L	< 0.1	< 0.1	0.0
		03/26/02	FSC-3	Inflow	NH3	mg/L	0.09	< 0.1	7.4
		04/15/02	FSC-3	Outflow	NH3	mg/L	0.079	0.129	34.0
		07/30/02	FSC-1	Outflow	NH3	mg/L	0.103	< 0.1	2.1
		08/28/02	FSC-1	Outflow	NH3	mg/L	0.097	0.104	4.9
		09/11/02	FSC-1	Outflow	NH3	mg/L	0.073	0.057	17.4
		09/25/02	FSC-1	stn_1/2	NH3	mg/L	0.076	0.065	11.0
		03/26/02	FSC-3	Inflow	NO2	mg/L	< 0.2	< 0.2	0.0
		04/15/02	FSC-3	Outflow	NO2	mg/L	< 0.1	< 0.1	0.0
		02/26/02	FSC-3	stn_1/2	NO2NO3	mg/L	0.68	0.67	1.1
		03/26/02	FSC-3	Inflow	NO2NO3	mg/L	0.31	0.09	77.8
		04/15/02	FSC-3	Outflow	NO2NO3	mg/L	0.049	0.1	48.4
		07/30/02	FSC-1	Outflow	NO2NO3	mg/L	0.043	0.045	3.2
		08/28/02	FSC-1	Outflow	NO2NO3	mg/L	< 0.2	< 0.2	0.0
		09/11/02	FSC-1	Outflow	NO2NO3	mg/L	< 0.1	< 0.1	0.0
		09/25/02	FSC-1	stn_1/2	NO2NO3	mg/L	< 0.2	< 0.2	0.0

EXHIBIT A.4-5

Field Duplicate Data for the Field-Scale Cells, Augsut 2001 to September 2002

Media	Laboratory	Date	Sampling Point: Cell	Sampling Point: Location	Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
		08/28/02	FSC-1	Outflow	SO4	mg/L	80.5	78.9	1.4
		12/18/01	FSC-4	Outflow	TKN	mg/L	< 1	< 1	0.0
		02/26/02	FSC-3	stn_1/2	TKN	mg/L	1.54	1.68	6.2
		03/26/02	FSC-3	Inflow	TKN	mg/L	< 1	< 1	0.0
		04/15/02	FSC-3	Outflow	TKN	mg/L	1.68	0.7	58.2
		07/30/02	FSC-1	Outflow	TKN	mg/L	0.763	0.65	11.3
		08/28/02	FSC-1	Outflow	TKN	mg/L	2.43	2.43	0.0
		09/11/02	FSC-1	Outflow	TKN	mg/L	2.09	2.1	0.3
		09/25/02	FSC-1	stn_1/2	TKN	mg/L	1.5	1.88	15.9
		12/18/01	FSC-4	Outflow	TN	mg/L	< 1	< 1	0.0
		02/26/02	FSC-3	stn_1/2	TN	mg/L	2.22	2.35	4.0
		03/26/02	FSC-3	Inflow	TN	mg/L	0.3	0.09	76.1
		04/15/02	FSC-3	Outflow	TN	mg/L	1.73	0.7	59.9
		07/30/02	FSC-1	Outflow	TN	mg/L	0.806	0.695	10.5
		08/28/02	FSC-1	Outflow	TN	mg/L	2.51	2.43	2.3
		09/11/02	FSC-1	Outflow	TN	mg/L	2.1	2.1	0.0
		09/25/02	FSC-1	stn_1/2	TN	mg/L	1.52	1.9	15.7
		02/26/02	FSC-3	stn_1/2	TSS	mg/L	< 2	< 2	0.0
		03/26/02	FSC-3	Inflow	TSS	mg/L	7	6	10.9
		04/15/02	FSC-3	Outflow	TSS	mg/L	5	5	0.0
		07/30/02	FSC-1	Outflow	TSS	mg/L	< 5	< 5	0.0
		08/28/02	FSC-1	Outflow	TSS	mg/L	< 5	< 5	0.0
		09/11/02	FSC-1	Outflow	TSS	mg/L	< 5	< 5	0.0
		09/25/02	FSC-1	stn_1/2	TSS	mg/L	< 2	< 2	0.0
Groundwater	IFAS	09/25/01	FSC-3	stn_1/2	TP	mg/L	0.013	0.014	5.2
		10/18/01	FSC-3	stn_1/2	TP	mg/L	0.017	0.017	0.0
		11/20/01	FSC-1	Inflow	TP	mg/L	0.013	0.013	0.0
		12/20/01	FSC-1	Outflow	TP	mg/L	0.018	0.02	7.4
		01/17/02	FSC-1	Inflow	TP	mg/L	0.012	0.011	6.1
		02/14/02	FSC-2	stn_1/2	TP	mg/L	0.011	0.011	0.0
		03/19/02	FSC-3	Outflow	TP	mg/L	0.018	0.018	0.0
		04/30/02	FSC-3	Outflow	TP	mg/L	0.016	0.017	4.3
		05/29/02	FSC-1	Berm	TP	mg/L	0.026	0.018	25.7
		06/13/02	FSC-3	Inflow	TP	mg/L	0.021	0.013	33.3
		07/25/02	FSC-1	Berm	TP	mg/L	0.014	0.015	4.9
		08/29/02	FSC-1	Outflow	TP	mg/L	0.032	0.032	0.0
		09/18/02	FSC-4	Berm	TP	mg/L	0.023	0.02	9.9
	Xenco	12/20/01	FSC-1	Outflow	CL	mg/L	194	195	0.4
		01/17/02	FSC-1	Inflow	CL	mg/L	109	114	3.2
		02/14/02	FSC-2	stn_1/2	CL	mg/L	110	112	1.3
		03/25/02	FSC-1	Berm	CL	mg/L	79.4	109	22.2
		04/30/02	FSC-3	Outflow	CL	mg/L	207	256	15.0
		05/29/02	FSC-1	Berm	CL	mg/L	198	207	3.1
		06/13/02	FSC-3	Inflow	CL	mg/L	75	75	0.0
		07/25/02	FSC-1	Berm	CL	mg/L	233	192	13.6
		08/29/02	FSC-1	Outflow	CL	mg/L	149	199	20.3
		09/18/02	FSC-4	Berm	CL	mg/L	161	186	10.2
Periphyton	Columbia	09/27/01	FSC-2	stn_1/2	AFDW	mg/L	1800	2200	14.1
		10/24/01	FSC-3	stn_1/2	AFDW	mg/L	1800	2500	23.0
		11/29/01	FSC-3	stn_1/2	AFDW	mg/L	2600	2700	2.7
		12/18/01	FSC-1	stn_1/2	AFDW	mg/L	2800	1800	30.7
		04/15/02	FSC-2	stn_1/2	AFDW	mg/L	3100	2600	12.4
		08/28/02	FSC-1	stn_1/2	AFDW	mg/L	1500	5500	80.8
		10/24/01	FSC-3	stn_1/2	ASH_WT	mg/L	6700	9700	25.9
		11/29/01	FSC-3	stn_1/2	ASH_WT	mg/L	14000	14000	0.0
		12/18/01	FSC-1	stn_1/2	ASH_WT	mg/L	6800	5300	17.5
		04/15/02	FSC-2	stn_1/2	ASH_WT	mg/L	14000	12000	10.9
		08/28/02	FSC-1	stn_1/2	ASH_WT	mg/L	3900	3600	5.7
		11/29/01	FSC-3	stn_1/2	CHL_A	mg/m3	2.6	2.7	2.7
		12/18/01	FSC-1	stn_1/2	CHL_A	mg/m3	0.31	1.1	79.2
		04/15/02	FSC-2	stn_1/2	CHL_A	mg/m3	2.3	3.1	21.0
		08/28/02	FSC-1	stn_1/2	CHL_A	mg/m3	0.23	0.3	18.7
		11/29/01	FSC-3	stn_1/2	CHL_B	mg/m3	0.31	< 0.05	102.1
		12/18/01	FSC-1	stn_1/2	CHL_B	mg/m3	< 0.025	< 0.025	0.0
		04/15/02	FSC-2	stn_1/2	CHL_B	mg/m3	0.001	0.001	0.0

EXHIBIT A.4-5
Field Duplicate Data for the Field-Scale Cells, Augsut 2001 to September 2002

Media	Laboratory	Date	Sampling Point		Parameter	units	Field Sample	Field Duplicate	Relative Standard Deviation (%)
			Cell	Location					
		08/28/02	FSC-1	stn_1/2	CHL_B	mg/m3	< 0.001	0.015	123.7
		11/29/01	FSC-3	stn_1/2	CHL_C	mg/m3	0.84	0.44	44.2
		12/18/01	FSC-1	stn_1/2	CHL_C	mg/m3	< 0.025	< 0.025	0.0
		04/15/02	FSC-2	stn_1/2	CHL_C	mg/m3	0.058	0.11	43.8
		08/28/02	FSC-1	stn_1/2	CHL_C	mg/m3	< 0.001	< 0.001	0.0
		10/24/01	FSC-3	stn_1/2	DRY_WT	mg/L	8500	12000	24.1
		11/29/01	FSC-3	stn_1/2	DRY_WT	mg/L	16000	17000	4.3
		12/18/01	FSC-1	stn_1/2	DRY_WT	mg/L	9600	7100	21.2
		04/15/02	FSC-2	stn_1/2	DRY_WT	mg/L	17000	15000	8.8
		08/28/02	FSC-1	stn_1/2	DRY_WT	mg/L	5400	9100	36.1
		11/29/01	FSC-3	stn_1/2	PHEO_A	mg/L	0.0095	0.25	131.1
		12/18/01	FSC-1	stn_1/2	PHEO_A	mg/L	0.019	0.1	96.3
		04/15/02	FSC-2	stn_1/2	PHEO_A	mg/L	0.001	0.001	0.0
		08/28/02	FSC-1	stn_1/2	PHEO_A	mg/L	< 0.001	0.087	138.2
	Sanders	09/27/01	FSC-2	stn_1/2	CA	mg/L	3500	3120	8.1
		10/24/01	FSC-3	stn_1/2	CA	mg/L	314	321	1.6
		10/24/01	FSC-3	stn_1/2	CA	mg/L	314	321	1.6
		10/24/01	FSC-3	stn_1/2	CA	mg/L	321	321	0.0
		10/24/01	FSC-3	stn_1/2	CHL_A	mg/m3	3.58	3.58	0.0
		10/24/01	FSC-3	stn_1/2	CHL_A	mg/m3	4.22	3.58	11.6
		10/24/01	FSC-3	stn_1/2	CHL_A	mg/m3	4.22	3.58	11.6
		10/24/01	FSC-3	stn_1/2	TKN	mg/L	118	118	0.0
		10/24/01	FSC-3	stn_1/2	TKN	mg/L	87.6	118	20.9
		10/24/01	FSC-3	stn_1/2	TKN	mg/L	87.6	118	20.9
	IFAS	10/24/01	FSC-3	stn_1/2	TP	mg/L	15.9	29.6	42.6
		09/27/01	FSC-2	stn_1/2	TIP	mg/L	1.505	1.4	5.1
		09/28/01	FSC-2	stn_1/2	TIP	mg/L	1.505	1.4	5.1
		10/24/01	FSC-3	stn_1/2	TIP	mg/L	0.829	0.608	21.8
		10/24/01	FSC-3	stn_1/2	TIP	mg/L	0.829	0.608	21.8
		10/24/01	FSC-3	stn_1/2	TIP	mg/L	0.829	0.608	21.8
		10/24/01	FSC-3	stn_1/2	TIP	mg/L	0.829	0.608	21.8
		11/29/01	FSC-3	stn_1/2	TIP	mg/L	0.792	0.84	4.2
		12/18/01	FSC-1	stn_1/2	TIP	mg/L	0.404	0.391	2.3
		01/22/02	FSC-3	stn_1/2	TIP	mg/L	0.527	0.507	2.7
		04/15/02	FSC-2	stn_1/2	TIP	mg/L	0.768	0.549	23.5
		09/27/01	FSC-2	stn_1/2	TP	mg/L	5.121	5.472	4.7
		09/28/01	FSC-2	stn_1/2	TP	mg/L	5.121	5.472	4.7
		10/24/01	FSC-3	stn_1/2	TP	mg/L	2.517	2.402	3.3
		10/24/01	FSC-3	stn_1/2	TP	mg/L	2.517	2.402	3.3
		10/24/01	FSC-3	stn_1/2	TP	mg/kg	160.2	150.2	4.6
		10/24/01	FSC-3	stn_1/2	TP	mg/L	2.517	2.402	3.3
		10/24/01	FSC-3	stn_1/2	TP	mg/L	2.517	2.402	3.3
		11/29/01	FSC-3	stn_1/2	TP	mg/L	3.62	3.39	4.6
		12/18/01	FSC-1	stn_1/2	TP	mg/L	3.69	3.68	0.2
		01/22/02	FSC-3	stn_1/2	TP	mg/L	2.22	2.46	7.3
		04/15/02	FSC-2	stn_1/2	TP	mg/L	4.299	5.206	13.5
	Xenco	11/29/01	FSC-3	stn_1/2	CA	mg/L	1600	1590	0.4
		12/18/01	FSC-1	stn_1/2	CA	mg/L	3450	3510	1.2
		01/22/02	FSC-3	stn_1/2	CA	mg/L	2630	2820	4.9
		04/15/02	FSC-2	stn_1/2	CA	mg/L	5670	4540	15.7
		08/28/02	FSC-1	stn_1/2	CA	mg/L	1940	1110	38.5
		04/15/02	FSC-2	stn_1/2	TKN	mg/L	12.1	6.06	47.0
		08/28/02	FSC-1	stn_1/2	TKN	mg/L	58.8	62.2	4.0
Sediment	Columbia	04/16/02	FSC-4	Inflow	DENSITY_DRY	g/cm3	0.251	0.229	6.5
		04/16/02	FSC-4	Inflow	DENSITY_WET	g/cm3	1.097	1.073	1.6
		04/16/02	FSC-4	Inflow	TOC	mg/L	41	41.1	0.2
		04/16/02	FSC-4	Inflow	TS	%	77.2	78.7	1.4
	IFAS	04/16/02	FSC-4	Inflow	TIP	mg/kg	93.57	100.26	4.9
		04/16/02	FSC-4	Inflow	TP	mg/kg	534.43	538.07	0.5
	Xenco	04/16/02	FSC-4	Inflow	TKN	mg/kg	2730	284	114.8

EXHIBIT A.4-6

Equipment Blank Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
Water	PPB	12/27/99	N_TOT	mg/L	2.02	0.10	yes
		02/22/00	N_TOT	mg/L	< 0.10	0.10	no
		02/22/00	N_TOT	mg/L	< 0.10	0.10	no
		03/06/00	N_TOT	mg/L	< 0.10	0.10	no
		12/27/99	NH_3	mg/L	< 0.004	0.004	no
		02/22/00	NH_3	mg/L	< 0.004	0.004	no
		02/22/00	NH_3	mg/L	< 0.004	0.004	no
		03/06/00	NH_3	mg/L	< 0.004	0.004	no
		12/27/99	NO_2NO_3	mg/L	0.187	0.004	yes
		02/22/00	NO_2NO_3	mg/L	0.509	0.004	yes
		02/22/00	NO_2NO_3	mg/L	0.509	0.004	yes
		03/06/00	NO_2NO_3	mg/L	< 0.004	0.004	no
		12/27/99	TKN	mg/L	1.830	0.100	yes
		02/22/00	TKN	mg/L	< 0.100	0.100	no
		02/22/00	TKN	mg/L	< 0.100	0.100	no
		03/06/00	TKN	mg/L	< 0.100	0.100	no
		12/27/99	TOC	mg/L	2.7	2.0	no
		02/22/00	TOC	mg/L	< 2.0	2.0	no
		02/22/00	TOC	mg/L	< 2.0	2.0	no
		03/06/00	TOC	mg/L	< 2.0	2.0	no
	TOXIKON	04/12/99	ALKAL	mg/L	7.0	1.0	yes
		05/21/99	ALKAL	mg/L	< 1.0	1.0	no
		06/14/99	ALKAL	mg/L	< 1.0	1.0	no
		07/14/99	ALKAL	mg/L	< 1.0	1.0	no
		08/16/99	ALKAL	mg/L	< 1.0	1.0	no
		09/29/99	ALKAL	mg/L	< 1.0	1.0	no
		10/25/99	ALKAL	mg/L	< 1.0	1.0	no
		11/29/99	ALKAL	mg/L	< 1.0	1.0	no
		12/27/99	ALKAL	mg/L	< 2.0	2.0	no
		01/24/00	ALKAL	mg/L	< 1.0	1.0	no
		01/24/00	ALKAL	mg/L	< 1.0	1.0	no
		02/22/00	ALKAL	mg/L	< 1.0	1.0	no
		03/06/00	ALKAL	mg/L	2.0	1.0	no
		04/12/99	CA	mg/L	0.13	0.05	yes
		05/21/99	CA	mg/L	< 0.10	0.10	no
		06/14/99	CA	mg/L	< 0.10	0.10	no
		07/14/99	CA	mg/L	< 1.00	1.00	no
		08/16/99	CA	mg/L	< 1.00	1.00	no
		09/29/99	CA	mg/L	< 1.00	1.00	no
		10/25/99	CA	mg/L	< 1.00	1.00	no
		11/29/99	CA	mg/L	< 1.00	1.00	no
		12/27/99	CA	mg/L	< 1.00	1.00	no
		01/24/00	CA	mg/L	< 1.00	1.00	no
		01/24/00	CA	mg/L	< 1.00	1.00	no
		02/22/00	CA	mg/L	< 1.00	1.00	no
		03/06/00	CA	mg/L	< 1.00	1.00	no
		04/12/99	N_TOT	mg/L	< 0.09	0.09	no
		05/21/99	N_TOT	mg/L	0.08	0.09	no
		06/14/99	N_TOT	mg/L	< 0.09	0.09	no
		07/14/99	N_TOT	mg/L	< 0.15	0.15	no
		08/16/99	N_TOT	mg/L	< 0.15	0.15	no
		09/29/99	N_TOT	mg/L	< 0.15	0.15	no
		10/25/99	N_TOT	mg/L	< 0.15	0.15	no
		11/29/99	N_TOT	mg/L	< 0.15	0.15	no
		04/12/99	NH_3	mg/L	< 0.04	0.04	no
		05/21/99	NH_3	mg/L	< 0.04	0.04	no
		06/14/99	NH_3	mg/L	< 0.04	0.04	no
		07/14/99	NH_3	mg/L	< 0.04	0.04	no
		08/16/99	NH_3	mg/L	< 0.04	0.04	no
		09/29/99	NH_3	mg/L	< 0.04	0.04	no
		10/25/99	NH_3	mg/L	< 0.04	0.04	no
		11/29/99	NH_3	mg/L	< 0.04	0.04	no
		04/12/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		05/21/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		06/14/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		07/14/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		08/16/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		09/29/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		10/25/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		11/29/99	NO_2NO_3	mg/L	< 0.05	0.05	no
		04/12/99	TKN	mg/L	< 0.04	0.04	no
		05/21/99	TKN	mg/L	0.08	0.04	no
		06/14/99	TKN	mg/L	< 0.10	0.10	no
		07/14/99	TKN	mg/L	< 0.10	0.10	no
		08/16/99	TKN	mg/L	< 0.10	0.10	no
		09/29/99	TKN	mg/L	< 0.10	0.10	no
		10/25/99	TKN	mg/L	< 0.40	0.40	no

EXHIBIT A.4-6

Equipment Blank Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		11/29/99	TKN	mg/L	< 0.10	0.10	no
		04/12/99	TOC	mg/L	< 1.00	1.00	no
		05/21/99	TOC	mg/L	1.25	1.00	no
		06/14/99	TOC	mg/L	< 1.00	1.00	no
		07/14/99	TOC	mg/L	0.49	1.00	no
		08/16/99	TOC	mg/L	< 1.00	1.00	no
		09/29/99	TOC	mg/L	1.25	1.00	no
		10/25/99	TOC	mg/L	< 1.00	1.00	no
		11/29/99	TOC	mg/L	< 1.00	1.00	no
		04/12/99	TSS	mg/L	< 4.00	4.00	no
		05/21/99	TSS	mg/L	< 4.00	4.00	no
		06/14/99	TSS	mg/L	< 4.00	4.00	no
		07/14/99	TSS	mg/L	< 4.00	4.00	no
		08/16/99	TSS	mg/L	< 2.00	2.00	no
		09/29/99	TSS	mg/L	< 1.25	1.25	no
		10/25/99	TSS	mg/L	< 1.00	1.00	no
		11/29/99	TSS	mg/L	< 1.00	1.00	no
		12/27/99	TSS	mg/L	< 1.00	1.00	no
		01/24/00	TSS	mg/L	< 1.00	1.00	no
		01/24/00	TSS	mg/L	< 1.00	1.00	no
		02/22/00	TSS	mg/L	< 1.00	1.00	no
		03/06/00	TSS	mg/L	< 1.00	1.00	no
	IFAS	02/23/99	DRP	mg/L	0.002	0.004	no
		03/29/99	DRP	mg/L	0.002	0.004	no
		04/12/99	DRP	mg/L	0.002	0.004	no
		05/20/99	DRP	mg/L	0.006	0.004	no
		06/01/99	DRP	mg/L	0.002	0.004	no
		06/14/99	DRP	mg/L	0.003	0.004	no
		06/21/99	DRP	mg/L	0.002	0.004	no
		06/28/99	DRP	mg/L	0.003	0.004	no
		07/06/99	DRP	mg/L	0.004	0.004	no
		07/14/99	DRP	mg/L	0.003	0.004	no
		07/19/99	DRP	mg/L	0.002	0.004	no
		07/26/99	DRP	mg/L	0.001	0.004	no
		08/02/99	DRP	mg/L	0.002	0.004	no
		08/09/99	DRP	mg/L	0.001	0.004	no
		08/31/99	DRP	mg/L	0.000	0.004	no
		09/29/99	DRP	mg/L	0.001	0.004	no
		10/18/99	DRP	mg/L	0.000	0.004	no
		10/25/99	DRP	mg/L	0.000	0.004	no
		11/29/99	DRP	mg/L	0.001	0.004	no
		12/27/99	DRP	mg/L	0.001	0.004	no
		01/24/00	DRP	mg/L	0.003	0.004	no
		02/16/00	DRP	mg/L	0.001	0.004	no
		02/22/00	DRP	mg/L	0.002	0.004	no
		03/06/00	DRP	mg/L	0.001	0.004	no
		03/14/00	DRP	mg/L	0.001	0.004	no
		03/20/00	DRP	mg/L	0.001	0.004	no
		02/23/99	TDP	mg/L	0.001	0.001	no
		03/29/99	TDP	mg/L	0.002	0.001	no
		04/12/99	TDP	mg/L	0.002	0.001	no
		05/20/99	TDP	mg/L	0.003	0.001	yes
		06/01/99	TDP	mg/L	0.003	0.001	yes
		06/14/99	TDP	mg/L	< 0.000	0.001	no
		06/21/99	TDP	mg/L	0.003	0.001	yes
		06/28/99	TDP	mg/L	< 0.000	0.001	no
		07/06/99	TDP	mg/L	0.001	0.001	no
		07/14/99	TDP	mg/L	0.000	0.001	no
		07/19/99	TDP	mg/L	0.001	0.001	no
		07/26/99	TDP	mg/L	0.000	0.001	no
		08/02/99	TDP	mg/L	0.001	0.001	no
		08/09/99	TDP	mg/L	0.002	0.001	yes
		08/16/99	TDP	mg/L	0.002	0.001	no
		08/25/99	TDP	mg/L	0.007	0.001	yes
		08/31/99	TDP	mg/L	0.001	0.001	no
		09/07/99	TDP	mg/L	0.001	0.001	no
		09/29/99	TDP	mg/L	0.001	0.001	no
		10/04/99	TDP	mg/L	0.002	0.001	no
		10/11/99	TDP	mg/L	0.003	0.001	yes
		10/18/99	TDP	mg/L	0.003	0.001	yes
		10/25/99	TDP	mg/L	0.000	0.001	no
		11/01/99	TDP	mg/L	0.002	0.001	no
		11/22/99	TDP	mg/L	0.002	0.001	no
		11/29/99	TDP	mg/L	0.001	0.001	no
		12/06/99	TDP	mg/L	0.004	0.001	yes
		12/15/99	TDP	mg/L	0.003	0.001	yes
		12/20/99	TDP	mg/L	0.002	0.001	yes
		12/27/99	TDP	mg/L	0.003	0.001	yes
		01/04/00	TDP	mg/L	0.006	0.001	yes
		01/10/00	TDP	mg/L	0.003	0.001	yes

EXHIBIT A.4-6
Equipment Blank Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		01/24/00	TDP	mg/L	0.003	0.001	yes
		02/07/00	TDP	mg/L	0.001	0.001	no
		02/16/00	TDP	mg/L	0.001	0.001	no
		02/22/00	TDP	mg/L	0.002	0.001	no
		03/06/00	TDP	mg/L	0.002	0.001	yes
		03/14/00	TDP	mg/L	0.002	0.001	yes
		03/20/00	TDP	mg/L	0.004	0.001	yes
		02/24/99	TP	mg/L	0.007	0.001	yes
		02/24/99	TP	mg/L	0.001	0.001	no
		04/12/99	TP	mg/L	0.007	0.001	yes
		05/20/99	TP	mg/L	0.004	0.001	yes
		06/01/99	TP	mg/L	0.003	0.001	yes
		06/01/99	TP	mg/L	0.003	0.001	yes
		06/14/99	TP	mg/L	< 0.000	0.001	no
		06/15/99	TP	mg/L	0.005	0.001	yes
		06/15/99	TP	mg/L	0.003	0.001	yes
		06/21/99	TP	mg/L	0.001	0.001	no
		06/28/99	TP	mg/L	0.001	0.001	no
		07/06/99	TP	mg/L	0.000	0.001	no
		07/14/99	TP	mg/L	0.000	0.001	no
		07/19/99	TP	mg/L	0.001	0.001	no
		07/26/99	TP	mg/L	0.002	0.001	no
		08/02/99	TP	mg/L	0.002	0.001	yes
		08/09/99	TP	mg/L	0.001	0.001	no
		08/16/99	TP	mg/L	0.002	0.001	yes
		08/25/99	TP	mg/L	0.002	0.001	no
		08/31/99	TP	mg/L	0.002	0.001	no
		09/07/99	TP	mg/L	0.001	0.001	no
		09/29/99	TP	mg/L	0.001	0.001	no
		10/04/99	TP	mg/L	0.001	0.001	no
		10/11/99	TP	mg/L	0.003	0.001	yes
		10/18/99	TP	mg/L	0.005	0.001	yes
		10/25/99	TP	mg/L	0.001	0.001	no
		11/01/99	TP	mg/L	0.002	0.001	no
		11/22/99	TP	mg/L	0.002	0.001	no
		11/29/99	TP	mg/L	0.002	0.001	no
		11/29/99	TP	mg/L	0.001	0.001	no
		11/30/99	TP	mg/L	0.002	0.001	no
		12/06/99	TP	mg/L	0.002	0.001	yes
		12/15/99	TP	mg/L	0.003	0.001	yes
		12/20/99	TP	mg/L	0.002	0.001	yes
		12/27/99	TP	mg/L	0.004	0.001	yes
		01/04/00	TP	mg/L	0.001	0.001	no
		01/10/00	TP	mg/L	0.003	0.001	yes
		01/24/00	TP	mg/L	0.003	0.001	yes
		01/24/00	TP	mg/L	0.004	0.001	yes
		01/25/00	TP	mg/L	0.002	0.001	no
		02/07/00	TP	mg/L	0.002	0.001	no
		02/16/00	TP	mg/L	0.001	0.001	no
		02/22/00	TP	mg/L	0.004	0.001	yes
		02/22/00	TP	mg/L	0.002	0.001	no
		02/22/00	TP	mg/L	0.002	0.001	no
		03/06/00	TP	mg/L	0.003	0.001	yes
		03/06/00	TP	mg/L	0.001	0.001	no
		03/06/00	TP	mg/L	0.003	0.001	yes
		03/14/00	TP	mg/L	0.002	0.001	yes
		03/20/00	TP	mg/L	0.003	0.001	yes
Sediment	**TOXIKON**	06/15/99	DENSIT	g/cm3	0.96	NA	NA
		07/12/99	DENSIT	g/cm3	1.03	NA	NA
		08/17/99	DENSIT	g/cm3	1.03	NA	NA
		10/26/99	DENSIT	g/cm3	1.01	NA	NA
		10/26/99	DENSIT	g/cm3	1.97	NA	NA
		11/30/99	DENSIT	g/cm3	0.96	NA	NA
		01/25/00	DENSIT	g/cm3	0.96	NA	NA
		01/25/00	DENSIT	g/cm3	0.96	NA	NA
		02/22/00	DENSIT	g/cm3	0.99	NA	NA
		03/06/00	DENSIT	g/cm3	0.98	NA	NA
		07/12/99	SOLID	%	4.43	NA	NA
		08/17/99	SOLID	%	12	NA	NA
		10/26/99	SOLID	%	8	NA	NA
		01/25/00	SOLID	%	< 0.0004	NA	NA
		01/25/00	SOLID	%	< 0.0004	NA	NA
		02/22/00	SOLID	%	8	NA	NA
		03/06/00	SOLID	%	6	NA	NA
		05/20/99	TKN	mg/kg	< 0.0	0.0	no
		09/30/99	TKN	mg/kg	< 10.0	10.0	no
		05/20/99	TOC	mg/kg	4.0	1.0	yes
		09/30/99	TOC	mg/kg	< 1.0	1.0	no
		06/15/99	VS	%	< 4.0	4.0	no
	IFAS	05/20/99	TP	mg/L	0.004	0.001	no

EXHIBIT A.4-6
Equipment Blank Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		07/12/99	TP	mg/L	0.001	0.001	no
		08/17/99	TP	mg/L	0.002	0.001	no
		09/30/99	TP	mg/L	0.010	0.001	no
Periphyton	**PPB**	04/14/99	ASH WT	mg/L	< 10	10	no
		05/24/99	ASH WT	mg/L	< 10	10	no
		06/15/99	ASH WT	mg/L	< 10	10	no
		07/12/99	ASH WT	mg/L	< 10	10	no
		08/31/99	ASH WT	mg/L	< 10	10	no
		09/30/99	ASH WT	mg/L	15	10	no
		10/25/99	ASH WT	mg/L	14	10	no
		11/29/99	ASH WT	mg/L	< 10	10	no
		01/25/00	ASH WT	mg/L	< 10	10	no
		02/22/00	ASH WT	mg/L	< 10	10	no
		03/06/00	ASH WT	mg/L	< 10	10	no
		04/14/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		05/24/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		06/15/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		07/12/99	ASH-FREE DRY WT	mg/L	19	10	no
		08/31/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		09/30/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		10/25/99	ASH-FREE DRY WT	mg/L	18	10	no
		11/29/99	ASH-FREE DRY WT	mg/L	< 10	10	no
		01/25/00	ASH-FREE DRY WT	mg/L	< 10	10	no
		02/22/00	ASH-FREE DRY WT	mg/L	< 10	10	no
		03/06/00	ASH-FREE DRY WT	mg/L	< 10	10	no
		04/14/99	CHL_A	µg/L	< 1.0	1.0	no
		05/24/99	CHL_A	µg/L	2.4	1.0	yes
		06/15/99	CHL_A	µg/L	1.6	1.0	no
		07/12/99	CHL_A	µg/L	< 1.0	1.0	no
		08/31/99	CHL_A	µg/L	8.6	1.0	yes
		09/30/99	CHL_A	µg/L	23.5	1.0	yes
		10/25/99	CHL_A	µg/L	2.9	1.0	yes
		11/29/99	CHL_A	µg/L	1.8	1.0	no
		01/25/00	CHL_A	µg/L	4.0	1.0	yes
		02/22/00	CHL_A	µg/L	3.9	1.0	yes
		03/06/00	CHL_A	µg/L	< 1.0	1.0	no
		04/14/99	CHL_A corr	µg/L	< 1.0	1.0	no
		05/24/99	CHL_A corr	µg/L	< 1.0	1.0	no
		06/15/99	CHL_A corr	µg/L	1.1	1.0	no
		07/12/99	CHL_A corr	µg/L	< 1.0	1.0	no
		08/31/99	CHL_A corr	µg/L	1.2	1.0	no
		09/30/99	CHL_A corr	µg/L	5.9	1.0	yes
		10/25/99	CHL_A corr	µg/L	< 1.0	1.0	no
		11/29/99	CHL_A corr	µg/L	< 1.0	1.0	no
		01/25/00	CHL_A corr	µg/L	1.3	1.0	no
		02/22/00	CHL_A corr	µg/L	< 1.0	1.0	no
		03/06/00	CHL_A corr	µg/L	< 1.0	1.0	no
		05/24/99	CHL_A Mono	µg/L	< 1.0	1.0	no
		04/14/99	CHL_B	µg/L	< 1.0	1.0	no
		05/24/99	CHL_B	µg/L	1.3	1.0	no
		06/15/99	CHL_B	µg/L	2.6	1.0	yes
		07/12/99	CHL_B	µg/L	< 1.0	1.0	no
		08/31/99	CHL_B	µg/L	1.4	1.0	no
		09/30/99	CHL_B	µg/L	9.5	1.0	yes
		10/25/99	CHL_B	µg/L	< 1.0	1.0	no
		11/29/99	CHL_B	µg/L	< 1.0	1.0	no
		01/25/00	CHL_B	µg/L	< 1.0	1.0	no
		02/22/00	CHL_B	µg/L	3.1	1.0	yes
		03/06/00	CHL_B	µg/L	< 1.0	1.0	no
		04/14/99	CHL_C	µg/L	< 1.0	1.0	no
		05/24/99	CHL_C	µg/L	1.3	1.0	no
		06/15/99	CHL_C	µg/L	5.1	1.0	no
		07/12/99	CHL_C	µg/L	< 1.0	1.0	no
		08/31/99	CHL_C	µg/L	2.8	1.0	yes
		09/30/99	CHL_C	µg/L	15.1	1.0	yes
		10/25/99	CHL_C	µg/L	< 1.0	1.0	no
		11/29/99	CHL_C	µg/L	< 1.0	1.0	no
		01/25/00	CHL_C	µg/L	1.4	1.0	no
		02/22/00	CHL_C	µg/L	3.2	1.0	yes
		03/06/00	CHL_C	µg/L	< 1.0	1.0	no
		04/14/99	DRY WT	mg/L	< 10.0	10.0	no
		05/24/99	DRY WT	mg/L	< 10.0	10.0	no
		06/15/99	DRY WT	mg/L	< 10.0	10.0	no
		07/12/99	DRY WT	mg/L	19.0	10.0	no
		08/31/99	DRY WT	mg/L	< 10.0	10.0	no
		09/30/99	DRY WT	mg/L	13.0	10.0	no
		10/25/99	DRY WT	mg/L	32.0	10.0	yes
		11/29/99	DRY WT	mg/L	< 10.0	10.0	no
		01/25/00	DRY WT	mg/L	< 10.0	10.0	no
		02/22/00	DRY WT	mg/L	< 10.0	10.0	no

EXHIBIT A.4-6

Equipment Blank Data for the South ENR Test Cells, February 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		03/06/00	DRY WT	mg/L	< 10.0	10.0	no
		04/14/99	PHEO_A	µg/L	< 1.0	1.0	no
		05/24/99	PHEO_A	µg/L	2.6	1.0	yes
		06/15/99	PHEO_A	µg/L	1.2	1.0	no
		07/12/99	PHEO_A	µg/L	< 1.0	1.0	no
		08/31/99	PHEO_A	µg/L	< 1.0	1.0	no
		09/30/99	PHEO_A	µg/L	7.6	1.0	yes
		10/25/99	PHEO_A	µg/L	< 1.0	1.0	no
		11/29/99	PHEO_A	µg/L	< 1.0	1.0	no
		01/25/00	PHEO_A	µg/L	< 1.0	1.0	no
		02/22/00	PHEO_A	µg/L	1.9	1.0	no
		03/06/00	PHEO_A	µg/L	< 1.0	1.0	no
	TOXIKON	02/24/99	CA	mg/L	0.19	0.05	yes
		04/14/99	CA	mg/L	0.98	0.10	yes
		05/24/99	CA	mg/L	0.41	0.50	no
		06/16/99	CA	mg/L	0.42	0.05	yes
		07/12/99	CA	mg/L	< 1.00	1.00	no
		08/17/99	CA	mg/L	< 1.00	1.00	no
		08/31/99	CA	mg/L	< 1.00	1.00	no
		09/30/99	CA	mg/L	< 1.00	1.00	no
		10/25/99	CA	mg/L	< 1.00	1.00	no
		01/24/00	CA	mg/L	< 1.00	1.00	no
		01/24/00	CA	mg/L	< 1.00	1.00	no
		02/22/00	CA	mg/L	< 1.00	1.00	no
		03/06/00	CA	mg/L	< 1.00	1.00	no
		05/24/99	TKN	mg/L	< 0.040	0.040	no
		09/30/99	TKN	mg/L	< 0.100	0.100	no
	IFAS	07/12/99	TP	mg/L	0.0007	0.0010	no
		08/17/99	TP	mg/L	0.0024	0.0010	no
		08/31/99	TP	mg/L	0.0006	0.0010	no
		09/29/99	TP	mg/L	0.0023	0.0010	no
		10/25/99	TP	mg/L	0.0013	0.0010	no

NA = Not available at this time.

EXHIBIT A.4-7

Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
Water	**PPB**	12/13/1999	N_TOT	mg/L	< 0.100	0.100	no
		12/15/1999	N_TOT	mg/L	0.160	0.100	no
		01/17/2000	N_TOT	mg/L	0.140	0.100	no
		01/19/2000	N_TOT	mg/L	< 0.100	0.100	no
		02/14/2000	N_TOT	mg/L	< 0.100	0.100	no
		02/15/2000	N_TOT	mg/L	< 0.100	0.100	no
		02/16/2000	N_TOT	mg/L	< 0.100	0.100	no
		02/16/2000	N_TOT	mg/L	< 0.100	0.100	no
		03/13/2000	N_TOT	mg/L	< 0.100	0.100	no
		03/15/2000	N_TOT	mg/L	< 0.100	0.100	no
		12/13/1999	NH_3	mg/L	0.021	0.040	no
		12/15/1999	NH_3	mg/L	0.018	0.004	yes
		01/17/2000	NH_3	mg/L	< 0.004	0.004	no
		01/19/2000	NH_3	mg/L	< 0.002	0.002	no
		02/14/2000	NH_3	mg/L	< 0.004	0.004	no
		02/15/2000	NH_3	mg/L	< 0.004	0.004	no
		12/13/1999	NO_2NO_3	mg/L	< 0.004	0.004	no
		12/15/1999	NO_2NO_3	mg/L	0.163	0.004	yes
		01/17/2000	NO_2NO_3	mg/L	0.144	0.004	yes
		01/19/2000	NO_2NO_3	mg/L	0.042	0.004	yes
		02/14/2000	NO_2NO_3	mg/L	0.005	0.004	no
		02/15/2000	NO_2NO_3	mg/L	0.005	0.004	no
		02/16/2000	NO_2NO_3	mg/L	0.210	0.004	yes
		02/16/2000	NO_2NO_3	mg/L	0.021	0.004	yes
		03/13/2000	NO_2NO_3	mg/L	< 0.004	0.004	no
		03/15/2000	NO_2NO_3	mg/L	< 0.004	0.004	no
		12/13/1999	TKN	mg/L	< 0.100	0.100	no
		12/15/1999	TKN	mg/L	< 0.100	0.100	no
		01/17/2000	TKN	mg/L	< 0.100	0.100	no
		01/19/2000	TKN	mg/L	< 0.100	0.100	no
		02/14/2000	TKN	mg/L	< 0.100	0.100	no
		02/15/2000	TKN	mg/L	< 0.100	0.100	no
		02/16/2000	TKN	mg/L	< 0.100	0.100	no
		02/16/2000	TKN	mg/L	< 0.100	0.100	no
		03/13/2000	TKN	mg/L	< 0.100	0.100	no
		03/15/2000	TKN	mg/L	< 0.100	0.100	no
		12/13/1999	TOC	mg/L	< 2.00	2.00	no
		12/15/1999	TOC	mg/L	< 2.00	2.00	no
		01/17/2000	TOC	mg/L	< 1.00	1.00	no
		01/19/2000	TOC	mg/L	1.00	1.00	no
		02/14/2000	TOC	mg/L	< 2.00	2.00	no
		02/15/2000	TOC	mg/L	< 2.00	2.00	no
		02/16/2000	TOC	mg/L	< 2.00	2.00	no
		02/16/2000	TOC	mg/L	< 2.00	2.00	no
		03/13/2000	TOC	mg/L	< 2.00	2.00	no
		03/15/2000	TOC	mg/L	< 2.00	2.00	no
	TOXIKON	04/26/1999	ALKAL	mg/L	< 1.00	1.00	no
		04/27/1999	ALKAL	mg/L	1.60	1.00	no
		04/27/1999	ALKAL	mg/L	1.60	1.00	no
		05/17/1999	ALKAL	mg/L	< 1.00	1.00	no
		05/17/1999	ALKAL	mg/L	< 1.00	1.00	no
		05/17/1999	ALKAL	mg/L	< 1.00	1.00	no
		05/19/1999	ALKAL	mg/L	< 1.00	1.00	no
		06/23/1999	ALKAL	mg/L	< 1.00	1.00	no
		07/19/1999	ALKAL	mg/L	< 1.00	1.00	no
		07/20/1999	ALKAL	mg/L	158	1.00	yes
		08/24/1999	ALKAL	mg/L	< 1.00	1.00	no
		09/20/1999	ALKAL	mg/L	< 1.00	1.00	no
		09/27/1999	ALKAL	mg/L	< 1.00	1.00	no
		09/27/1999	ALKAL	mg/L	< 1.00	1.00	no
		10/18/1999	ALKAL	mg/L	< 1.00	1.00	no
		10/20/1999	ALKAL	mg/L	< 1.00	1.00	no
		11/15/1999	ALKAL	mg/L	< 1.00	1.00	no
		12/13/1999	ALKAL	mg/L	3	1.00	yes
		12/15/1999	ALKAL	mg/L	< 1.00	1.00	no
		01/17/2000	ALKAL	mg/L	< 1.00	1.00	no
		01/19/2000	ALKAL	mg/L	< 1.00	1.00	no
		02/14/2000	ALKAL	mg/L	< 1.00	1.00	no
		02/16/2000	ALKAL	mg/L	< 1.00	1.00	no
		03/13/2000	ALKAL	mg/L	< 1.00	1.00	no
		03/15/2000	ALKAL	mg/L	< 1.00	1.00	no
		04/26/1999	CA	mg/L	< 0.050	0.050	no
		04/27/1999	CA	mg/L	< 0.050	0.050	no
		04/27/1999	CA	mg/L	< 0.050	0.050	no
		05/17/1999	CA	mg/L	0.104	0.100	no
		05/17/1999	CA	mg/L	0.111	0.100	no
		05/17/1999	CA	mg/L	< 0.100	0.100	no
		05/19/1999	CA	mg/L	0.717	0.100	yes

EXHIBIT A.4-7
Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		06/23/1999	CA	mg/L	< 1.0	1.0	no
		07/19/1999	CA	mg/L	< 1.0	1.0	no
		07/20/1999	CA	mg/L	< 1.0	1.0	no
		08/24/1999	CA	mg/L	< 1.0	1.0	no
		09/20/1999	CA	mg/L	< 1.0	1.0	no
		09/27/1999	CA	mg/L	< 1.0	1.0	no
		09/27/1999	CA	mg/L	< 1.0	1.0	no
		10/18/1999	CA	mg/L	< 1.0	1.0	no
		10/20/1999	CA	mg/L	< 1.0	1.0	no
		11/15/1999	CA	mg/L	< 1.0	1.0	no
		12/13/1999	CA	mg/L	< 1.0	1.0	no
		12/15/1999	CA	mg/L	< 1.0	1.0	no
		01/17/2000	CA	mg/L	< 1.0	1.0	no
		01/19/2000	CA	mg/L	< 1.0	1.0	no
		02/14/2000	CA	mg/L	< 1.0	1.0	no
		02/16/2000	CA	mg/L	< 1.0	1.0	no
		03/13/2000	CA	mg/L	< 1.0	1.0	no
		03/15/2000	CA	mg/L	< 1.0	1.0	no
		03/15/2000	CA	mg/L	< 1.0	1.0	no
		04/26/1999	N_TOT	mg/L	< 0.090	0.090	no
		04/27/1999	N_TOT	mg/L	0.046	0.090	no
		04/27/1999	N_TOT	mg/L	0.069	0.090	no
		05/17/1999	N_TOT	mg/L	< 0.090	0.090	no
		05/17/1999	N_TOT	mg/L	< 0.090	0.090	no
		05/17/1999	N_TOT	mg/L	< 0.090	0.090	no
		06/23/1999	N_TOT	mg/L	< 0.150	0.150	no
		07/19/1999	N_TOT	mg/L	< 0.150	0.150	no
		07/20/1999	N_TOT	mg/L	0.491	0.150	yes
		08/24/1999	N_TOT	mg/L	0.100	0.150	no
		09/20/1999	N_TOT	mg/L	< 0.150	0.150	no
		09/27/1999	N_TOT	mg/L	< 0.150	0.150	no
		09/27/1999	N_TOT	mg/L	0.100	0.150	no
		10/18/1999	N_TOT	mg/L	< 0.150	0.150	no
		10/20/1999	N_TOT	mg/L	< 0.150	0.150	no
		11/15/1999	N_TOT	mg/L	0.150	0.150	no
		04/26/1999	NH_3	mg/L	< 0.04	0.04	no
		04/27/1999	NH_3	mg/L	< 0.04	0.04	no
		04/27/1999	NH_3	mg/L	< 0.04	0.04	no
		05/17/1999	NH_3	mg/L	< 0.04	0.04	no
		05/17/1999	NH_3	mg/L	0.07	0.04	no
		05/17/1999	NH_3	mg/L	< 0.04	0.04	no
		05/19/1999	NH_3	mg/L	< 0.04	0.04	no
		06/23/1999	NH_3	mg/L	0.05	0.04	no
		07/19/1999	NH_3	mg/L	< 0.04	0.04	no
		07/20/1999	NH_3	mg/L	< 0.04	0.04	no
		08/24/1999	NH_3	mg/L	< 0.04	0.04	no
		09/20/1999	NH_3	mg/L	< 0.04	0.04	no
		09/27/1999	NH_3	mg/L	< 0.04	0.04	no
		09/27/1999	NH_3	mg/L	< 0.04	0.04	no
		10/18/1999	NH_3	mg/L	< 0.04	0.04	no
		10/20/1999	NH_3	mg/L	< 0.04	0.04	no
		11/15/1999	NH_3	mg/L	< 0.04	0.04	no
		04/26/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		04/27/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		04/27/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		05/17/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		05/17/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		05/17/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		05/19/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		06/23/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		07/19/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		07/20/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		08/24/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		09/20/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		09/27/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		09/27/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		10/18/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		10/20/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		11/15/1999	NO_2NO_3	mg/L	< 0.05	0.05	no
		04/26/1999	TKN	mg/L	< 0.04	0.04	no
		04/27/1999	TKN	mg/L	0.05	0.04	no
		04/27/1999	TKN	mg/L	0.07	0.04	no
		05/17/1999	TKN	mg/L	< 0.04	0.04	no
		05/17/1999	TKN	mg/L	< 0.04	0.04	no
		05/17/1999	TKN	mg/L	< 0.04	0.04	no
		05/19/1999	TKN	mg/L	< 0.04	0.04	no

EXHIBIT A.4-7
Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		06/23/1999	TKN	mg/L	< 0.10	0.10	no
		07/19/1999	TKN	mg/L	< 0.10	0.10	no
		07/20/1999	TKN	mg/L	0.49	0.10	yes
		08/24/1999	TKN	mg/L	0.10	0.10	no
		09/20/1999	TKN	mg/L	< 0.10	0.10	no
		09/27/1999	TKN	mg/L	< 0.10	0.10	no
		09/27/1999	TKN	mg/L	0.10	0.10	no
		10/18/1999	TKN	mg/L	< 0.10	0.10	no
		10/20/1999	TKN	mg/L	< 0.10	0.10	no
		11/15/1999	TKN	mg/L	0.15	0.10	no
		04/26/1999	TOC	mg/L	< 1.00	1.00	no
		04/27/1999	TOC	mg/L	< 1.00	1.00	no
		04/27/1999	TOC	mg/L	< 1.00	1.00	no
		05/17/1999	TOC	mg/L	< 1.00	1.00	no
		05/17/1999	TOC	mg/L	< 1.00	1.00	no
		05/17/1999	TOC	mg/L	< 1.00	1.00	no
		05/19/1999	TOC	mg/L	1.04	1.00	no
		06/23/1999	TOC	mg/L	< 1.00	1.00	no
		07/19/1999	TOC	mg/L	< 1.00	1.00	no
		07/20/1999	TOC	mg/L	< 1.00	1.00	no
		08/24/1999	TOC	mg/L	< 1.00	1.00	no
		09/20/1999	TOC	mg/L	1.10	1.00	no
		09/27/1999	TOC	mg/L	1.28	1.00	no
		09/27/1999	TOC	mg/L	< 1.00	1.00	no
		10/18/1999	TOC	mg/L	< 1.00	1.00	no
		10/20/1999	TOC	mg/L	< 1.00	1.00	no
		11/15/1999	TOC	mg/L	< 1.00	1.00	no
		04/26/1999	TSS	mg/L	4.00	4.00	no
		04/27/1999	TSS	mg/L	4.00	4.00	no
		04/27/1999	TSS	mg/L	4.00	4.00	no
		05/17/1999	TSS	mg/L	< 4.00	4.00	no
		05/17/1999	TSS	mg/L	< 4.00	4.00	no
		05/17/1999	TSS	mg/L	< 4.00	4.00	no
		05/19/1999	TSS	mg/L	< 4.00	4.00	no
		06/23/1999	TSS	mg/L	< 4.00	4.00	no
		07/19/1999	TSS	mg/L	< 4.00	4.00	no
		07/20/1999	TSS	mg/L	< 4.00	4.00	no
		08/24/1999	TSS	mg/L	< 2.00	2.00	no
		09/20/1999	TSS	mg/L	< 1.20	1.20	no
		09/27/1999	TSS	mg/L	< 1.00	1.00	no
		09/27/1999	TSS	mg/L	1.00	1.00	no
		10/18/1999	TSS	mg/L	< 1.00	1.00	no
		10/20/1999	TSS	mg/L	< 1.00	1.00	no
		11/15/1999	TSS	mg/L	< 1.00	1.00	no
		12/13/1999	TSS	mg/L	2.00	1.00	no
		12/15/1999	TSS	mg/L	< 1.00	1.00	no
		01/17/2000	TSS	mg/L	< 1.00	1.00	no
		01/19/2000	TSS	mg/L	< 1.00	1.00	no
		02/14/2000	TSS	mg/L	2.00	1.00	no
		02/16/2000	TSS	mg/L	< 1.00	1.00	no
		03/13/2000	TSS	mg/L	< 1.00	1.00	no
		03/15/2000	TSS	mg/L	< 1.00	1.00	no
	IFAS	04/13/1999	DRP	mg/L	0.0040	0.0004	yes
		04/19/1999	DRP	mg/L	0.0030	0.0004	yes
		04/19/1999	DRP	mg/L	0.0040	0.0004	yes
		04/26/1999	DRP	mg/L	0.0020	0.0004	yes
		04/27/1999	DRP	mg/L	0.0020	0.0004	yes
		04/27/1999	DRP	mg/L	0.0020	0.0004	yes
		05/03/1999	DRP	mg/L	0.0029	0.0004	yes
		05/03/1999	DRP	mg/L	0.0028	0.0004	yes
		05/10/1999	DRP	mg/L	0.0023	0.0004	yes
		05/10/1999	DRP	mg/L	0.0037	0.0004	yes
		05/17/1999	DRP	mg/L	0.0026	0.0004	yes
		05/17/1999	DRP	mg/L	0.0025	0.0004	yes
		05/17/1999	DRP	mg/L	0.0026	0.0004	yes
		05/19/1999	DRP	mg/L	0.0036	0.0004	yes
		05/25/1999	DRP	mg/L	0.0024	0.0004	yes
		05/25/1999	DRP	mg/L	0.0024	0.0004	yes
		06/01/1999	DRP	mg/L	0.0003	0.0004	no
		06/09/1999	DRP	mg/L	0.0022	0.0004	yes
		06/23/1999	DRP	mg/L	0.0027	0.0004	yes
		06/23/1999	DRP	mg/L	0.0023	0.0004	yes
		06/28/1999	DRP	mg/L	0.0026	0.0004	yes
		07/06/1999	DRP	mg/L	0.0023	0.0004	yes
		07/14/1999	DRP	mg/L	0.0022	0.0004	yes
		07/19/1999	DRP	mg/L	0.0020	0.0004	yes
		07/20/1999	DRP	mg/L	0.0024	0.0004	yes
		07/26/1999	DRP	mg/L	0.0286	0.0004	yes
		08/02/1999	DRP	mg/L	0.0009	0.0004	yes
		08/09/1999	DRP	mg/L	0.0009	0.0004	yes

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Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		08/24/1999	DRP	mg/L	0.0008	0.0004	no
		08/25/1999	DRP	mg/L	0.0006	0.0004	no
		08/30/1999	DRP	mg/L	0.0007	0.0004	no
		09/20/1999	DRP	mg/L	0.0002	0.0004	no
		09/27/1999	DRP	mg/L	0.0008	0.0004	no
		09/27/1999	DRP	mg/L	0.0004	0.0004	no
		10/18/1999	DRP	mg/L	0.0007	0.0004	no
		10/20/1999	DRP	mg/L	0.0008	0.0004	no
		11/15/1999	DRP	mg/L	0.0002	0.0004	no
		11/17/1999	DRP	mg/L	0.0011	0.0004	yes
		12/13/1999	DRP	mg/L	0.0014	0.0004	yes
		12/15/1999	DRP	mg/L	0.0010	0.0004	yes
		01/17/2000	DRP	mg/L	0.0016	0.0004	yes
		01/19/2000	DRP	mg/L	0.0011	0.0004	yes
		01/31/2000	DRP	mg/L	0.0008	0.0004	no
		02/07/2000	DRP	mg/L	0.0010	0.0004	yes
		02/16/2000	DRP	mg/L	0.0010	0.0004	yes
		02/16/2000	DRP	mg/L	0.0010	0.0004	yes
		02/21/2000	DRP	mg/L	0.0010	0.0004	yes
		02/28/2000	DRP	mg/L	0.0010	0.0004	yes
		03/07/2000	DRP	mg/L	0.0005	0.0004	no
		03/20/2000	DRP	mg/L	0.0003	0.0004	no
		03/27/2000	DRP	mg/L	0.0006	0.0004	no
		04/13/1999	TDP	mg/L	0.0020	0.0010	no
		04/19/1999	TDP	mg/L	0.0060	0.0010	yes
		04/19/1999	TDP	mg/L	0.0050	0.0010	yes
		04/26/1999	TDP	mg/L	0.0020	0.0010	no
		04/27/1999	TDP	mg/L	0.0010	0.0010	no
		04/27/1999	TDP	mg/L	0.0010	0.0010	no
		05/03/1999	TDP	mg/L	0.0036	0.0010	yes
		05/03/1999	TDP	mg/L	0.0046	0.0010	yes
		05/10/1999	TDP	mg/L	0.0000	0.0010	no
		05/10/1999	TDP	mg/L	0.0000	0.0010	no
		05/17/1999	TDP	mg/L	0.0061	0.0010	yes
		05/17/1999	TDP	mg/L	0.0042	0.0010	yes
		05/17/1999	TDP	mg/L	0.0014	0.0010	no
		05/19/1999	TDP	mg/L	0.0027	0.0010	yes
		05/25/1999	TDP	mg/L	0.0030	0.0010	yes
		05/25/1999	TDP	mg/L	0.0021	0.0010	yes
		06/01/1999	TDP	mg/L	0.0016	0.0010	no
		06/09/1999	TDP	mg/L	0.0026	0.0010	yes
		06/23/1999	TDP	mg/L	0.0032	0.0010	yes
		06/23/1999	TDP	mg/L	0.0041	0.0010	yes
		06/28/1999	TDP	mg/L	0.0007	0.0010	no
		07/06/1999	TDP	mg/L	0.0001	0.0010	no
		07/14/1999	TDP	mg/L	0.0000	0.0010	no
		07/19/1999	TDP	mg/L	0.0008	0.0010	no
		07/20/1999	TDP	mg/L	0.0007	0.0010	no
		07/26/1999	TDP	mg/L	0.0625	0.0010	yes
		08/02/1999	TDP	mg/L	0.0005	0.0010	no
		08/09/1999	TDP	mg/L	0.0024	0.0010	yes
		08/16/1999	TDP	mg/L	0.0015	0.0010	no
		08/24/1999	TDP	mg/L	0.0017	0.0010	no
		08/25/1999	TDP	mg/L	0.0006	0.0010	no
		08/30/1999	TDP	mg/L	0.0006	0.0010	no
		09/07/1999	TDP	mg/L	0.0007	0.0010	no
		09/20/1999	TDP	mg/L	0.0000	0.0010	no
		09/27/1999	TDP	mg/L	0.0000	0.0010	no
		09/27/1999	TDP	mg/L	0.0000	0.0010	no
		10/04/1999	TDP	mg/L	0.0006	0.0010	no
		10/11/1999	TDP	mg/L	0.0059	0.0010	yes
		10/18/1999	TDP	mg/L	0.0028	0.0010	yes
		10/20/1999	TDP	mg/L	0.0020	0.0010	no
		10/26/1999	TDP	mg/L	0.0013	0.0010	no
		11/01/1999	TDP	mg/L	0.0028	0.0010	yes
		11/08/1999	TDP	mg/L	0.0037	0.0010	yes
		11/15/1999	TDP	mg/L	0.0019	0.0010	no
		11/17/1999	TDP	mg/L	0.0020	0.0010	no
		11/22/1999	TDP	mg/L	0.0016	0.0010	no
		11/30/1999	TDP	mg/L	0.0016	0.0010	no
		12/06/1999	TDP	mg/L	0.0039	0.0010	yes
		12/13/1999	TDP	mg/L	0.0022	0.0010	yes
		12/15/1999	TDP	mg/L	0.0017	0.0010	no
		12/20/1999	TDP	mg/L	0.0036	0.0010	yes
		12/27/1999	TDP	mg/L	0.0027	0.0010	yes
		01/03/2000	TDP	mg/L	0.0019	0.0010	no
		01/10/2000	TDP	mg/L	0.0028	0.0010	yes
		01/17/2000	TDP	mg/L	0.0045	0.0010	yes
		01/19/2000	TDP	mg/L	0.0017	0.0010	no
		01/25/2000	TDP	mg/L	0.0027	0.0010	yes

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Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		01/31/2000	TDP	mg/L	0.0021	0.0010	yes
		02/07/2000	TDP	mg/L	0.0010	0.0010	no
		02/14/2000	TDP	mg/L	0.0040	0.0010	yes
		02/16/2000	TDP	mg/L	0.0010	0.0010	no
		02/21/2000	TDP	mg/L	0.0030	0.0010	yes
		02/28/2000	TDP	mg/L	0.0030	0.0010	yes
		03/07/2000	TDP	mg/L	0.0010	0.0010	no
		03/13/2000	TDP	mg/L	0.0025	0.0010	yes
		03/15/2000	TDP	mg/L	0.0034	0.0010	yes
		03/20/2000	TDP	mg/L	0.0025	0.0010	yes
		03/27/2000	TDP	mg/L	0.0017	0.0010	no
		04/13/1999	TP	mg/L	0.0040	0.0010	yes
		04/19/1999	TP	mg/L	0.0120	0.0010	yes
		04/19/1999	TP	mg/L	0.0130	0.0010	yes
		04/26/1999	TP	mg/L	0.0040	0.0010	yes
		04/27/1999	TP	mg/L	0.0040	0.0010	yes
		04/27/1999	TP	mg/L	0.0040	0.0010	yes
		05/03/1999	TP	mg/L	0.0036	0.0010	yes
		05/03/1999	TP	mg/L	0.0036	0.0010	yes
		05/10/1999	TP	mg/L	0.0002	0.0010	no
		05/10/1999	TP	mg/L	0.0011	0.0010	no
		05/17/1999	TP	mg/L	0.0153	0.0010	yes
		05/17/1999	TP	mg/L	0.0135	0.0010	yes
		05/17/1999	TP	mg/L	0.0172	0.0010	yes
		05/19/1999	TP	mg/L	0.0042	0.0010	yes
		05/25/1999	TP	mg/L	0.0158	0.0010	yes
		05/25/1999	TP	mg/L	0.0039	0.0010	yes
		06/01/1999	TP	mg/L	0.0032	0.0010	yes
		06/09/1999	TP	mg/L	0.0019	0.0010	no
		06/23/1999	TP	mg/L	0.0045	0.0010	yes
		06/23/1999	TP	mg/L	< 0.0001	0.0010	no
		06/28/1999	TP	mg/L	0.0032	0.0010	yes
		07/06/1999	TP	mg/L	0.0010	0.0010	no
		07/14/1999	TP	mg/L	0.0000	0.0010	no
		07/19/1999	TP	mg/L	0.0017	0.0010	no
		07/20/1999	TP	mg/L	0.0017	0.0010	no
		07/26/1999	TP	mg/L	0.0020	0.0010	no
		08/02/1999	TP	mg/L	0.0005	0.0010	no
		08/09/1999	TP	mg/L	0.0005	0.0010	no
		08/16/1999	TP	mg/L	0.0015	0.0010	no
		08/24/1999	TP	mg/L	0.0017	0.0010	no
		08/25/1999	TP	mg/L	0.0015	0.0010	no
		08/30/1999	TP	mg/L	0.0015	0.0010	no
		09/07/1999	TP	mg/L	0.0016	0.0010	no
		09/20/1999	TP	mg/L	0.0017	0.0010	no
		09/27/1999	TP	mg/L	0.0003	0.0010	no
		09/27/1999	TP	mg/L	0.0011	0.0010	no
		10/04/1999	TP	mg/L	0.0006	0.0010	no
		10/11/1999	TP	mg/L	0.0045	0.0010	yes
		10/18/1999	TP	mg/L	0.0037	0.0010	yes
		10/20/1999	TP	mg/L	0.0028	0.0010	yes
		10/26/1999	TP	mg/L	0.0013	0.0010	no
		11/01/1999	TP	mg/L	0.0037	0.0010	yes
		11/08/1999	TP	mg/L	0.0019	0.0010	no
		11/15/1999	TP	mg/L	0.0056	0.0010	yes
		11/17/1999	TP	mg/L	0.0037	0.0010	yes
		11/17/1999	TP	mg/L	0.0029	0.0010	yes
		11/17/1999	TP	mg/L	0.0029	0.0010	yes
		11/22/1999	TP	mg/L	0.0025	0.0010	yes
		11/30/1999	TP	mg/L	0.0025	0.0010	yes
		12/06/1999	TP	mg/L	0.0020	0.0010	no
		12/13/1999	TP	mg/L	0.0022	0.0010	yes
		12/15/1999	TP	mg/L	0.0038	0.0010	yes
		12/15/1999	TP	mg/L	0.0021	0.0010	yes
		12/20/1999	TP	mg/L	0.0029	0.0010	yes
		12/27/1999	TP	mg/L	0.0045	0.0010	yes
		01/03/2000	TP	mg/L	0.0010	0.0010	no
		01/10/2000	TP	mg/L	0.0010	0.0010	no
		01/17/2000	TP	mg/L	0.0036	0.0010	yes
		01/19/2000	TP	mg/L	0.0026	0.0010	yes
		01/19/2000	TP	mg/L	0.0008	0.0010	no
		01/19/2000	TP	mg/L	0.0017	0.0010	no
		01/25/2000	TP	mg/L	0.0027	0.0010	yes
		01/31/2000	TP	mg/L	0.0036	0.0010	yes
		02/07/2000	TP	mg/L	0.0020	0.0010	no
		02/14/2000	TP	mg/L	0.0020	0.0010	no
		02/16/2000	TP	mg/L	0.0010	0.0010	no
		02/16/2000	TP	mg/L	0.0020	0.0010	no
		02/16/2000	TP	mg/L	0.0020	0.0010	no
		02/21/2000	TP	mg/L	0.0030	0.0010	yes

EXHIBIT A.4-7
Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		02/28/2000	TP	mg/L	0.0040	0.0010	yes
		03/07/2000	TP	mg/L	0.0050	0.0010	yes
		03/13/2000	TP	mg/L	0.0025	0.0010	yes
		03/13/2000	TP	mg/L	0.0025	0.0010	yes
		03/13/2000	TP	mg/L	0.0025	0.0010	yes
		03/15/2000	TP	mg/L	0.0061	0.0010	yes
		03/15/2000	TP	mg/L	0.0025	0.0010	yes
		03/15/2000	TP	mg/L	0.0034	0.0010	yes
		03/20/2000	TP	mg/L	0.0016	0.0010	no
		03/27/2000	TP	mg/L	0.0026	0.0010	yes
Sediment	**TOXIKON**	05/18/1999	DENSIT	g/cm3	0.9000	NA	NA
		06/21/1999	DENSIT	g/cm3	0.9670	NA	NA
		07/19/1999	DENSIT	g/cm3	1.0100	NA	NA
		08/26/1999	DENSIT	g/cm3	0.9780	NA	NA
		10/20/1999	DENSIT	g/cm3	0.9570	NA	NA
		11/17/1999	DENSIT	g/cm3	0.9600	NA	NA
		12/15/1999	DENSIT	g/cm3	1.0200	NA	NA
		01/19/2000	DENSIT	g/cm3	0.9900	NA	NA
		02/16/2000	DENSIT	g/cm3	0.9900	NA	NA
		03/13/2000	DENSIT	g/cm3	0.9900	NA	NA
		03/15/2000	DENSIT	g/cm3	1.0000	NA	NA
		05/18/1999	SOLID	%	< 4.0000	NA	NA
		10/20/1999	SOLID	%	12.0	NA	NA
		11/17/1999	SOLID	%	0.656	NA	NA
		12/15/1999	SOLID	%	< 4.0	NA	NA
		02/16/2000	SOLID	%	6.0	NA	NA
		03/15/2000	SOLID	%	32	NA	NA
		05/18/1999	TKN	mg/kg	0.1	0.04	yes
		09/20/1999	TKN	mg/kg	< 10.0	10.00	no
		09/29/1999	TKN	mg/kg	0.1	0.10	no
		12/15/1999	TKN	mg/kg	< 250	250.00	no
		05/18/1999	TOC	mg/kg	< 1.0	1.0	no
		09/20/1999	TOC	mg/kg	< 1.0	1.0	no
		09/29/1999	TOC	mg/kg	< 1.0	1.0	no
		12/15/1999	TOC	mg/kg	< 1.0	1.0	no
		06/21/1999	VS	%	0.0000	0.0000	no
	IFAS	05/18/1999	TP	mg/L	0.011	0.001	no
		07/19/1999	TP	mg/L	0.001	0.001	no
Periphyton	**PPB**	04/29/1999	ASH WT	mg/L	< 10.00	10.00	no
		05/18/1999	ASH WT	mg/L	< 10.00	10.00	no
		05/18/1999	ASH WT	mg/L	< 10.00	10.00	no
		06/25/1999	ASH WT	mg/L	< 10.00	10.00	no
		08/26/1999	ASH WT	mg/L	30.00	10.00	yes
		09/29/1999	ASH WT	mg/L	< 10.00	10.00	no
		09/29/1999	ASH WT	mg/L	< 10.00	10.00	no
		10/20/1999	ASH WT	mg/L	10.00	10.00	no
		11/17/1999	ASH WT	mg/L	< 10.00	10.00	no
		12/14/1999	ASH WT	mg/L	< 10.00	10.00	no
		12/15/1999	ASH WT	mg/L	< 10.00	10.00	no
		02/16/2000	ASH WT	mg/L	< 10.00	10.00	no
		03/13/2000	ASH WT	mg/L	< 10.00	10.00	no
		03/15/2000	ASH WT	mg/L	12.00	10.00	no
		04/29/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		05/18/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		05/18/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		06/25/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		08/26/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		09/29/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		09/29/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		10/20/1999	ASH-FREE DRY WT	mg/L	40.00	10.00	yes
		11/17/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		12/14/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		12/15/1999	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		02/16/2000	ASH-FREE DRY WT	mg/L	< 10.00	10.00	no
		03/13/2000	ASH-FREE DRY WT	mg/L	17.00	10.00	no
		03/15/2000	ASH-FREE DRY WT	mg/L	36.00	10.00	yes
		04/29/1999	CHL_A	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_A	µg/L	1.60	1.00	no
		05/18/1999	CHL_A	µg/L	2.50	1.00	yes
		06/25/1999	CHL_A	µg/L	3.20	1.00	yes
		08/26/1999	CHL_A	µg/L	< 1.00	1.00	no
		09/29/1999	CHL_A	µg/L	12.50	1.00	yes
		09/29/1999	CHL_A	µg/L	6.90	1.00	yes
		10/20/1999	CHL_A	µg/L	1.60	1.00	no
		11/17/1999	CHL_A	µg/L	2.20	1.00	yes
		12/14/1999	CHL_A	µg/L	5.20	1.00	yes
		12/15/1999	CHL_A	µg/L	12.40	1.00	yes
		02/16/2000	CHL_A	µg/L	24.40	1.00	yes
		03/13/2000	CHL_A	µg/L	2.70	1.00	yes
		03/15/2000	CHL_A	µg/L	12.60	1.00	yes

EXHIBIT A.4-7

Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		04/29/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		06/25/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		08/26/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		09/29/1999	CHL_A corr	µg/L	3.50	1.00	yes
		09/29/1999	CHL_A corr	µg/L	2.00	1.00	yes
		10/20/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		11/17/1999	CHL_A corr	µg/L	< 1.00	1.00	no
		12/14/1999	CHL_A corr	µg/L	1.10	1.00	no
		12/15/1999	CHL_A corr	µg/L	2.50	1.00	yes
		02/16/2000	CHL_A corr	µg/L	7.00	1.00	yes
		03/13/2000	CHL_A corr	µg/L	< 1.00	1.00	no
		03/15/2000	CHL_A corr	µg/L	1.20	1.00	no
		05/18/1999	CHL_A Mono	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_A Mono	µg/L	< 1.00	1.00	no
		04/29/1999	CHL_B	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_B	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_B	µg/L	< 1.00	1.00	no
		06/25/1999	CHL_B	µg/L	< 1.00	1.00	no
		08/26/1999	CHL_B	µg/L	< 1.00	1.00	no
		09/29/1999	CHL_B	µg/L	3.10	1.00	no
		09/29/1999	CHL_B	µg/L	5.90	1.00	no
		10/20/1999	CHL_B	µg/L	< 1.00	1.00	no
		11/17/1999	CHL_B	µg/L	< 1.00	1.00	no
		12/14/1999	CHL_B	µg/L	1.30	1.00	no
		12/15/1999	CHL_B	µg/L	4.30	1.00	no
		02/16/2000	CHL_B	µg/L	10.90	1.00	no
		03/13/2000	CHL_B	µg/L	< 1.00	1.00	no
		03/15/2000	CHL_B	µg/L	3.70	1.00	no
		04/29/1999	CHL_C	µg/L	1.20	1.00	no
		05/18/1999	CHL_C	µg/L	< 1.00	1.00	no
		05/18/1999	CHL_C	µg/L	< 1.00	1.00	no
		06/25/1999	CHL_C	µg/L	< 1.00	1.00	no
		08/26/1999	CHL_C	µg/L	1.00	1.00	no
		09/29/1999	CHL_C	µg/L	8.80	1.00	no
		09/29/1999	CHL_C	µg/L	5.70	1.00	no
		10/20/1999	CHL_C	µg/L	< 1.00	1.00	no
		11/17/1999	CHL_C	µg/L	< 1.00	1.00	no
		12/14/1999	CHL_C	µg/L	3.10	1.00	no
		12/15/1999	CHL_C	µg/L	6.60	1.00	no
		02/16/2000	CHL_C	µg/L	12.40	1.00	no
		03/13/2000	CHL_C	µg/L	1.70	1.00	no
		03/15/2000	CHL_C	µg/L	5.80	1.00	no
		04/29/1999	DRY WT	mg/L	< 10.00	10.00	no
		05/18/1999	DRY WT	mg/L	< 10.00	10.00	no
		05/18/1999	DRY WT	mg/L	< 10.00	10.00	no
		06/25/1999	DRY WT	mg/L	< 10.00	10.00	no
		08/26/1999	DRY WT	mg/L	30.00	10.00	yes
		09/29/1999	DRY WT	mg/L	< 10.00	10.00	no
		09/29/1999	DRY WT	mg/L	< 10.00	10.00	no
		10/20/1999	DRY WT	mg/L	50.00	10.00	no
		11/17/1999	DRY WT	mg/L	< 10.00	10.00	no
		12/14/1999	DRY WT	mg/L	< 10.00	10.00	no
		12/15/1999	DRY WT	mg/L	< 10.00	10.00	no
		02/16/2000	DRY WT	mg/L	< 10.00	10.00	no
		03/13/2000	DRY WT	mg/L	27.00	10.00	no
		03/15/2000	DRY WT	mg/L	48.00	10.00	no
		04/29/1999	PHEO_A	µg/L	< 1.00	1.00	no
		05/18/1999	PHEO_A	µg/L	< 1.00	1.00	no
		05/18/1999	PHEO_A	µg/L	< 1.00	1.00	no
		06/25/1999	PHEO_A	µg/L	1.80	1.00	no
		08/26/1999	PHEO_A	µg/L	1.80	1.00	no
		09/29/1999	PHEO_A	µg/L	1.30	1.00	no
		09/29/1999	PHEO_A	µg/L	3.70	1.00	no
		10/20/1999	PHEO_A	µg/L	< 1.00	1.00	no
		11/17/1999	PHEO_A	µg/L	2.50	1.00	no
		12/14/1999	PHEO_A	µg/L	7.20	1.00	no
		12/15/1999	PHEO_A	µg/L	4.80	1.00	no
		02/16/2000	PHEO_A	µg/L	< 1.00	1.00	no
		03/13/2000	PHEO_A	µg/L	2.90	1.00	no
		03/15/2000	PHEO_A	µg/L	4.60	1.00	no
	TOXIKON	04/29/1999	CA	mg/L	0.40	0.05	yes
		04/29/1999	CA	mg/L	1.34	0.05	yes
		05/18/1999	CA	mg/L	0.11	0.10	no
		05/18/1999	CA	mg/L	0.25	0.10	yes
		06/24/1999	CA	mg/L	< 1.00	1.00	no
		07/19/1999	CA	mg/L	< 1.00	1.00	no
		08/26/1999	CA	mg/L	< 1.00	1.00	no
		09/20/1999	CA	mg/L	< 1.00	1.00	no

EXHIBIT A.4-7

Equipment Blank Data for the Porta-PSTAs, April 1999 to March 2000

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2x MDL)
		09/29/1999	CA	mg/L	< 1.00	1.00	no
		10/20/1999	CA	mg/L	< 1.00	1.00	no
		11/17/1999	CA	mg/L	< 1.00	1.00	no
		12/15/1999	CA	mg/L	< 1.00	1.00	no
		01/19/2000	CA	mg/L	< 1.00	1.00	no
		02/16/2000	CA	mg/L	< 1.00	1.00	no
		03/13/2000	CA	mg/L	< 1.00	1.00	no
		05/18/1999	TKN	mg/L	< 0.04	0.04	no
		05/18/1999	TKN	mg/L	0.05	0.04	no
		09/20/1999	TKN	mg/L	< 0.10	0.10	no
		09/29/1999	TKN	mg/L	0.10	0.10	no
		12/15/1999	TKN	mg/L	< 1.00	0.10	yes
	IFAS	07/19/1999	TP	mg/L	0.001	0.001	no
		08/26/1999	TP	mg/L	0.002	0.001	no
		09/29/1999	TP	mg/L	0.001	0.001	no
		10/20/1999	TP	mg/L	0.002	0.001	no

NA = Not available at this time.

EXHIBIT A.4-8

Equipment Blank Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
Water	PPB	06/27/2000	ALKAL	mg/L	1	<	1	no
		07/17/2000	ALKAL	mg/L	1	<	1	no
		08/14/2000	ALKAL	mg/L	1	=	1	no
		10/24/2000	ALKAL	mg/L	1	=	1	no
		11/28/2000	ALKAL	mg/L	2	=	1	no
		12/18/2000	ALKAL	mg/L	1	=	1	no
		01/23/2001	ALKAL	mg/L	2	=	1	no
		02/20/2001	ALKAL	mg/L	2	=	1	no
		03/07/2001	ALKAL	mg/L	2	=	1	no
		03/20/2001	ALKAL	mg/L	2	=	1	no
		06/27/2000	CA	mg/L	0.04	=	0.02	no
		07/17/2000	CA	mg/L	0.02	<	0.02	no
		08/14/2000	CA	mg/L	0.02	<	0.02	no
		10/24/2000	CA	mg/L	0.02	=	0.02	no
		11/28/2000	CA	mg/L	0.02	=	0.02	no
		12/18/2000	CA	mg/L	0.02	<	0.02	no
		01/23/2001	CA	mg/L	0.02	<	0.02	no
		02/20/2001	CA	mg/L	0.02	=	0.02	no
		03/20/2001	CA	mg/L	0.03	=	0.02	no
		03/07/2001	CA_DIS	mg/L	0.02	<	0.02	no
		03/07/2001	CL	mg/L	0.2	<	0.2	no
		03/07/2001	COLOR	cpu	5	<	5	no
		03/07/2001	FE_DIS	µg/L	2.5	<	2.5	no
		03/07/2001	K_DIS	mg/L	0.04	<	0.04	no
		03/07/2001	MG_DIS	mg/L	0.01	<	0.01	no
		06/27/2000	N_TOT	mg/L	0.1	<	0.1	no
		07/17/2000	N_TOT	mg/L	0.1	<	0.1	no
		08/14/2000	N_TOT	mg/L	0.1	<	0.1	no
		09/19/2000	N_TOT	mg/L	0.1	<	0.1	no
		09/19/2000	N_TOT	mg/L	0.1	<	0.1	no
		10/24/2000	N_TOT	mg/L	0.1	<	0.1	no
		11/28/2000	N_TOT	mg/L	0.1	<	0.1	no
		12/18/2000	N_TOT	mg/L	0.1	<	0.1	no
		01/23/2001	N_TOT	mg/L	0.1	<	0.1	no
		02/20/2001	N_TOT	mg/L	0.1	<	0.1	no
		03/20/2001	N_TOT	mg/L	0.1	<	0.1	no
		03/07/2001	NA_DIS	mg/L	0.15	<	0.15	no
		06/27/2000	NH_3	mg/L	0.004	<	0.004	no
		08/14/2000	NH_3	mg/L	0.004	<	0.004	no
		11/28/2000	NH_3	mg/L	0.003	<	0.003	no
		12/18/2000	NH_3	mg/L	0.004	<	0.004	no
		01/23/2001	NH_3	mg/L	0.003	<	0.003	no
		02/20/2001	NH_3	mg/L	0.003	<	0.003	no
		03/07/2001	NH_3	mg/L	0.004	<	0.004	no
		03/20/2001	NH_3	mg/L	0.003	<	0.003	no
		06/27/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		07/17/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		08/14/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		09/19/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		09/19/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		10/24/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		11/28/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		12/18/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		01/23/2001	NO_2NO_3	mg/L	0.004	<	0.004	no
		02/20/2001	NO_2NO_3	mg/L	0.004	<	0.004	no
		03/07/2001	NO_2NO_3	mg/L	0.004	<	0.004	no
		03/20/2001	NO_2NO_3	mg/L	0.004	<	0.004	no
		03/07/2001	SI	mg/L	0.2	<	0.2	no
		03/07/2001	SO4	mg/L	2	<	2	no
		03/07/2001	TDS	mg/L	6	=		no
		06/27/2000	TKN	mg/L	0.1	<	0.1	no
		07/17/2000	TKN	mg/L	0.1	<	0.1	no
		08/14/2000	TKN	mg/L	0.1	<	0.1	no
		09/19/2000	TKN	mg/L	0.1	<	0.1	no
		09/19/2000	TKN	mg/L	0.1	<	0.1	no
		10/24/2000	TKN	mg/L	0.1	<	0.1	no
		11/28/2000	TKN	mg/L	0.1	<	0.1	no
		12/18/2000	TKN	mg/L	0.1	<	0.1	no
		01/23/2001	TKN	mg/L	0.1	<	0.1	no

EXHIBIT A.4-8
Equipment Blank Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		02/20/2001	TKN	mg/L	0.1	<	0.1	no
		03/07/2001	TKN	mg/L	0.1	<	0.1	no
		03/20/2001	TKN	mg/L	0.1	<	0.1	no
		06/27/2000	TOC	mg/L	1	=	1	no
		07/17/2000	TOC	mg/L	1	<	1	no
		08/14/2000	TOC	mg/L	1	=	1	no
		09/19/2000	TOC	mg/L	1	=	1	no
		09/19/2000	TOC	mg/L	1	<	1	no
		10/24/2000	TOC	mg/L	1	<	1	no
		11/28/2000	TOC	mg/L	1	<	1	no
		12/18/2000	TOC	mg/L	1	<	1	no
		01/23/2001	TOC	mg/L	1	<	1	no
		02/20/2001	TOC	mg/L	1	<	1	no
		03/07/2001	TOC	mg/L	2	<	2	no
		03/20/2001	TOC	mg/L	2	<	2	no
		06/27/2000	TSS	mg/L	2	<	2	no
		07/17/2000	TSS	mg/L	2	<	2	no
		08/14/2000	TSS	mg/L	2	<	2	no
		10/24/2000	TSS	mg/L	2	<	2	no
		11/28/2000	TSS	mg/L	2	=	2	no
		12/18/2000	TSS	mg/L	2	<	2	no
		01/23/2001	TSS	mg/L	3	=	2	no
		02/20/2001	TSS	mg/L	2	<	2	no
		03/07/2001	TSS	mg/L	2	<	2	no
		03/20/2001	TSS	mg/L	3	=	2	no
		03/07/2001	TURBIDITY	ntu	0.2	=		no
	IFAS	04/03/2000	DRP	mg/L	0.0008	=	0.001	yes
		08/14/2000	DRP	mg/L	0.001	=	0.001	yes
		08/21/2000	DRP	mg/L	0.002	=	0.001	yes
		09/19/2000	DRP	mg/L	0.002	=	0.001	yes
		09/19/2000	DRP	mg/L	0.002	=	0.001	yes
		10/24/2000	DRP	mg/L	0.001	=	0.001	yes
		11/01/2000	DRP	mg/L	0.001	=	0.001	no
		11/01/2000	DRP	mg/L	0.001	=	0.001	no
		11/01/2000	DRP	mg/L	0.001	=	0.001	no
		11/07/2000	DRP	mg/L	0.002	=	0.001	no
		11/07/2000	DRP	mg/L	0.001	=	0.001	no
		11/07/2000	DRP	mg/L	0.001	=	0.001	no
		11/14/2000	DRP	mg/L	0.001	=	0.001	no
		11/14/2000	DRP	mg/L	0.002	=	0.001	no
		11/14/2000	DRP	mg/L	0.001	=	0.001	no
		11/28/2000	DRP	mg/L	0.001	=	0.001	no
		11/28/2000	DRP	mg/L	0.001	=	0.001	no
		12/18/2000	DRP	mg/L	0.001	=	0.001	no
		01/23/2001	DRP	mg/L	0.001	=	0.001	no
		02/20/2001	DRP	mg/L	0.002	=	0.001	no
		03/05/2001	DRP	mg/L	0.001	=	0.001	no
		03/20/2001	DRP	mg/L	0.003	=	0.001	no
		04/03/2000	TDP	mg/L	0.004	=	0.001	yes
		05/08/2000	TDP	mg/L	0.003	=	0.001	yes
		05/22/2000	TDP	mg/L	0.003	=	0.001	yes
		05/30/2000	TDP	mg/L	0.002	=	0.001	no
		06/19/2000	TDP	mg/L	0.002	=	0.001	no
		06/27/2000	TDP	mg/L	0.003	=	0.001	yes
		07/10/2000	TDP	mg/L	0.002	=	0.001	no
		07/17/2000	TDP	mg/L	0.001	=	0.001	no
		07/24/2000	TDP	mg/L	0.002	=	0.001	no
		07/31/2000	TDP	mg/L	0.001	=	0.001	no
		08/07/2000	TDP	mg/L	0.001	=	0.001	no
		08/07/2000	TDP	mg/L	0.001	=	0.001	no
		08/14/2000	TDP	mg/L	0.001	=	0.001	no
		08/21/2000	TDP	mg/L	0.001	=	0.001	no
		09/05/2000	TDP	mg/L	0.002	=	0.001	no
		09/13/2000	TDP	mg/L	0.003	=	0.001	yes
		09/25/2000	TDP	mg/L	0.003	=	0.001	yes
		10/02/2000	TDP	mg/L	0.001	=	0.001	no
		10/24/2000	TDP	mg/L	0.004	=	0.001	yes
		11/28/2000	TDP	mg/L	0.003	=	0.001	no
		12/18/2000	TDP	mg/L	0.002	=	0.001	no
		01/09/2001	TDP	mg/L	0.002	=	0.001	no

EXHIBIT A.4-8
Equipment Blank Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		01/23/2001	TDP	mg/L	0.017	=	0.001	no
		01/30/2001	TDP	mg/L	0.001	=	0.001	no
		02/20/2001	TDP	mg/L	0.002	=	0.001	no
		03/05/2001	TDP	mg/L	0.003	=	0.001	no
		03/05/2001	TDP	mg/L	0.003	=	0.001	no
		03/20/2001	TDP	mg/L	0.002	=	0.001	no
		04/03/2000	TP	mg/L	0.002	=	0.001	no
		05/08/2000	TP	mg/L	0.003	=	0.001	yes
		05/22/2000	TP	mg/L	0.001	=	0.001	no
		05/22/2000	TP	mg/L	0.018	=	0.001	yes
		05/22/2000	TP	mg/L	0.002	=	0.001	no
		05/30/2000	TP	mg/L	0.002	=	0.001	no
		06/19/2000	TP	mg/L	0.004	=	0.001	yes
		06/27/2000	TP	mg/L	0.002	=	0.001	no
		07/10/2000	TP	mg/L	0.001	<	0.001	no
		07/17/2000	TP	mg/L	0.001	<	0.001	no
		07/24/2000	TP	mg/L	0.001	<	0.001	no
		07/31/2000	TP	mg/L	0.001	<	0.001	no
		08/14/2000	TP	mg/L	0.001	=	0.001	no
		08/21/2000	TP	mg/L	0.001	<	0.001	no
		09/05/2000	TP	mg/L	0.002	=	0.001	no
		09/13/2000	TP	mg/L	0.001	=	0.001	no
		09/19/2000	TP	mg/L	0.001	=	0.001	no
		09/19/2000	TP	mg/L	0.001	=	0.001	no
		09/25/2000	TP	mg/L	0.002	=	0.001	no
		10/02/2000	TP	mg/L	0.001	=	0.001	no
		10/24/2000	TP	mg/L	0.001	=	0.001	no
		10/24/2000	TP	mg/L	0.002	=	0.001	no
		10/24/2000	TP	mg/L	0.005	=	0.001	yes
		11/28/2000	TP	mg/L	0.002	=	0.001	no
		11/28/2000	TP	mg/L	0.002	=	0.001	no
		12/18/2000	TP	mg/L	0.003	=	0.001	no
		12/18/2000	TP	mg/L	0.002	=	0.001	no
		01/09/2001	TP	mg/L	0.001	=	0.001	no
		01/23/2001	TP	mg/L	0.002	=	0.001	no
		01/23/2001	TP	mg/L	0.001	=	0.001	no
		01/30/2001	TP	mg/L	0.001	=	0.001	no
		02/20/2001	TP	mg/L	0.001	=	0.001	no
		02/20/2001	TP	mg/L	0.002	=	0.001	no
		03/05/2001	TP	mg/L	0.002	=	0.001	no
		03/05/2001	TP	mg/L	0.002	=	0.001	no
		03/20/2001	TP	mg/L	0.001	=	0.001	no
		03/20/2001	TP	mg/L	0.002	=	0.001	no
		03/20/2001	TP	mg/L	0.001	=	0.001	no
Sediment	**PPB**	05/22/2000	DENSIT	g/cm^3	1	=	--	--
		07/24/2000	DENSIT	g/cm^3	1	=	--	--
		08/14/2000	DENSIT	g/cm^3	0.99	=	--	--
		10/24/2000	DENSIT	g/cm^3	1	=	--	--
		10/24/2000	SOLID	%	0.1	<	0.1	no
		05/22/2000	SOLID	%	0.1	<	0.1	no
		07/24/2000	SOLID	%	0.1	<	0.1	no
		08/14/2000	SOLID	%	0.5	<	0.5	no
		07/24/2000	TIP	mg/L		=	0.004	no
		08/14/2000	TIP	mg/L		=	0.004	no
		07/24/2000	TP	mg/L	0.007	=	0.004	no
		08/14/2000	TP	mg/L		=	0.004	no
		03/20/2001	TKN	mg/kg	0.1	<	0.1	no
Periphyton	**PPB**	05/22/2000	ASH WT	mg/L	1440	=	10	yes
		06/27/2000	ASH WT	mg/L	10	<	10	no
		08/14/2000	ASH WT	mg/L	23	=	10	yes
		09/19/2000	ASH WT	mg/L	3	=	10	no
		10/24/2000	ASH WT	mg/L	12	<	12	no
		11/28/2000	ASH WT	mg/L	12	<	12	no
		01/23/2001	ASH WT	mg/L	12	<	12	no
		02/20/2001	ASH WT	mg/L	12	<	12	no
		03/20/2001	ASH WT	mg/L	12	<	12	no
		05/22/2000	ASH-FREE DRY WT	mg/L	11	=	10	no
		06/27/2000	ASH-FREE DRY WT	mg/L	10	<	10	no
		08/14/2000	ASH-FREE DRY WT	mg/L	12	<	12	no
		09/19/2000	ASH-FREE DRY WT	mg/L	12	=	12	no

EXHIBIT A.4-8
Equipment Blank Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		10/24/2000	ASH-FREE DRY WT	mg/L	12	<	12	no
		01/23/2001	ASH-FREE DRY WT	mg/L	12	<	12	no
		01/23/2001	ASH-FREE DRY WT	mg/L	12	<	12	no
		02/20/2001	ASH-FREE DRY WT	mg/L	12	<	12	no
		03/20/2001	ASH-FREE DRY WT	mg/L	12	<	12	no
		05/22/2000	CA	mg/L	0.67	=	1	no
		06/27/2000	CA	mg/L	0.16	=	1	no
		07/17/2000	CA	mg/L	4.2	=	1	yes
		08/14/2000	CA	mg/L	0.12	=	1	no
		09/19/2000	CA	mg/L	0.26	=	1	no
		10/24/2000	CA	mg/L	0.3	=	1	no
		11/28/2000	CA	mg/L	0.64	=	1	no
		12/18/2000	CA	mg/L	0.16	=	1	no
		01/23/2001	CA	mg/L	0.08	=	1	no
		02/20/2001	CA	mg/L	0.27	=	1	no
		03/20/2001	CA	mg/L	0.06	=	1	no
		05/22/2000	CHL_A	µg/L	13.4	=	1	yes
		06/27/2000	CHL_A	µg/L	5.4	=	1	yes
		07/17/2000	CHL_A	µg/L	48.2	=	1	yes
		08/14/2000	CHL_A	µg/L	1	<	1	no
		09/19/2000	CHL_A	µg/L	3.9	=	1	yes
		10/24/2000	CHL_A	µg/L	1	<	1	no
		11/28/2000	CHL_A	µg/L	4.8	=	1	no
		12/18/2000	CHL_A	µg/L	5.4	=	1	no
		01/23/2001	CHL_A	µg/L	5.2	=	1	no
		02/20/2001	CHL_A	µg/L	15.1	=	1	no
		03/20/2001	CHL_A	µg/L	8.8	=	1	no
		05/22/2000	CHL_A corr	µg/L	2	=	1	no
		06/27/2000	CHL_A corr	µg/L	1.4	=	1	no
		07/17/2000	CHL_A corr	µg/L	7.3	=	1	yes
		08/14/2000	CHL_A corr	µg/L	3.7	=	1	yes
		09/19/2000	CHL_A corr	µg/L	5.6	=	1	yes
		10/24/2000	CHL_A corr	µg/L	1.8	=	1	no
		11/28/2000	CHL_A corr	µg/L	2.7	=	1	no
		12/18/2000	CHL_A corr	µg/L	1	<	1	no
		01/23/2001	CHL_A corr	µg/L	4.4	=	1	no
		02/20/2001	CHL_A corr	µg/L	56.1	=	1	no
		03/20/2001	CHL_A corr	µg/L	1	<	1	no
		05/22/2000	CHL_B	µg/L	3.1	=	1	yes
		06/27/2000	CHL_B	µg/L	1.7	=	1	no
		07/17/2000	CHL_B	µg/L	11.4	=	2	yes
		08/14/2000	CHL_B	µg/L	4.7	=	1	yes
		09/19/2000	CHL_B	µg/L	3.7	=	1	yes
		10/24/2000	CHL_B	µg/L	1	<	1	no
		11/28/2000	CHL_B	µg/L	1	<	1	no
		12/18/2000	CHL_B	µg/L	1	<	1	no
		01/23/2001	CHL_B	µg/L	1.6	=	1	no
		02/20/2001	CHL_B	µg/L	10.9	=	1	no
		03/20/2001	CHL_B	µg/L	1	<	1	no
		05/22/2000	CHL_C	µg/L	40.8	=	1	yes
		06/27/2000	CHL_C	µg/L	2	=	1	no
		07/17/2000	CHL_C	µg/L	18.3	=	1	yes
		08/14/2000	CHL_C	µg/L	5.5	=	1	yes
		09/19/2000	CHL_C	µg/L	6.2	=	1	yes
		10/24/2000	CHL_C	µg/L	1	<	1	no
		11/28/2000	CHL_C	µg/L	1	=	1	no
		12/18/2000	CHL_C	µg/L	1	<	1	no
		01/23/2001	CHL_C	µg/L	1.7	=	1	no
		02/20/2001	CHL_C	µg/L	13.2	=	1	no
		03/20/2001	CHL_C	µg/L	1.1	=	1	no
		05/22/2000	DRY WT	mg/L	2130	=	10	yes
		06/27/2000	DRY WT	mg/L	10	<	10	no
		08/14/2000	DRY WT	mg/L	23	=	10	yes
		09/19/2000	DRY WT	mg/L	15	=	10	no
		10/24/2000	DRY WT	mg/L	12	<	12	no
		11/28/2000	DRY WT	mg/L	17	=	12	no
		01/23/2001	DRY WT	mg/L	12	<	12	no
		02/20/2001	DRY WT	mg/L	12	<	12	no
		03/20/2001	DRY WT	mg/L	12	<	12	no
		05/22/2000	PHEO_A	µg/L	1	<	1	no

EXHIBIT A.4-8
Equipment Blank Data for the South ENR Test Cells, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		06/27/2000	PHEO_A	µg/L	1	<	1	no
		07/17/2000	PHEO_A	µg/L	200	<	200	no
		08/14/2000	PHEO_A	µg/L	107	=	50	yes
		09/19/2000	PHEO_A	µg/L	7.9	=	50	no
		10/24/2000	PHEO_A	µg/L	1	<	1	no
		11/28/2000	PHEO_A	µg/L	1	<	1	no
		12/18/2000	PHEO_A	µg/L	1	<	1	no
		01/23/2001	PHEO_A	mg/m^3	2	=		no
		02/20/2001	PHEO_A	µg/L	25.4	=		no
		03/20/2001	PHEO_A	mg/m^3	1	<	1	no
		06/27/2000	TKN	mg/L	0.18	=	0.1	no
		12/18/2000	TKN	mg/L	0.1	<	0.1	no
		01/23/2001	TKN	mg/L	0.1	<	0.1	no
		02/20/2001	TKN	mg/L	0.1	<	0.1	no
		03/20/2001	TKN	mg/L	0.1	<	0.1	no
	IFAS	06/27/2000	TP	mg/L	0.01	=	0.004	yes
		07/17/2000	TP	mg/L	0.004	<	0.004	no
		08/14/2000	TP	mg/L	0.004	<	0.004	no
		07/17/2000	TIP	mg/L	0.004	<	0.004	no
		07/17/2000	TIP	mg/L	0.004	<	0.004	no
		08/14/2000	TIP	mg/L	0.004	<	0.004	no

EXHIBIT A.4-9
Equipment Blank Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
Water	**PPB**	06/19/2000	ALKAL	mg/L	2	=	1	no
		06/19/2000	ALKAL	mg/L	2	=	1	no
		06/19/2000	ALKAL	mg/L	1	<	1	no
		07/10/2000	ALKAL	mg/L	4	=	1	no
		08/21/2000	ALKAL	mg/L	2	=	1	no
		08/21/2000	ALKAL	mg/L	2	=	1	no
		10/02/2000	ALKAL	mg/L	2	=	1	no
		10/02/2000	ALKAL	mg/L	2	=	1	no
		10/02/2000	ALKAL	mg/L	2	=	1	no
		06/19/2000	CA	mg/L	0.07	=	0.02	yes
		06/19/2000	CA	mg/L	0.02	<	0.02	no
		06/19/2000	CA	mg/L	0.02	<	0.02	no
		07/10/2000	CA	mg/L	0.02	=	0.02	no
		08/21/2000	CA	mg/L	0.02	=	0.02	no
		08/21/2000	CA	mg/L	0.02	<	0.02	no
		10/02/2000	CA	mg/L	0.02	<	0.02	no
		10/02/2000	CA	mg/L	0.03	=	0.02	no
		10/02/2000	CA	mg/L	0.04	=	0.02	no
		04/17/2000	N_TOT	mg/L	0.1	<	0.1	no
		04/18/2000	N_TOT	mg/L	0.1	<	0.1	no
		06/19/2000	N_TOT	mg/L	0.1	<	0.1	no
		06/19/2000	N_TOT	mg/L	0.1	<	0.1	no
		06/19/2000	N_TOT	mg/L	0.1	<	0.1	no
		07/10/2000	N_TOT	mg/L	0.1	<	0.1	no
		08/21/2000	N_TOT	mg/L	0.11	=	0.1	no
		08/21/2000	N_TOT	mg/L	0.1	<	0.1	no
		10/02/2000	N_TOT	mg/L	0.1	<	0.1	no
		10/02/2000	N_TOT	mg/L	0.1	<	0.1	no
		10/02/2000	N_TOT	mg/L	0.11	=	0.1	no
		04/17/2000	NH_3	mg/L	0.003	=	0.004	no
		06/19/2000	NH_3	mg/L	0.003	<	0.003	no
		06/19/2000	NH_3	mg/L	0.003	<	0.003	no
		06/19/2000	NH_3	mg/L	0.089	=	0.003	yes
		07/10/2000	NH_3	mg/L	0.004	<	0.004	no
		04/17/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		04/18/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		06/19/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		06/19/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		06/19/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		07/10/2000	NO_2NO_3	mg/L	0.007	=	0.004	no
		08/21/2000	NO_2NO_3	mg/L	0.019	=	0.004	yes
		08/21/2000	NO_2NO_3	mg/L	0.109	=	0.004	yes
		10/02/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		10/02/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		10/02/2000	NO_2NO_3	mg/L	0.004	<	0.004	no
		04/17/2000	TKN	mg/L	0.1	<	0.1	no
		04/18/2000	TKN	mg/L	0.1	<	0.1	no
		06/19/2000	TKN	mg/L	0.1	<	0.1	no
		06/19/2000	TKN	mg/L	0.1	<	0.1	no
		06/19/2000	TKN	mg/L	0.1	<	0.1	no
		07/10/2000	TKN	mg/L	0.1	<	0.1	no
		08/21/2000	TKN	mg/L	0.1	<	0.1	no
		08/21/2000	TKN	mg/L	0.1	<	0.1	no
		10/02/2000	TKN	mg/L	0.11	=	0.1	no
		10/02/2000	TKN	mg/L	0.1	<	0.1	no
		10/02/2000	TKN	mg/L	0.1	<	0.1	no
		04/17/2000	TOC	mg/L	1	<	1	no
		04/18/2000	TOC	mg/L	1	<	1	no
		06/19/2000	TOC	mg/L	1.5	=	1	no
		06/19/2000	TOC	mg/L	1.6	=	1	no
		06/19/2000	TOC	mg/L	3.3	=	1	yes
		07/10/2000	TOC	mg/L	1	<	1	no
		08/21/2000	TOC	mg/L	1	<	1	no
		08/21/2000	TOC	mg/L	1	=	1	no
		10/02/2000	TOC	mg/L	1	<	1	no
		10/02/2000	TOC	mg/L	1	<	1	no
		10/02/2000	TOC	mg/L	1	<	1	no

EXHIBIT A.4-9
Equipment Blank Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		06/19/2000	TSS	mg/L	2	<	2	no
		06/19/2000	TSS	mg/L	2	<	2	no
		06/19/2000	TSS	mg/L	2	<	2	no
		07/10/2000	TSS	mg/L	2	<	2	no
		08/21/2000	TSS	mg/L	2	<	2	no
		08/21/2000	TSS	mg/L	2	<	2	no
		10/02/2000	TSS	mg/L	2	=	2	no
		10/02/2000	TSS	mg/L	2	=	2	no
		10/02/2000	TSS	mg/L	9	=	2	yes
	TOXIKON	04/17/2000	ALKAL	mg/L	1	<	1	no
		04/18/2000	ALKAL	mg/L	1	<	1	no
		04/17/2000	CA	mg/L	1	<	1	no
		04/18/2000	CA	mg/L	1	<	1	no
		04/17/2000	TSS	mg/L	1	<	1	no
		04/18/2000	TSS	mg/L	2	<	2	no
	IFAS	04/03/2000	DRP	mg/L	0.0008	=	0.0001	yes
		05/01/2000	DRP	mg/L	0.0009	=	0.0001	yes
		08/14/2000	DRP	mg/L	0.001	=	0.0001	yes
		08/21/2000	DRP	mg/L	0.001	=	0.0001	yes
		08/21/2000	DRP	mg/L	0.001	=	0.0001	yes
		08/28/2000	DRP	mg/L	0.001	=	0.0001	yes
		09/05/2000	DRP	mg/L	0.001	=	0.0001	yes
		10/02/2000	DRP	mg/L	0.002	=	0.0001	yes
		10/02/2000	DRP	mg/L	0.002	=	0.0001	yes
		10/02/2000	DRP	mg/L	0.001	=	0.0001	yes
		04/03/2000	TDP	mg/L	0.002	=	0.001	no
		04/10/2000	TDP	mg/L	0.003	=	0.001	yes
		04/17/2000	TDP	mg/L	0.004	=	0.001	yes
		04/18/2000	TDP	mg/L	0.003	=	0.001	yes
		04/24/2000	TDP	mg/L	0.002	=	0.001	no
		05/01/2000	TDP	mg/L	0.003	=	0.001	yes
		05/08/2000	TDP	mg/L	0.003	=	0.001	yes
		05/15/2000	TDP	mg/L	0.005	=	0.001	yes
		05/15/2000	TDP	mg/L	0.004	=	0.001	yes
		05/22/2000	TDP	mg/L	0.004	=	0.001	yes
		05/30/2000	TDP	mg/L	0.003	=	0.001	yes
		06/05/2000	TDP	mg/L	0.004	=	0.001	yes
		06/12/2000	TDP	mg/L	0.005	=	0.001	yes
		06/19/2000	TDP	mg/L	0.003	=	0.001	yes
		06/19/2000	TDP	mg/L	0.005	=	0.001	yes
		06/19/2000	TDP	mg/L	0.004	=	0.001	yes
		06/26/2000	TDP	mg/L	0.004	=	0.001	yes
		07/10/2000	TDP	mg/L	0.001	<	0.001	no
		07/24/2000	TDP	mg/L	0.001	<	0.001	no
		07/31/2000	TDP	mg/L	0.001	=	0.001	no
		08/07/2000	TDP	mg/L	0.001	=	0.001	no
		08/14/2000	TDP	mg/L	0.001	=	0.001	no
		08/21/2000	TDP	mg/L	0.001	<	0.001	no
		08/21/2000	TDP	mg/L	0.001	<	0.001	no
		08/28/2000	TDP	mg/L	0.006	=	0.001	yes
		09/05/2000	TDP	mg/L	0.001	=	0.001	no
		09/20/2000	TDP	mg/L	0.001	=	0.001	no
		09/25/2000	TDP	mg/L	0.004	=	0.001	yes
		10/02/2000	TDP	mg/L	0.001	=	0.001	no
		10/02/2000	TDP	mg/L	0.001	=	0.001	no
		10/02/2000	TDP	mg/L	0.002	=	0.001	no
		04/03/2000	TP	mg/L	0.003	=	0.001	yes
		04/10/2000	TP	mg/L	0.002	=	0.001	no
		04/17/2000	TP	mg/L	0.004	=	0.001	yes
		04/18/2000	TP	mg/L	0.003	=	0.001	yes
		04/24/2000	TP	mg/L	0.003	=	0.001	yes
		04/24/2000	TP	mg/L	0.003	=	0.001	yes
		04/24/2000	TP	mg/L	0.003	=	0.001	yes
		05/01/2000	TP	mg/L	0.012	=	0.001	yes

EXHIBIT A.4-9
Equipment Blank Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		05/08/2000	TP	mg/L	0.002	=	0.001	no
		05/15/2000	TP	mg/L	0.003	=	0.001	yes
		05/15/2000	TP	mg/L	0.005	=	0.001	yes
		05/17/2000	TP	mg/L	0.001	=	0.001	no
		05/17/2000	TP	mg/L	0.001	=	0.001	no
		05/22/2000	TP	mg/L	0.004	=	0.001	yes
		05/30/2000	TP	mg/L	0.002	=	0.001	no
		06/05/2000	TP	mg/L	0.003	=	0.001	yes
		06/12/2000	TP	mg/L	0.003	=	0.001	yes
		06/19/2000	TP	mg/L	0.003	=	0.001	yes
		06/26/2000	TP	mg/L	0.001	=	0.001	no
		07/10/2000	TP	mg/L	0.001	<	0.001	no
		07/17/2000	TP	mg/L	0.001	<	0.001	no
		07/24/2000	TP	mg/L	0.001	=	0.001	no
		07/31/2000	TP	mg/L	0.001	<	0.001	no
		08/07/2000	TP	mg/L	0.006	=	0.001	yes
		08/14/2000	TP	mg/L	0.001	=	0.001	no
		08/21/2000	TP	mg/L	0.001	<	0.001	no
		08/21/2000	TP	mg/L	0.001	<	0.001	no
		08/28/2000	TP	mg/L	0.001	<	0.001	no
		09/05/2000	TP	mg/L	0.002	=	0.001	no
		09/25/2000	TP	mg/L	0.002	=	0.001	no
		10/03/2000	TP	mg/L	0.004	=	0.001	yes
		10/03/2000	TP	mg/L	0.001	=	0.001	no
Sediment	**PPB**	05/17/2000	DENSIT	g/cm3	1	=	--	--
		10/03/2000	DENSIT	g/cm3	1	=	--	--
		05/17/2000	SOLID	%	0.1	<	0.1	no
		08/23/2000	SOLID	%	0.1	<	0.1	no
		10/03/2000	SOLID	mg/L	3	<	3	no
		08/23/2000	TIP	mg/L	0.004	<	0.004	no
		10/03/2000	TKN	mg/L	0.1	<	0.1	no
		10/03/2000	TOC	mg/L	2	<	2	no
		08/23/2000	TP	mg/L	0.004	<	0.004	no
	TOXIKON	04/25/2000	DENSIT	g/cm^3	1	=		no
		04/25/2000	SOLID	%	6	=	0.1	yes
Periphyton	**PPB**	04/25/2000	ASH WT	mg/L	10	<	10	no
		05/17/2000	ASH WT	mg/L	4	<	10	no
		06/20/2000	ASH WT	mg/L	10	<	10	no
		07/11/2000	ASH WT	mg/L	6	=	10	no
		08/22/2000	ASH WT	mg/L	23	=	10	yes
		04/25/2000	ASH-FREE DRY WT	mg/L	21.3	<	10	yes
		05/17/2000	ASH-FREE DRY WT	mg/L	12	=	10	no
		06/20/2000	ASH-FREE DRY WT	mg/L	10	<	10	no
		07/11/2000	ASH-FREE DRY WT	mg/L	24	=	10	yes
		08/22/2000	ASH-FREE DRY WT	mg/L	12	<	12	no
		10/03/2000	ASH-FREE DRY WT	mg/L	12	<	12	no
		06/20/2000	CA	mg/L	0.42	=	1	no
		07/11/2000	CA	mg/L	1.02	=	1	no
		08/22/2000	CA	mg/L	1.8	=	1	no
		10/03/2000	CA	mg/L	0.22	=	1	no
		04/25/2000	CHL_A	µg/L	1	<	1	no
		05/17/2000	CHL_A	µg/L	3.5	=	1	yes
		06/20/2000	CHL_A	µg/L	9.9	=	1	yes
		07/11/2000	CHL_A	µg/L	14.6	=	1	yes
		08/22/2000	CHL_A	µg/L	1	<	1	no
		10/03/2000	CHL_A	µg/L	1	<	1	no

EXHIBIT A.4-9
Equipment Blank Data for the Porta-PSTAs, April 2000 to March 2001

Matrix	Analytical Laboratory	Date	Parameter	Units	Equipment Blank Result	QC CODE	Method Detection Limit	Above Criteria (>2x MDL)
		04/25/2000	CHL_A corr	µg/L	1	<	1	no
		05/17/2000	CHL_A corr	µg/L	1.1	=	1	no
		06/20/2000	CHL_A corr	µg/L	1.7	=	1	no
		07/11/2000	CHL_A corr	µg/L	6.4	=	1	yes
		08/22/2000	CHL_A corr	µg/L	6.7	=	1	yes
		10/03/2000	CHL_A corr	µg/L	3.3	=	1	yes
		04/25/2000	CHL_B	µg/L	1	<	1	no
		05/17/2000	CHL_B	µg/L	1	<	1	no
		06/20/2000	CHL_B	µg/L	2.1	=	1	yes
		07/11/2000	CHL_B	µg/L	3	=	1	yes
		08/22/2000	CHL_B	µg/L	6.3	=	1	yes
		10/03/2000	CHL_B	µg/L	4.1	=	1	yes
		04/25/2000	CHL_C	µg/L	1	<	1	no
		05/17/2000	CHL_C	µg/L	1	<	1	no
		06/20/2000	CHL_C	µg/L	2.5	=	1	yes
		07/11/2000	CHL_C	µg/L	15.6	=	1	yes
		08/22/2000	CHL_C	µg/L	10.4	=	1	yes
		10/03/2000	CHL_C	µg/L	4.9	=	1	yes
		04/25/2000	DRY WT	mg/L	21.3	=	10	yes
		05/17/2000	DRY WT	mg/L	8	=	10	no
		06/20/2000	DRY WT	mg/L	10	<	10	no
		07/11/2000	DRY WT	mg/L	18	=	10	no
		08/22/2000	DRY WT	mg/L	23	=	10	yes
		04/25/2000	PHEO_A	µg/L	1	<	1	no
		05/17/2000	PHEO_A	µg/L	1	<	1	no
		06/20/2000	PHEO_A	µg/L	1	<	1	no
		07/11/2000	PHEO_A	µg/L	200	<	200	no
		08/22/2000	PHEO_A	µg/L	50	<	50	no
		10/03/2000	PHEO_A	µg/L	6	=	1	yes
		07/11/2000	TIP	mg/L	0.004	<	0.004	no
		08/22/2000	TIP	mg/L	0.004	<	0.004	no
		06/20/2000	TKN	mg/L	0.1	<	0.1	no
		10/03/2000	TKN	mg/L	0.1	<	0.1	no
		10/03/2000	TKN	mg/L	0.1	<	0.1	no
		06/20/2000	TP	mg/L	0.007	=	0.004	no
		07/11/2000	TP	mg/L	0.004	<	0.004	no
	TOXIKON	04/25/2000	CA	mg/L	1	<	1	no

EXHIBIT A.4-10

Equipment Blank Data for the Field-Scale Cells, August 2001 to Spetember 2002

Media	Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2X MDL)
Water	Columbia	08/28/01	TOC	mg/L	1.8	1	no
		09/25/01	TOC	mg/L	1.2	1	no
		10/23/01	TOC	mg/L	< 1	1	no
		11/29/01	TOC	mg/L	< 1	1	no
		12/18/01	TOC	mg/L	< 1	1	no
		02/26/02	TOC	mg/L	< 1	1	no
		03/26/02	TOC	mg/L	< 1	1	no
		04/15/02	TOC	mg/L	< 1	1	no
	Sanders	08/28/01	ALK	mg/L	< 3	3	no
		09/25/01	ALK	mg/L	< 3	3	no
		10/23/01	ALK	mg/L	< 3	3	no
		08/28/01	CA	mg/L	< 0.0023	0.0023	no
		09/25/01	CA	mg/L	< 0.0023	0.0023	no
		10/23/01	CA	mg/L	0.095	0.0023	yes
		09/25/01	CL	mg/L	< 0.6	0.6	no
		10/23/01	CL	mg/L	< 1	1	no
		08/28/01	NH3	mg/L	< 0.05	0.05	no
		09/25/01	NH3	mg/L	< 0.05	0.05	no
		10/23/01	NH3	mg/L	< 0.05	0.05	no
		08/28/01	NO2NO3	mg/L	< 0.05	0.05	no
		09/25/01	NO2NO3	mg/L	< 0.05	0.05	no
		10/23/01	NO2NO3	mg/L	< 0.05	0.05	no
		08/28/01	TKN	mg/L	< 0.05	0.05	no
		09/25/01	TKN	mg/L	< 0.05	0.05	no
		10/23/01	TKN	mg/L	< 0.05	0.05	no
		08/28/01	TN	mg/L	< 0.05	0.05	no
		09/25/01	TN	mg/L	< 0.25	0.25	no
		10/23/01	TN	mg/L	< 0.05	0.05	no
		08/28/01	TSS	mg/L	< 2.6	2.6	no
		09/25/01	TSS	mg/L	< 0.6	0.6	no
		10/23/01	TSS	mg/L	< 0.06	0.6	no
	IFAS	07/31/01	SRP	mg/L	0.001	0.004	no
		08/07/01	SRP	mg/L	0.001	0.004	no
		08/28/01	SRP	mg/L	0.001	0.004	no
		09/04/01	SRP	mg/L	0.002	0.004	no
		09/25/01	SRP	mg/L	0.004	0.004	no
		10/02/01	SRP	mg/L	0.001	0.004	no
		10/23/01	SRP	mg/L	0.001	0.004	no
		11/06/01	SRP	mg/L	0.001	0.004	no
		11/29/01	SRP	mg/L	0.001	0.004	no
		12/18/01	SRP	mg/L	0.001	0.004	no
		01/03/02	SRP	mg/L	0.001	0.004	no
		01/22/02	SRP	mg/L	0.001	0.004	no
		01/29/02	SRP	mg/L	0.001	0.004	no
		02/26/02	SRP	mg/L	0.001	0.004	no
		03/12/02	SRP	mg/L	0.001	0.004	no
		03/26/02	SRP	mg/L	0.001	0.004	no
		04/09/02	SRP	mg/L	0.002	0.004	no
		04/15/02	SRP	mg/L	0.001	0.004	no
		07/30/02	SRP	mg/L	0.001	0.004	no
		08/13/02	SRP	mg/L	0.002	0.004	no
		08/28/02	SRP	mg/L	0.001	0.004	no
		09/11/02	SRP	mg/L	0.009	0.004	no
		09/18/02	SRP	mg/L	0.008	0.004	no
		09/25/02	SRP	mg/L	< 0.001	0.004	no

EXHIBIT A.4-10
Equipment Blank Data for the Field-Scale Cells, August 2001 to Spetember 2002

Media	Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2X MDL)
		07/31/01	TDP	mg/L	0.003	0.001	no
		08/07/01	TDP	mg/L	0.005	0.001	yes
		08/28/01	TDP	mg/L	0.002	0.001	no
		09/04/01	TDP	mg/L	0.002	0.001	no
		09/25/01	TDP	mg/L	0.001	0.001	no
		10/02/01	TDP	mg/L	0.001	0.001	no
		10/23/01	TDP	mg/L	0.002	0.001	no
		11/06/01	TDP	mg/L	0.003	0.001	no
		11/29/01	TDP	mg/L	0.001	0.001	no
		12/18/01	TDP	mg/L	0.001	0.001	no
		12/27/01	TDP	mg/L	0.003	0.001	no
		01/03/02	TDP	mg/L	0.001	0.001	no
		01/22/02	TDP	mg/L	0.000	0.001	no
		01/29/02	TDP	mg/L	0.001	0.001	no
		02/26/02	TDP	mg/L	0.002	0.001	no
		03/12/02	TDP	mg/L	0.002	0.001	no
		03/26/02	TDP	mg/L	0.002	0.001	no
		04/09/02	TDP	mg/L	0.002	0.001	no
		04/15/02	TDP	mg/L	0.003	0.001	no
		07/30/02	TDP	mg/L	0.006	0.001	no
		08/13/02	TDP	mg/L	0.002	0.001	no
		08/22/02	TDP	mg/L	0.002	0.001	no
		08/28/02	TDP	mg/L	0.001	0.001	no
		09/06/02	TDP	mg/L	0.009	0.001	yes
		09/09/02	TDP	mg/L	0.009	0.001	yes
		09/11/02	TDP	mg/L	< 0.001	0.001	no
		09/18/02	TDP	mg/L	0.001	0.001	no
		09/25/02	TDP	mg/L	0.001	0.001	no
		07/31/01	TP	mg/L	0.002	0.001	no
		08/07/01	TP	mg/L	0.012	0.001	yes
		08/28/01	TP	mg/L	0.002	0.001	no
		08/30/01	TP	mg/L	0.016	0.001	yes
		09/04/01	TP	mg/L	0.002	0.001	no
		09/25/01	TP	mg/L	0.001	0.001	no
		09/27/01	TP	mg/L	0.000	0.001	no
		10/02/01	TP	mg/L	0.001	0.001	no
		10/23/01	TP	mg/L	0.002	0.001	no
		10/24/01	TP	mg/L	0.001	0.001	no
		10/24/01	TP	mg/L	0.001	0.001	no
		10/30/01	TP	mg/L	0.001	0.001	no
		11/06/01	TP	mg/L	0.002	0.001	no
		11/29/01	TP	mg/L	0.002	0.001	no
		12/18/01	TP	mg/L	0.000	0.001	no
		12/18/01	TP	mg/L	0.001	0.001	no
		12/20/01	TP	mg/L	0.002	0.001	no
		12/27/01	TP	mg/L	0.001	0.001	no
		01/03/02	TP	mg/L	0.002	0.001	no
		01/22/02	TP	mg/L	0.001	0.001	no
		01/29/02	TP	mg/L	0.001	0.001	no
		02/07/02	TP	mg/L	0.001	0.001	no
		02/26/02	TP	mg/L	0.001	0.001	no
		03/12/02	TP	mg/L	0.001	0.001	no
		03/19/02	TP	mg/L	0.002	0.001	no
		03/26/02	TP	mg/L	0.001	0.001	no
		04/09/02	TP	mg/L	0.001	0.001	no

EXHIBIT A.4-10

Equipment Blank Data for the Field-Scale Cells, August 2001 to Spetember 2002

Media	Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2X MDL)
		04/15/02	TP	mg/L	0.002	0.001	no
		08/13/02	TP	mg/L	0.002	0.001	no
		08/22/02	TP	mg/L	0.001	0.001	no
		08/28/02	TP	mg/L	0.000	0.001	no
		09/06/02	TP	mg/L	< 0.001	0.001	no
		09/09/02	TP	mg/L	0.000	0.001	no
		09/11/02	TP	mg/L	< 0.000	0.001	no
		09/18/02	TP	mg/L	0.008	0.001	yes
		09/25/02	TP	mg/L	0.003	0.001	no
	Xenco	11/29/01	ALK	mg/L	< 4	4	no
		12/18/01	ALK	mg/L	< 4	4	no
		01/22/02	ALK	mg/L	< 4	4	no
		03/26/02	ALK	mg/L	3.33	4	no
		04/15/02	ALK	mg/L	1.67	4	no
		07/30/02	ALK	mg/L	< 4	4	no
		08/28/02	ALK	mg/L	< 4	4	no
		09/11/02	ALK	mg/L	< 4	4	no
		09/25/02	ALK	mg/L	< 4	4	no
		11/29/01	CA	mg/L	< 2	2	no
		12/18/01	CA	mg/L	< 2	2	no
		01/22/02	CA	mg/L	< 4	4	no
		03/26/02	CA	mg/L	< 0.05	0.05	no
		04/15/02	CA	mg/L	< 0.18	0.18	no
		07/30/02	CA	mg/L	< 2	2	no
		08/28/02	CA	mg/L	< 1	1	no
		09/11/02	CA	mg/L	< 0.05	0.5	no
		09/25/02	CA	mg/L	< 1	1	no
		12/18/01	CL	mg/L	5.13	2	yes
		01/22/02	CL	mg/L	< 4	4	no
		03/25/02	CL	mg/L	< 2	2	no
		03/26/02	CL	mg/L	0.99	2	no
		04/15/02	CL	mg/L	< 5	5	no
		07/30/02	CL	mg/L	< 5	5	no
		08/28/02	CL	mg/L	< 5	5	no
		09/11/02	CL	mg/L	< 5	5	no
		09/25/02	CL	mg/L	< 5	5	no
		03/26/02	NH3	mg/L	0.05	0.1	no
		04/15/02	NH3	mg/L	< 0.1	0.1	no
		07/30/02	NH3	mg/L	< 0.1	0.1	no
		08/28/02	NH3	mg/L	0.074	0.05	no
		09/11/02	NH3	mg/L	< 0.05	0.05	no
		09/25/02	NH3	mg/L	< 0.05	0.05	no
		03/26/02	NO2	mg/L	< 0.2	0.2	no
		04/15/02	NO2	mg/L	< 0.1	0.1	no
		03/26/02	NO2NO3	mg/L	0.04	0.2	no
		04/15/02	NO2NO3	mg/L	0.1	4	no
		07/30/02	NO2NO3	mg/L	< 0.025	0.025	no
		08/28/02	NO2NO3	mg/L	< 0.2	0.2	no
		09/11/02	NO2NO3	mg/L	< 0.1	1	no
		09/25/02	NO2NO3	mg/L	< 0.2	0.2	no
		12/18/01	TKN	mg/L	< 1	1	no
		03/26/02	TKN	mg/L	< 1	1	no
		04/15/02	TKN	mg/L	< 4	4	no
		07/30/02	TKN	mg/L	< 0.4	0.4	no
		08/28/02	TKN	mg/L	< 1	1	no

EXHIBIT A.4-10
Equipment Blank Data for the Field-Scale Cells, August 2001 to Spetember 2002

Media	Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2X MDL)
		09/11/02	TKN	mg/L	< 1	1	no
		09/25/02	TKN	mg/L	< 1	1	no
		12/18/01	TN	mg/L	< 1	1	no
		03/26/02	TN	mg/L	< 1	1	no
		04/15/02	TN	mg/L	< 4	4	no
		07/30/02	TN	mg/L	< 0.4	0.4	no
		08/28/02	TN	mg/L	< 1	1	no
		09/11/02	TN	mg/L	< 1	1	no
		09/25/02	TN	mg/L	< 1	1	no
		03/26/02	TSS	mg/L	< 2	2	no
		04/15/02	TSS	mg/L	< 2	2	no
		07/30/02	TSS	mg/L	< 5	5	no
		08/28/02	TSS	mg/L	< 5	5	no
		09/11/02	TSS	mg/L	< 5	5	no
		09/25/02	TSS	mg/L	< 2	2	no
Groundwater	**IFAS**	09/25/01	TP	mg/L	0.001	0.001	no
		10/18/01	TP	mg/L	0.003	0.001	no
		11/20/01	TP	mg/L	0.002	0.001	no
		12/20/02	TP	mg/L	0.002	0.001	no
		01/17/02	TP	mg/L	0.001	0.001	no
		02/14/02	TP	mg/L	0.002	0.001	no
		03/19/02	TP	mg/L	0.002	0.001	no
		04/30/02	TP	mg/L	0.001	0.001	no
		05/29/02	TP	mg/L	0.001	0.001	no
		06/13/02	TP	mg/L	0.001	0.001	no
		07/25/02	TP	mg/L	0.001	0.001	no
		08/29/02	TP	mg/L	0.001	0.001	no
		09/18/02	TP	mg/L	< 0.002	0.001	no
	Xenco	12/20/01	CL	mg/L	< 2	2	no
		01/17/02	CL	mg/L	< 2	2	no
		02/14/02	CL	mg/L	< 5	5	no
		03/25/02	CL	mg/L	< 2	2	no
		04/30/02	CL	mg/L	< 5	5	no
		05/29/02	CL	mg/L	< 5	5	no
		06/13/02	CL	mg/L	< 5	5	no
		07/25/02	CL	mg/L	< 5	5	no
		08/29/02	CL	mg/L	< 5	5	no
		09/18/02	CL	mg/L	< 5	5	no
Periphyton	**Columbia**	09/27/01	AFDW	mg/L	< 1	1	no
		10/24/01	AFDW	mg/L	< 1	1	no
		11/29/01	AFDW	mg/L	< 10	10	no
		12/18/01	AFDW	mg/L	< 10	10	no
		04/15/02	AFDW	mg/L	10	10	no
		08/29/02	AFDW	mg/L	< 10	10	no
		10/24/01	ASH_WT	mg/L	< 1	1	no
		11/29/01	ASH_WT	mg/L	< 10	10	no
		12/18/01	ASH_WT	mg/L	< 10	10	no
		04/15/02	ASH_WT	mg/L	10	10	no
		08/29/02	ASH_WT	mg/L	< 10	10	no
		11/29/01	CHL_A	mg/m^3	< 0.0073	0.05	no
		12/18/01	CHL_A	mg/m^3	< 0.001	0.025	no
		04/15/02	CHL_A	mg/m^3	0.001	0.025	no
		08/29/02	CHL_A	mg/m^3	< 0.69	0.69	no
		11/29/01	CHL_B	mg/m^3	< 0.012	0.05	no
		12/18/01	CHL_B	mg/m^3	< 0.001	0.025	no

EXHIBIT A.4-10

Equipment Blank Data for the Field-Scale Cells, August 2001 to Spetember 2002

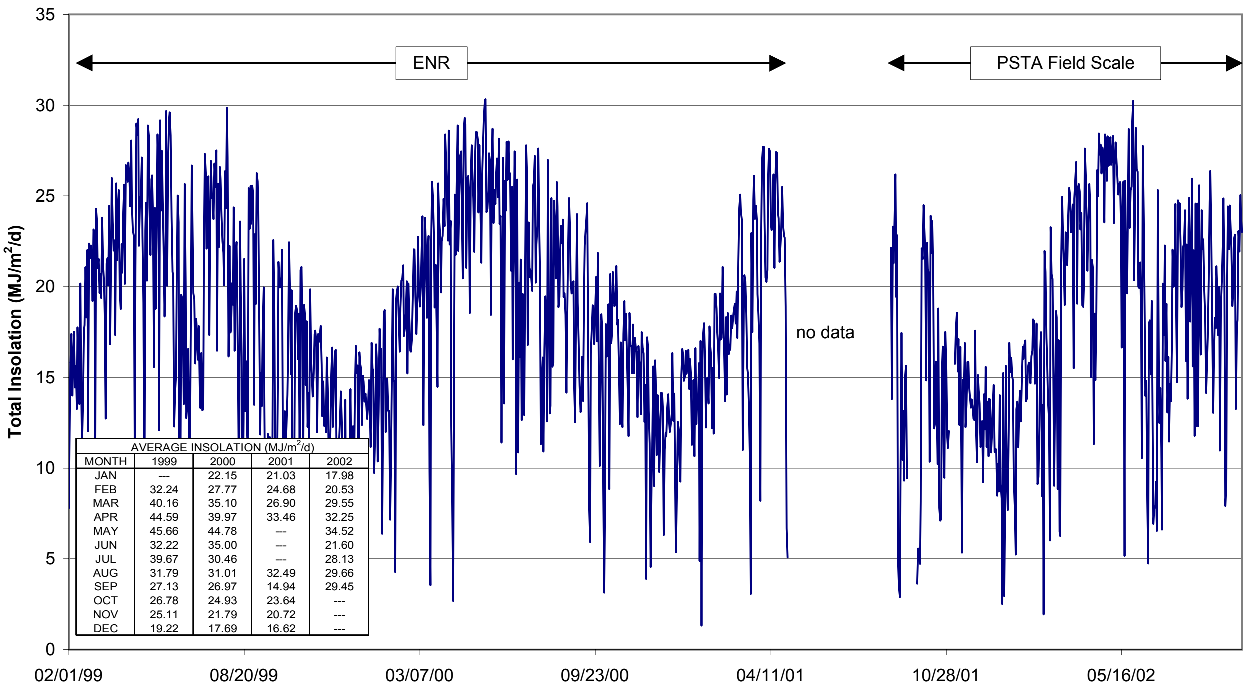
Media	Laboratory	Date	Parameter	Units	Equipment Blank Result	Method Detection Limit	Above Criteria (>2X MDL)
		04/15/02	CHL_B	mg/m^3	0.001	0.025	no
		08/29/02	CHL_B	mg/m^3	< 0.69	0.69	no
		11/29/01	CHL_C	mg/m^3	< 0.019	0.05	no
		12/18/01	CHL_C	mg/m^3	< 0.001	0.025	no
		04/15/02	CHL_C	mg/m^3	0.001	0.025	no
		08/29/02	CHL_C	mg/m^3	< 0.69	0.69	no
		10/24/01	DRY_WT	mg/L	< 1	1	no
		11/29/01	DRY_WT	mg/L	< 10	10	no
		12/18/01	DRY_WT	mg/L	< 10	10	no
		04/15/02	DRY_WT	mg/L	10	10	no
		08/29/02	DRY_WT	mg/L	< 10	10	no
		11/29/01	PHEO_A	mg/m^3	0.013	0.001	yes
		12/18/01	PHEO_A	mg/m^3	< 0.001	0.001	no
		04/15/02	PHEO_A	mg/m^3	0.001	0.001	no
		08/29/02	PHEO_A	mg/m^3	< 0.69	0.69	no
	Sanders	09/27/01	CA	mg/L	0.125	0.023	yes
		10/24/01	CA	mg/L	0.876	0.023	yes
		10/24/01	CHL_A	mg/L	< 1	1	no
		10/24/01	TKN	mg/L	< 0.05	0.05	no
	IFAS	10/24/01	TP	mg/L	< 0.003	0.001	yes
		09/27/01	TP	mg/L	0.002	0.001	no
		01/22/02	TP	mg/L	0.001	0.001	no
		04/15/02	TP	mg/L	0.002	0.001	no
	Xenco	11/29/01	CA	mg/L	< 2.00	2.00	no
		12/18/01	CA	mg/L	< 0.2	0.2	no
		01/22/02	CA	mg/L	< 0.2	0.2	no
		04/15/02	CA	mg/L	< 0.18	0.18	no
		08/29/02	CA	mg/L	< 0.0007	0.1	no
		04/15/02	TKN	mg/L	2.33	4	no
		08/29/02	TKN	mg/L	< 1	1	no
Sediment	**Columbia**	04/16/02	TOC	mg/L	0.05	0.05	no
	IFAS	04/16/02	TP	mg/L	0.003	0.002	no
	Xenco	04/16/02	TKN	mg/kg	2.24	4	no

APPENDIX B

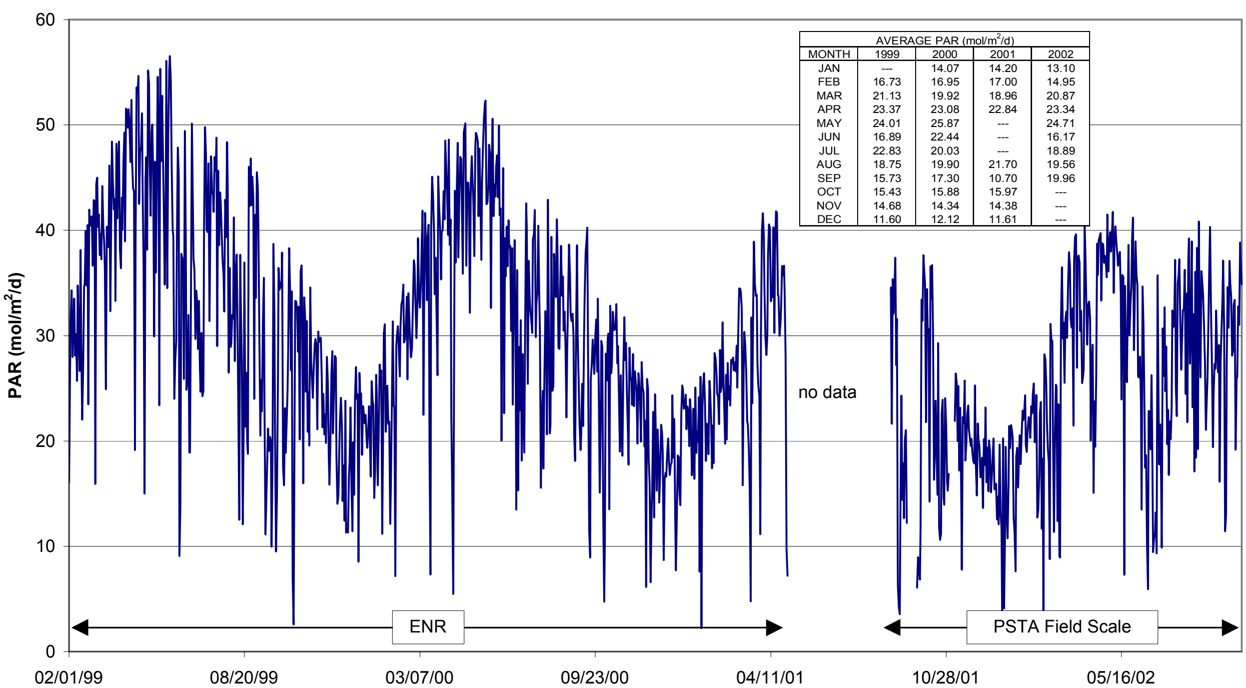
Meteorological Data

APPENDIX B-1

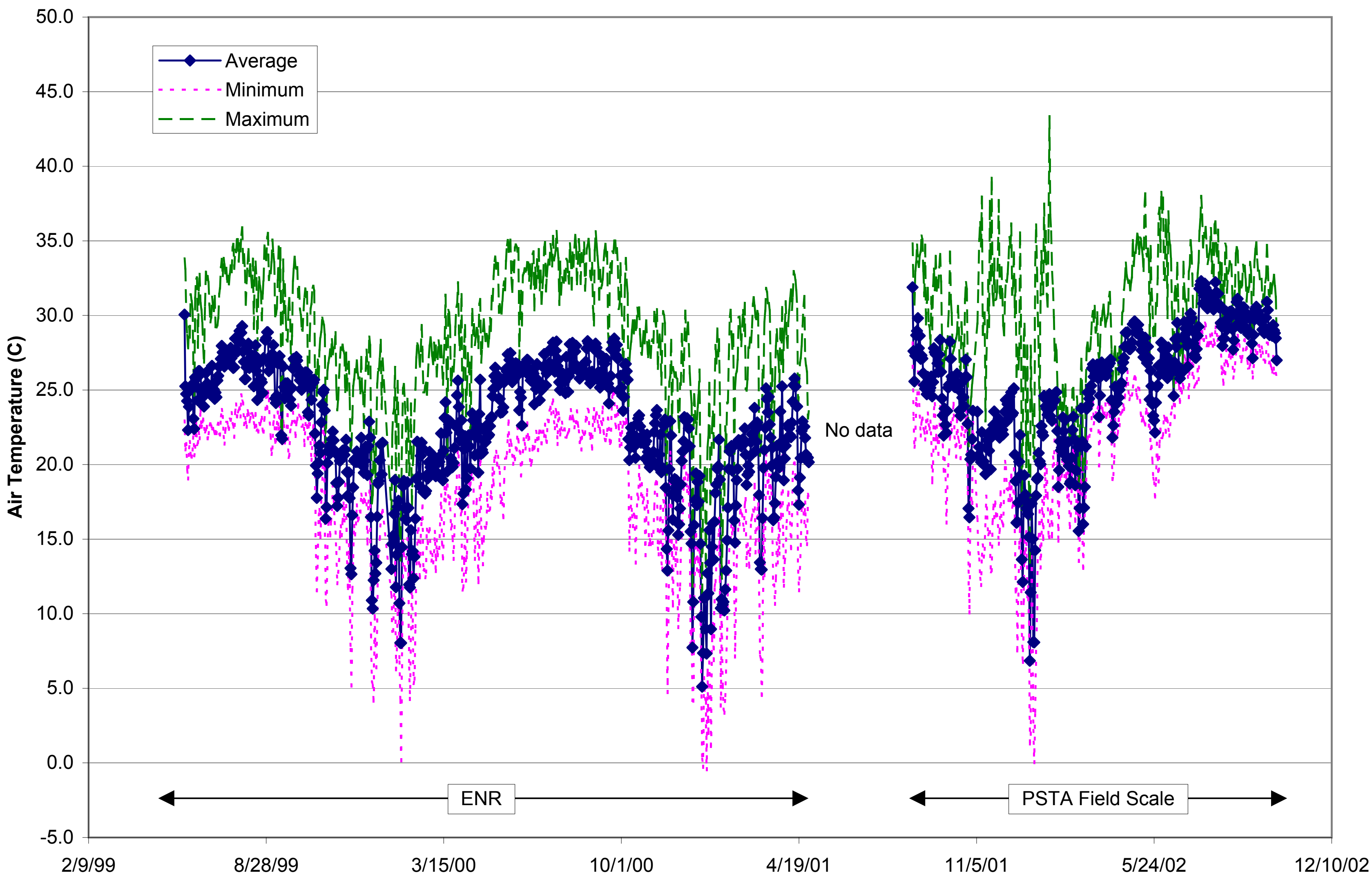
Solar Energy Inputs at the South ENR Technology Research Compound and Field Scale PSTA Site



AVERAGE INSOLATION (MJ/m²/d)				
MONTH	1999	2000	2001	2002
JAN	---	22.15	21.03	17.98
FEB	32.24	27.77	24.68	20.53
MAR	40.16	35.10	26.90	29.55
APR	44.59	39.97	33.46	32.25
MAY	45.66	44.78	---	34.52
JUN	32.22	35.00	---	21.60
JUL	39.67	30.46	---	28.13
AUG	31.79	31.01	32.49	29.66
SEP	27.13	26.97	14.94	29.45
OCT	26.78	24.93	23.64	---
NOV	25.11	21.79	20.72	---
DEC	19.22	17.69	16.62	---

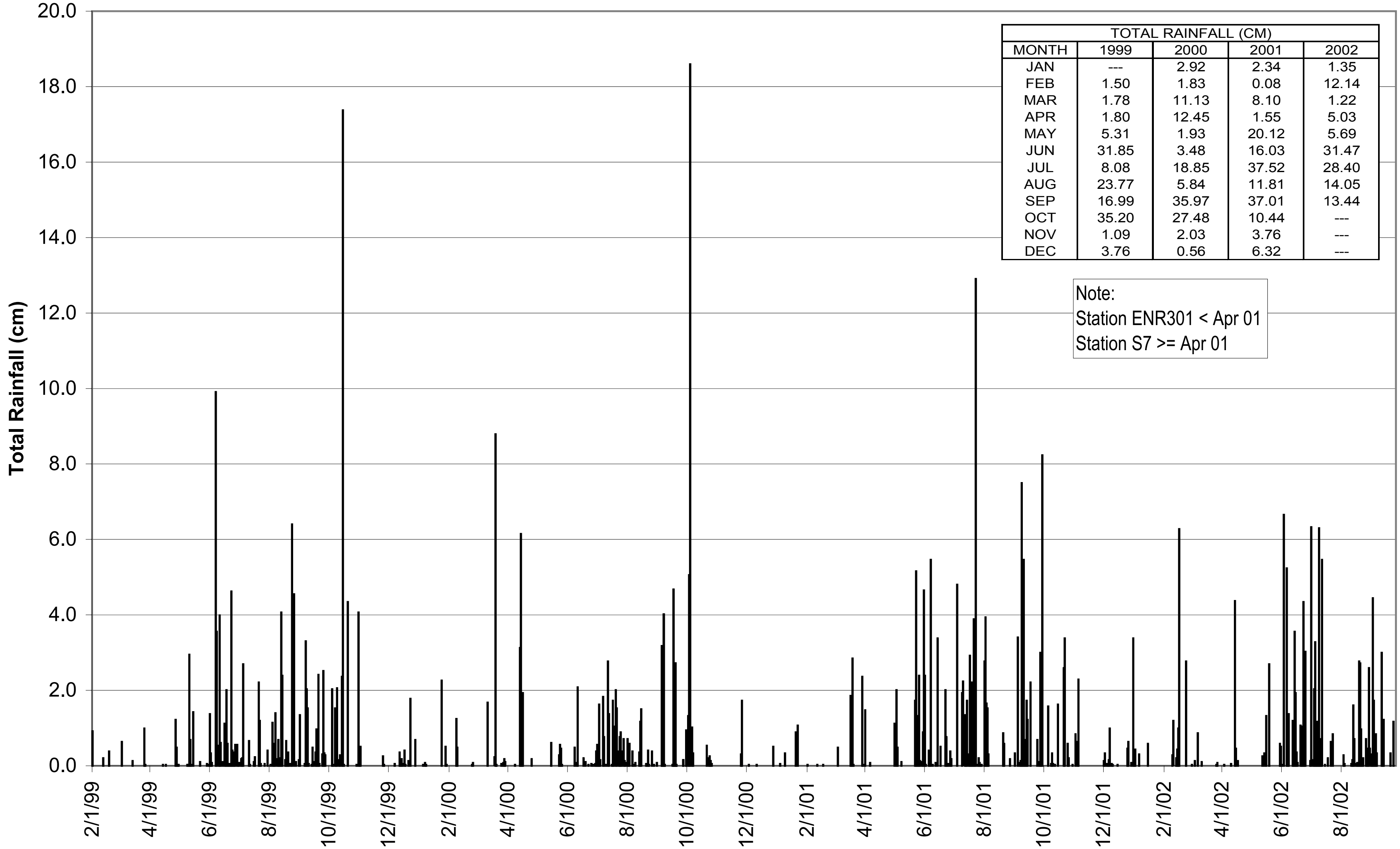


AVERAGE PAR (mol/m²/d)				
MONTH	1999	2000	2001	2002
JAN	---	14.07	14.20	13.10
FEB	16.73	16.95	17.00	14.95
MAR	21.13	19.92	18.96	20.87
APR	23.37	23.08	22.84	23.34
MAY	24.01	25.87	---	24.71
JUN	16.89	22.44	---	16.17
JUL	22.83	20.03	---	18.89
AUG	18.75	19.90	21.70	19.56
SEP	15.73	17.30	10.70	19.96
OCT	15.43	15.88	15.97	---
NOV	14.68	14.34	14.38	---
DEC	11.60	12.12	11.61	---



APPENDIX B-2

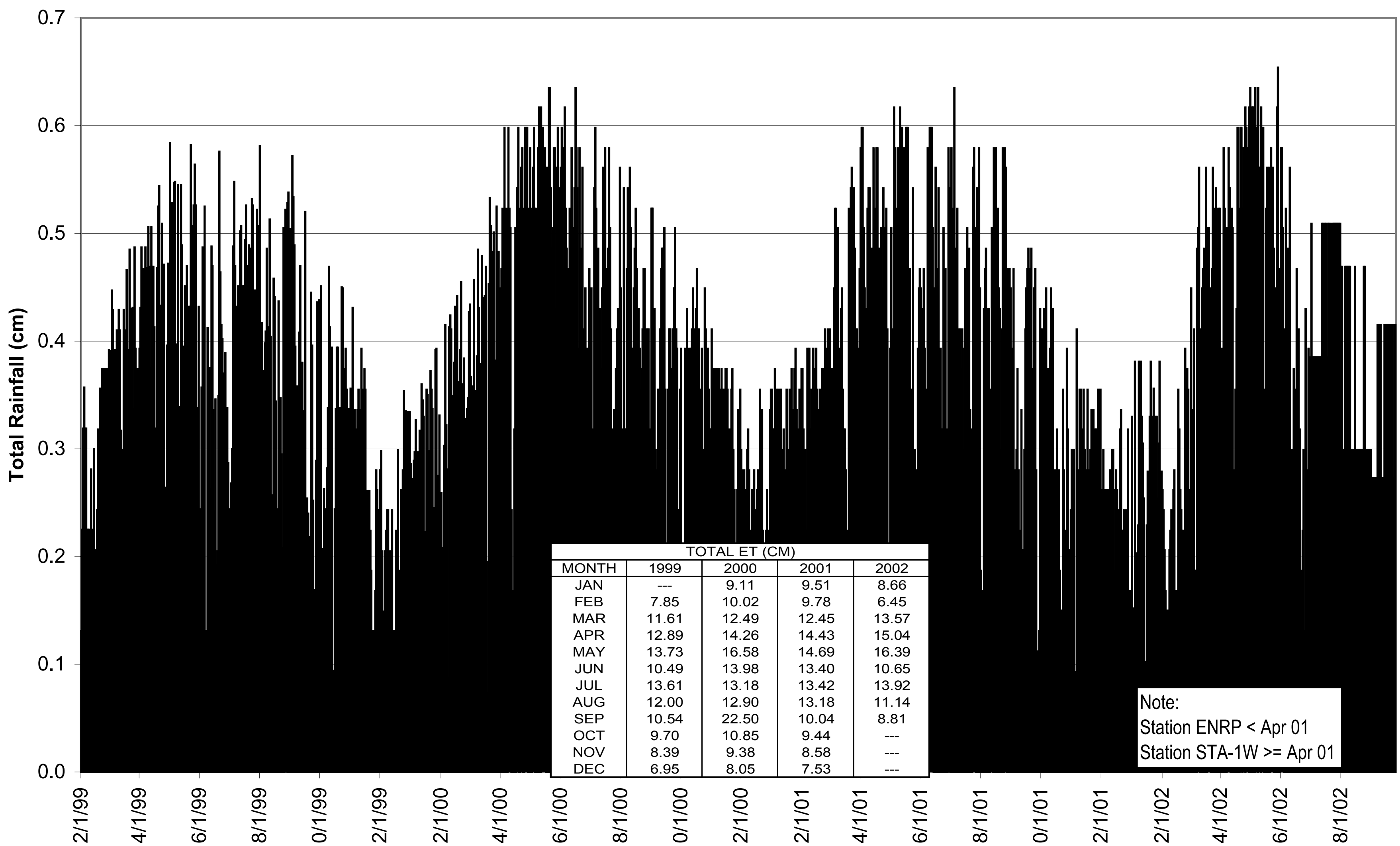
Average Daily Air Temperature Data at the South ENR Technology Research Compound and Field Scale PSTA Site



TOTAL RAINFALL (CM)				
MONTH	1999	2000	2001	2002
JAN	---	2.92	2.34	1.35
FEB	1.50	1.83	0.08	12.14
MAR	1.78	11.13	8.10	1.22
APR	1.80	12.45	1.55	5.03
MAY	5.31	1.93	20.12	5.69
JUN	31.85	3.48	16.03	31.47
JUL	8.08	18.85	37.52	28.40
AUG	23.77	5.84	11.81	14.05
SEP	16.99	35.97	37.01	13.44
OCT	35.20	27.48	10.44	---
NOV	1.09	2.03	3.76	---
DEC	3.76	0.56	6.32	---

APPENDIX B-3

Daily Rainfall Data during at the ENR Rainfall Station ENR301 and S7



TOTAL ET (CM)				
MONTH	1999	2000	2001	2002
JAN	---	9.11	9.51	8.66
FEB	7.85	10.02	9.78	6.45
MAR	11.61	12.49	12.45	13.57
APR	12.89	14.26	14.43	15.04
MAY	13.73	16.58	14.69	16.39
JUN	10.49	13.98	13.40	10.65
JUL	13.61	13.18	13.42	13.92
AUG	12.00	12.90	13.18	11.14
SEP	10.54	22.50	10.04	8.81
OCT	9.70	10.85	9.44	---
NOV	8.39	9.38	8.58	---
DEC	6.95	8.05	7.53	---

APPENDIX B-4

Daily Evapotranspiration Data during at the ENR Evapotranspiration Station ENRP and STA-1W

APPENDIX C

ENR Test Cells

APPENDIX C.1

Detailed Data

Phase 1 Data Summaries

EXHIBIT C.1-1

Water Balances for the PSTA Test Cells, February 1999 - March 2000

			Depth	HLR	Inflow		Outflow		Rainfall		ET		ΔSTORAGE	Residual	Residual
Treatment	Cell	Month	(m)	(cm/d)	(m3/d)	(m3)	(m3/d)	(m3)	(in)	(m3)	(mm)	(m3)	(m3)	(m3)	(% of inflow)
1	13	Feb-1999	0 51	4.64	122 90	3809.81	---	---	0 59	38.01	78 47	199 05	641.72	---	---
		Mar-1999	0 65	4.66	114 37	3545.55	129 11	4002.54	0 70	46.77	116.11	305 42	48 11	-763.75	-21 26
		Apr-1999	0.66	4.96	122 83	3807.80	143 10	4435 97	0 71	47.69	128.92	340 92	-64.48	-856.91	-22.23
		May-1999	0 63	6 07	122 79	3806.51	178 09	5520 89	2 09	139 42	137.33	360 68	-520.34	-1415.30	-35.87
		Jun-1999	0 63	5.24	122 91	3810 16	139.77	4332 88	12.54	834.94	104.86	274 87	111.86	-74.52	-1.60
		Jul-1999	0.64	5.41	122.98	3812 31	145 11	4498 41	3 18	212.51	136.10	358 07	24 06	-855.72	-21 26
		Aug-1999	0.64	4.65	123.03	3814 07	113 96	3532 80	9 36	629.42	120.04	317.80	16 14	576 75	12 98
		Sep-1999	0.65	4.37	123.01	3813 37	93.17	2888 40	6 69	447.66	105.39	277.64	40 15	1054.84	24.76
		Oct-1999	0.66	4.34	119.73	3711 62	100 78	3124.13	13.86	929.75	96.96	256.07	-40.25	1301.42	28.04
		Nov-1999	0.64	4.22	124.21	3850 64	87.64	2716 98	0 43	29.20	83 91	224.32	-66.41	1004.95	25 90
		Dec-1999	0.68	4.23	122 65	3802 13	85.27	2643.26	1 48	101 47	69.54	187.70	98 72	973.92	24.95
2	8	Feb-1999	0.54	3.87	122.74	3804.94	---	---	0 59	38.29	78.47	200 47	642.43	---	---
		Mar-1999	0.62	4 37	114.19	3539.77	149.12	4622.67	0.70	46 62	116.11	304.46	-31.97	-1308.76	-36.49
		Apr-1999	0.66	4.68	122.67	3802.92	139.87	4336.10	0.71	47 55	128.92	339.93	120.55	-946.11	-24.57
		May-1999	0.61	4.71	122.63	3801.63	117.24	3634.36	2.09	137.48	137.33	355.65	7.89	-58.80	-1.49
		Jun-1999	0.63	4.67	122.75	3805.28	142.63	4421.48	12.54	837.07	104 86	275.58	16.02	-70.72	-1.52
		Jul-1999	0 64	4.67	122.82	3807.44	142.39	4414.17	3.18	212.40	136 10	357.90	-24 05	-728 18	-18 11
		Aug-1999	0 65	4.64	122.88	3809.20	116.61	3614.89	9.36	628.10	120 04	317.14	80.53	424 75	9 57
		Sep-1999	0.68	4.64	122 85	3806.50	161.46	5005.41	6.69	452.68	105 39	280.76	48 72	-1073.71	-25.20
		Oct-1999	0 66	4.53	119 87	3715.88	133 77	4147.00	13 86	932.47	96 96	256.82	-56 51	301.05	6.48
		Nov-1999	0 66	4.69	125 45	3889.00	142 51	4417.75	0.43	28.91	83.91	222.14	-62 53	-659 43	-16 83
		Dec-1999	0 68	4.43	123 90	3841.04	99 52	3084 99	1.48	100.00	69.54	184 99	36.49	634.58	16.10
		Jan-2000	0 53	4.20	110 11	3413.36	139 62	4328.34	1.15	74.85	---	---	-796 67	---	---
		Feb-2000	0 37	4.84	108.98	3378.31	143 35	4443 80	0.72	44.79	---	---	-261.25	---	---
		Mar-2000	0.29	5.09	123 16	3818.07	149 48	4633.85	4.38	266.71	---	---	-118 19	---	---
3	3	Feb-1999	0.59	4 66	122 74	3804.94	---	---	0 59	39.07	78.47	204 61	683 48	---	---
		Mar-1999	0.67	4.29	114 19	3539 77	154 99	4804.54	0 70	47.37	116.11	309.37	81.21	-1607 98	-44 83
		Apr-1999	0 57	3.24	91.61	2839.76	276 98	8586 35	0 71	47.08	128.92	336 58	-389.92	-5646.16	-195 58
		May-1999	0.39	2.97	67.81	2102.11	102 19	3167 76	2 09	130.72	137.33	338 17	105 08	-1378 18	-61.72
		Jun-1999	0.71	4 48	119.09	3691.94	130 06	4031 92	12 54	859.82	104.86	283 06	1077.86	-841.08	-18.48
		Jul-1999	0.79	4 47	122.82	3807 44	142 24	4409 36	3 18	221.94	136.10	373 97	-8 38	-745 57	-18 50
		Aug-1999	0.80	4.78	122.88	3809.20	157 67	4887.75	9 36	653.35	120.04	329.89	0.00	-755.08	-16 92
		Sep-1999	0.74	8 55	220.29	6829 08	240.36	7451 01	6 69	459.07	105.39	284 72	0.00	-447.58	-6 14
		Oct-1999	0.73	4 19	146.31	4535.57	128.95	3997.50	13.86	955.14	96.96	263.07	-95.10	1325.25	24 14
		Nov-1999	0.55	2.67	73.68	2284 07	88.50	2743.47	0 43	28 15	83.91	216 30	-624.63	-22.92	-0 99
		Dec-1999	0 49	2 76	67.29	2086 11	102.97	3191.99	1.48	95.55	69.54	176 75	-61.98	-1125.11	-51 57
		Jan-2000	0 37	4 27	99.87	3095 83	97.68	3028.00	1 15	71 85	---	---	-369.24	---	---
		Feb-2000	0.21	5 04	106.43	3299 28	100 60	3118 68	0 72	43 12	---	---	-510.22	---	---
		Mar-2000	0 11	5 28	120.95	3749 45	582.94	18071.23	4 38	254.92	---	---	-21 30	---	---

EXHIBIT C 1-2

Monthly Averages of Field Measurements Collected from the ENR South Head Cell and the PSTA Test Cells February 1999 - March 2000

Parameter	Month	Head Cell	Treatment 1* (Peat)	Treatment 2 (Shellrock)	Treatment 3 Shellrock (Variable Water Depth)
Water Temp (°C)	Feb-99	17.93	17.78	19.16	18.04
	Mar-99	21.81	22.35	22.00	22.81
	Apr-99	25.44	26.45	27.38	25.34
	May-99	27.09	27.80	28.11	29.12
	Jun-99	27.73	28.82	28.71	28.06
	Jul-99	28.05	31.05	30.50	31.34
	Aug-99	28.63	28.47	30.27	31.06
	Sep-99	27.42	26.50	30.73	28.32
	Oct-99	24.98	24.86	27.60	24.26
	Nov-99	21.83	20.33	23.15	22.75
	Dec-99	19.88	20.29	21.37	18.90
	Jan-00	19.56	20.48	18.24	18.11
	Feb-00	20.41	--	20.84	17.70
	Mar-00	23.35	--	23.96	21.79
pH (units)	Feb-99	7.67	7.96	8.37	8.01
	Mar-99	7.80	8.59	8.38	8.36
	Apr-99	7.84	8.61	8.44	8.39
	May-99	7.95	8.99	8.55	8.51
	Jun-99	7.63	8.70	8.63	8.45
	Jul-99	7.50	8.93	8.51	8.47
	Aug-99	7.41	8.27	8.34	8.35
	Sep-99	7.26	7.84	8.37	7.88
	Oct-99	7.30	7.64	8.15	8.13
	Nov-99	7.47	7.54	8.07	8.31
	Dec-99	7.60	7.52	8.13	8.04
	Jan-00	7.64	7.58	8.19	8.10
	Feb-00	7.55	--	8.09	8.19
	Mar-00	7.57	--	8.03	7.85
Conductivity (µmhos/cm)	Feb-99	1219	1225	1187	1227
	Mar-99	1245	1260	1247	1313
	Apr-99	1173	1278	1309	1375
	May-99	875	905	977	929
	Jun-99	800	635	677	741
	Jul-99	832	703	733	780
	Aug-99	999	847	918	844
	Sep-99	1318	1064	981	1210
	Oct-99	1186	964	1173	954
	Nov-99	1041	986	965	985
	Dec-99	1132	1083	1128	1066
	Jan-00	1089	1024	1063	1091
	Feb-00	22	--	984	973
	Mar-00	27	--	982	1120
Salinity (ppt)	Feb-99	--	--	0.62	--
	Mar-99	--	--	0.66	0.69
	Apr-99	--	0.67	0.69	0.73
	May-99	--	0.47	0.51	0.48
	Jun-99	--	0.33	0.35	0.38
	Jul-99	--	0.36	0.38	0.40
	Aug-99	--	0.44	0.48	0.44
	Sep-99	--	0.56	0.51	0.64
	Oct-99	--	0.50	0.62	0.50
	Nov-99	--	0.52	0.50	0.51
	Dec-99	--	0.57	0.59	0.56
	Jan-00	--	0.54	0.56	0.57
	Feb-00	--	--	0.51	0.51
	Mar-00	--	--	0.51	--
Total Dissolved Solids (g/L)	Feb-99	--	--	0.759	--
	Mar-99	--	--	0.798	0.841
	Apr-99	0.673	0.818	0.838	0.881
	May-99	0.560	0.730	0.752	--
	Jun-99	0.512	0.406	0.430	0.433
	Jul-99	0.534	0.486	0.527	0.499
	Aug-99	0.640	0.542	0.588	0.540
	Sep-99	0.844	0.681	0.628	0.775
	Oct-99	0.759	0.616	0.750	0.608
	Nov-99	0.666	0.631	0.618	0.630
	Dec-99	0.724	0.695	0.722	0.682
	Jan-00	0.697	0.655	0.680	0.696
	Feb-00	0.636	--	0.630	0.623
	Mar-00	0.658	--	0.628	0.717
Dissolved Oxygen Saturation (%)	Feb-99	--	--	92.5	
	Mar-99	--	--	94.7	93.6
	Apr-99	62.3	120.0	99.9	96.7
	May-99	71.6	126.9	109.2	91.3
	Jun-99	39.8	117.0	117.1	87.0
	Jul-99	28.6	153.3	118.3	102.7
	Aug-99	9.3	96.8	110.9	111.3
	Sep-99	5.2	34.2	103.0	90.3
	Oct-99	15.6	32.6	110.2	101.4
	Nov-99	21.8	22.8	104.7	108.5
	Dec-99	35.6	28.1	97.7	103.3
	Jan-00	52.5	37.3	106.3	104.3
	Feb-00	82.4	--	118.4	102.7
	Mar-00	62.7	--	112.8	85.3
Dissolved Oxygen (mg/L)	Feb-99	5.97	8.00	8.50	8.05
	Mar-99	6.45	9.19	8.21	7.99
	Apr-99	4.98	9.59	7.84	7.72
	May-99	5.68	9.98	8.50	6.97
	Jun-99	3.12	8.98	9.06	6.76
	Jul-99	2.23	11.43	8.82	7.56
	Aug-99	0.72	7.43	8.28	8.22
	Sep-99	0.41	2.73	7.62	6.97
	Oct-99	1.30	2.70	8.64	8.47
	Nov-99	1.90	2.06	8.93	9.30
	Dec-99	3.34	2.53	8.63	9.57
	Jan-00	4.81	3.35	9.97	9.79
	Feb-00	7.48	-	10.53	9.70
	Mar-00	5.30	--	9.52	7.38

* STC-1 was operated as a batch system from January - March 2000; these data are presented in Appendix D

EXHIBIT C.1-2

Monthly Averages of Field Measurements Collected from the ENR South Head Cell and the PSTA Test Cells February 1999 - March 2000

Parameter	Month	Head Cell	Treatment 1* (Peat)	Treatment 2 (Shellrock)	Treatment 3 Shellrock (Variable Water Depth)
Water Temp (°C)	Feb-99	17.93	17.78	19.16	18.04
	Mar-99	21.81	22.35	22.00	22.81
	Apr-99	26.44	26.45	27.38	28.34
	May-99	27.09	27.80	28.11	29.12
	Jun-99	27.73	28.82	28.71	28.06
	Jul-99	28.05	31.05	30.50	31.34
	Aug-99	28.63	28.47	30.27	31.06
	Sep-99	27.42	26.50	30.73	28.32
	Oct-99	24.98	24.86	27.60	24.26
	Nov-99	21.83	20.33	23.15	22.75
	Dec-99	19.88	20.29	21.37	18.90
	Jan-00	19.56	20.48	18.24	18.11
	Feb-00	20.41	--	20.84	17.70
	Mar-00	23.35	--	23.96	21.79
pH (units)	Feb-99	7.67	7.96	8.37	8.01
	Mar-99	7.80	8.59	8.38	8.36
	Apr-99	7.84	8.61	8.44	8.39
	May-99	7.95	8.99	8.55	8.51
	Jun-99	7.63	8.70	8.63	8.45
	Jul-99	7.50	8.93	8.51	8.47
	Aug-99	7.41	8.27	8.34	8.36
	Sep-99	7.26	7.84	8.37	7.88
	Oct-99	7.30	7.64	8.15	8.13
	Nov-99	7.47	7.54	8.07	8.31
	Dec-99	7.60	7.52	8.13	8.04
	Jan-00	7.64	7.58	8.19	8.10
	Feb-00	7.55	--	8.09	8.19
	Mar-00	7.57	--	8.03	7.85
Conductivity (µmhos/cm)	Feb-99	1219	1225	1187	1227
	Mar-99	1245	1260	1247	1313
	Apr-99	1173	1278	1309	1375
	May-99	875	905	977	929
	Jun-99	600	635	677	741
	Jul-99	632	703	733	780
	Aug-99	999	847	918	844
	Sep-99	1318	1064	981	1210
	Oct-99	1186	964	1173	954
	Nov-99	1041	986	965	985
	Dec-99	1132	1083	1128	1066
	Jan-00	1089	1024	1063	1091
	Feb-00	22	--	984	973
	Mar-00	27	--	982	1120
Salinity (ppl)	Feb-99	--	--	0.62	--
	Mar-99	--	--	0.66	0.69
	Apr-99	--	0.67	0.69	0.73
	May-99	--	0.47	0.51	0.48
	Jun-99	--	0.33	0.35	0.38
	Jul-99	--	0.35	0.38	0.40
	Aug-99	--	0.44	0.48	0.44
	Sep-99	--	0.56	0.51	0.64
	Oct-99	--	0.50	0.62	0.50
	Nov-99	--	0.52	0.50	0.51
	Dec-99	--	0.57	0.59	0.56
	Jan-00	--	0.54	0.56	0.57
	Feb-00	--	--	0.51	0.51
	Mar-00	--	--	0.51	--
Total Dissolved Solids (g/L)	Feb-99	--	--	0.759	--
	Mar-99	--	--	0.798	0.841
	Apr-99	0.673	0.818	0.838	0.881
	May-99	0.560	0.730	0.752	--
	Jun-99	0.512	0.406	0.430	0.433
	Jul-99	0.534	0.486	0.527	0.499
	Aug-99	0.640	0.542	0.588	0.540
	Sep-99	0.844	0.681	0.628	0.775
	Oct-99	0.759	0.616	0.750	0.608
	Nov-99	0.666	0.631	0.618	0.630
	Dec-99	0.724	0.695	0.722	0.682
	Jan-00	0.697	0.655	0.680	0.696
	Feb-00	0.636	--	0.630	0.623
	Mar-00	0.658	--	0.628	0.717
Dissolved Oxygen Saturation (%)	Feb-99	--	--	92.5	
	Mar-99	--	--	94.7	93.6
	Apr-99	62.3	120.0	99.9	96.7
	May-99	71.6	126.9	109.2	91.3
	Jun-99	39.8	117.0	117.1	87.0
	Jul-99	28.6	153.3	118.3	102.7
	Aug-99	9.3	96.8	110.9	111.3
	Sep-99	5.2	34.2	103.0	90.3
	Oct-99	15.8	32.6	110.2	101.4
	Nov-99	21.8	22.8	104.7	108.5
	Dec-99	36.6	28.1	97.7	103.3
	Jan-00	52.5	37.3	106.3	104.3
	Feb-00	82.4	--	118.4	102.7
	Mar-00	62.7	--	112.8	85.3
Dissolved Oxygen (mg/L)	Feb-99	5.97	8.00	8.50	8.05
	Mar-99	6.45	9.19	8.21	7.99
	Apr-99	4.98	9.59	7.84	7.72
	May-99	5.68	9.98	8.50	6.97
	Jun-99	3.12	8.98	9.06	6.76
	Jul-99	2.23	11.43	8.82	7.56
	Aug-99	0.72	7.43	8.28	8.22
	Sep-99	0.41	2.73	7.62	6.97
	Oct-99	1.30	2.70	8.64	8.47
	Nov-99	1.90	2.06	8.93	9.30
	Dec-99	3.34	2.53	8.63	9.57
	Jan-00	4.81	3.35	9.97	9.79
	Feb-00	7.48	--	10.53	9.70
	Mar-00	5.30	--	9.52	7.38

* STC-1 was operated as a batch system from January - March 2000; these data are presented in Appendix D

EXHIBIT C.1-3

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, February 1999 - March 2000

		Treatment					
		1[a] (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
Parameter	Month	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow
Total Phosphorus as P (mg/L)	Feb-99	0.019	0.086	0.021	0.026	0.019	0.035
	Mar-99	0.020	0.039	0.021	0.030	0.020	0.039
	Apr-99	0.025	0.036	0.025	0.032	0.026	0.037
	May-99	0.020	0.021	0.021	0.021	0.022	0.027
	Jun-99	0.020	0.018	0.021	0.021	0.022	0.024
	Jul-99	0.026	0.013	0.026	0.014	0.026	0.017
	Aug-99	0.035	0.022	0.035	0.017	0.033	0.021
	Sep-99	0.032	0.021	0.031	0.015	0.031	0.023
	Oct-99	0.026	0.019	0.026	0.015	0.026	0.019
	Nov-99	0.037	0.012	0.037	0.011	0.037	0.013
	Dec-99	0.019	0.014	0.020	0.012	0.019	0.014
	Jan-00	0.017	0.014	0.015	0.011	0.015	0.013
	Feb-00	0.019	0.086	0.017	0.011	0.017	0.018
	Mar-00	0.020	0.039	0.022	0.012	0.018	0.021
	--	0.025	0.036	--	--	--	--
Total Particulate Phosphorus (mg/L)	Feb-99	0.010	0.070	0.012	0.009	0.010	0.024
	Mar-99	0.011	0.028	0.012	0.017	0.011	0.028
	Apr-99	0.015	0.019	0.015	0.016	0.012	0.020
	May-99	0.004	0.004	0.000	0.004	0.005	0.009
	Jun-99	0.006	0.007	0.008	0.010	0.014	0.014
	Jul-99	0.006	0.004	0.006	0.003	0.008	0.009
	Aug-99	0.025	0.011	0.021	0.007	0.015	0.011
	Sep-99	0.010	0.011	0.008	0.006	0.008	0.013
	Oct-99	0.007	0.010	0.008	0.008	0.008	0.010
	Nov-99	0.011	0.004	0.011	0.005	0.011	0.006
	Dec-99	0.008	0.004	0.009	0.005	0.008	0.006
	Jan-00	0.009	0.005	0.005	0.003	0.005	0.006
	Feb-00	--	--	0.004	0.004	0.005	0.008
	Mar-00	--	--	0.008	0.004	0.007	0.009
	--	--	--	--	--	--	--
Total Dissolved Phosphorus (mg/L)	Feb-99	0.009	0.016	0.009	0.018	0.009	0.011
	Mar-99	0.011	0.012	0.011	0.013	0.011	0.011
	Apr-99	0.014	0.017	0.014	0.016	0.016	0.017
	May-99	0.019	0.017	0.028	0.017	0.017	0.018
	Jun-99	0.015	0.011	0.014	0.010	0.013	0.011
	Jul-99	0.013	0.009	0.012	0.013	0.010	0.008
	Aug-99	0.013	0.011	0.015	0.010	0.014	0.010
	Sep-99	0.013	0.010	0.014	0.009	0.014	0.010
	Oct-99	0.011	0.009	0.011	0.007	0.011	0.009
	Nov-99	0.011	0.009	0.010	0.007	0.010	0.007
	Dec-99	0.011	0.010	0.011	0.007	0.011	0.008
	Jan-00	0.008	0.009	0.010	0.008	0.010	0.008
	Feb-00	--	--	0.013	0.007	0.012	0.009
	Mar-00	--	--	0.014	0.008	0.011	0.012
	--	--	--	--	--	--	--

EXHIBIT C.1-3

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, February 1999 - March 2000

		Treatment					
		1[a] (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
Parameter	Month	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow
Dissolved Reactive Phosphorus (mg/L)	Feb-99	0.009	0.005	0.006	0.003	0.004	0.002
	Mar-99	0.006	0.005	0.005	0.006	0.007	0.003
	Apr-99	0.006	0.004	0.005	0.003	0.007	0.004
	May-99	0.008	0.007	0.010	0.006	0.008	0.008
	Jun-99	0.007	0.002	0.007	0.002	0.006	0.002
	Jul-99	0.005	0.003	0.005	0.003	0.005	0.002
	Aug-99	0.002	0.001	0.002	0.001	0.002	0.001
	Sep-99	0.003	0.002	0.002	0.002	0.002	0.002
	Oct-99	0.003	0.002	0.003	0.001	0.002	0.002
	Nov-99	0.003	0.002	0.004	0.002	0.003	0.002
	Dec-99	0.006	0.004	0.006	0.001	0.006	0.002
	Jan-00	0.008	--	0.005	--	0.005	--
	Feb-00	--	--	0.003	0.001	0.003	--
	Mar-00	--	--	0.003	--	0.001	--
	--	--	--	--	--	--	--
Dissolved Organic Phosphorus (mg/L)	Feb-99	0.000	0.011	0.003	0.015	0.005	0.009
	Mar-99	0.006	0.007	0.007	0.007	0.005	0.008
	Apr-99	0.009	0.013	0.010	0.013	0.010	0.014
	May-99	0.006	0.011	0.018	0.011	0.006	0.010
	Jun-99	0.009	0.010	0.009	0.007	0.009	0.009
	Jul-99	0.007	0.006	0.007	0.010	0.006	0.006
	Aug-99	0.011	0.009	0.013	0.010	0.012	0.009
	Sep-99	0.009	0.010	0.012	0.008	0.011	0.009
	Oct-99	0.006	0.005	0.006	0.005	0.009	0.006
	Nov-99	0.008	0.005	0.007	0.005	0.007	0.005
	Dec-99	0.005	0.008	0.005	0.006	0.005	0.006
	Jan-00	0.003	--	0.006	--	0.005	--
	Feb-00	--	--	0.010	0.005	0.009	--
	Mar-00	--	--	0.012	--	0.010	--
	--	--	--	--	--	--	--
Total Nitrogen, as N (mg/L)	Feb-99	2.27	1.74	2.25	0.98	2.22	1.43
	Mar-99	2.16	0.63	1.85	1.10	1.98	0.67
	Apr-99	1.90	0.93	1.77	0.86	1.80	1.09
	May-99	1.60	1.16	1.58	1.38	2.19	1.28
	Jun-99	1.53	0.84	1.49	1.00	1.50	0.93
	Jul-99	1.60	0.44	1.55	0.65	1.58	0.57
	Aug-99	2.13	1.60	2.11	1.70	2.13	1.60
	Sep-99	2.05	1.20	1.66	1.50	1.80	0.46
	Oct-99	1.92	0.86	1.92	1.20	1.92	0.92
	Nov-99	1.94	1.40	1.94	1.45	1.94	1.60
	Dec-99	2.44	2.17	2.43	2.21	2.34	3.01
	Jan-00		--	2.05	2.04	2.05	2.03
	Feb-00	--	--	2.01	2.00	2.01	2.38
	Mar-00	--	--	1.91	1.88	1.87	2.61
	--	--	--	--	--	--	--

EXHIBIT C.1-3

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, February 1999 - March 2000

Parameter	Month	Treatment 1[a] (Peat) Inflow[b]	Treatment 1[a] (Peat) Outflow	Treatment 2 (Shellrock) Inflow[b]	Treatment 2 (Shellrock) Outflow	Treatment 3 (Shellrock-Variable Stage) Inflow[b]	Treatment 3 (Shellrock-Variable Stage) Outflow
Total Kjeldahl Nitrogen, as N (mg/L)	Feb-99	2.10	1.66	2.10	0.98	2.10	1.43
	Mar-99	1.99	0.63	1.68	1.50	1.83	1.34
	Apr-99	1.83	0.93	1.69	1.06	1.73	1.43
	May-99	1.63	1.16	1.61	1.38	2.01	1.28
	Jun-99	1.54	0.84	1.51	1.00	1.52	0.93
	Jul-99	1.71	0.44	1.67	0.65	1.70	0.57
	Aug-99	2.12	1.60	2.11	1.70	2.12	1.60
	Sep-99	2.05	1.20	1.66	1.50	1.65	0.46
	Oct-99	2.02	0.86	2.02	1.20	2.02	0.92
	Nov-99	1.93	1.40	1.93	1.45	1.93	1.40
	Dec-99	2.35	2.17	2.35	2.21	2.25	3.01
	Jan-00		--	2.00	2.01	2.00	2.03
	Feb-00	--	--	1.94	2.00	1.94	2.38
	Mar-00	--	--	1.79	1.88	1.76	2.61
	--	--	--	--	--	--	--
Nitrate/Nitrite, as N (mg/L)	Feb-99	0.170	0.079	0.150	0.025	0.120	0.025
	Mar-99	0.173	0.025	0.175	0.015	0.154	0.017
	Apr-99	0.084	0.025	0.087	0.020	0.079	0.021
	May-99	0.048	0.025	0.038	0.025	0.034	0.025
	Jun-99	0.045	0.025	0.042	0.025	0.041	0.025
	Jul-99	0.032	0.025	0.036	0.025	0.027	0.025
	Aug-99	0.016	0.025	0.016	0.025	0.016	0.025
	Sep-99	0.014	0.025	0.014	0.025	0.154	0.025
	Oct-99	0.022	0.025	0.022	0.025	0.022	0.025
	Nov-99	0.058	0.025	0.058	0.025	0.058	0.093
	Dec-99	0.090	0.002	0.087	0.002	0.088	0.002
	Jan-00		--	0.047	0.032	0.047	0.002
	Feb-00	--	--	0.067	0.002	0.067	0.002
	Mar-00	--	--	0.116	0.002	0.107	0.002
	--	--	--	--	--	--	--
Ammonia, as NH_3 (mg/L)	Feb-99	0.146	0.020	0.146	0.020	0.146	0.020
	Mar-99	0.020	0.020	0.020	0.020	0.020	0.020
	Apr-99	0.020	0.020	0.020	0.020	0.020	0.020
	May-99	0.064	0.047	0.072	0.047	0.053	0.047
	Jun-99	0.020	0.020	0.020	0.020	0.020	0.020
	Jul-99	0.058	0.020	0.053	0.020	0.020	0.020
	Aug-99	0.210	0.020	0.175	0.020	0.180	0.020
	Sep-99	0.020	0.020	0.020	0.020	0.020	0.020
	Oct-99	0.070	0.020	0.070	0.070	0.070	0.020
	Nov-99	0.020	0.020	0.020	0.020	0.020	0.020
	Dec-99	0.100	0.014	0.113	0.016	0.099	0.002
	Jan-00	--	--	0.021	--	0.021	--
	Feb-00	--	--	0.097	--	0.097	--
	Mar-00	--	--	0.113	--	0.113	--
	--	--	--	--	--	--	--

EXHIBIT C.1-3

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, February 1999 - March 2000

Parameter	Month	Treatment					
		1[a] (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
		Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow
Organic Nitrogen (mg/L)	Feb-99	1.95	1.64	1.95	0.96	1.95	1.41
	Mar-99	1.68	0.61	0.70	1.48	1.13	1.32
	Apr-99	1.56	0.91	1.07	1.04	1.29	1.41
	May-99	1.40	1.11	1.44	1.33	2.88	1.23
	Jun-99	1.18	0.82	1.18	0.98	1.18	0.91
	Jul-99	0.77	0.42	0.59	0.63	0.76	0.55
	Aug-99	1.79	1.58	1.78	1.68	1.82	1.58
	Sep-99	1.38	1.18	0.60	1.48	0.58	0.44
	Oct-99	1.33	0.84	1.33	1.13	1.33	0.90
	Nov-99	1.78	1.38	1.78	1.43	1.78	1.38
	Dec-99	2.11	2.16	2.09	2.19	1.71	3.01
	Jan-00	--	--	1.98	--	1.98	--
	Feb-00	--	--	1.85	--	1.85	--
	Mar-00	--	--	1.68	--	1.65	--
	--	--	--	--	--	--	--
TOC (mg/L)	Feb-99	31.0	32.7	31.0	32.5	31.0	33.0
	Mar-99	37.3	35.6	37.9	35.3	38.1	35.4
	Apr-99	39.4	38.4	38.9	37.7	38.8	37.6
	May-99	30.9	29.4	29.9	32.1	30.3	30.7
	Jun-99	28.8	20.7	28.7	23.5	28.8	21.5
	Jul-99	28.2	26.4	28.4	29.0	28.1	26.9
	Aug-99	35.9	28.0	34.8	29.2	34.8	29.2
	Sep-99	42.5	69.0	42.8	39.5	42.0	39.5
	Oct-99	36.3	30.0	36.3	30.0	36.3	32.0
	Nov-99	35.0	39.0	35.0	40.5	35.0	39.0
	Dec-99	38.9	40.7	38.2	41.0	37.2	38.2
	Jan-00	37.8	--	35.8	33.0	35.8	34.0
	Feb-00	--	--	32.5	35.1	32.5	41.7
	Mar-00	--	--	31.0	35.0	30.7	44.0
	--	--	--	--	--	--	--
TSS (mg/L)	Feb-99	4.0	2.0	4.7	2.0	4.5	2.0
	Mar-99	2.7	6.0	2.7	5.5	2.7	3.0
	Apr-99	5.5	6.5	5.5	3.8	5.5	7.5
	May-99	3.1	4.0	2.9	4.0	3.2	10.0
	Jun-99	3.1	2.0	3.1	2.0	3.1	26.0
	Jul-99	3.0	2.0	4.5	2.0	3.0	2.0
	Aug-99	3.3	1.0	3.3	3.8	3.3	2.8
	Sep-99	1.9	3.8	1.6	1.8	1.3	7.8
	Oct-99	2.6	1.2	2.6	2.4	2.6	2.8
	Nov-99	2.6	0.5	2.6	0.8	2.6	2.0
	Dec-99	2.6	0.5	2.6	1.2	2.6	6.6
	Jan-00	1.0	--	2.0	0.5	2.0	1.0
	Feb-00	--	--	2.2	22.0	2.2	8.0
	Mar-00	--	--	3.3	6.2	1.0	2.8
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EXHIBIT C.1-3

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, February 1999 - March 2000

Parameter	Month	Treatment 1[a] (Peat) Inflow[b]	Treatment 1[a] (Peat) Outflow	Treatment 2 (Shellrock) Inflow[b]	Treatment 2 (Shellrock) Outflow	Treatment 3 (Shellrock-Variable Stage) Inflow[b]	Treatment 3 (Shellrock-Variable Stage) Outflow
Calcium (mg/L)	Feb-99	76.0	70.9	76.0	72.0	77.0	77.7
	Mar-99	70.1	49.2	70.5	66.1	71.2	71.2
	Apr-99	56.9	45.2	56.9	56.0	57.7	63.2
	May-99	48.6	15.7	48.7	32.2	48.1	34.1
	Jun-99	53.7	22.0	53.8	30.0	53.8	30.0
	Jul-99	59.4	23.0	59.6	40.6	59.5	37.9
	Aug-99	60.2	29.0	59.5	40.0	59.7	38.0
	Sep-99	78.2	62.0	75.2	62.0	78.7	73.0
	Oct-99	85.4	54.0	85.4	53.0	85.4	59.0
	Nov-99	79.6	59.0	79.6	65.0	79.6	60.0
	Dec-99	82.5	63.0	82.5	66.0	82.3	64.0
	Jan-00	78.8	--	76.3	66.0	76.3	66.0
	Feb-00	--	--	72.7	54.0	72.7	56.0
	Mar-00	--	--	66.3	55.0	67.0	49.0
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Alkalinity (mg/L)	Feb-99	290	278	290	276	290	276
	Mar-99	304	258	304	278	306	283
	Apr-99	231	241	231	263	232	272
	May-99	184	105	185	161	186	163
	Jun-99	185	104	185	123	185	114
	Jul-99	226	126	228	183	211	230
	Aug-99	254	160	253	192	254	187
	Sep-99	284	238	289	248	287	288
	Oct-99	261	187	261	187	261	196
	Nov-99	263	237	263	243	263	229
	Dec-99	278	250	275	250	278	240
	Jan-00	280	--	264	240	264	230
	Feb-00	--	--	250	230	250	230
	Mar-00	--	--	248	130	260	220
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Notes:

One-half the method detection limit used in the calculation of monthly averages for undetected values.

[a] STC-1 was operated as a batch system from January - March 2000; these data are presented in Appendix D.

[b] Inflow averages include data from constant head cell outlet and samples collected from individual cell inlets.

EXHIBIT C.1-4

Period-of-Record, Quarterly, and Monthly Summaries Total Phosphorus Mass Balance Data from the ENR Test Cells, February 1999 to March 2000

Treatment	Cell	Date	TP (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TP (g/m²/y)		Removal		Calc_k
			Inflow	Outflow	(m³/d)	(m³/d)	(m³/d)	(cm/d)	Inflow	Outflow	(g/m²/y)	(%)	(m/y)
Period of Record													
1	13	1999-2000	0.025	0.022	121.11	133.87	127.08	4.57	0.424	0.421	0.002	0.58	2.14
2	8	1999-2000	0.024	0.017	120.10	112.76	116.52	4.64	0.406	0.278	0.128	31.51	5.37
3	3	1999-2000	0.024	0.022	105.38	94.24	100.07	3.98	0.354	0.323	0.031	8.75	0.96
Quarterly													
1	13	Qtr-3	0.022	0.043	118.75	140.24	128.62	4.48	0.351	0.818	-0.467	-132.92	-12.16
		Qtr-4	0.022	0.017	122.89	170.47	146.68	4.65	0.374	0.415	-0.042	-11.14	4.73
		Qtr-5	0.031	0.021	121.68	116.11	118.90	4.59	0.516	0.343	0.173	33.52	6.37
		Qtr-6	0.027	0.013	120.56	100.08	110.71	4.53	0.452	0.182	0.270	59.69	11.10
2	8	Qtr-3	0.022	0.030	118.57	136.32	126.76	4.51	0.362	0.559	-0.197	-54.57	-5.59
		Qtr-4	0.022	0.018	122.74	108.55	115.64	4.69	0.381	0.277	0.104	27.22	3.00
		Qtr-5	0.031	0.016	121.62	103.51	112.57	4.61	0.516	0.231	0.285	55.20	9.95
		Qtr-6	0.024	0.011	119.33	106.90	113.12	4.57	0.406	0.172	0.234	57.56	11.67
		Qtr-7	0.019	0.012	116.22	114.12	115.17	4.81	0.338	0.206	0.132	39.06	8.34
3	3	Qtr-3	0.022	0.039	104.48	142.95	122.70	3.89	0.314	0.774	-0.460	-146.83	-9.72
		Qtr-4	0.023	0.023	103.46	84.15	93.81	3.83	0.322	0.257	0.065	20.07	0.02
		Qtr-5	0.030	0.021	144.95	122.31	133.63	5.24	0.572	0.347	0.225	39.29	6.61
		Qtr-6	0.024	0.013	82.19	63.20	72.70	3.22	0.285	0.123	0.162	56.93	6.03
		Qtr-7	0.017	0.018	93.00	55.00	74.00	3.98	0.252	0.172	0.080	31.83	-0.65
Monthly													
1	13	Feb-99	0.019	0.086	122.76	–	122.76	4.64	0.313	1.457	-1.143	-364.86	-26.03
		Mar-99	0.020	0.039	114.66	131.91	123.29	4.33	0.308	0.703	-0.395	-128.19	-11.35
		Apr-99	0.025	0.036	120.32	143.64	131.98	4.52	0.415	0.737	-0.322	-77.77	-6.17
		May-99	0.020	0.021	122.79	198.96	160.87	4.63	0.344	0.574	-0.230	-66.91	-0.66
		Jun-99	0.020	0.018	122.92	153.44	138.18	4.67	0.347	0.383	-0.036	-10.46	2.25
		Jul-99	0.026	0.013	122.97	163.26	143.11	4.65	0.437	0.297	0.140	32.11	13.42
		Aug-99	0.035	0.022	123.03	122.89	122.96	4.65	0.598	0.394	0.204	34.16	7.83
		Sep-99	0.032	0.021	123.00	108.42	115.71	4.64	0.535	0.313	0.222	41.51	6.53
		Oct-99	0.026	0.019	119.34	111.48	115.41	4.49	0.424	0.294	0.130	30.60	4.82
		Nov-99	0.037	0.012	124.21	99.10	111.65	4.69	0.636	0.171	0.465	73.07	17.22
		Dec-99	0.019	0.014	121.94	104.18	113.06	4.57	0.324	0.194	0.130	40.17	5.33
		Jan-00	0.017	0.014	108.68	88.59	103.67	4.06	0.249	0.187	0.062	24.93	2.88
2	8	Feb-99	0.021	0.026	122.60	--	122.60	4.64	0.359	0.440	-0.081	-22.64	-3.46
		Mar-99	0.021	0.030	114.48	148.65	131.56	4.37	0.323	0.612	-0.289	-89.36	-6.49
		Apr-99	0.025	0.032	120.17	126.80	123.48	4.57	0.418	0.529	-0.110	-26.42	-4.03
		May-99	0.021	0.021	122.63	99.69	111.16	4.71	0.363	0.289	0.075	20.51	0.34
		Jun-99	0.021	0.021	122.76	109.88	116.32	4.68	0.351	0.313	0.038	10.84	0.02
		Jul-99	0.026	0.014	122.81	115.75	119.28	4.68	0.436	0.221	0.215	49.29	10.29
		Aug-99	0.035	0.017	122.87	90.90	106.89	4.67	0.593	0.221	0.373	62.80	10.34
		Sep-99	0.031	0.015	122.84	134.84	128.84	4.65	0.528	0.279	0.248	47.08	12.97
		Oct-99	0.026	0.015	119.46	103.59	111.53	4.52	0.434	0.221	0.213	49.12	8.29
		Nov-99	0.037	0.011	125.45	112.13	118.79	4.74	0.640	0.177	0.463	72.30	19.26
		Dec-99	0.020	0.012	123.21	98.32	110.76	4.64	0.332	0.170	0.161	48.71	6.81
		Jan-00	0.015	0.011	110.11	108.55	109.33	4.33	0.231	0.169	0.062	26.91	4.86
		Feb-00	0.017	0.011	110.66	109.56	110.11	4.54	0.282	0.190	0.092	32.67	6.37
		Mar-00	0.022	0.012	123.17	119.81	121.49	5.15	0.408	0.226	0.182	44.59	10.73
3	3	Feb-99	0.019	0.035	122.60	--	122.60	4.53	0.314	0.579	-0.264	-84.21	-10.10
		Mar-99	0.020	0.039	114.48	153.74	134.11	4.24	0.295	0.825	-0.530	-179.49	-12.41
		Apr-99	0.026	0.037	91.97	134.30	113.13	3.45	0.346	0.697	-0.351	-101.31	-5.77
		May-99	0.022	0.027	67.81	61.08	64.44	2.70	0.214	0.240	-0.026	-12.41	-1.94
		Jun-99	0.022	0.024	116.49	87.44	101.96	4.26	0.337	0.291	0.047	13.87	-1.50
		Jul-99	0.026	0.017	122.81	103.13	112.97	4.41	0.411	0.233	0.178	43.31	5.84
		Aug-99	0.033	0.021	122.87	132.64	127.75	4.41	0.531	0.350	0.181	34.15	7.48
		Sep-99	0.031	0.023	212.31	181.02	196.66	7.72	0.818	0.602	0.217	26.49	7.99
		Oct-99	0.026	0.019	138.87	80.05	109.46	5.05	0.490	0.217	0.273	55.69	4.90
		Nov-99	0.037	0.013	74.46	55.91	65.19	2.84	0.433	0.101	0.333	76.78	9.54
		Dec-99	0.019	0.014	66.90	79.16	73.03	2.60	0.182	0.163	0.019	10.37	2.95
		Jan-00	0.015	0.013	102.14	57.73	79.93	4.11	0.220	0.113	0.107	48.58	1.36
		Feb-00	0.017	0.018	108.15	64.21	86.18	4.62	0.293	0.200	0.092	31.52	-0.51
		Mar-00	0.018	0.021	17.27	8.95	13.11	0.77	0.051	0.031	0.021	40.59	-0.29

EXHIBIT C.1-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the ENR Test Cells, February 1999 - March 2000

Treatment	Cell	Date	TN (mg/L) Inflow	TN (mg/L) Outflow	Inflow (m^3/d)	Outflow (m^3/d)	Avg_flow (m^3/d)	q_in (cm/d)	MB_TN ($g/m^2/y$) Inflow	MB_TN ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Period of Record													
1	13	1999-2000	1.94	1.21	121.11	133.87	127.49	4.57	32.27	22.23	10.04	31.11	8.30
2	8	1999-2000	1.89	1.41	120.10	112.76	116.43	4.64	32.05	22.38	9.67	30.17	4.88
3	3	1999-2000	1.96	1.50	105.38	94.24	99.81	3.98	28.46	19.39	9.07	31.88	3.66
Quarterly													
1	13	Qtr-3	2.08	1.20	118.75	140.24	129.49	4.48	33.94	23.15	10.79	31.80	9.78
		Qtr-4	1.57	0.81	122.89	170.47	146.68	4.65	26.73	19.10	7.63	28.54	13.41
		Qtr-5	2.03	1.22	121.68	116.11	118.90	4.59	34.02	19.51	14.51	42.64	8.33
		Qtr-6	2.16	1.79	120.56	100.08	110.32	4.53	35.74	24.52	11.23	31.41	2.89
2	8	Qtr-3	2.01	0.90	118.57	136.32	127.45	4.51	33.04	17.06	15.98	48.37	14.20
		Qtr-4	1.54	1.01	122.74	108.55	115.64	4.69	26.27	15.24	11.04	42.01	6.80
		Qtr-5	1.95	1.47	121.62	103.51	112.57	4.61	32.74	20.99	11.75	35.88	4.40
		Qtr-6	2.15	1.90	119.33	106.90	113.12	4.57	35.79	28.43	7.36	20.57	1.94
		Qtr-7	1.96	1.94	116.22	114.12	115.17	4.81	34.44	33.42	1.01	2.94	0.19
3	3	Qtr-3	2.01	1.21	104.48	142.95	123.71	3.89	28.62	23.52	5.10	17.81	8.64
		Qtr-4	1.77	0.93	103.46	84.15	93.81	3.83	24.72	10.49	14.23	57.56	8.20
		Qtr-5	1.98	0.99	144.95	122.31	133.63	5.24	37.90	16.00	21.90	57.79	12.19
		Qtr-6	2.11	2.21	82.19	63.20	72.70	3.22	24.82	19.89	4.92	19.84	-0.50
		Qtr-7	1.94	2.50	93.00	55.00	74.00	3.98	28.21	21.64	6.57	23.29	-2.91
Monthly													
1	13	Feb-99	2.27	1.74	122.76	---	122.76	4.64	*38.45*	*29.48*	8.98	23.35	4.50
		Mar-99	2.16	0.63	114.66	131.91	123.29	4.33	34.20	11.44	22.76	66.54	21.00
		Apr-99	1.90	0.93	120.32	143.64	131.98	4.52	31.33	18.33	13.00	41.51	12.93
		May-99	1.60	1.16	122.79	198.96	160.87	4.63	27.11	31.79	-4.68	-17.27	7.17
		Jun-99	1.53	0.84	122.92	153.44	138.18	4.67	26.05	17.84	8.21	31.53	11.46
		Jul-99	1.60	0.44	122.97	163.26	143.11	4.65	27.11	9.82	17.29	63.79	25.64
		Aug-99	2.13	1.60	123.03	122.89	122.96	4.65	36.14	27.15	8.99	24.87	4.83
		Sep-99	2.05	1.20	123.00	108.42	115.71	4.64	34.66	17.92	16.74	48.30	8.50
		Oct-99	1.92	0.86	119.34	111.48	115.41	4.49	31.52	13.16	18.36	58.25	12.75
		Nov-99	1.94	1.40	124.21	99.10	111.65	4.69	33.23	19.12	14.11	42.46	5.03
		Dec-99	2.44	2.17	121.94	104.18	113.06	4.57	40.61	30.90	9.71	23.91	1.79
		Jan-00											
2	8	Feb-99	2.25	0.98	122.60	---	122.60	4.64	*38.11*	*16.61*	21.49	56.40	14.06
		Mar-99	1.85	1.10	114.48	148.65	131.56	4.37	29.59	22.80	6.79	22.95	9.57
		Apr-99	1.77	0.86	120.17	126.80	123.48	4.57	29.52	15.12	14.40	48.79	12.40
		May-99	1.58	1.38	122.63	99.69	111.16	4.71	27.09	19.31	7.78	28.71	2.06
		Jun-99	1.49	1.00	122.76	109.88	116.32	4.68	25.39	15.20	10.19	40.12	6.50
		Jul-99	1.55	0.65	122.81	115.75	119.28	4.68	26.40	10.38	16.02	60.69	14.50
		Aug-99	2.11	1.70	122.87	90.90	106.89	4.67	36.02	21.42	14.60	40.53	3.23
		Sep-99	1.66	1.50	122.84	134.84	128.84	4.65	28.09	27.93	0.16	0.58	1.76
		Oct-99	1.92	1.20	119.46	103.59	111.53	4.52	31.71	17.16	14.55	45.88	7.26
		Nov-99	1.94	1.45	125.45	112.13	118.79	4.74	33.61	22.45	11.17	33.22	4.78
		Dec-99	2.43	2.21	123.21	98.32	110.76	4.64	41.14	29.84	11.30	27.47	1.45
		Jan-00	2.05	2.04	110.11	108.55	109.33	4.33	32.34	31.86	0.48	1.49	0.04
		Feb-00	2.01	2.00	110.66	109.56	110.11	4.54	33.33	32.78	0.56	1.67	0.11
		Mar-00	1.91	1.88	123.17	119.81	121.49	5.15	35.92	34.37	1.55	4.31	0.29
3	3	Feb-99	2.22	1.43	122.60	---	122.60	4.53	*36.70*	*23.64*	13.06	35.59	7.27
		Mar-99	1.98	0.67	114.48	153.74	134.11	4.24	30.71	13.88	16.83	54.80	19.73
		Apr-99	1.80	1.09	91.97	134.30	113.13	3.45	22.70	20.20	2.50	11.00	7.74
		May-99	2.19	1.28	67.81	61.08	64.44	2.70	21.58	11.36	10.22	47.36	5.02
		Jun-99	1.50	0.93	116.49	87.44	101.96	4.26	23.30	10.75	12.55	53.88	6.47
		Jul-99	1.58	0.57	122.81	103.13	112.97	4.41	25.35	7.66	17.69	69.78	15.12
		Aug-99	2.13	1.60	122.87	132.64	127.75	4.41	34.21	27.78	6.43	18.80	4.76
		Sep-99	1.80	0.46	212.31	181.02	196.66	7.72	50.77	11.05	39.72	78.23	35.64
		Oct-99	1.92	0.92	138.87	80.05	109.46	5.05	35.43	9.74	25.70	72.53	10.79
		Nov-99	1.94	1.60	74.46	55.91	65.19	2.84	20.12	12.35	7.76	38.58	1.75
		Dec-99	2.34	3.01	66.90	79.16	73.03	2.60	22.13	33.73	-11.60	-52.42	-2.62
		Jan-00	2.05	2.03	102.14	57.73	79.93	4.11	30.67	17.21	13.46	43.88	0.09
		Feb-00	2.01	2.38	108.15	64.21	86.18	4.62	33.97	24.08	9.89	29.12	-2.26
		Mar-00	1.87	2.61	17.27	8.95	13.11	0.77	5.23	3.79	1.45	27.65	-0.71

EXHIBIT C.1-6
Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data from the ENR Test Cells, February 1999 - March 2000

Treatment*	Cell	Date	Density (g/cm³)	Solids (%)	Bulk Den (g/cm³)	Vol Solids (%)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
Period of Record										
1	13	1999-2000	1.18	40.82	0.48	42.25	319.4	273.0	6579.7	61266.7
2	8	1999-2000	1.93	73.39	1.42	10.11	830.7	792.7	125.6	4571.7
3	3	1999-2000	1.91	72.95	1.39	6.76	886.2	863.6	93.0	3573.3
Quarterly										
1	13	Qtr-3	0.91	41.28	0.38	--	424.1	419.1	--	--
		Qtr-4	1.23	40.67	0.50	42.25	318.1	257.4	1071.5	48850.0
		Qtr-5	1.26	42.07	0.54	--	276.2	223.9	3217.5	36150.0
		Qtr-6	1.27	38.73	0.49	--	281.4	224.0	15450.0	98800.0
		Qtr-7	--	--	--	--	--	--	--	--
2	8	Qtr-3	1.92	69.94	1.34	--	816.7	823.2	--	--
		Qtr-4	2.00	76.08	1.52	10.11	817.1	734.2	51.8	4915.0
		Qtr-5	1.88	74.05	1.40	--	808.6	744.1	135.0	2850.0
		Qtr-6	1.84	72.92	1.34	--	860.6	843.5	190.0	5950.0
		Qtr-7	2.05	72.50	1.49	--	858.8	858.5	--	--
3	3	Qtr-3	1.90	68.69	1.31	--	959.0	952.1	--	--
		Qtr-4	1.89	74.00	1.40	6.76	823.0	774.5	72.4	5170.0
		Qtr-5	1.88	73.58	1.39	--	901.9	851.9	76.5	1900.0
		Qtr-6	1.90	73.28	1.39	--	907.5	908.9	130.0	3650.0
		Qtr-7	2.00	74.25	1.49	--	852.5	858.6	--	--
Monthly										
1	13	Feb-99	0.90	51.15	0.43	--	380.5	384.1	--	--
		Apr-99	1.16	39.50	0.46	--	367.9	306.8	1071.5	48850.0
		May-99	1.25	42.00	0.52	42.25	300.1	237.7	--	--
		Jun-99	1.28	40.50	0.52	--	286.3	227.6	--	--
		Jul-99	1.23	48.50	0.61	--	295.5	243.6	--	--
		Aug-99	1.31	41.45	0.54	--	275.8	238.1	3217.5	36150.0
		Sep-99	1.25	36.25	0.45	--	257.4	189.9	--	--
		Oct-99	1.29	42.45	0.55	--	277.5	200.9	--	--
		Nov-99	1.25	35.00	0.44	--	285.4	247.1	15450.0	98800.0
		Dec-99	1.25	35.00	0.44	--	285.4	247.1	15450.0	98800.0
		Jan-00	--	--	--	--	--	--	--	--
		Feb-00	--	--	--	--	--	--	--	--
		Mar-00	--	--	--	--	--	--	--	--
2	8	Feb-99	1.91	70.08	1.34	--	863.4	861.1	--	--
		Apr-99	1.93	69.80	1.35	--	770.1	785.3	--	--
		May-99	1.93	70.00	1.35	--	832.7	737.0	51.8	4915.0
		Jun-99	2.04	81.00	1.65	10.11	802.3	744.5	--	--
		Jul-99	2.02	77.25	1.56	--	816.5	721.2	--	--
		Aug-99	1.70	67.00	1.14	--	859.7	803.3	--	--
		Sep-99	2.02	79.45	1.60	--	747.4	696.5	135.0	2850.0
		Oct-99	1.94	75.70	1.47	--	793.1	702.8	--	--
		Nov-99	1.71	73.25	1.25	--	953.6	845.1	--	--
		Dec-99	1.90	70.00	1.33	--	828.8	840.2	190.0	5950.0
		Jan-00	1.90	75.50	1.43	--	799.3	845.2	--	--
		Feb-00	2.08	76.50	1.59	--	740.4	749.3	--	--
		Mar-00	2.03	68.50	1.38	--	977.2	967.8	--	--
3	3	Feb-99	1.90	67.55	1.28	--	1034.4	1030.8	--	--
		Apr-99	1.90	69.83	1.33	--	883.6	873.4	--	--
		May-99	1.80	70.50	1.27	--	866.7	735.4	72.4	5170.0
		Jun-99	1.91	78.00	1.49	6.76	873.3	764.0	--	--
		Jul-99	1.96	73.50	1.44	--	729.1	824.0	--	--
		Aug-99	1.73	66.50	1.15	--	959.5	892.8	--	--
		Sep-99	1.98	77.65	1.54	--	903.8	877.5	76.5	1900.0
		Oct-99	1.94	76.60	1.48	--	842.5	785.3	--	--
		Nov-99	1.90	76.40	1.45	--	1017.2	962.8	--	--
		Dec-99	1.85	71.00	1.32	--	821.4	860.9	130.0	3650.0
		Jan-00	1.95	73.00	1.42	--	883.8	903.1	--	--
		Feb-00	2.00	74.00	1.48	--	832.6	803.2	--	--
		Mar-00	2.00	74.50	1.49	--	872.4	914.1	--	--

* Treatment 1 was operated as a batch system from January - March 2000; these data are presented in Appendix O.

EXHIBIT C.1-7
Non-Reactive Phosphorus Data Summary for PSTA Test Cell Sediments, February 1999 - March 2000

Treatment	Soil	Sampling Date	Moisture %	TP (mg/kg)	$NaHCO_3$ Pi (mg/kg)	$NaHCO_3$TP (mg/kg)	Labile Po (mg/kg)	HClPi (mg/kg)	Alkali Hydrolyz Po (NaOH TP) (mg/kg)	Residual Po (mg/kg)
1	PE	9/30/99	29.45	450.9	13.97	17.42	3.45	108.6	-3.4	34.7
	PE	9/30/99	48.56	275.2	20.02	21.08	1.06	156.0	-7.5	45.4
	PE	12/28/99	59.8	291.5	14.54	23.51	8.97	250.9	-25.61	67.64
	PE	3/6/00	48.4	383.6	44.54	45.67	1.13	236.2	-25.5	60.5
	PE	6/15/00	--	331.2	31.28	39.02	7.74	191.4	-13.2	56.3
2	SR	9/30/99	18.01	850.7	3.66	4.08	0.42	489.5	4.3	94.4
	SR	12/28/99	23.8	766.9	2.54	3.58	1.05	840.2	-29.61	46.23
	SR	12/28/99	24.3	820.3	2.34	2.60	0.25	797.7	-28.76	51.16
	SR	3/6/00	20.8	920.9	1.86	4.73	2.87	923.3	-35.1	69.2
	SR	3/6/00	22.1	841.2	3.00	5.42	2.41	817.8	-28.3	54.3
3	SR	9/30/99	18.53	844.2	4.16	4.54	0.38	766.7	11.6	60.1
	SR	12/28/99	22.6	858.0	2.70	3.68	0.98	942.5	-34.21	54.13
	SR	3/6/00	18.1	705.2	3.93	4.83	0.90	693.3	-19.8	48.4

Notes:

Data represent composite samples collected from the 1/3 and 2/3 walkways within each Test Cell.
Identical sampling dates include duplicate results

EXHIBIT C.1-8

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover Estimates for the PSTA Test Cells, February 1999 - March 2000

Treatment[a]	Cell	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover
Period of Record										
1	13	1999-2000	29%	3%	20%	0%	71%	32%	91%	124%
2	8	1999-2000	4%	3%	15%	0%	32%	7%	47%	54%
3	3	1999-2000	5%	4%	17%	0%	19%	8%	36%	44%
Quarterly										
1	13	Qtr-3	4%	4%	4%	0%	22%	8%	26%	34%
		Qtr-4	10%	0%	14%	0%	94%	11%	108%	119%
		Qtr-5	69%	2%	31%	0%	96%	71%	127%	197%
		Qtr-6	48%	9%	46%	0%	99%	57%	144%	201%
		Qtr-7	--	--	--	--	--	--	--	
2	8	Qtr-3	2%	2%	2%	0%	2%	4%	4%	9%
		Qtr-4	3%	0%	8%	0%	15%	3%	24%	27%
		Qtr-5	3%	1%	22%	0%	64%	4%	86%	91%
		Qtr-6	8%	4%	27%	0%	59%	11%	86%	97%
		Qtr-7	4%	14%	21%	0%	28%	17%	48%	66%
3	3	Qtr-3	3%	2%	2%	0%	3%	5%	5%	10%
		Qtr-4	4%	0%	14%	0%	19%	4%	33%	37%
		Qtr-5	10%	1%	20%	0%	28%	10%	48%	58%
		Qtr-6	7%	5%	31%	0%	31%	11%	62%	74%
		Qtr-7	1%	13%	24%	0%	18%	14%	42%	55%
Monthly										
1	13	Feb-99	1%	0%	2%	0%	9%	1%	11%	12%
		Mar-99	1%	0%	2%	0%	13%	1%	16%	17%
		Apr-99	14%	14%	8%	0%	54%	28%	62%	90%
		May-99	3%	0%	8%	0%	97%	3%	105%	108%
		Jun-99	11%	0%	18%	0%	93%	11%	110%	121%
		Jul-99	18%	1%	18%	0%	93%	18%	110%	128%
		Oct-99	69%	2%	31%	0%	96%	71%	127%	197%
		Nov-99	83%	5%	61%	0%	97%	87%	158%	245%
		Dec-99	14%	13%	31%	0%	100%	27%	131%	158%
		Jan-00	--	--	--	--	--	--	--	--
		Feb-00	--	--	--	--	--	--	--	--
		Mar-00	--	--	--	--	--	--	--	--
2	8	Feb-99	0%	0%	1%	0%	0%	0%	1%	2%
		Mar-99	1%	0%	2%	0%	1%	1%	3%	4%
		Apr-99	8%	8%	3%	0%	8%	15%	11%	26%
		May-99	2%	0%	3%	0%	11%	3%	14%	17%
		Jun-99	3%	0%	11%	0%	18%	3%	28%	31%
		Jul-99	3%	1%	11%	0%	18%	4%	28%	32%
		Oct-99	3%	1%	22%	0%	64%	4%	86%	91%
		Nov-99	14%	2%	26%	0%	89%	17%	115%	132%
		Dec-99	3%	2%	18%	0%	69%	5%	87%	92%
		Jan-00	6%	6%	38%	0%	18%	12%	55%	67%
		Feb-00	3%	14%	18%	0%	38%	17%	55%	72%
		Mar-00	5%	14%	24%	0%	18%	18%	42%	60%
3	3	Feb-99	1%	0%	1%	0%	0%	1%	1%	2%
		Mar-99	1%	1%	2%	0%	2%	2%	4%	6%
		Apr-99	8%	8%	3%	0%	8%	15%	11%	26%
		May-99	5%	0%	8%	0%	21%	5%	28%	33%
		Jun-99	3%	0%	18%	0%	18%	3%	35%	38%
		Jul-99	3%	1%	18%	0%	18%	4%	35%	39%
		Oct-99	10%	1%	20%	0%	28%	10%	48%	58%
		Nov-99	8%	2%	46%	0%	61%	10%	107%	117%
		Dec-99	3%	2%	18%	0%	24%	6%	42%	47%
		Jan-00	9%	9%	31%	0%	8%	19%	38%	57%
		Feb-00	2%	16%	24%	0%	18%	18%	42%	59%
		Mar-00	0%	9%	24%	0%	18%	9%	42%	51%

[a] Treatment 1 was operated as a batch system from January - March 2000; these data are presented in Appendix D.

EXHIBIT C.1-9

Period-of-Record, Quarterly, and Monthly Summaries of Periphyton Data from the ENR Test Cells, February 1999 - March 2000

Treatment[a]	Cell	Date	Periphyton Biomass (g/m²) Dry Wt	Periphyton Biomass (g/m²) Ash Wt	Periphyton Biomass (g/m²) AFDW	Ca (g/m²)	Chl_a (corr) (mg/m²)	Pheo_a (mg/m²)	TP (g/m²)	TIP (g/m²)	TKN (g/m²)	Blue Green Algae (# cells/m²)*10⁶	Blue Green Algae (# taxa)	Diatoms (# cells/m²)*10⁶	Diatoms (# taxa)	Green Algae (# cells/m²)*10⁶	Green Algae (# taxa)	Other Taxa (# cells/m²)*10⁶	Other Taxa (# taxa)	Total Taxa (# cells/m²)*10⁶	Total Taxa (# taxa)	Biovolume (cm³/m²)	Evenness	SWDI
Period of Record																								
Period of Record																								
1	13	1999- 2000	2065 9	1348.1	711 4	299 6	207 5	39.7	0 838	0 199	7 59	54681.3	8.9	2032 7	9 8	5547.4	9.0	103 8	1.0	62306 3	28.0	20 55	0.701	3 27
2	8	1999- 2000	535.0	416 7	118 4	96 6	50 7	8.1	0.266	0 097	3 98	112360.6	12.7	3857 6	10 5	1626 3	5.9	119 5	2 5	117873 5	29 7	11 55	0.718	3.48
3	3	1999- 2000	461.3	344 3	117.2	66 8	29 9	6 4	0 175	0.043	0 99	36486 2	11.7	1477 0	10 8	1772 0	7 4	134.0	2 6	39453.5	31 0	3 74	0 736	3 63
Quarterly																								
1[a]	13	Qtr-3	3236 1	2014 4	1023 6	544 8	47.1	22.0	1 605	0 320	–	5752.3	1 5	1774 9	10 5	780.9	3 0	0 0	0 0	6308 1	15.0	1.37	0 793	2 99
		Qtr-4	3019 6	2043.3	981 9	405 5	279 9	79.2	1 145	0 334	9 21	25712.5	6.7	3859 1	15 7	9511 9	8.8	0 0	0 0	39083 4	32 2	21.36	0 700	3 48
		Qtr-5	1360 5	868.7	492 9	203 5	249 2	22.0	0 458	0 096	8 64	71167 7	12 5	367.4	4 3	5105 6	10.7	101.2	0 9	76732 1	28 2	14 80	0 694	3.33
		Qtr-6	523 2	358.3	164 9	87 5	197.0	24 5	0 181	0.031	4.91	122333 8	14 3	2048.8	8 3	5029 8	11 0	174.9	1 5	129600 0	34 3	47 13	0 625	3 16
		Qtr-7	--	--	--	--	--	–	--	--	--	–	--	--	--	--	--	--	–	--	--	–	--	–
2	8	Qtr-3	521 0	418.4	103 1	140 5	13 0	1.3	0 222	0 077	–	4024.7	4.0	817 2	12 5	1417.3	11 0	58 4	3 3	6281 1	28 5	3 63	0.665	3.19
		Qtr-4	744 2	576 2	168.0	131.1	27 8	6 9	0 512	0.268	1 68	18075 2	11 8	2660 8	15.7	1169 0	7.8	12 8	0.3	21913 4	35 5	18 78	0 741	3.61
		Qtr-5	599 4	451 6	147 8	71 9	38.5	5 4	0 129	0.038	4 17	37915 7	14 2	2266.8	8 3	1491 7	5 7	158 5	2 8	41766.5	30 0	3 21	0 722	3 54
		Qtr-6	415 4	334 5	81 0	79 1	59.7	19.7	0 291	0 043	6 10	148695 3	16 5	3541 0	8 5	1903.6	3 2	25.5	0 5	154148 4	28.3	13.57	0 702	3 37
		Qtr-7	346 2	267 4	80 8	76 7	125.6	0.4	0 239	0 033	–	419290 2	14 8	11554 3	6 8	2306.9	2.5	0 0	0 0	433151 4	24.0	18.14	0.744	3 36
3	3	Qtr-3	399 5	323 0	77 2	130 3	12 9	6.6	0 224	0 028	–	1480.9	4 3	557 0	12 3	661.5	10.0	165 2	2 8	2794 2	28 3	0 62	0 773	3.69
		Qtr-4	587 2	438 5	148 6	77 1	26 5	13 5	0.288	0 104	0 64	14216 6	11.3	1443 0	15 2	1235 5	8.2	48 0	1.8	16921.7	35 5	2.61	0 743	3.62
		Qtr-5	642.2	484.3	158.0	50 4	14 6	3 0	0.073	0 019	1 85	26083 8	12.8	958.1	7 5	673 0	6.5	150.7	2 9	27633 5	29 2	1 82	0 693	3.37
		Qtr-6	221 1	156 1	65.5	24.3	36.2	3 5	0 068	0.010	0 35	18413 2	13 2	1503.1	9 4	2068 8	3 8	0.0	0 0	20475.4	26.4	4 41	0 742	3 49
		Qtr-7	363 2	249 3	113 9	57 9	66.9	2 2	0 232	0 048	--	143090 7	16 3	3193 8	9 8	4964.8	9 3	0 0	0 0	151063.0	35.3	6 62	0 748	3 83
Monthly																								
1	13	Feb-99	1718.1	1090.7	627 4	338 0	65 9	14.6	0.672	0 041	--	61.3	0 5	397.8	8 0	196 4	3.0	0 0	0.0	654.5	11 5	0 24	0 690	3.05
		Apr-99	4754 1	2938 1	1816 1	751.7	28.3	29 4	2 338	0 598	--	11443 3	2 5	3152 0	13.0	1386 4	3 0	0.0	0 0	15961 8	18 5	2 50	0 696	2 93
		May-99	5040 6	3351 8	1688 8	641 9	211.6	112.4	1 635	0 716	9.21	18197 7	4 0	6431 9	24.5	6058 5	10 5	0.0	0 0	30698.0	39.0	18.38	0 698	3 68
		Jun-99	2677 3	1914 5	762 8	349 9	419 3	106 3	1.139	0 044	--	42063.3	7 5	4137 7	13 0	20361.6	9.0	0 0	0.0	68562 6	29.5	29.75	0 710	3.45
		Jul-99	1340.9	863 6	494 3	224.7	208 7	18 9	0.662	0 243	--	16876 5	6 5	1007 7	9 5	2115 5	10.0	0 0	0.0	19999 6	28 0	15 98	0 692	3.32
		Aug-99	1083.7	751 7	335.4	249.2	121.3	6 6	0.402	0.141	--	16782 1	9 0	338.8	4 5	3194 5	8.5	0.0	0 0	22315.3	22 0	13 01	0 690	3.09
		Sep-99	1084 5	774 1	310 4	144.2	234.3	39 7	0 321	0.076	8.64	42576 2	14 5	543 4	5.0	6172 5	11 5	0 0	0 0	49294.1	31 0	20 75	0 765	3 79
		Oct-99	1913 2	1080 2	833 1	171 2	391.6	19.9	0.651	0 072	--	152142.7	14 0	219 8	3 5	5949 8	12 0	274 5	2.0	158586 9	31.5	10 63	0 628	3 12
		Nov-99	696 0	485 3	210.7	96 0	144 7	13.5	0.280	0 040	--	105526.3	13.5	703 2	4 0	6425 2	10 5	174 9	1.5	112829 6	29 5	39 66	0 643	3.11
		Dec-99	350.5	231.4	119 1	79 0	249 3	35 5	0.082	0.022	4 91	139141 4	15.0	3394 5	12 5	3634 5	11 5	0.0	0 0	146170.3	39 0	54 59	0 607	3.21
		Jan-00	--	--	–	--	--	--	--	--	--	–	--	--	--	–	--	--	--	--	--	–	--	--
		Feb-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	–	--
		Mar-00	--	--	--	--	--	--	--	--	--	--	–	--	--	--	--	--	--	–	--	--	--	--
2	8	Feb-99	339 6	300.1	39 5	187 4	22 4	1 8	0.157	0 010	--	2210.7	3.5	719 0	14 0	790 6	6.0	0 0	0.0	3720 3	25 5	5 82	0.697	3.23
		Apr-99	702.5	536.6	166 8	93.6	3.6	0 9	0.287	0.145	–	5838 6	4 5	915 4	11 0	2044 0	14.0	87 3	4 0	8841 8	31 5	1 45	0 634	3 16
		May-99	952 5	752 2	200 3	175.6	35.5	17.7	0 705	0.372	1.68	8660 9	10 0	1921 1	23.5	778 4	8 0	0.0	0 0	11360.4	41.5	8 52	0 718	3 88
		Jun-99	798 6	622 7	175 9	131 1	24 0	2.2	0 584	0 302	–	28869.4	12 0	3743 3	14 5	1367.7	8.5	0 0	0 0	34000 4	35 0	45.37	0.746	3 83
		Jul-99	481 4	353 6	127 8	66 7	23 9	0.7	0.247	0 129	--	16675.4	13.5	2317 6	9 0	1361 1	7.0	25 2	0 5	20379 4	30 0	2 43	0 759	3 73
		Aug-99	460.8	369 1	91.7	78.1	21 3	0.6	0.077	0.051	–	33310 0	14.0	4598.4	11 0	646 4	6 0	24 4	0 5	38579.1	31.5	3.95	0 703	3.49
		Sep-99	711 8	561 8	150.0	92.7	86.8	13 5	0 255	0.056	4 17	65353 8	13 5	1610.3	6.0	3492 3	6 5	166.1	1 5	70622.4	27.5	4.90	0 723	3 46
		Oct-99	625 6	423 8	201 7	38 8	7.3	2.1	0 054	0.008	--	15083.2	15 0	591 6	8 0	336.6	4 5	62 1	3 5	16103.9	31.0	0.78	0.739	3 67
		Nov-99	440 5	341 2	99 3	48 5	10 8	1.8	0 044	0 009	–	24718.6	13 5	1022 3	6 5	362 0	3.5	25 5	0 5	26128 4	24 0	1.89	0.752	3.45
		Dec-99	771.8	637 8	134 0	147 3	109 6	55 0	0 704	0 101	6 10	271493.7	17 0	6137 6	10 5	4388 9	3.5	0 0	0 0	282020 2	31.0	31 57	0 632	3 13
		Jan-00	161 1	127 8	33.3	41.6	59.1	8 0	0.124	0 019	--	149873 6	19 0	3463.0	8 5	960 0	2 5	0 0	0 0	154296.6	30.0	7 25	0 723	3 55
		Feb-00	394 0	296 3	97.8	75.6	150.5	0 0	0 219	0.004	--	268380 6	15 0	7252 7	7 5	2784 2	4 0	0 0	0 0	278417 5	26.5	12.69	0 762	3 51
		Mar-00	302 5	238 6	63 9	77 9	100.7	0.7	0 258	0 061	–	570199.6	14.5	15855 9	6 0	1829.6	1.0	0 0	0.0	587885 3	21 5	23 58	0 727	3.21
3	3	Feb-99	413 2	353 0	60 2	167 7	23 8	15.3	0 272	0 018	--	1599.1	3 5	782 8	12 0	346.4	6.0	6 6	0 5	2734 9	22 0	0 54	0.787	3.51
		Apr-99	385 7	293 0	84 2	44 2	1 9	1.9	0.152	0.043	--	1362 7	5 0	331 2	12 5	976 7	14.0	182.9	3 0	2853.4	34 5	1 10	0 759	3.87
		May-99	307 2	199 1	108 2	35 0	13.7	4 0	0.087	0 033	0 64	4301.5	6 5	962 0	18 0	896 0	11.0	23.6	1 5	5983.1	39 0	1 23	0 725	3 83
		Jun-99	990 6	765 4	225 1	137 5	40.6	30.3	0.603	0 210	--	18152 8	11.5	2056 5	17 0	1175 9	6 0	0.0	0 0	21385.2	34.5	3 55	0 714	3 64
		Jul-99	463 8	351 0	112 4	58 7	25.4	8 2	0.174	0 070	--	20195.5	14.0	1310 4	10 5	1834 6	7.5	56.3	1 0	23396.8	33 0	3 05	0 792	3.99
		Aug-99	480 4	382 5	97.9	42 9	27 8	3 6	0.053	0.025	--	45884 2	17.0	2189 4	10.5	1085 9	8 0	56.5	1 0	50216.1	36.5	3 00	0 753	3 90
		Sep-99	618.9	505 4	113.9	66.3	5 7	0 7	0.114	0 019	1.85	12434 9	10 5	294 2	5.0	630.8	7.5	120 2	3.5	13480 2	26 5	1.03	0.645	3.05
		Oct-99	827.3	565.1	262.2	49.6	10.4	4 8	0.053	0.014	--	18932.3	11 0	390 7	7 0	302.4	4.0	148 9	2.5	19804 3	24 5	1 44	0 682	3.14
		Nov-99	499 2	347 9	152 5	52 7	64.6	7 1	0 135	0 016	--	27733 4	12.5	3209 1	11 5	4952 5	5.5	0.0	0 0	35895.0	29.5	9 43	0 731	3.55
		Dec-99	51 5	39 1	12 4	7 7	2 0	0 5	0.029	0 007	0 35	6503 3	12.0	288.1	11.0	41 2	2 0	0.0	0 0	6832.6	25.0	1 66	0.720	3.34
		Jan-00	27 7	22 8	5 0	4 3	4 9	1 4	0.020	0.005	--	14047 9	14 5	404 6	6.5	198 8	3 0	0 0	0.0	10877 2	24 0	0 75	0.765	3.51
		Feb-00	317 9	223 0	94 9	36 9	39 5	0.2	0 183	0 024	--	66597 0	17 0	1361 2	11 0	2182.7	10 5	0 0	0.0	70141.0	38 5	3 34	0 736	3 87
		Mar-00	408 6	275 7	132 9	78 9	94 4	4 2	0 260	0.072	--	219584 4	15 5	5026 4	8.5	7746 9	8.0	0.0	0.0	231985 1	32 0	9 90	0 760	3 80

Notes:

SWDI = Shannon-Weaver Diversity Index

[a] STC-1 was operated as a batch system from January - March 2000; these data are presented in Appendix D

EXHIBIT C.1-10

Non-Reactive Phosphorus Data Summary for PSTA Test Cell Periphyton, February 1999 - March 2000

Treatment	Soil	Sampling Date	Moisture %	TP mg/kg	NaHCO3 Pi mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPi mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg	Comments
1	PE	06/15/1999	--	611.8	8 39	50 90	42.50	124 3	11 6	139 5	See Footnote
	PE	06/15/1999	--	554.2	4.20	37.70	33.50	116 6	-1.3	129.8	See Footnote
	PE	10/08/1999	93.9	370.6	2 23	342.12	339.88	187.8	33.23	80.70	
	PE	12/28/1999	96.3	349 4	2.32	428.17	425 85	104.3	44.32	88 59	
	PE	12/28/1999	95 9	253.0	2.44	817 38	814 94	224.7	-1 78	123.00	
	PE	03/06/2000	94 7	431.4	1.48	190 02	188 54	63 0	37 0	65.6	
2	SR	10/08/1999	96 2	182 2	2.61	180 56	177 95	55 5	28 96	62 97	
	SR	10/08/1999	96 6	345 1	2.09	199 86	197 78	71.6	47 53	71 30	
	SR	12/28/1999	86 1	423 7	1.57	83 51	81.94	143 1	17.12	56 93	
	SR	03/06/2000	91.4	620 4	1 80	98 56	96 76	429.5	27 3	90.0	
	SR	03/06/2000	90.2	472 1	1 36	105.90	104.54	217.3	43.9	72.5	
3	SR	06/15/1999	--	678 3	3 16	38 30	35.10	328 8	4 5	--	See Footnote
	SR	10/08/1999	94 9	358.7	1 92	245.06	243.14	53.9	33 01	47.67	
	SR	12/28/1999	94.5	332.9	3 63	282 99	279.36	87.0	23 11	93.97	
	SR	03/06/2000	91.6	1255.4	3.21	228.61	225.40	363 2	33.4	125 5	

Notes:

From Comment section in Report NO. 99-9

Several problems were encountered in analyzing periphyton samples for reactive and non reactive phosphorus forms

1) Water samples provided to us contained small amounts of periphyton.

2) On a dry weight basis, < 100 mg of sample was available for all analysis

3) Use of small samples (< 20-mg dry weight basis) in sequential extraction scheme results in serious carryover effects. This results in unrealistic values for each of the P fractions

This problem was reported to Dr R L. Knight Recommendation was made to provide a larger sample of bulk periphyton for analysis

Data reported in Report 99-9 for periphyton P fractionation should be treated with caution. Our recommendation is not to use these data in developing nay conclusions from the experiment.

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 X 10^{-5}), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
ACH CHI SU	4	ACHNANTHES CHILENSIS V SUBAEQUALIS	--	--	--
ACH EXI	4	ACHNANTHES EXIGUA	104.3	43.4	28.3
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	116.1	213.2	302.8
AMP ACUTI	4	AMPHORA ACUTIUSCULA	--	--	20.4
AMP HOL	4	AMPHORA HOLSATICA	53.5	54.8	194.3
AMP LIN	4	AMPHORA LINEOLATA?	--	--	29.4
AMP OVA	4	AMPHORA OVALIS	321.5	14.8	50.4
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	--	--	--
AMP PEL	4	AMPHIPLEURA PELLUCIDA	--	--	--
AMP SAB	4	AMPHORA SABINIANA?	--	--	--
AMP VEN	4	AMPHORA VENETA	111.2	54.8	40.5
ANA OSC	1	ANABAENA OSCILLARIOIDES	--	--	--
ANK FAL	3	ANKISTRODESMUS FALCATUS	52.2	60.1	41.1
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	--	51.9	27.7
ANK SPI	3	ANKISTRODESMUS SPIRALIS	188.2	168.4	217.1
APH CON	1	APHANOCAPSA CONFERTA	--	11520.9	2870.5
APH DEL	1	APHANOCAPSA DELICATISSIMA	9519.3	5786.8	6469.4
APH ELA	1	APHANOCAPSA ELACHISTA	--	--	--
APH GRE	1	APHANOCAPSA GREVILLEI	--	9786.8	12939.6
APH INC	1	APHANOCAPSA INCERTA	--	29.3	--
APH PLA	1	APHANOCAPSA PLANCTONICA?	1349.5	4697.3	1342.5
APHA CLA	1	APHANOTHECE CLATHRATA	--	6098.4	--
APHA MIC	1	APHANOTHECE MICROSCOPICA	--	--	--
APHA NID	1	APHANOTHECE NIDULANS	--	--	--
APHA SAX	1	APHANOTHECE SAXICOLA	--	--	--
APHA SMI	1	APHANOTHECE SMITHII	5686.6	11445.1	3356.6
APHA STA	1	APHANOTHECE STAGNINA	1898.1	12890.8	7439.5
APHA STA	1	APHANOTHECE STAGNINA?	1067.6	1694.3	1336.8
APHA VAR	1	APHANOTHECE VARIABILIS?	--	--	--
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	3361.8	--
ART GOM	1	ARTHOSPIRA GOMONTIANA?	--	--	--
ART GOM	1	ARTHROSPIRA GOMONTIANA?	--	--	4534.1
ART JEN	1	ARTHROSPIRA JENNERI	--	--	--
ART TEN	1	ARTHROSPIRA TENUIS?	--	--	--
AUL ITA TE	4	AULACOSEIRA ITALICA V TENUISSIMA	--	--	--
AUL LAX	1	AULOSIRA LAXA?	1063.7	--	--
BAC PAR	4	BACILLARIA PARADOXA	--	--	--
BOT SUD	3	BOTRYOCOCCUS SUDETICUS	--	740.7	668.6
BRA VIT	4	BRACHYSIRA VITREA	--	22.5	29.4
CAP CAR	4	CAPONEA CARIBBEA	--	--	--
CHA ENS	3	CHARACIUM ENSIFORME	148.6	--	67.7
CHLO HUM	3	CHLOROCOCCUM HUMICOLA	--	--	32.5
CHR DIS	1	CHROOCOCCUS DISPERSUS	2046.0	836.6	1952.0
CHR DIS MI	1	CHROOCOCCUS DISPERSUS V MINOR	--	433.8	1043.2
CHR DIST	1	CHROOCOCCUS DISTANS	1358.7	51.1	793.8
CHR LIM	1	CHROOCOCCUS LIMNETICUS	--	--	130.3
CHR MIN	1	CHROOCOCCUS MINUTUS	881.5	1176.5	1308.8
CHR MINI	1	CHROOCOCCUS MINIMUS	1531.8	4926.6	2058.0
CHR PLA	1	CHROOCOCCUS PLANCTONICUS	--	1049.9	246.9
CHR PRE	1	CHROOCOCCUS PRESCOTTII	455.4	960.1	283.8
CHR TUR	1	CHROOCOCCUS TURGIDUS	109.4	181.3	210.9
CLO ACE	3	CLOSTERIUM ACEROSUM	--	12.6	--
CLO ACU	3	CLOSTERIUM ACUTUM	68.6	--	--
CLO DIA	3	CLOSTERIUM DIANAE	104.0	--	--
CLO INC	3	CLOSTERIUM INCURVUM	122.0	--	119.9
CLO LUN MA	3	CLOSTERIUM LUNULA V MASSARTII	--	14.9	--
CLO PAR	3	CLOSTERIUM PARVULUM	--	137.1	--
COC PLA	4	COCCONEIS PLACENTULA	--	--	--
COC PLA EU	4	COCCONEIS PLACENTULA V EUGLYPTA	--	--	--
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	105.3	--	--
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	--	474.1	--
COE MIC	3	COELASTRUM MICROPORUM	--	37.5	--
COE SPH	3	COELASTRUM SPHAERICUM	1207.7	315.4	615.5
COS ANG CO	3	COSMARIUM ANGULOSUM V CONCINNUM	--	--	--
COS BAC	3	COSMARIUM BACCATUM	--	--	--

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m² X 10⁻⁶), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
COS BLY HO	3	COSMARIUM BLYTTII V HOFFII?	--	--	--
COS BOT	3	COSMARIUM BOTRYTIS	--	54.2	13.0
COS CON	3	COSMARIUM CONTRACTUM	215.7	--	--
COS GRA	4	COSCINODISCUS GRANII	--	--	--
COS GRAN	3	COSMARIUM GRANATUM	--	--	--
COS IMP	3	COSMARIUM IMPRESSULUM	--	--	--
COS MON	3	COSMARIUM MONILIFORME	--	--	56.8
COS NIT JA	3	COSMARIUM NITIDULUM V JAVANICUM	992.3	--	--
COS ORB	3	COSMARIUM ORBICULATUM	--	--	--
COS ORN	3	COSMARIUM ORNATUM	122.3	--	--
COS ORT	3	COSMARIUM ORTHOSTICHUM	--	--	--
COS POK	3	COSMARIUM POKORNYANUM	--	--	--
COS POR	3	COSMARIUM PORTIANUM	--	--	--
COS PUN	3	COSMARIUM PUNCTULATUM	58.5	--	--
COS REN	3	COSMARIUM RENIFORME	56.7	54.8	29.8
COS SUBR	3	COSMARIUM SUBRENIFORME	395.1	92.5	81.7
COS TEN	3	COSMARIUM TENUE	--	--	--
COS TRI	3	COSMARIUM TRILOBULATUM	113.7	50.4	--
COS TUB	3	COSMOCLADIUM TUBURCULATUM	415.2	--	--
COS UND MI	3	COSMARIUM UNDULATUM V MINUTUM	--	--	--
COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	25.2	--	--
CRU API	3	CRUCIGENIA APICULATA	342.9	154.8	568.1
CRU CRU	3	CRUCIGENIA CRUCIFERA	927.5	214.2	--
CRU QUA	3	CRUCIGENIA QUADRATA	--	72.7	43.2
CRU TET	3	CRUCIGENIA TETRAPEDIA	--	--	--
CRY ERO	11	CRYPTOMONAS EROSA	--	68.1	31.7
CRY OVA	11	CRYPTOMONAS OVATA	29.2	21.0	20.4
CYC MEN	4	CYCLOTELLA MENEGHINIANA	12.2	19.5	32.3
CYL CLO	4	CYLINDROTHECA CLOSTERIUM	73.5	42.1	26.2
CYL MIN	1	CYLINDROSPERMUM MINUTUM?	--	--	--
CYL MUS	1	CYLINDROSPERMUM MUSCICOLA?	1472.4	1714.4	--
CYL STA	1	CYLINDROSPERMUM STAGNALE	--	3017.3	--
CYM ASP	4	CYMBELLA ASPERA	--	--	--
CYM MIC	4	CYMBELLA MICROCEPHALA	322.8	118.8	96.7
CYM MIN PS	4	CYMBELLA MINUTA V PSEUDOGRACILIS	--	83.6	35.4
DEN KUE	4	DENTICULA KUETZINGII	--	--	--
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	320.0	--	64.1
DIN CYL	5	DINOBRYON CYLINDRICUM	--	--	--
DIN SER	5	DINOBRYON SERTULARIA	--	--	--
DIP ELL	4	DIPLONEIS ELLIPTICA	42.9	23.1	7.8
DIP OBL	4	DIPLONEIS OBLONGELLA	122.3	--	56.8
DIP OVA	4	DIPLONEIS OVALIS	113.4	168.9	81.5
DIP PARM	4	DIPLONEIS PARMA	--	23.1	16.2
DIP SMI	4	DIPLONEIS SMITHII	--	--	--
ELA GEL	3	ELAKATOTHRIX GELATINOSA	--	51.0	124.5
ENC EVE	4	ENCYONEMA EVERGLADIANUM	104.0	1159.8	216.9
ENC HEB	4	ENCYONEMA HEBRIDICA	--	--	--
ENC LUN	4	ENCYONEMA LUNATUM	333.0	24.0	14.7
ENC MIN	4	ENCYONEMA MINUTUM	73.5	--	10.5
ENC MUE	4	ENCYONEMA MUELLERI	--	--	--
ENC SIL	4	ENCYONEMA SILESIACUM	--	26.7	--
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	--	--	--
EPI ADN	4	EPITHEMIA ADNATA	239.6	--	--
EUA ABR MI	3	EUASTRUM ABRUPTUM F MINOR	--	--	--
EUA BID	3	EUASTRUM BIDENTATUM	54.5	--	56.5
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	29.2	51.7	56.8
EUA TUR ST	3	EUASTRUM TURNERI V STRICTUM	--	--	--
EUC MIN	1	EUCAPSIS MINOR	548.6	--	--
EUD ELE	3	EUDORINA ELEGANS	--	--	--
EUG ACU	10	EUGLENA ACUS	--	21.0	--
EUG OXY MI	10	EUGLENA OXYURIS V MINOR	--	--	22.8
EUN PEC	4	EUNOTIA PECTINALIS	73.5	--	--
EUN PEC MI	4	EUNOTIA PECTINALIS V MINOR	--	--	--
FRA CAP	4	FRAGILARIA CAPUCINA	--	--	--
FRA CAP GR	4	FRAGILARIA CAPUCINA V GRACILIS	--	--	--

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 X 10^{-5}), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
FRA CRO	4	FRAGILARIA CROTONENSIS	--	1219.7	--
FRA DEL	4	FRAGILARIA DELICATISSIMA	122.3	--	109.6
FRA FAM	4	FRAGILARIA FAMELICA	358.2	154.9	48.2
FRA FAS	4	FRAGILARIA FASCICULATA?	91.1	917.4	1025.0
FRA NAN	4	FRAGILARIA NANANA?	--	609.9	--
FRA OVA	3	FRANCEIA OVALIS	--	--	--
FRA SYN	4	FRAGILARIA SYNEGROTESCA	390.5	493.0	164.9
FRA TEN	4	FRAGILARIA TENERA	--	--	--
FRA ULN	4	FRAGILARIA ULNA	111.2	--	29.8
G ACH	4	ACHNANTHES SP	480.0	--	--
G AMP	4	AMPHORA SP	80.9	36.6	--
G ANA	1	ANABAENA SP	2915.4	2535.1	389.4
G ANAB	1	ANABAENOPSIS SP	179.6	400.0	--
G APH	1	APHANOCAPSA SP	--	--	--
G APHA	1	APHANOTHECE SP	--	1089.3	--
G BUL	3	BULBOCHAETE SP	--	--	--
G CHI	11	CHILOMONAS SP	104.0	--	25.1
G CHL	3	CHLORELLA SP	--	--	--
G CHLA	3	CHLAMYDOMONAS SP	--	50.5	183.0
G CHLR	3	CHLOROGONIUM SP	--	--	--
G CHR	1	CHROOCOCCUS SP	--	--	--
G CHRM	11	CHROOMONAS SP	29.2	61.0	122.7
G CLO	3	CLOSTERIUM SP	--	--	--
G COS	3	COSMARIUM SP	105.4	177.8	116.6
G CRY	11	CRYPTOMONAS SP	90.7	44.2	134.1
G CYC	4	CYCLOTELLA SP	--	24.7	10.5
G CYL	1	CYLINDROSPERMUM SP	3966.8	8293.7	4577.7
G CYM	4	CYMBELLA SP	--	--	--
G DIP	4	DIPLONEIS SP	--	--	10.5
G EUA	3	EUASTRUM SP	--	--	--
G EUG	10	EUGLENA SP	277.5	46.1	37.5
G EUN	4	EUNOTIA SP	--	--	5.1
G FRA	4	FRAGILARIA SP	205.7	17.0	--
G GLO	1	GLOEOCAPSA SP	823.0	654.1	1119.6
G GLOE	3	GLOEOCYSTIS SP	--	--	--
G GLOT	1	GLOEOTHECE SP	--	--	--
G GOMP	1	GOMPHOSPHAERIA SP	--	--	--
G GYR	4	GYROSIGMA SP	--	25.4	10.5
G LYN	1	LYNGBYA SP	7491.9	653.7	255.7
G LYN ME	1	LYNGBYA SP (MEDIUM)	--	--	--
G LYN SM	1	LYNGBYA SP (SMALL)	15384.3	5479.4	2248.6
G MES	3	MESOTAENIUM SP?	--	--	384.1
G MICRO	1	MICROCYSTIS SP	--	--	--
G MOU	3	MOUGEOTIA SP	--	--	--
G NAV	4	NAVICULA SP	220.6	--	31.2
G NAV SM	4	NAVICULA SP (SMALL)	122.3	--	--
G NIT	4	NITZSCHIA SP	1579.0	138.1	46.0
G NIT ME	4	NITZSCHIA SP (MEDIUM)	211.8	33.7	20.6
G NIT SM	4	NITZSCHIA SP (SMALL)	169.2	98.7	64.7
G OED	3	OEDOGONIUM SP	1056.2	319.6	1145.9
G OOC	3	OOCYSTIS SP	--	--	--
G OSC	1	OSCILLATORIA SP	2453.0	6987.7	634.4
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	2495.7	1416.5	1198.0
G OSC SM	1	OSCILLATORIA SP (SMALL)	7401.0	3670.6	1500.0
G PER	12	PERIDINIUM SP	--	--	--
G PIN	4	PINNULARIA SP	--	--	--
G PLEUR	3	PLEUROTAENIUM SP	--	189.0	--
G SCY	1	SCYTONEMA SP?	14269.4	523.1	--
G SPI	3	SPIROGYRA SP	--	--	--
G STAU	3	STAURASTRUM SP	90.0	--	--
G TET	3	TETRAEDRON SP	--	--	--
G ULO	3	ULOTHRIX SP	--	--	--
GLO AER	1	GLOEOCAPSA AERUGINOSA	--	--	--
GLO LIN	1	GLOEOTHECE LINEARIS	--	--	--
GLO PUN	1	GLOEOCAPSA PUNCTATA	--	--	--

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 X 10^{-6}), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment		
			1	2	3
			Cell 13	Cell 8	Cell 3
GLO RUP	1	GLOEOCAPSA RUPESTRIS	--	--	--
GOL RAD	3	GOLENKINIA RADIATA	--	69.5	--
GOM AFF IN	4	GOMPHONEMA AFFINE V INSIGNE	177.5	--	297.8
GOM APO	1	GOMPHOSPHAERIA APONINA	--	2611.5	455.4
GOM DIC	4	GOMPHONEMA DICHOTOMUM	--	--	--
GOM GRA	4	GOMPHONEMA GRACILE	116.2	--	20.4
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	68.6	205.8	20.8
GOM PAR	4	GOMPHONEMA PARVULUM	90.3	20.8	6.8
GON MUT	7	GONIOCHLORIS MUTICA	--	14.6	--
GYR ACU	4	GYROSIGMA ACUMINATUM	--	48.0	--
GYR NOD	4	GYROSIGMA NODIFERUM	--	--	--
GYR OBS	4	GYROSIGMA OBSCURUM?	--	--	63.5
GYR SPE CU	4	GYROSIGMA SPENCERI V CURVULA	--	53.4	--
HAN VIV	4	HANTZSCHIA VIVAX	--	--	--
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	--	2468.8	2720.6
KIR LUN	3	KIRCHNERIELLA LUNARIS	175.7	31.0	53.1
KIR OBE	3	KIRCHNERIELLA OBESA	--	65.1	15.6
LEM PAL	1	LEMMERMANNIELLA PALLIDA	--	--	4080.8
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	3238.6	--	617.9
LYN AES	1	LYNGBYA AESTUARII	5052.6	--	--
LYN BIR	1	LYNGBYA BIRGEI	10135.9	--	--
LYN EPI	1	LYNGBYA EPIPHYTICA	73790.4	35980.4	--
LYN LAG	1	LYNGBYA LAGERHEIMII	28018.1	17968.8	5921.7
LYN LIM	1	LYNGBYA LIMNETICA	34048.3	45464.8	10143.2
LYN LIM	1	LYNGBYA LIMNETICA?	3563.4	4147.7	3553.2
LYN PER	1	LYNGBYA PERELEGANS?	--	--	--
LYN SUB	1	LYNGBYA SUBTILIS	--	--	--
MAS LANC	4	MASTOGLOIA LANCEOLATA	--	19.5	--
MAS SMI	4	MASTOGLOIA SMITHII	220.5	274.9	114.5
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	374.5	257.9	71.0
MER DUP	1	MERISMOPEDIA DUPLEX	--	--	--
MER GLA	1	MERISMOPEDIA GLAUCA	1105.1	819.3	882.8
MER PUN	1	MERISMOPEDIA PUNCTATA	--	1138.5	2063.8
MER TEN	1	MERISMOPEDIA TENUISSIMA	493.3	1005.2	959.7
MIC AER	1	MICROCYSTIS AERUGINOSA	2461.4	2191.8	2048.6
MIC FIR	1	MICROCYSTIS FIRMA	1641.5	3125.2	3229.9
MIC FLO	1	MICROCYSTIS FLOS-AQUAE	--	2564.0	--
MIC INC	1	MICROCYSTIS INCERTA	--	--	--
MIC PIN	3	MICRASTERIAS PINNATIFIDA	--	--	--
MIC SMI	1	MICROCYSTIS SMITHII	--	1197.0	5519.9
NAV CRY	4	NAVICULA CRYPTOCEPHALA	229.6	47.8	37.5
NAV CRYP	4	NAVICULA CRYPTOTENELLA	164.6	206.0	88.5
NAV CUS	4	NAVICULA CUSPIDATA	--	--	--
NAV PLA	4	NAVICULA PLACENTA	111.2	--	--
NAV POD	4	NAVICULA PODZORSKII	68.6	274.3	56.8
NAV PUP CA	4	NAVICULA PUPULA V CAPITATA	--	--	--
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	221.8	--	9.9
NAV RAD	4	NAVICULA RADIOSA	--	--	--
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	34.7	--
NAV SUBR	4	NAVICULA SUBRHYNCHOCEPHALA	--	--	--
NAV SUBT	4	NAVICULA SUBTILISSIMA	--	--	--
NEI AFF	4	NEIDIUM AFFINE	--	--	--
NIT ACI	4	NITZSCHIA ACICULARIS	79.4	14.8	58.9
NIT AMP	4	NITZSCHIA AMPHIBIA	171.5	77.6	70.4
NIT ANG	4	NITZSCHIA ANGUSTATA	--	--	--
NIT CON	4	NITZSCHIA CONSTRICTA	154.3	80.4	58.5
NIT DEN	4	NITZSCHIA DENTICULA?	366.0	67.8	75.0
NIT DIS	4	NITZSCHIA DISSIPATA	--	--	--
NIT FON	4	NITZSCHIA FONTICOLA	111.2	26.9	44.0
NIT FRU	4	NITZSCHIA FRUSTULUM	414.8	106.0	55.2
NIT GRA	4	NITZSCHIA GRACILIS	28.3	36.4	14.7
NIT GRAF	4	NITZSCHIA GRACILIFORMIS?	--	--	56.8
NIT HUN	4	NITZSCHIA HUNGARICA?	--	118.1	44.5
NIT IGN	4	NITZSCHIA IGNORATA	--	19.5	--
NIT LEV	4	NITZSCHIA LEVIDENSIS	73.3	--	--

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 X 10^{-6}), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
NIT MIC	4	NITZSCHIA MICROCEPHALA	--	--	44.4
NIT NAN	4	NITZSCHIA NANA	--	82.0	50.6
NIT OBT	4	NITZSCHIA OBTUSA	--	--	34.3
NIT PAL	4	NITZSCHIA PALEA	68.6	61.8	87.6
NIT PAL DE	4	NITZSCHIA PALEA V DEBILIS	--	--	--
NIT PALE	4	NITZSCHIA PALEACEA	96.4	68.2	87.2
NIT PALF	4	NITZSCHIA PALEAFORMIS	40.4	51.1	40.5
NIT PAR	4	NITZSCHIA PARVULA	213.2	--	--
NIT REV	4	NITZSCHIA REVERSA?	269.5	14.6	25.8
NIT SEM	4	NITZSCHIA SEMIROBUSTA	119.7	2004.7	343.1
NIT SER	4	NITZSCHIA SERIATA	--	--	694.3
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	--	85.2	61.9
NIT SIGM	4	NITZSCHIA SIGMOIDEA	--	--	--
NIT VER	4	NITZSCHIA VERMICULARIS	122.3	--	--
NOD SPU	1	NODULARIA SPUMIGENA	--	--	--
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	--	--	--
OOC LAC	3	OOCYSTIS LACUSTRIS	286.4	107.8	--
OOC PAR	3	OOCYSTIS PARVA	269.0	133.5	70.3
OOC SOL	3	OOCYSTIS SOLITARIA	275.4	258.9	237.1
OPH CAP	7	OPHIOCYTIUM CAPITATUM	--	112.4	--
OSC AMP	1	OSCILLATORIA AMPHIBIA	6121.2	6522.9	2518.0
OSC AMPH	1	OSCILLATORIA AMPHIGRANULATA	--	--	--
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	17873.2	21250.0	3376.1
OSC FOR	1	OSCILLATORIA FORMOSA	1351.2	7424.7	1223.1
OSC GEM	1	OSCILLATORIA GEMINATA	--	261.5	240.3
OSC GRA	1	OSCILLATORIA GRANULATA	--	--	2249.6
OSC LAC	1	OSCILLATORIA LACUSTRIS?	1830.2	--	--
OSC LEM	1	OSCILLATORIA LEMMERMANNI	--	--	--
OSC LIM	1	OSCILLATORIA LIMNETICA	19266.6	46704.0	3829.5
OSC LIM	1	OSCILLATORIA LIMNETICA?	7470.0	2302.7	1748.6
OSC LIMO	1	OSCILLATORIA LIMOSA	2273.3	7484.6	--
OSC PRI	1	OSCILLATORIA PRINCEPS	--	--	--
OSC PRO	1	OSCILLATORIA PROLIFICA	--	--	620.4
OSC QUA	1	OSCILLATORIA QUADRIPUNCTULATA	--	761.4	264.8
OSC TEN	1	OSCILLATORIA TENUIS	1953.4	5946.6	1587.6
OSC WIL	1	OSCILLATORIA WILLEI?	--	--	4534.1
PED OBT	3	PEDIASTRUM OBTUSUM	--	--	--
PED TET	3	PEDIASTRUM TETRAS	--	--	62.5
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	--	--	117.6
PEL BAC	1	PELOGLOEA BACILLIFERA	--	--	--
PER ACI	12	PERIDINIUM ACICULIFERUM	--	14.6	29.4
PER INC	12	PERIDINIUM INCONSPICUUM	--	35.7	47.9
PER PUS	12	PERIDINIUM PUSILLUM	--	--	20.4
PER PUS	12	PERIDINIUM PUSILUM	--	--	14.7
PIN ABA SU	4	PINNULARIA ABAUJENSIS V SUBUNDULATA	111.2	17.0	--
PIN BIC	4	PINNULARIA BICEPS	--	--	--
PIN RUT	4	PINNULARIA RUTTNERI	--	--	--
PIN SOC	4	PINNULARIA SOCIALIS	--	19.5	--
PIN STR	4	PINNULARIA STREPTORAPHE	--	--	--
PIN VIR	4	PINNULARIA VIRIDIS	--	274.3	13.7
PIN VIR MI	4	PINNULARIA VIRIDULA V MINOR	--	--	29.4
PLA LEP	4	PLAGIOTROPIS LEPIDOPTERA	56.5	22.2	--
PLE DEL	4	PLEUROSIGMA DELICATULUM	--	--	--
PLE SAL BO	4	PLEUROSIGMA SALINARUM V BOYERI	--	--	--
QUA CHO	3	QUADRIGULA CHODATI	--	--	--
QUA LAC	3	QUADRIGULA LACUSTRIS	--	--	--
RAD IRR	3	RADIOFILUM IRREGULARE	960.1	--	--
RAD NIM	3	RADIOCOCCUS NIMBATUS	708.2	--	--
RHA LIN	1	RHABDODERMA LINEARE?	--	34863.5	--
RHO GIB VA	4	RHOPALODIA GIBBERULA V VANHEURCKII	--	--	--
RHO GIB VE	4	RHOPALODIA GIBBA V VENTRICOSA	238.3	--	--
RHO GIBA	4	RHOPALODIA GIBBA	199.4	104.6	20.8
SCE ACU	3	SCENEDESMUS ACUMINATUS	--	--	--
SCE ARM	3	SCENEDESMUS ARMATUS	415.2	174.2	40.9
SCE BIJ	3	SCENEDESMUS BIJUGA	532.9	313.5	240.0

EXHIBIT C.1-11

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m² X 10⁻⁶), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	695.9	185.0	274.7
SCE BRE	3	SCENEDESMUS BREVISPINA	--	--	61.5
SCE DEN	3	SCENEDESMUS DENTICULATUS	422.6	122.6	159.4
SCE DIM	3	SCENEDESMUS DIMORPHUS	--	--	--
SCE OBL	3	SCENEDESMUS OBLIQUUS	--	--	--
SCE QUA	3	SCENEDESMUS QUADRICAUDA	220.3	296.9	129.4
SCE SEM	3	SCENEDESMUS SEMIPULCHER	370.5	68.8	41.7
SCE SOL	3	SCENEDESMUS SOLI?	--	--	--
SCE SUB	3	SCENEDESMUS SUBSPICATUS	--	87.3	5.1
SCH ARE	1	SCHIZOTHRIX ARENARIA?	52446.1	--	--
SCH CAL	1	SCHIZOTHRIX CALCICOLA	--	--	--
SCH SET	3	SCHROEDERIA SETIGERA	--	--	--
SCY HOF	1	SCYTONEMA HOFMANII?	50347.9	--	--
SNO LAC	1	SNOWELLA LACUSTRIS	2062.2	2480.8	2646.5
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	1753.0	1583.6	1528.8
SPI LAX	1	SPIRULINA LAXA	150.1	84.4	512.1
SPI MAJ	1	SPIRULINA MAJOR	113.7	137.1	--
SPI SUB	1	SPIRULINA SUBSALSA	1159.2	1793.6	--
SPI SUBT	3	SPIRULINA SUBTILISSIMA	--	--	13.1
SPO PLA	3	SPONDYLOSIUM PLANUM	835.8	112.4	42.1
STA PHO GR	4	STAURONEIS PHOENICENTERON F GRACILIS	--	--	--
STAU CYC A	3	STAURASTRUM CYCLACANTHUM V AMERICANUM	--	--	--
STAU GRA	3	STAURASTRUM GRACILE	--	--	16.2
STAU HEX	3	STAURASTRUM HEXACERUM	46.9	48.7	28.3
STAU LEP I	3	STAURASTRUM LEPTOCLADUM V INSIGNE	56.5	--	28.3
STAU LEP S	3	STAURASTRUM LEPTOCLADUM V SINUATUM	159.8	171.4	--
STAU MAN F	3	STAURASTRUM MANFELDTII V FLUMINENSE	--	--	--
STAU PAR P	3	STAURASTRUM PARADOXUM V PARVULUM	--	--	--
STAU TET	3	STAURASTRUM TETRACERUM	106.1	--	40.5
SUR ELE	4	SURIRELLA ELEGANS	--	--	--
SYN ACU	4	SYNEDRA ACUS	--	--	--
SYN RUM FA	4	SYNEDRA RUMPENS V FAMILIARIS	--	--	--
TET MIN	3	TETRAEDRON MINIMUM	78.6	38.3	17.2
TET TRI	3	TETRAEDRON TRIGONUM	293.0	71.6	95.2
UN CHL FI	3	UNID CHLOROPHYCEAE FILAMENT BASAL CELLS	--	174.1	250.8
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	--	3246.0	870.2

Codes:

1 = Cyanobacteria (Bluegreens)
3 = Chlorophytea (Greens)
4 = Bacillariophyceae (Diatoms)
5 = Chrysomonodates (Dinobryon)
7 = Xanthophyceae (Yellow greens)
10 = Euglenophyta (Euglenoids)
11 = Cryptophyta (Cryptomoniads)
12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
ACH CHI SU	4	ACHNANTHES CHILENSIS V SUBAEQUALIS	--	--	--
ACH EXI	4	ACHNANTHES EXIGUA	0.0135	0.0054	0.0035
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	0.0162	0.0299	0.0424
AMP ACUTI	4	AMPHORA ACUTIUSCULA	--	--	0.0295
AMP HOL	4	AMPHORA HOLSATICA	0.1123	0.1152	0.4072
AMP LIN	4	AMPHORA LINEOLATA?	--	--	0.1604
AMP OVA	4	AMPHORA OVALIS	0.6928	0.0317	0.1087
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	--	--	--
AMP PEL	4	AMPHIPLEURA PELLUCIDA	--	--	--
AMP SAB	4	AMPHORA SABINIANA?	--	--	--
AMP VEN	4	AMPHORA VENETA	0.0449	0.0219	0.0162
ANA OSC	1	ANABAENA OSCILLARIOIDES	--	--	--
ANK FAL	3	ANKISTRODESMUS FALCATUS	0.0026	0.0031	0.0020
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	--	0.0004	0.0003
ANK SPI	3	ANKISTRODESMUS SPIRALIS	0.0023	0.0021	0.0026
APH CON	1	APHANOCAPSA CONFERTA	--	0.0461	0.0114
APH DEL	1	APHANOCAPSA DELICATISSIMA	0.0096	0.0057	0.0065
APH ELA	1	APHANOCAPSA ELACHISTA	--	--	--
APH GRE	1	APHANOCAPSA GREVILLEI	--	0.6362	0.8410
APH INC	1	APHANOCAPSA INCERTA	--	0.0003	--
APH PLA	1	APHANOCAPSA PLANCTONICA?	0.0110	0.0363	0.0099
APHA CLA	1	APHANOTHECE CLATHRATA	--	0.0183	--
APHA MIC	1	APHANOTHECE MICROSCOPICA	--	--	--
APHA NID	1	APHANOTHECE NIDULANS	--	--	--
APHA SAX	1	APHANOTHECE SAXICOLA	--	--	--
APHA SMI	1	APHANOTHECE SMITHII	0.0342	0.0681	0.0199
APHA STA	1	APHANOTHECE STAGNINA	0.0456	0.3094	0.1785
APHA STA	1	APHANOTHECE STAGNINA?	0.0257	0.0407	0.0322
APHA VAR	1	APHANOTHECE VARIABILIS?	--	--	--
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	0.0740	--
ART GOM	1	ARTHOSPIRA GOMONTIANA?	--	--	--
ART GOM	1	ARTHROSPIRA GOMONTIANA?	--	--	0.0727
ART JEN	1	ARTHROSPIRA JENNERI	--	--	--
ART TEN	1	ARTHROSPIRA TENUIS?	--	--	--
AUL ITA TE	4	AULACOSEIRA ITALICA V TENUISSIMA	--	--	--
AUL LAX	1	AULOSIRA LAXA?	0.1499	--	--
BAC PAR	4	BACILLARIA PARADOXA	--	--	--
BOT SUD	3	BOTRYOCOCCUS SUDETICUS	--	0.0046	0.0039
BRA VIT	4	BRACHYSIRA VITREA	--	0.0101	0.0134
CAP CAR	4	CAPONEA CARIBBEA	--	--	--
CHA ENS	3	CHARACIUM ENSIFORME	0.0105	--	0.0049
CHLO HUM	3	CHLOROCOCCUM HUMICOLA	--	--	0.0037
CHR DIS	1	CHROOCOCCUS DISPERSUS	0.0285	0.0117	0.0273
CHR DIS MI	1	CHROOCOCCUS DISPERSUS V MINOR	--	0.0018	0.0041
CHR DIST	1	CHROOCOCCUS DISTANS	0.1536	0.0057	0.0896
CHR LIM	1	CHROOCOCCUS LIMNETICUS	--	--	0.0085
CHR MIN	1	CHROOCOCCUS MINUTUS	0.0098	0.0130	0.0145
CHR MINI	1	CHROOCOCCUS MINIMUS	0.0060	0.0197	0.0082
CHR PLA	1	CHROOCOCCUS PLANCTONICUS	--	0.1891	0.0445
CHR PRE	1	CHROOCOCCUS PRESCOTTII	0.0737	0.1556	0.0459
CHR TUR	1	CHROOCOCCUS TURGIDUS	0.0292	0.0485	0.0563
CLO ACE	3	CLOSTERIUM ACEROSUM	--	9.7327	--
CLO ACU	3	CLOSTERIUM ACUTUM	0.0447	--	--
CLO DIA	3	CLOSTERIUM DIANAE	0.0413	--	--
CLO INC	3	CLOSTERIUM INCURVUM	0.2167	--	0.2129
CLO LUN MA	3	CLOSTERIUM LUNULA V MASSARTII	--	8.6214	--
CLO PAR	3	CLOSTERIUM PARVULUM	--	0.2016	--
COC PLA	4	COCCONEIS PLACENTULA	--	--	--
COC PLA EU	4	COCCONEIS PLACENTULA V EUGLYPTA	--	--	--
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	0.1236	--	--
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	--	0.0044	--
COE MIC	3	COELASTRUM MICROPORUM	--	0.0025	--
COE SPH	3	COELASTRUM SPHAERICUM	0.0942	0.0245	0.0480
COS ANG CO	3	COSMARIUM ANGULOSUM V CONCINNUM	--	--	--
COS BAC	3	COSMARIUM BACCATUM	--	--	--
COS BLY HO	3	COSMARIUM BLYTTII V HOFFII?	--	--	--
COS BOT	3	COSMARIUM BOTRYTIS	--	1.4375	0.3437

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
COS CON	3	COSMARIUM CONTRACTUM	1.4637	--	--
COS GRA	4	COSCINODISCUS GRANII	--	--	--
COS GRAN	3	COSMARIUM GRANATUM	--	--	--
COS IMP	3	COSMARIUM IMPRESSULUM	--	--	--
COS MON	3	COSMARIUM MONILIFORME	--	--	0.0642
COS NIT JA	3	COSMARIUM NITIDULUM V JAVANICUM	0.3742	--	--
COS ORB	3	COSMARIUM ORBICULATUM	--	--	--
COS ORN	3	COSMARIUM ORNATUM	0.1959	--	--
COS ORT	3	COSMARIUM ORTHOSTICHUM	--	--	--
COS POK	3	COSMARIUM POKORNYANUM	--	--	--
COS POR	3	COSMARIUM PORTIANUM	--	--	--
COS PUN	3	COSMARIUM PUNCTULATUM	0.5918	--	--
COS REN	3	COSMARIUM RENIFORME	1.0468	1.0131	0.5513
COS SUBR	3	COSMARIUM SUBRENIFORME	0.1034	0.0242	0.0213
COS TEN	3	COSMARIUM TENUE	--	--	--
COS TRI	3	COSMARIUM TRILOBULATUM	0.1102	0.0485	--
COS TUB	3	COSMOCLADIUM TUBURCULATUM	0.0555	--	--
COS UND MI	3	COSMARIUM UNDULATUM V MINUTUM	--	--	--
COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	0.0743	--	--
CRU API	3	CRUCIGENIA APICULATA	0.0089	0.0039	0.0145
CRU CRU	3	CRUCIGENIA CRUCIFERA	0.0260	0.0060	--
CRU QUA	3	CRUCIGENIA QUADRATA	--	0.0014	0.0008
CRU TET	3	CRUCIGENIA TETRAPEDIA	--	--	--
CRY ERO	11	CRYPTOMONAS EROSA	--	0.0352	0.0164
CRY OVA	11	CRYPTOMONAS OVATA	0.0753	0.0540	0.0521
CYC MEN	4	CYCLOTELLA MENEGHINIANA	0.0134	0.0209	0.0347
CYL CLO	4	CYLINDROTHECA CLOSTERIUM	0.0030	0.0016	0.0013
CYL MIN	1	CYLINDROSPERMUM MINUTUM?	--	--	--
CYL MUS	1	CYLINDROSPERMUM MUSCICOLA?	0.0412	0.0480	--
CYL STA	1	CYLINDROSPERMUM STAGNALE	--	0.2384	--
CYM ASP	4	CYMBELLA ASPERA	--	--	--
CYM MIC	4	CYMBELLA MICROCEPHALA	0.0547	0.0203	0.0165
CYM MIN PS	4	CYMBELLA MINUTA V PSEUDOGRACILIS	--	0.1477	0.0626
DEN KUE	4	DENTICULA KUETZINGII	--	--	--
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	0.0044	--	0.0008
DIN CYL	5	DINOBRYON CYLINDRICUM	--	--	--
DIN SER	5	DINOBRYON SERTULARIA	--	--	--
DIP ELL	4	DIPLONEIS ELLIPTICA	0.0537	0.0291	0.0098
DIP OBL	4	DIPLONEIS OBLONGELLA	0.0410	--	0.0191
DIP OVA	4	DIPLONEIS OVALIS	0.0457	0.0680	0.0328
DIP PARM	4	DIPLONEIS PARMA	--	0.0479	0.0337
DIP SMI	4	DIPLONEIS SMITHII	--	--	--
ELA GEL	3	ELAKATOTHRIX GELATINOSA	--	0.0077	0.0186
ENC EVE	4	ENCYONEMA EVERGLADIANUM	0.0194	0.2181	0.0408
ENC HEB	4	ENCYONEMA HEBRIDICA	--	--	--
ENC LUN	4	ENCYONEMA LUNATUM	0.0629	0.0048	0.0029
ENC MIN	4	ENCYONEMA MINUTUM	0.0132	--	0.0020
ENC MUE	4	ENCYONEMA MUELLERI	--	--	--
ENC SIL	4	ENCYONEMA SILESIACUM	--	0.0200	--
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	--	--	--
EPI ADN	4	EPITHEMIA ADNATA	2.0134	--	--
EUA ABR MI	3	EUASTRUM ABRUPTUM F MINOR	--	--	--
EUA BID	3	EUASTRUM BIDENTATUM	0.2796	--	0.2898
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	0.0774	0.1364	0.1499
EUA TUR ST	3	EUASTRUM TURNERI V STRICTUM	--	--	--
EUC MIN	1	EUCAPSIS MINOR	0.0077	--	--
EUD ELE	3	EUDORINA ELEGANS	--	--	--
EUG ACU	10	EUGLENA ACUS	--	0.1069	--
EUG OXY MI	10	EUGLENA OXYURIS V MINOR	--	--	0.2815
EUN PEC	4	EUNOTIA PECTINALIS	0.1388	--	--
EUN PEC MI	4	EUNOTIA PECTINALIS V MINOR	--	--	--
FRA CAP	4	FRAGILARIA CAPUCINA	--	--	--
FRA CAP GR	4	FRAGILARIA CAPUCINA V GRACILIS	--	--	--
FRA CRO	4	FRAGILARIA CROTONENSIS	--	0.9989	--
FRA DEL	4	FRAGILARIA DELICATISSIMA	0.1283	--	0.1150
FRA FAM	4	FRAGILARIA FAMELICA	0.1292	0.0558	0.0173
FRA FAS	4	FRAGILARIA FASCICULATA?	0.1687	1.6954	1.8942

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm³/m²), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
FRA NAN	4	FRAGILARIA NANANA?	--	0.2300	--
FRA OVA	3	FRANCEIA OVALIS	--	--	--
FRA SYN	4	FRAGILARIA SYNEGROTESCA	0.4186	0.5285	0.1769
FRA TEN	4	FRAGILARIA TENERA	--	--	--
FRA ULN	4	FRAGILARIA ULNA	1.3078	--	0.3500
G ACH	4	ACHNANTHES SP	0.0408	--	--
G AMP	4	AMPHORA SP	0.0310	0.0141	--
G ANA	1	ANABAENA SP	0.0555	0.0482	0.0075
G ANAB	1	ANABAENOPSIS SP	0.0022	0.0058	--
G APH	1	APHANOCAPSA SP	--	--	--
G APHA	1	APHANOTHECE SP	--	0.0022	--
G BUL	3	BULBOCHAETE SP	--	--	--
G CHI	11	CHILOMONAS SP	0.2938	--	0.0707
G CHL	3	CHLORELLA SP	--	--	--
G CHLA	3	CHLAMYDOMONAS SP	--	0.0136	0.0490
G CHLR	3	CHLOROGONIUM SP	--	--	--
G CHR	1	CHROOCOCCUS SP	--	--	--
G CHRM	11	CHROOMONAS SP	0.0007	0.0008	0.0018
G CLO	3	CLOSTERIUM SP	--	--	--
G COS	3	COSMARIUM SP	0.2634	0.4444	0.2914
G CRY	11	CRYPTOMONAS SP	0.0045	0.0022	0.0067
G CYC	4	CYCLOTELLA SP	--	0.0049	0.0020
G CYL	1	CYLINDROSPERMUM SP	0.1490	0.2932	0.1705
G CYM	4	CYMBELLA SP	--	--	--
G DIP	4	DIPLONEIS SP	--	--	0.0055
G EUA	3	EUASTRUM SP	--	--	--
G EUG	10	EUGLENA SP	3.5746	0.5929	0.4823
G EUN	4	EUNOTIA SP	--	--	0.0062
G FRA	4	FRAGILARIA SP	0.0516	0.0044	--
G GLO	1	GLOEOCAPSA SP	0.0033	0.0027	0.0046
G GLOE	3	GLOEOCYSTIS SP	--	--	--
G GLOT	1	GLOEOTHECE SP	--	--	--
G GOMP	1	GOMPHOSPHAERIA SP	--	--	--
G GYR	4	GYROSIGMA SP	--	0.4764	0.1970
G LYN	1	LYNGBYA SP	0.0225	0.0022	0.0008
G LYN ME	1	LYNGBYA SP (MEDIUM)	--	--	--
G LYN SM	1	LYNGBYA SP (SMALL)	0.0769	0.0274	0.0113
G MES	3	MESOTAENIUM SP?	--	--	0.2988
G MICRO	1	MICROCYSTIS SP	--	--	--
G MOU	3	MOUGEOTIA SP	--	--	--
G NAV	4	NAVICULA SP	0.0219	--	0.0031
G NAV SM	4	NAVICULA SP (SMALL)	0.0577	--	--
G NIT	4	NITZSCHIA SP	0.1106	0.0098	0.0032
G NIT ME	4	NITZSCHIA SP (MEDIUM)	0.3304	0.0526	0.0321
G NIT SM	4	NITZSCHIA SP (SMALL)	0.0179	0.0103	0.0067
G OED	3	OEDOGONIUM SP	2.1242	0.6426	2.3044
G OOC	3	OOCYSTIS SP	--	--	--
G OSC	1	OSCILLATORIA SP	0.0614	0.1747	0.0160
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	0.2120	0.1203	0.1022
G OSC SM	1	OSCILLATORIA SP (SMALL)	0.0369	0.0183	0.0074
G PER	12	PERIDINIUM SP	--	--	--
G PIN	4	PINNULARIA SP	--	--	--
G PLEUR	3	PLEUROTAENIUM SP	--	0.1601	--
G SCY	1	SCYTONEMA SP?	19.7631	0.7244	--
G SPI	3	SPIROGYRA SP	--	--	--
G STAU	3	STAURASTRUM SP	0.1191	--	--
G TET	3	TETRAEDRON SP	--	--	--
G ULO	3	ULOTHRIX SP	--	--	--
GLO AER	1	GLOEOCAPSA AERUGINOSA	--	--	--
GLO LIN	1	GLOEOTHECE LINEARIS	--	--	--
GLO PUN	1	GLOEOCAPSA PUNCTATA	--	--	--
GLO RUP	1	GLOEOCAPSA RUPESTRIS	--	--	--
GOL RAD	3	GOLENKINIA RADIATA	--	0.0079	--
GOM AFF IN	4	GOMPHONEMA AFFINE V INSIGNE	0.2405	--	0.4034
GOM APO	1	GOMPHOSPHAERIA APONINA	--	0.0732	0.0127
GOM DIC	4	GOMPHONEMA DICHOTOMUM	--	--	--
GOM GRA	4	GOMPHONEMA GRACILE	0.0404	--	0.0068

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1	2	3
			Cell 13	Cell 8	Cell 3
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	0.1498	0.4493	0.0453
GOM PAR	4	GOMPHONEMA PARVULUM	0.1612	0.0372	0.0122
GON MUT	7	GONIOCHLORIS MUTICA	--	0.0016	--
GYR ACU	4	GYROSIGMA ACUMINATUM	--	0.3492	--
GYR NOD	4	GYROSIGMA NODIFERUM	--	--	--
GYR OBS	4	GYROSIGMA OBSCURUM?	--	--	0.5486
GYR SPE CU	4	GYROSIGMA SPENCERI V CURVULA	--	0.4872	--
HAN VIV	4	HANTZSCHIA VIVAX	--	--	--
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	--	0.1382	0.1524
KIR LUN	3	KIRCHNERIELLA LUNARIS	0.0022	0.0006	0.0008
KIR OBE	3	KIRCHNERIELLA OBESA	--	0.0005	0.0002
LEM PAL	1	LEMMERMANNIELLA PALLIDA	--	--	0.0243
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	0.3824	--	0.0729
LYN AES	1	LYNGBYA AESTUARII	1.3389	--	--
LYN BIR	1	LYNGBYA BIRGEI	2.3921	--	--
LYN EPI	1	LYNGBYA EPIPHYTICA	0.4428	0.2159	--
LYN LAG	1	LYNGBYA LAGERHEIMII	0.1681	0.1078	0.0355
LYN LIM	1	LYNGBYA LIMNETICA	0.8513	1.1366	0.2536
LYN LIM	1	LYNGBYA LIMNETICA?	0.0889	0.1037	0.0888
LYN PER	1	LYNGBYA PERELEGANS?	--	--	--
LYN SUB	1	LYNGBYA SUBTILIS	--	--	--
MAS LANC	4	MASTOGLOIA LANCEOLATA	--	0.1307	--
MAS SMI	4	MASTOGLOIA SMITHII	0.7668	0.9560	0.3983
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	0.6021	0.4148	0.1142
MER DUP	1	MERISMOPEDIA DUPLEX	--	--	--
MER GLA	1	MERISMOPEDIA GLAUCA	0.0155	0.0114	0.0123
MER PUN	1	MERISMOPEDIA PUNCTATA	--	0.0035	0.0063
MER TEN	1	MERISMOPEDIA TENUISSIMA	0.0005	0.0010	0.0010
MIC AER	1	MICROCYSTIS AERUGINOSA	0.0836	0.0745	0.0696
MIC FIR	1	MICROCYSTIS FIRMA	0.0132	0.0250	0.0258
MIC FLO	1	MICROCYSTIS FLOS-AQUAE	--	0.3690	--
MIC INC	1	MICROCYSTIS INCERTA	--	--	--
MIC PIN	3	MICRASTERIAS PINNATIFIDA	--	--	--
MIC SMI	1	MICROCYSTIS SMITHII	--	0.0406	0.1877
NAV CRY	4	NAVICULA CRYPTOCEPHALA	0.0971	0.0202	0.0159
NAV CRYP	4	NAVICULA CRYPTOTENELLA	0.1221	0.1528	0.0656
NAV CUS	4	NAVICULA CUSPIDATA	--	--	--
NAV PLA	4	NAVICULA PLACENTA	0.6086	--	--
NAV POD	4	NAVICULA PODZORSKII	0.1512	0.6049	0.1253
NAV PUP CA	4	NAVICULA PUPULA V CAPITATA	--	--	--
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	0.1997	--	0.0089
NAV RAD	4	NAVICULA RADIOSA	--	--	--
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	0.0331	--
NAV SUBR	4	NAVICULA SUBRHYNCHOCEPHALA	--	--	--
NAV SUBT	4	NAVICULA SUBTILISSIMA	--	--	--
NEI AFF	4	NEIDIUM AFFINE	--	--	--
NIT ACI	4	NITZSCHIA ACICULARIS	0.0093	0.0016	0.0066
NIT AMP	4	NITZSCHIA AMPHIBIA	0.0413	0.0187	0.0169
NIT ANG	4	NITZSCHIA ANGUSTATA	--	--	--
NIT CON	4	NITZSCHIA CONSTRICTA	0.0933	0.0484	0.0353
NIT DEN	4	NITZSCHIA DENTICULA?	0.0881	0.0161	0.0180
NIT DIS	4	NITZSCHIA DISSIPATA	--	--	--
NIT FON	4	NITZSCHIA FONTICOLA	0.0484	0.0117	0.0190
NIT FRU	4	NITZSCHIA FRUSTULUM	0.0934	0.0238	0.0125
NIT GRA	4	NITZSCHIA GRACILIS	0.0227	0.0287	0.0117
NIT GRAF	4	NITZSCHIA GRACILIFORMIS?	--	--	0.0353
NIT HUN	4	NITZSCHIA HUNGARICA?	--	0.2837	0.1068
NIT IGN	4	NITZSCHIA IGNORATA	--	0.0180	--
NIT LEV	4	NITZSCHIA LEVIDENSIS	0.3451	--	--
NIT MIC	4	NITZSCHIA MICROCEPHALA	--	--	0.0022
NIT NAN	4	NITZSCHIA NANA	--	0.2306	0.1424
NIT OBT	4	NITZSCHIA OBTUSA	--	--	0.6071
NIT PAL	4	NITZSCHIA PALEA	0.0360	0.0324	0.0461
NIT PAL DE	4	NITZSCHIA PALEA V DEBILIS	--	--	--
NIT PALE	4	NITZSCHIA PALEACEA	0.0062	0.0044	0.0055
NIT PALF	4	NITZSCHIA PALEAFORMIS	0.0345	0.0434	0.0344
NIT PAR	4	NITZSCHIA PARVULA	0.1366	--	--

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
NIT REV	4	NITZSCHIA REVERSA?	0.1853	0.0103	0.0176
NIT SEM	4	NITZSCHIA SEMIROBUSTA	0.0705	1.1787	0.2017
NIT SER	4	NITZSCHIA SERIATA	--	--	1.1774
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	--	0.7926	0.5756
NIT SIGM	4	NITZSCHIA SIGMOIDEA	--	--	--
NIT VER	4	NITZSCHIA VERMICULARIS	0.1450	--	--
NOD SPU	1	NODULARIA SPUMIGENA	--	--	--
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	--	--	--
OOC LAC	3	OOCYSTIS LACUSTRIS	0.1246	0.0469	--
OOC PAR	3	OOCYSTIS PARVA	0.0067	0.0033	0.0018
OOC SOL	3	OOCYSTIS SOLITARIA	0.3739	0.3513	0.3219
OPH CAP	7	OPHIOCYTIUM CAPITATUM	--	0.0084	--
OSC AMP	1	OSCILLATORIA AMPHIBIA	0.3917	0.4175	0.1612
OSC AMPH	1	OSCILLATORIA AMPHIGRANULATA	--	--	--
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	0.0356	0.0425	0.0068
OSC FOR	1	OSCILLATORIA FORMOSA	0.1068	0.5866	0.0966
OSC GEM	1	OSCILLATORIA GEMINATA	--	0.0087	0.0082
OSC GRA	1	OSCILLATORIA GRANULATA	--	--	0.1778
OSC LAC	1	OSCILLATORIA LACUSTRIS?	0.0767	--	--
OSC LEM	1	OSCILLATORIA LEMMERMANNI	--	--	--
OSC LIM	1	OSCILLATORIA LIMNETICA	0.1348	0.3269	0.0268
OSC LIM	1	OSCILLATORIA LIMNETICA?	0.0521	0.0161	0.0121
OSC LIMO	1	OSCILLATORIA LIMOSA	0.9048	2.9789	--
OSC PRI	1	OSCILLATORIA PRINCEPS	--	--	--
OSC PRO	1	OSCILLATORIA PROLIFICA	--	--	0.0191
OSC QUA	1	OSCILLATORIA QUADRIPUNCTULATA	--	0.0054	0.0018
OSC TEN	1	OSCILLATORIA TENUIS	0.1150	0.3510	0.0939
OSC WIL	1	OSCILLATORIA WILLEI?	--	--	0.0953
PED OBT	3	PEDIASTRUM OBTUSUM	--	--	--
PED TET	3	PEDIASTRUM TETRAS	--	--	0.0047
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	--	--	0.0099
PEL BAC	1	PELOGLOEA BACILLIFERA	--	--	--
PER ACI	12	PERIDINIUM ACICULIFERUM	--	0.0347	0.0692
PER INC	12	PERIDINIUM INCONSPICUUM	--	0.0473	0.0634
PER PUS	12	PERIDINIUM PUSILLUM	--	--	0.0325
PER PUS	12	PERIDINIUM PUSILUM	--	--	0.0234
PIN ABA SU	4	PINNULARIA ABAUJENSIS V SUBUNDULATA	0.4594	0.0703	--
PIN BIC	4	PINNULARIA BICEPS	--	--	--
PIN RUT	4	PINNULARIA RUTTNERI	--	--	--
PIN SOC	4	PINNULARIA SOCIALIS	--	1.0095	--
PIN STR	4	PINNULARIA STREPTORAPHE	--	--	--
PIN VIR	4	PINNULARIA VIRIDIS	--	22.9112	1.1481
PIN VIR MI	4	PINNULARIA VIRIDULA V MINOR	--	--	0.8382
PLA LEP	4	PLAGIOTROPIS LEPIDOPTERA	1.0788	0.4243	--
PLE DEL	4	PLEUROSIGMA DELICATULUM	--	--	--
PLE SAL BO	4	PLEUROSIGMA SALINARUM V BOYERI	--	--	--
QUA CHO	3	QUADRIGULA CHODATI	--	--	--
QUA LAC	3	QUADRIGULA LACUSTRIS	--	--	--
RAD IRR	3	RADIOFILUM IRREGULARE	0.1632	--	--
RAD NIM	3	RADIOCOCCUS NIMBATUS	0.0025	--	--
RHA LIN	1	RHABDODERMA LINEARE?	--	1.5689	--
RHO GIB VA	4	RHOPALODIA GIBBERULA V VANHEURCKII	--	--	--
RHO GIB VE	4	RHOPALODIA GIBBA V VENTRICOSA	2.9568	--	--
RHO GIBA	4	RHOPALODIA GIBBA	5.0531	2.6506	0.5283
SCE ACU	3	SCENEDESMUS ACUMINATUS	--	--	--
SCE ARM	3	SCENEDESMUS ARMATUS	0.0278	0.0117	0.0027
SCE BIJ	3	SCENEDESMUS BIJUGA	0.0053	0.0031	0.0025
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	0.0222	0.0057	0.0088
SCE BRE	3	SCENEDESMUS BREVISPINA	--	--	0.0154
SCE DEN	3	SCENEDESMUS DENTICULATUS	0.0874	0.0254	0.0329
SCE DIM	3	SCENEDESMUS DIMORPHUS	--	--	--
SCE OBL	3	SCENEDESMUS OBLIQUUS	--	--	--
SCE QUA	3	SCENEDESMUS QUADRICAUDA	0.0225	0.0303	0.0132
SCE SEM	3	SCENEDESMUS SEMIPULCHER	0.0140	0.0026	0.0016
SCE SOL	3	SCENEDESMUS SOLI?	--	--	--
SCE SUB	3	SCENEDESMUS SUBSPICATUS	--	0.0033	0.0002
SCH ARE	1	SCHIZOTHRIX ARENARIA?	0.6818	--	--

EXHIBIT C.1-12

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April 1999 - March 2000

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment 1 Cell 13	2 Cell 8	3 Cell 3
SCH CAL	1	SCHIZOTHRIX CALCICOLA	--	--	--
SCH SET	3	SCHROEDERIA SETIGERA	--	--	--
SCY HOF	1	SCYTONEMA HOFMANII?	3.7758	--	--
SNO LAC	1	SNOWELLA LACUSTRIS	0.0514	0.0619	0.0661
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	0.1981	0.1789	0.1727
SPI LAX	1	SPIRULINA LAXA	0.0189	0.0105	0.0645
SPI MAJ	1	SPIRULINA MAJOR	0.0071	0.0086	--
SPI SUB	1	SPIRULINA SUBSALSA	0.0729	0.1130	--
SPI SUBT	3	SPIRULINA SUBTILISSIMA	--	--	0.0003
SPO PLA	3	SPONDYLOSIUM PLANUM	0.0476	0.0063	0.0026
STA PHO GR	4	STAURONEIS PHOENICENTERON F GRACILIS	--	--	--
STAU CYC A	3	STAURASTRUM CYCLACANTHUM V AMERICANUM	--	--	--
STAU GRA	3	STAURASTRUM GRACILE	--	--	0.0097
STAU HEX	3	STAURASTRUM HEXACERUM	0.2482	0.2576	0.1502
STAU LEP I	3	STAURASTRUM LEPTOCLADUM V INSIGNE	0.4882	--	0.2444
STAU LEP S	3	STAURASTRUM LEPTOCLADUM V SINUATUM	0.3197	0.3430	--
STAU MAN F	3	STAURASTRUM MANFELDTII V FLUMINENSE	--	--	--
STAU PAR P	3	STAURASTRUM PARADOXUM V PARVULUM	--	--	--
STAU TET	3	STAURASTRUM TETRACERUM	0.0060	--	0.0024
SUR ELE	4	SURIRELLA ELEGANS	--	--	--
SYN ACU	4	SYNEDRA ACUS	--	--	--
SYN RUM FA	4	SYNEDRA RUMPENS V FAMILIARIS	--	--	--
TET MIN	3	TETRAEDRON MINIMUM	0.0035	0.0018	0.0009
TET TRI	3	TETRAEDRON TRIGONUM	0.2851	0.0696	0.0927
UN CHL FI	3	UNID CHLOROPHYCEAE FILAMENT BASAL CELLS	--	0.0136	0.0199
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	--	2.7526	0.7379

Codes:

1 = Cyanobacteria (Bluegreens)
3 = Chlorophytea (Greens)
4 = Bacillanophyceae (Diatoms)
5 = Chrysomonodates (Dinobryon)
7 = Xanthophyceae (Yellow greens)
10 = Euglenophyta (Euglenoids)
11 = Cryptophyta (Cryptomoniads)
12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT C.1-13

Summary of Macrophyte Biomass Data (g dry/m2) from the Test Cells (Phase 1)

	Treatment (Cell)		
	1	2	3
Month	13	8	3
Jul-1999	0	0	0
Aug-1999	1107	57	285
Sep-1999	1630	92	0
Oct-1999	232	12	29
Dec-1999	306	86	35
Jan-2000	--	146	21
Feb-2000	--	28	65
Mar-2000	218	65	9
Treatment Average	582	61	55

Note:

-- = Not Sampled

EXHIBIT C.1-14

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the ENR Test Cells, February 1999 - March 2000

Treatment*	Cell	Date	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Res g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
Period of Record										
1	13	1999-2000	0.859	2.908	3.065	2.908	-0.157	0.128	34.3	1.624
2	8	1999-2000	1.174	3.005	3.034	3.005	-0.015	0.126	34.9	1.649
3	3	1999-2000	0.869	2.263	2.271	2.263	-0.008	0.095	35.5	1.218
Quarterly										
1	13	Qtr-3	0.771	2.063	2.141	2.063	-0.079	0.089	42.0	0.941
		Qtr-4	1.886	5.338	5.350	5.338	-0.011	0.223	39.9	2.558
		Qtr-5	0.032	1.519	1.784	1.519	-0.265	0.074	26.9	1.079
		Qtr-6	0.058	1.127	1.527	1.127	-0.400	0.064	22.7	0.952
		Qtr-7	--	--	--	--	--	--	--	--
2	8	Qtr-3	0.734	1.755	1.751	1.755	0.005	0.073	38.7	0.867
		Qtr-4	1.488	4.146	4.074	4.146	0.073	0.170	39.1	2.031
		Qtr-5	1.340	3.569	3.816	3.569	-0.247	0.159	28.0	2.436
		Qtr-6	0.873	2.091	2.184	2.091	-0.010	0.091	21.6	1.856
		Qtr-7	1.914	4.681	4.748	4.681	-0.067	0.198	33.4	2.684
3	3	Qtr-3	0.648	1.588	1.590	1.588	-0.003	0.066	42.9	0.708
		Qtr-4	0.804	2.383	2.438	2.383	-0.055	0.102	39.1	1.167
		Qtr-5	1.348	3.056	2.991	3.056	0.066	0.125	31.6	1.851
		Qtr-6	0.924	2.615	2.583	2.615	0.033	0.108	22.3	2.249
		Qtr-7	1.036	2.288	2.428	2.288	-0.140	0.101	22.8	1.917
Monthly										
1	13	Mar-99	0.721	1.748	1.765	1.748	-0.016	0.074	41.4	0.808
		Apr-99	0.820	2.377	2.518	2.377	-0.141	0.105	42.5	1.070
		May-99	2.178	6.002	5.944	6.002	0.058	0.248	44.9	2.556
		Jun-99	1.416	4.336	4.487	4.336	-0.151	0.187	31.1	2.667
		Jul-99	1.763	4.115	3.764	4.115	0.352	0.157	48.4	1.628
		Aug-99	0.629	2.941	3.247	2.941	-0.306	0.135	30.5	1.842
		Sep-99	-0.713	0.135	0.344	0.135	-0.209	0.014	24.0	0.108
		Oct-99	0.153	1.223	1.507	1.223	-0.283	0.063	25.3	0.925
		Nov-99	0.111	1.291	1.773	1.291	-0.483	0.074	25.5	0.969
		Dec-99	0.125	1.191	1.576	1.191	-0.384	0.066	19.0	1.202
		Jan-00	-0.472	0.000	0.000	0.000	0.000	0.000	20.1	0.000
		Feb-00	--	--	--	--	--	--	--	--
		Mar-00	--	--	--	--	--	--	--	--
2	8	Feb-99	0.578	1.312	1.329	1.312	-0.017	0.055	32.2	0.779
		Mar-99	0.649	1.547	1.540	1.547	0.008	0.064	40.2	0.736
		Apr-99	1.050	2.603	2.575	2.603	0.028	0.107	44.9	1.110
		May-99	1.155	3.091	3.033	3.091	0.058	0.126	45.8	1.291
		Jun-99	1.699	4.764	4.670	4.764	0.095	0.195	33.4	2.733
		Jul-99	1.622	4.618	4.552	4.618	0.066	0.190	37.7	2.343
		Aug-99	1.478	4.188	4.335	4.188	-0.147	0.181	24.4	3.288
		Sep-99	1.468	3.967	4.285	3.967	-0.317	0.179	34.2	2.218
		Oct-99	1.141	2.806	3.074	2.806	-0.268	0.128	26.1	2.054
		Nov-99	0.836	2.061	2.341	2.061	0.015	0.098	24.1	1.635
		Dec-99	1.127	2.635	2.792	2.635	-0.157	0.116	16.5	3.052
		Jan-00	0.739	1.765	1.698	1.765	0.068	0.071	22.9	1.475
		Feb-00	1.475	3.674	3.788	3.674	-0.114	0.158	30.8	2.283
		Mar-00	2.156	5.234	5.276	5.234	-0.042	0.220	34.8	2.880
3	3	Feb-99	0.098	0.359	0.481	0.359	-0.122	0.020	34.6	0.199
		Mar-99	0.642	1.521	1.506	1.521	0.015	0.063	40.6	0.716
		Apr-99	0.682	1.726	1.742	1.726	-0.017	0.073	45.9	0.720
		May-99	0.716	2.076	2.109	2.076	-0.033	0.088	45.2	0.879
		Jun-99	0.823	2.407	2.458	2.407	-0.051	0.102	32.0	1.441
		Jul-99	0.960	3.026	3.141	3.026	-0.115	0.131	42.3	1.367
		Aug-99	1.500	3.632	3.606	3.632	0.026	0.150	38.3	1.816
		Sep-99	1.109	2.483	2.423	2.483	0.061	0.101	26.1	1.818
		Oct-99	1.423	2.957	2.832	2.957	0.125	0.118	29.0	1.948
		Nov-99	0.758	4.047	4.012	4.047	0.035	0.167	27.8	2.789
		Dec-99	0.924	2.060	2.010	2.060	0.050	0.084	20.3	1.942
		Jan-00	1.089	2.202	2.204	2.202	-0.001	0.092	20.3	2.072
		Feb-00	1.036	2.288	2.428	2.288	-0.140	0.101	22.8	1.917
		Mar-00	--	--	--	--	--	--	--	--

Notes:

Photosynthetic efficiency is calculated with above-water PAR and the assumption that 1 g O_2/m^2 equals 10 kcal and 1 Einstein (E) of photons equals 52.27 kcal.

* Treatment 1 was operated as a batch system from January - March 2000; these data are presented in Appendix D.

EXHIBIT C.1-15

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the ENR Test Cells, February 1999 - March 2000

Treatment[a]	Date	Water Depth (m)	PAR (μmol/m^2/s) Surface	PAR (μmol/m^2/s) Bottom	z (m)	Ext Coeff (m^{-1})
Period of Record						
1	1999- 2000	0.63	1113.2	378.5	0.51	4.61
2	1999- 2000	0.56	1127.3	549.9	0.42	2.02
3	1999- 2000	0.58	1326.8	551.3	0.48	2.41
Quarterly						
1	Qtr-3	0.65	1476.0	463.8	0.51	2.24
	Qtr-4	0.59	1513.1	743.1	0.49	1.94
	Qtr-5	0.64	508.6	65.9	0.52	7.65
	Qtr-6	0.64	543.8	9.1	0.52	9.34
	Qtr-7	--	--	--	--	--
2	Qtr-3	0.62	1187.6	611.2	0.44	1.57
	Qtr-4	0.56	1643.0	922.0	0.44	1.33
	Qtr-5	0.65	1206.5	358.5	0.52	2.56
	Qtr-6	0.57	500.2	174.6	0.45	2.62
	Qtr-7	0.34	1115.1	643.9	0.22	2.35
3	Qtr-3	0.68	1426.8	556.0	0.53	1.97
	Qtr-4	0.69	1551.8	683.2	0.57	1.54
	Qtr-5	0.77	1485.7	516.8	0.65	1.80
	Qtr-6	0.49	837.6	316.5	0.37	2.71
	Qtr-7	0.17	1501.0	913.7	0.10	6.65
Monthly						
1	Feb-99	0.66	1741.3	448.3	0.47	2.94
	Mar-99	0.67	1432.2	481.3	0.54	1.84
	Apr-99	0.64	1261.7	458.9	0.52	2.01
	May-99	0.46	2039.2	1258.2	0.34	1.48
	Jun-99	0.66	1619.4	594.2	0.58	1.97
	Jul-99	0.67	880.7	377.0	0.54	2.38
	Sep-99	0.62	767.8	129.8	0.50	4.83
	Oct-99	0.66	249.4	1.9	0.54	10.47
	Nov-99	0.61	194.7	3.7	0.48	9.86
	Dec-99	0.68	892.9	14.4	0.56	8.82
	Jan-00	--	--	--	--	--
	Feb-00	--	--	--	--	--
	Mar-00	--	--	--	--	--
2	Feb-99	0.62	752.6	356.8	0.41	1.86
	Mar-99	0.60	1356.9	770.1	0.44	1.36
	Apr-99	0.64	1396.8	653.8	0.48	1.57
	May-99	0.46	1081.1	610.9	0.34	1.67
	Jun-99	0.61	2095.5	1117.7	0.49	1.29
	Jul-99	0.62	1752.5	1037.5	0.50	1.03
	Sep-99	0.66	1803.3	506.8	0.53	2.61
	Oct-99	0.63	609.7	210.1	0.50	2.51
	Nov-99	0.64	839.9	285.6	0.52	2.33
	Dec-99	0.67	320.8	82.8	0.55	2.61
	Jan-00	0.41	339.9	155.3	0.29	2.91
	Feb-00	0.39	1471.0	705.9	0.27	2.87
	Mar-00	0.29	759.2	581.8	0.17	1.84
3	Feb-99	0.68	941.1	253.0	0.47	2.73
	Mar-99	0.71	1902.8	747.4	0.60	1.48
	Apr-99	0.63	1436.7	603.7	0.51	1.71
	May-99	0.43	1251.6	784.9	0.30	1.89
	Jun-99	0.82	1506.2	539.5	0.70	1.47
	Jul-99	0.82	1897.6	725.3	0.70	1.26
	Sep-99	0.78	1865.4	715.7	0.66	1.44
	Oct-99	0.77	1106.0	317.9	0.65	2.17
	Nov-99	0.56	903.9	376.4	0.44	1.94
	Dec-99	0.54	1077.9	327.8	0.42	3.22
	Jan-00	0.38	531.1	245.4	0.26	2.98
	Feb-00	0.23	1501.0	913.7	0.10	6.65
	Mar-00	0.11	--	--	--	--

Notes:

Extinction coefficient = (lnPARsurf - lnPARbot)/z and z = water depth - 0.122 m

PAR in Treatment 1 (Test Cell 13) influenced by macrophyte and submerged aquatic vegetation shading

[a] Treatment 1 was operated as a batch system from January - March 2000; these data are presented in Appendix D.

Phase 2 Data Summaries

EXHIBIT C.1-16

Water Balances for the PSTA Test Cells, April 2000 - March 2001

Treatment	Cell	Month	Depth (m)	HLR (cm/d)	Inflow (m3/d)	Inflow (m^3)	Outflow (m3/d)	Outflow (m^3)	Rainfall (In)	Rainfall (m^3)	ET (mm)	ET (m^3)	ΔSTORAGE (m^3)	Residual (m^3)	Residual (% of Inflow)
4	13	Apr-00	0.147	4 57	121.93	3779.84	88.66	2748.47	4.90	289.63	142.60	331.84	424.87	564.28	13.87
		May-00	0.250	5.15	121.90	3779.05	115.26	3573.17	0.76	45.95	165.76	394.59	108.84	-251.60	-6.58
		Jun-00	0.282	5.17	121.82	3776.30	144.55	4481.03	1.37	83.55	139.80	335.67	3.29	-960.15	-24.88
		Jul-00	0.283	5.20	121.93	3779.79	128.64	3987.71	7.42	452.91	131.78	316.68	-15.02	-56.68	-1.34
		Aug-00	0.289	5.29	121 89	3778.45	124.94	3873 11	2.30	140.57	129.00	310.41	46.94	-311 43	-7.95
		Sep-00	0.327	5.28	121 99	3781.72	142.92	4430.38	14.16	874.26	225.02	546.97	97.80	-419.17	-9.00
		Oct-00	0.327	5.46	121.99	3781.69	145.57	4512.76	10.82	668.00	108.45	263.60	-77.79	-248.89	-5.59
		Nov-00	0.302	4 91	122.01	3782.31	114.89	3561.68	0.80	49.06	93.83	226.56	-39.74	82.89	2.16
		Dec-00	0.283	4.45	121.81	3776.14	91.72	2843.38	0.22	13.42	80.53	193.39	-21.96	774.75	20.44
		Jan-01	0.279	4.70	121.03	3752.04	104.25	3231.77	0.92	56.07	95.14	228.26	-10.97	359.03	9.43
		Feb-01	0.281	4.66	121.70	3772.82	95.36	2956.05	0.03	1.83	97.78	234.67	9.51	574.43	15.22
		Mar-01	0.282	4.67	122.35	3792.92	103.90	3220.79	3.19	194.57	124.49	298.94	5.12	462.63	11.60
5	8	Apr-00	0.263	4.71	123.19	3818.89	100.45	3114.08	4.90	295.44	142.60	338.50	-66.02	727.76	17.69
		May-00	0.242	4.82	123.16	3818.10	106.69	3307.25	0.76	45 54	165.76	391.06	111.46	53.89	1.39
		Jun-00	0.284	4.65	123.08	3815.39	99.02	3069.69	1.37	83.05	139.80	333.67	19.28	475.81	12.21
		Jul-00	0.303	5.19	123.19	3818.84	128.90	3996.01	7.42	452.38	131.78	316.31	9.69	-50.80	-1.19
		Aug-00	0.295	5.25	123.15	3817.52	118.35	3668.80	2.30	139.85	129.00	308.81	-10.94	-9.29	-0.23
		Sep-00	0.307	5.69	123.25	3820.75	150.98	4680.23	14.16	863 88	225.02	540.48	47.22	-583.29	-12.45
		Oct-00	0.317	6 03	123.25	3820.72	174.82	5419.45	10.82	661.80	108.45	261.15	-3.67	-1194.42	-26.65
		Nov-00	0.314	5 34	123.27	3821.34	133.83	4148.76	0.80	48.91	93.83	225.86	16.51	-520.87	-13.46
		Dec-00	0.314	4.82	123.07	3815.23	109.08	3381 63	0.22	13.45	80.53	193.83	-3.67	256.88	6.71
		Jan-01	0.309	4 71	122.30	3791.22	104.15	3228.57	0.92	56.18	95.14	228.73	-21.98	412.08	10.71
		Feb-01	0.303	4.47	122.97	3811.96	90.02	2790.62	0.03	1.83	97.78	234.65	-1.46	789.98	20.71
		Mar-01	0.305	4.86	123.61	3831.84	110.18	3415.43	3.19	194.58	124.49	298.95	20.13	291.91	7.25
6	3	Apr-00	0.000	--	0.00	0.00	6.78	210.11	4.90	280.36	142.60	321.22	0.00	-250.97	-89.52
		May-00	0.092	3.44	54.60	1692.72	11.10	344.20	0 76	44.68	165.76	383.62	768.90	240.68	13.85
		Jun-00	0.371	9.91	221.25	6858.68	198.82	6163.29	1.37	87.05	139.80	349.73	174.61	258.10	3.72
		Jul-00	0.433	10.27	258 04	7999.26	269.30	8348.39	7.42	478.68	131.78	334.70	261.66	-466.81	-5.51
		Aug-00	0.569	9.68	257.95	7996.38	253.89	7870.54	2.30	153.79	129.00	339.59	75.42	-135.38	-1.66
		Sep-00	0.413	4.60	103.17	3198.17	121.04	3752.13	14.16	910.58	225.02	569.70	-1316.10	1103.03	26.85
		Oct-00	0.018	--	0.00	0.00	26.77	829.94	10.82	619.08	108.45	244.29	0.00	-455.16	-73.52
		Nov-00	-0.008	--	0.00	0.00	0.00	0.00	0.80	45.77	93.83	211.36	17.16	-182.75	-399.26
		Dec-00	-0.007	--	0.00	0.00	0.00	0.00	0.22	12.59	80.53	181.40	0.00	-168.81	-1341.12
		Jan-01	0.113	2.32	47.31	1466.63	26.65	826.10	0.92	54.40	95.14	221.48	549.91	-76.46	-5.03
		Feb-01	0.235	2.73	66.77	2069.80	64.20	1990.09	0.03	1.83	97.78	235.40	7.34	-161.19	-7.78
		Mar-01	0.244	2.82	67.13	2081.00	69.75	2162.19	3.19	195.49	124.49	300.35	28.31	-214.36	-9.42

EXHIBIT C.1-17

Monthly Averages of Field Measurements Collected from the ENR South Head Cell and the PSTA Test Cells, April 2000 - March 2001

Parameter	Month	Head Cell	Treatment 4 (Peat- Ca amended)	Treatment 5 (Shellrock)	Treatment 6 (Shellrock - Variable Stage)
Water Temp (°C)	Apr-00	24.68	26.09	25.21	21.74
	May-00	27.19	28.46	27.23	26.12
	Jun-00	28.57	29.87	28.91	30.24
	Jul-00	28.97	29.38	28.91	30.88
	Aug-00	28.87	28.21	28.13	29.70
	Sep-00	28.09	26.92	28.52	28.15
	Oct-00	24.61	24.59	23.84	--
	Nov-00	21.93	20.44	20.00	--
	Dec-00	19.74	21.02	19.39	--
	Jan-01	15.67	18.87	14.37	--
	Feb-01	21.61	21.14	20.42	--
	Mar-01	23.19	22.27	21.86	--
pH (units)	Apr-00	7.56	7.85	8.01	7.26
	May-00	7.42	7.73	7.86	7.63
	Jun-00	7.39	8.67	7.85	7.79
	Jul-00	7.27	8.49	7.78	7.76
	Aug-00	7.29	7.64	7.28	7.69
	Sep-00	7.13	7.21	7.13	7.72
	Oct-00	7.61	7.22	7.08	--
	Nov-00	--	7.26	7.21	--
	Dec-00	7.24	7.10	7.20	--
	Jan-01	7.51	7.50	7.65	--
	Feb-01	7.50	7.48	7.48	--
	Mar-01	7.75	7.71	7.52	--
Conductivity (μmhos/cm)	Apr-00	1020	1117	980	775
	May-00	1152	1184	1167	1176
	Jun-00	1136	1011	1056	1162
	Jul-00	740	974	1021	1013
	Aug-00	20	1083	1201	1222
	Sep-00	1210	1086	1236	1083
	Oct-00	939	1055	993	--
	Nov-00	--	1086	1082	--
	Dec-00	1168	1139	1141	--
	Jan-01	1241	1237	1259	--
	Feb-01	1283	1253	1260	--
	Mar-01	1284	1219	1065	--

EXHIBIT C.1-17

Monthly Averages of Field Measurements Collected from the ENR South Head Cell and the PSTA Test Cells, April 2000 - March 2001

Parameter	Month	Head Cell	Treatment 4 (Peat- Ca amended)	Treatment 5 (Shellrock)	Treatment 6 (Shellrock - Variable Stage)
Total Dissolved Solids (g/L)	Apr-00	0.652	0.715	0.627	0.496
	May-00	0.737	0.758	0.747	0.752
	Jun-00	0.727	0.647	0.676	0.744
	Jul-00	0.704	0.623	0.653	0.648
	Aug-00	0.796	0.693	0.769	0.782
	Sep-00	0.772	0.695	0.791	0.693
	Oct-00	0.681	0.674	0.637	--
	Nov-00	0.705	0.704	0.696	--
	Dec-00	0.748	0.739	0.725	--
	Jan-01	0.795	0.792	0.805	--
	Feb-01	0.821	0.802	0.806	--
	Mar-01	0.817	0.780	0.681	--
Dissolved Oxygen Saturation (%)	Apr-00	62.6	22.2	110.1	6.3
	May-00	40.4	29.5	111.0	63.1
	Jun-00	13.5	119.3	91.7	107.3
	Jul-00	5.9	111.8	75.0	120.0
	Aug-00	7.3	45.8	40.7	122.8
	Sep-00	2.9	6.1	29.0	111.5
	Oct-00	16.8	16.7	7.8	--
	Nov-00	15.9	5.6	6.5	--
	Dec-00	28.7	29.3	10.7	--
	Jan-01	40.6	20.1	48.3	--
	Feb-01	45.8	13.0	32.0	--
	Mar-01	55.2	78.5	44.8	--
Dissolved Oxygen (mg/L)	Apr-00	5.14	1.69	8.89	0.55
	May-00	3.21	2.15	8.56	5.07
	Jun-00	1.04	9.77	6.91	7.97
	Jul-00	0.46	9.23	5.66	8.86
	Aug-00	0.56	3.48	3.11	9.25
	Sep-00	0.23	0.48	2.13	8.63
	Oct-00	1.41	1.35	0.65	--
	Nov-00	1.43	0.55	0.83	--
	Dec-00	2.63	1.80	1.30	--
	Jan-01	4.02	1.95	4.94	--
	Feb-01	4.10	1.07	2.85	--
	Mar-01	4.70	6.78	3.88	--

EXHIBIT C.1-18

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, April 2000 - March 2001

Parameter	Month	Treatment 4 (Peat- Ca amended) Inflow*	Treatment 4 (Peat- Ca amended) Outflow	Treatment 5 (Shellrock) Inflow*	Treatment 5 (Shellrock) Outflow	Treatment 6 (Shellrock-Variable Stage) Inflow*	Treatment 6 (Shellrock-Variable Stage) Outflow
Total Phosphorus as P (µg/L)	Apr-00	19.0	99.0	20.5	12.3	--	--
	May-00	17.6	87.1	18.8	11.3	17.5	22.0
	Jun-00	41.5	27.3	41.5	18.3	28.5	20.8
	Jul-00	31.0	13.1	30.8	10.0	30.8	14.8
	Aug-00	21.8	13.9	21.0	10.3	21.0	10.3
	Sep-00	24.0	20.4	23.8	14.6	24.3	11.8
	Oct-00	18.0	13.5	18.0	12.0	0.0	0.0
	Nov-00	20.6	18.1	20.2	9.5	0.0	0.0
	Dec-00	17.5	18.4	18.3	10.5	0.0	0.0
	Jan-01	16.0	17.0	16.2	7.4	16.0	31.3
	Feb-01	21.3	28.3	21.1	11.7	21.3	20.9
	Mar-01	24.4	31.8	24.6	13.3	24.4	23.1
Total Particulate Phosphorus (µg/L)	Apr-00	5.0	58.5	5.6	2.4	--	--
	May-00	5.4	41.7	6.6	3.3	4.5	17.0
	Jun-00	22.5	10.3	22.5	7.3	10.0	7.7
	Jul-00	20.0	2.4	19.8	3.3	20.3	5.4
	Aug-00	8.5	6.8	6.8	4.9	8.0	3.6
	Sep-00	13.0	9.9	13.0	6.8	13.8	3.9
	Oct-00	7.4	5.0	7.4	5.5	--	--
	Nov-00	10.8	9.1	10.4	3.2	--	--
	Dec-00	7.3	8.0	8.0	3.5	--	--
	Jan-01	7.0	5.2	7.2	2.2	7.3	18.3
	Feb-01	7.4	12.1	7.6	4.8	8.4	8.5
	Mar-01	10.1	15.7	10.1	5.5	9.7	9.2
Total Dissolved Phosphorus (µg/L)	Apr-00	14.0	40.5	14.9	9.9	--	--
	May-00	12.2	45.4	12.2	8.0	13.0	5.0
	Jun-00	19.0	17.0	19.0	11.0	18.5	13.2
	Jul-00	12.2	11.6	12.2	7.0	11.8	10.1
	Aug-00	24.0	7.1	25.0	5.4	23.8	6.6
	Sep-00	11.0	10.5	10.8	7.9	10.5	7.9
	Oct-00	10.6	8.5	10.6	6.5	--	--
	Nov-00	9.8	9.0	9.8	6.3	--	--
	Dec-00	10.3	10.4	10.3	7.0	--	--
	Jan-01	9.0	11.8	9.0	5.2	8.7	13.0
	Feb-01	13.9	16.1	13.5	6.9	12.9	12.4
	Mar-01	14.3	16.1	14.5	7.8	14.7	13.9
Dissolved Reactive Phosphorus (µg/L)	Apr-00	4.7	--	4.0	--	--	--
	May-00	3.8	5.1	3.2	--	3.9	--
	Jun-00	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--
	Aug-00	23.0	1.0	22.3	2.0	22.0	1.0
	Sep-00	7.5	1.0	7.3	2.0	7.0	1.0
	Oct-00	3.0	1.4	3.0	2.2	--	--
	Nov-00	2.4	1.4	2.4	1.3	--	--
	Dec-00	4.0	1.0	5.0	1.0	--	--
	Jan-01	4.0	2.0	4.0	2.0	3.0	4.0
	Feb-01	5.3	3.0	4.8	2.7	3.3	2.0
	Mar-01	3.7	2.6	4.3	2.1	3.9	1.0
Dissolved Organic Phosphorus (µg/L)	Apr-00	9.4	--	10.9	--	--	--
	May-00	8.4	25.9	9.0	--	9.2	--
	Jun-00	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--
	Aug-00	2.5	7.0	4.3	4.5	3.3	7.0
	Sep-00	5.2	11.0	5.0	6.5	5.0	5.5
	Oct-00	7.6	6.9	7.6	4.2	--	--
	Nov-00	7.1	7.3	7.1	4.8	--	--
	Dec-00	9.0	9.5	8.0	6.0	--	--
	Jan-01	5.0	9.0	5.0	3.0	5.0	10.0
	Feb-01	11.5	14.8	11.0	5.5	11.0	11.0
	Mar-01	10.6	13.5	10.2	5.7	10.8	12.0

EXHIBIT C.1-18

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, April 2000 - March 2001

Parameter	Month	Treatment 4 (Peat- Ca amended) Inflow*	4 Outflow	5 (Shellrock) Inflow*	5 Outflow	6 (Shellrock-Variable Stage) Inflow*	6 Outflow
Total Nitrogen, as N (mg/L)	Apr-00	1.60	3.46	1.60	1.94	--	--
	May-00	2.21	3.01	2.21	2.58	2.21	--
	Jun-00	3.55	3.39	3.48	3.22	3.69	3.12
	Jul-00	2.10	2.05	2.10	2.47	2.10	1.91
	Aug-00	2.41	2.26	2.41	2.58	2.41	2.36
	Sep-00	2.34	2.25	2.30	1.89	2.51	2.17
	Oct-00	2.34	2.10	2.34	2.18	--	--
	Nov-00	2.54	2.28	2.54	2.08	--	--
	Dec-00	2.44	1.92	2.39	2.17	--	--
	Jan-01	2.60	2.09	2.60	2.12	2.60	2.60
	Feb-01	2.59	2.60	2.59	2.68	2.76	2.89
	Mar-01	2.64	2.55	2.67	2.52	2.72	3.04
Total Kjeldahl Nitrogen, as N (mg/L)	Apr-00	1.58	3.46	1.58	1.94	--	--
	May-00	2.19	3.01	2.19	2.58	2.19	--
	Jun-00	3.52	3.32	3.45	3.22	3.66	3.12
	Jul-00	2.08	2.05	2.08	2.47	2.08	1.91
	Aug-00	2.41	2.24	2.41	2.58	2.41	2.36
	Sep-00	2.33	2.25	2.29	1.89	2.49	2.17
	Oct-00	2.29	2.10	2.29	2.18	--	--
	Nov-00	2.42	2.28	2.42	2.08	--	--
	Dec-00	2.27	1.92	2.23	2.17	--	--
	Jan-01	2.43	2.08	2.43	2.12	2.43	2.60
	Feb-01	2.50	1.33	2.50	2.60	2.72	2.89
	Mar-01	2.50	2.10	2.52	2.55	2.58	3.04
Nitrate/Nitrite, as N (mg/L)	Apr-00	0.018	0.002	0.018	0.002	--	--
	May-00	0.019	0.002	0.019	0.002	0.019	--
	Jun-00	0.029	0.071	0.026	0.002	0.036	0.002
	Jul-00	0.022	0.002	0.022	0.002	0.022	0.002
	Aug-00	0.002	0.019	0.002	0.002	0.002	0.002
	Sep-00	0.007	0.002	0.009	0.002	0.016	0.002
	Oct-00	0.053	0.002	0.053	0.004	--	--
	Nov-00	0.125	0.002	0.125	0.002	--	--
	Dec-00	0.167	0.002	0.164	0.002	--	--
	Jan-01	0.170	0.006	0.170	0.002	0.170	0.005
	Feb-01	0.090	0.002	0.090	0.002	0.042	0.002
	Mar-01	0.146	0.002	0.148	0.002	0.148	0.002
Ammonia, as NH_3 (mg/L)	Apr-00	0.020	0.113	0.020	0.017	--	--
	May-00	0.034	0.041	0.034	0.045	0.034	--
	Jun-00	0.168	0.007	0.174	0.002	0.184	0.007
	Jul-00	0.052	--	0.052	--	0.052	--
	Aug-00	0.040	--	0.040	--	0.040	--
	Sep-00	0.112	--	0.112	--	0.112	--
	Oct-00	--	--	--	--	--	--
	Nov-00	0.064	0.002	0.064	0.003	--	--
	Dec-00	0.107	0.002	0.098	0.002	--	--
	Jan-01	0.230	0.028	0.230	0.034	0.230	0.028
	Feb-01	0.047	0.018	0.047	0.015	0.054	0.030
	Mar-01	0.077	0.016	0.076	0.021	0.075	0.055
Organic Nitrogen (mg/L)	Apr-00	1.56	3.35	1.56	1.92	--	--
	May-00	2.16	2.97	2.16	2.54	2.16	--
	Jun-00	3.35	3.31	3.28	3.22	3.47	3.11
	Jul-00	2.03	--	2.03	--	2.03	--
	Aug-00	2.37	--	2.37	--	2.37	--
	Sep-00	2.22	--	2.18	--	2.38	--
	Oct-00	--	--	--	--	--	--
	Nov-00	2.36	2.28	2.36	2.08	--	--
	Dec-00	2.16	1.92	2.13	2.16	--	--
	Jan-01	2.20	2.05	2.20	2.09	2.20	2.57
	Feb-01	2.45	1.31	2.45	2.58	2.66	2.86
	Mar-01	2.42	2.08	2.44	2.53	2.50	2.99

EXHIBIT C.1-18

Monthly Averages of Water Quality Data Collected at the ENR South Head Cell and PSTA Test Cells, April 2000 - March 2001

Parameter	Month	Treatment 4 (Peat- Ca amended) Inflow[a]	Outflow	5 (Shellrock) Inflow[a]	Outflow	6 (Shellrock-Variable Stage) Inflow[a]	Outflow
TOC (mg/L)	Apr-00	44.0	54.0	38.6	41.0	--	--
	May-00	43.0	54.0	43.0	48.0	43.0	--
	Jun-00	45.0	42.5	46.0	45.0	44.0	44.0
	Jul-00	33.0	34.0	33.0	37.5	33.0	35.0
	Aug-00	42.0	44.0	42.0	43.5	42.0	42.0
	Sep-00	48.0	41.0	47.0	39.5	47.0	42.0
	Oct-00	36.0	35.0	36.0	37.0	--	--
	Nov-00	37.0	35.5	37.0	34.0	--	--
	Dec-00	39.0	41.0	39.0	40.5	--	--
	Jan-01	39.9	38.1	39.9	38.1	39.9	46.3
	Feb-01	44.8	48.8	44.8	46.2	47.7	51.0
	Mar-01	46.0	47.5	45.8	47.7	46.4	46.3
TSS (mg/L)	Apr-00	1.0	9.3	2.3	1.4	--	--
	May-00	3.0	5.5	3.0	7.0	3.0	--
	Jun-00	2.0	2.0	1.0	2.0	1.0	1.0
	Jul-00	1.0	2.0	1.0	4.0	1.0	1.0
	Aug-00	2.0	6.0	2.0	5.5	2.0	2.0
	Sep-00	--	--	--	--	--	--
	Oct-00	1.0	1.5	1.0	1.0	--	--
	Nov-00	13.0	6.5	13.0	8.0	--	--
	Dec-00	1.0	1.0	1.0	2.5	--	--
	Jan-01	5.0	4.0	5.0	4.0	5.0	4.0
	Feb-01	3.0	6.0	3.0	3.5	2.5	4.0
	Mar-01	4.9	5.5	4.7	3.6	4.9	4.0
Calcium (mg/L)	Apr-00	70.6	58.0	68.8	44.0	--	--
	May-00	62.6	52.3	62.6	44.8	62.6	--
	Jun-00	48.6	18.0	52.3	43.3	44.7	48.7
	Jul-00	70.6	22.8	70.6	48.0	70.6	64.2
	Aug-00	87.7	35.4	87.7	65.1	87.7	80.2
	Sep-00	--	--	--	--	--	--
	Oct-00	83.1	55.6	83.1	75.5	--	--
	Nov-00	81.4	63.2	81.4	68.1	--	--
	Dec-00	80.1	57.5	81.0	65.0	--	--
	Jan-01	87.0	71.0	87.0	75.1	87.0	106.0
	Feb-01	80.1	55.6	80.1	69.4	70.4	72.6
	Mar-01	77.1	57.4	79.6	63.0	78.0	70.7
Alkalinity (mg/L)	Apr-00	248	220	244	180	--	--
	May-00	230	202	230	192	230	--
	Jun-00	224	113	220	204	224	228
	Jul-00	232	100	232	182	232	220
	Aug-00	296	158	296	246	296	274
	Sep-00	--	--	--	--	--	--
	Oct-00	258	197	258	242	--	--
	Nov-00	288	278	288	248	--	--
	Dec-00	304	278	304	280	--	--
	Jan-01	312	272	312	276	312	288
	Feb-01	300	254	300	281	290	284
	Mar-01	296	235	296	263	296	268

Notes:

One-half the method detection limit used in the calculation of monthly averages for undetected values.

[a]Inflow averages include data from constant head cell outlet and samples collected from individual cell inlets.

EXHIBIT C.1-19

Monthly Summaries Total Phosphorus Mass Balance Data from the ENR Test Cells, April 2000 - March 2001

Treatment	Cell	Date	TP (mg/L) Inflow	TP (mg/L) Outflow	Inflow (m^3/d)	Outflow (m^3/d)	Avg_flow (m^3/d)	q_in (cm/d)	MB_TP ($g/m^2/y$) Inflow	MB_TP ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Monthly													
4	13	Apr-00	0.02	0.10	121.98	94.86	108.42	5.14	0.357	1.446	-1.089	-305.21	-27.55
		May-00	0.02	0.09	121.90	123.59	122.74	5.12	0.329	1.515	-1.186	-360.75	-30.07
		Jun-00	0.04	0.03	121.78	126.51	124.14	5.07	0.768	0.527	0.240	31.33	7.88
		Jul-00	0.03	0.01	121.91	127.86	124.89	5.07	0.574	0.244	0.330	57.52	16.30
		Aug-00	0.02	0.01	121.90	143.71	127.36	5.06	0.402	0.276	0.126	31.24	8.68
		Sep-00	0.02	0.02	122.00	134.77	128.38	5.02	0.439	0.416	0.023	5.24	3.15
		Oct-00	0.02	0.01	121.95	143.64	132.80	5.02	0.329	0.293	0.037	11.19	5.73
		Nov-00	0.02	0.02	122.03	114.89	118.46	5.05	0.380	0.313	0.067	17.60	2.32
		Dec-00	0.02	0.02	121.78	91.72	106.75	5.07	0.324	0.254	0.070	21.71	-0.79
		Jan-01	0.02	0.02	121.16	104.25	112.71	5.05	0.295	0.272	0.023	7.85	-1.04
		Feb-01	0.02	0.03	121.74	102.14	111.94	5.07	0.394	0.429	-0.034	-8.71	-4.83
		Mar-01	0.02	0.03	122.35	101.77	112.06	5.10	0.453	0.498	-0.045	-9.86	-4.54
5	8	Apr-00	0.02	0.01	123.19	100.45	111.82	5.19	0.388	0.190	0.199	51.19	8.65
		May-00	0.02	0.01	123.16	104.66	113.91	5.22	0.358	0.184	0.174	48.50	8.96
		Jun-00	0.04	0.02	123.04	98.97	111.00	5.15	0.779	0.272	0.508	65.16	13.86
		Jul-00	0.03	0.01	123.17	126.04	124.61	5.13	0.576	0.197	0.379	65.84	21.29
		Aug-00	0.02	0.01	123.16	116.29	121.45	5.32	0.409	0.194	0.215	52.57	13.74
		Sep-00	0.02	0.01	123.26	150.24	136.75	5.13	0.445	0.330	0.115	25.75	10.07
		Oct-00	0.02	0.01	123.21	167.48	145.34	5.12	0.336	0.313	0.023	6.92	8.93
		Nov-00	0.02	0.01	123.29	133.83	128.56	5.12	0.378	0.194	0.184	48.75	14.71
		Dec-00	0.02	0.01	123.04	109.08	116.06	5.11	0.340	0.177	0.163	47.87	9.73
		Jan-01	0.02	0.01	122.43	104.15	113.29	5.09	0.301	0.117	0.184	61.12	13.48
		Feb-01	0.02	0.01	123.01	91.78	107.39	5.13	0.395	0.163	0.232	58.76	9.63
		Mar-01	0.02	0.01	123.60	109.80	116.70	5.15	0.462	0.223	0.239	51.72	10.90
6	3	Apr-00	--	--	--	--	--	--	--	--	--	--	--
		May-00	0.018	0.022	120.91	47.55	84.23	4.96	0.317	0.309	0.008	2.59	-2.88
		Jun-00	0.029	0.021	257.72	240.57	249.14	10.26	1.065	0.734	0.331	31.06	11.34
		Jul-00	0.031	0.015	258.01	265.77	261.89	10.11	1.132	0.579	0.554	48.89	27.37
		Aug-00	0.021	0.010	257.97	246.00	254.99	9.79	0.751	0.358	0.393	52.35	25.34
		Sep-00	0.024	0.012	92.12	146.75	119.43	3.53	0.305	0.232	0.073	23.91	12.18
		Oct-00	--	--	--	--	--	--	--	--	--	--	--
		Nov-00	--	--	--	--	--	--	--	--	--	--	--
		Dec-00	--	--	--	--	--	--	--	--	--	--	--
		Jan-01	0.02	0.03	66.82	44.41	55.62	2.80	0.164	0.125	0.038	23.40	-5.69
		Feb-01	0.02	0.02	66.79	64.68	65.74	2.77	0.216	0.205	0.011	5.07	0.21
		Mar-01	0.02	0.02	67.13	69.12	68.12	2.78	0.247	0.241	0.006	2.52	0.55

EXHIBIT C.1-20

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the ENR Test Cells, April 2000 - March 2001

Treatment	Cell	Date	TN (mg/L) Inflow	TN (mg/L) Outflow	Inflow (m^3/d)	Outflow (m^3/d)	Avg_flow (m^3/d)	q_in (cm/d)	MB_TN ($g/m^2/y$) Inflow	MB_TN ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Monthly													
4	13	Apr-00	1.60	3.46	121.98	94.86	108.42	5.14	30.04	50.53	-20.48	-68.17	-12.87
		May-00	2.21	3.01	121.90	123.59	122.74	5.12	41.28	56.96	-15.68	-37.99	-5.81
		Jun-00	3.55	3.39	121.78	126.51	124.14	5.07	65.73	65.20	0.53	0.81	0.87
		Jul-00	2.10	2.05	121.91	127.86	124.89	5.07	38.89	39.81	-0.92	-2.38	0.46
		Aug-00	2.41	2.26	121.90	143.71	132.80	5.06	44.54	49.20	-4.66	-10.47	1.29
		Sep-00	2.34	2.25	122.00	134.77	128.38	5.02	42.85	45.49	-2.64	-6.16	0.76
		Oct-00	2.34	2.10	121.95	143.64	132.80	5.02	42.84	45.27	-2.43	-5.67	2.16
		Nov-00	2.54	2.28	122.03	114.89	118.46	5.05	46.85	39.60	7.26	15.49	1.93
		Dec-00	2.44	1.92	121.78	91.72	106.75	5.07	45.17	26.77	18.40	40.73	3.89
		Jan-01	2.60	2.09	121.16	104.25	112.71	5.05	47.93	33.15	14.78	30.83	3.74
		Feb-01	2.59	2.60	121.74	102.14	111.94	5.07	47.98	40.40	7.58	15.81	-0.06
		Mar-01	2.64	2.55	122.35	101.77	112.06	5.10	49.15	39.44	9.71	19.75	0.61
5	8	Apr-00	1.60	1.94	123.19	100.45	111.82	5.19	30.30	29.96	0.34	1.11	-3.31
		May-00	2.21	2.58	123.16	104.66	113.91	5.22	42.08	41.74	0.33	0.79	-2.73
		Jun-00	3.48	3.22	123.04	98.97	111.00	5.15	65.45	48.71	16.74	25.58	1.32
		Jul-00	2.10	2.47	123.17	126.04	124.61	5.13	39.34	47.34	-8.00	-20.35	-3.08
		Aug-00	2.41	2.58	123.16	116.29	119.72	5.32	46.81	47.18	-0.37	-0.78	-1.25
		Sep-00	2.30	1.89	123.26	150.24	136.75	5.13	43.07	43.13	-0.06	-0.15	4.08
		Oct-00	2.34	2.18	123.21	167.48	145.34	5.12	43.69	55.29	-11.59	-26.53	1.56
		Nov-00	2.54	2.08	123.29	133.83	128.56	5.12	47.49	42.21	5.28	11.11	3.90
		Dec-00	2.39	2.17	123.04	109.08	116.06	5.11	44.59	35.81	8.78	19.69	1.74
		Jan-01	2.60	2.12	122.43	104.15	113.29	5.09	48.33	33.53	14.81	30.64	3.51
		Feb-01	2.59	2.68	123.01	91.78	107.39	5.13	48.47	37.41	11.06	22.83	-0.55
		Mar-01	2.67	2.52	123.60	109.80	116.70	5.15	50.14	42.06	8.09	16.12	1.02
6	3	Apr-00	--	--	--	--	--	--	--	--	--	--	--
		May-00	2.21	---	120.91	47.55	84.23	4.96	40.04	---	---	---	---
		Jun-00	3.69	3.12	257.72	240.57	249.14	10.26	138.12	109.01	29.11	21.08	6.07
		Jul-00	2.10	1.91	258.01	265.77	261.89	10.11	77.53	72.65	4.88	6.30	3.55
		Aug-00	2.41	2.36	257.97	246.00	251.98	9.79	86.13	80.65	5.48	6.36	0.73
		Sep-00	2.51	2.17	92.12	146.75	119.43	3.53	32.33	44.87	-12.53	-38.76	2.48
		Oct-00	--	--	--	--	--	--	--	--	--	--	--
		Nov-00	--	--	--	--	--	--	--	--	--	--	--
		Dec-00	--	--	--	--	--	--	--	--	--	--	--
		Jan-01	2.60	2.60	66.82	44.41	55.62	2.80	26.58	17.50	9.08	34.15	0.00
		Feb-01	2.76	2.89	66.79	64.68	65.74	2.77	27.91	28.34	-0.43	-1.55	-0.47
		Mar-01	2.72	3.04	67.13	69.12	68.12	2.78	27.67	31.79	-4.12	-14.87	-1.13

EXHIBIT C.1-21

Monthly Summaries of Sediment Data from the ENR Test Cells, April 2000 - March 2001

Treatment[a]	Cell	Month	Density Wet (g/cm^3)	Solids (%)	Bulk Den Dry (g/cm^3)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
4	13	Apr-00	1.25	34.50	0.43	247.3	238.4	--	--
		May-00	0.64	44.20	0.28	226.7	215.1	--	--
		Jun-00	0.48	39.30	0.19	182.5	245.0	6800.0	--
		Jul-00	0.61	46.85	0.28	170.5	186.0	--	--
		Aug-00	0.64	38.90	0.25	413.0	159.5	--	--
		Sep-00	0.71	43.05	0.30	262.2	229.8	4745.0	--
		Oct-00	0.63	47.18	0.29	234.0	221.4	--	--
		Mar-01	0.60	41.10	0.25	252.8	189.0	7880.0	--
5	8	Apr-00	2.00	75.00	1.50	808.9	872.5	--	--
		May-00	1.42	62.48	0.89	805.8	791.8	--	--
		Jun-00	1.62	84.38	1.37	790.5	779.0	263.3	--
		Jul-00	1.65	81.40	1.34	710.0	861.5	--	--
		Aug-00	1.62	49.70	0.81	593.5	620.0	--	--
		Sep-00	1.80	73.98	1.33	811.9	786.6	141.5	--
		Oct-00	1.75	83.45	1.46	662.6	667.3	--	--
		Mar-01	1.57	71.40	1.12	909.4	747.4	241.0	--
6	3	Apr-00	1.95	72.00	1.40	1023.3	1031.5	--	--
		May-00	1.76	78.80	1.39	912.5	943.1	--	--
		Jun-00	1.63	83.55	1.36	956.0	938.0	246.0	--
		Jul-00	1.73	83.20	1.44	814.0	845.5	--	--
		Aug-00	1.55	74.05	1.15	726.0	657.5	--	--
		Sep-00	1.71	74.30	1.27	953.6	915.2	131.5	--
		Nov-00	1.60	84.40	1.35	892.8	844.9	--	--
		Mar-01	1.63	75.05	1.22	923.8	822.4	268.0	--

No sediment samples collected from STC- 4 and -5 during November and December 2000.

STC-6 sediment collected during the month of November 2000 for the October 2000 sampling event.

EXHIBIT C.1-22

Non-Reactive Phosphorus Data Summary for PSTA Test Cell Sediments, April 2000 - March 2001

Treatment	Soil	Sampling Date	Moisture %	TP (mg/kg)	$NaHCO_3$ Pi (mg/kg)	$NaHCO_3$TP (mg/kg)	Labile Po (mg/kg)	HClPi (mg/kg)	Alkali Hydrolyz Po (NaOH TP) (mg/kg)	Residual Po (mg/kg)
4	PE_limed	6/27/00	58 24	272.3	31.67	30 36	-1.31	199.4	-5.6	40 1
		9/19/00	61.17	237.6	17.16	24.25	7.09	150.3	-29.7	73.8
		3/20/01	59.0	232.4	20.30	33 77	13.47	145.92	5.89	42.22
5	SR	6/27/00	19.00	824.6	3.50	4.28	0.77	742.0	-24 9	49.3
		9/19/00	20.01	752.8	3.16	2.87	-0.29	678.6	-14.3	43.4
		3/20/01	22.1	752.7	4.03	6.95	2.91	759.55	-18.24	49.08
6	SR	6/27/00	19.28	925.4	3.28	3.87	0.59	1075.2	-34.6	48.4
		9/19/00	19.91	979 4	2.58	3.62	1.03	990.0	-33.70	47.62
		3/20/01	22.0	824.1	4.47	7.74	3.27	889.53	-21.51	38.55

Notes:

Data from 6/00 represent composite samples collected from the 1/3 and 2/3 walkways within each Test Cell.

EXHIBIT C.1-23
Monthly Summaries of Algae and Macrophyte Percent Cover Estimates for the PSTA Test Cells, April 2000 - March 2001

Treatment[a]	Cell	Month	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover
4	13	Apr-00	0%	0%	1%	0%	0%	0%	1%	1%
		May-00	2%	0%	3%	0%	1%	2%	4%	6%
		Jun-00	1%	3%	5%	0%	54%	4%	59%	63%
		Jul-00	1%	0%	11%	0%	97%	1%	107%	108%
		Aug-00	3%	0%	14%	0%	100%	3%	114%	117%
		Sep-00	3%	0%	18%	0%	97%	3%	115%	118%
		Oct-00	18%	0%	38%	0%	97%	18%	135%	152%
		Nov-00	5%	1%	38%	0%	97%	6%	135%	140%
		Dec-00	3%	3%	31%	0%	97%	6%	128%	133%
		Jan-01	2%	1%	24%	0%	97%	3%	121%	124%
		Feb-01	12%	7%	32%	0%	97%	19%	129%	148%
		Mar-01	24%	0%	46%	0%	97%	24%	143%	167%
5	8	Apr-00	11%	0%	18%	0%	69%	11%	87%	98%
		May-00	5%	0%	31%	0%	89%	5%	120%	125%
		Jun-00	8%	0%	14%	0%	53%	8%	67%	74%
		Jul-00	14%	0%	31%	0%	96%	14%	126%	141%
		Aug-00	6%	0%	48%	0%	97%	6%	145%	151%
		Sep-00	26%	0%	63%	0%	83%	26%	145%	171%
		Oct-00	18%	0%	63%	0%	83%	18%	145%	163%
		Nov-00	3%	6%	63%	0%	93%	9%	155%	164%
		Dec-00	1%	8%	38%	0%	97%	9%	135%	143%
		Jan-01	21%	1%	31%	0%	58%	22%	89%	111%
		Feb-01	40%	2%	46%	0%	92%	42%	137%	180%
		Mar-01	76%	0%	46%	0%	89%	76%	135%	211%
6	3	Apr-00	0%	0%	31%	0%	0%	0%	31%	31%
		May-00	0%	0%	24%	0%	0%	0%	24%	25%
		Jun-00	0%	0%	39%	0%	8%	0%	47%	47%
		Jul-00	1%	0%	53%	0%	61%	1%	113%	114%
		Aug-00	2%	0%	46%	0%	68%	2%	113%	116%
		Sep-00	11%	0%	69%	0%	63%	11%	132%	143%
		Oct-00	--	--	--	--	--	--	--	--
		Nov-00	--	--	--	--	--	--	--	--
		Dec-00	0%	0%	18%	0%	0%	0%	18%	18%
		Jan-01	0%	0%	11%	0%	53%	0%	63%	64%
		Feb-01	26%	0%	10%	0%	20%	26%	30%	57%
		Mar-01	40%	0%	18%	0%	5%	40%	22%	62%

Test Cells, April 2000 - March 2001

Periphyton Biomass (g/m^2)			Ca	Chl_a (corr)	Pheo_a	TP	TIP	TKN[a]	Blue Green Algae		Diatoms		Green Algae		Other Taxa		Total
Dry Wt	Ash Wt	AFDW	(g/m^2)	(mg/m^2)	(mg/m^2)	(g/m^2)	(g/m^2)	(g/m^2)	(# $cells/m^2$)*10^6	(# taxa)	(# $cells/m^2$)*10^6	(# taxa)	(# $cells/m^2$)*10^6	(# taxa)	(# $cells/m^2$)*10^6	(# taxa)	(# $cells/m^2$)*10
2354.9	3484.2	1129.2	565.9	142.8	19.3	2.067	1.234	--	55945.6	9.0	5361.7	14.0	2077.4	6.0	0.0	0.0	63384.9
607.1	821.2	214.0	216.5	177.6	7.6	0.525	0.176	--	297348.1	12.0	7057.8	7.5	9182.5	7.5	330.9	1.0	313753.9
961.0	1399.2	438.2	355.0	396.5	113.4	0.800	0.436	10.97	94780.3	9.0	2256.0	6.0	3754.3	4.5	0.0	0.0	100790.6
138.6	199.4	60.8	16.3	33.8	5.8	0.169	0.080	--	58927.9	14.5	48963.3	19.0	819.5	6.0	0.0	0.0	59890.1
494.0	708.4	214.3	213.8	172.5	91.8	0.363	0.210	--	41722.7	7.5	1185.7	7.0	639.8	3.0	0.0	0.0	43548.3
194.6	303.3	108.7	52.5	126.4	13.9	0.217	0.038	4.39	150799.2	14.0	194.1	1.0	944.1	3.0	0.0	0.0	151937.5
555.0	763.7	209.5	200.6	391.1	60.3	0.504	0.074	--	--	--	--	--	--	--	--	--	--
805.0	1351.4	546.4	199.1	164.4	75.1	0.750	0.235	--	--	--	--	--	--	--	--	--	--
229.2	369.3	140.1	70.7	191.6	20.6	0.371	0.031	6.88	658750.5	12.0	0.0	0.0	1027.0	2.0	0.0	0.0	659777.4
279.4	431.2	151.8	114.0	177.8	23.5	0.814	0.079	4.46	--	--	--	--	--	--	--	--	--
341.5	497.8	156.3	71.0	117.5	19.8	0.413	0.078	5.57	--	--	--	--	--	--	--	--	--
1341.1	1871.8	530.0	378.7	383.0	55.5	--	--	16.21	215952.1	12.0	3045.5	6.0	385.6	1.0	0.0	0.0	219383.1
427.8	578.8	151.0	124.9	172.5	0.0	0.365	0.043	--	431530.2	10.5	19515.1	7.5	1573.8	2.0	0.0	0.0	452619.1
333.1	476.2	143.1	89.1	197.7	22.8	0.157	0.062	--	255802.2	13.0	12194.8	10.5	1439.2	2.5	0.0	0.0	269436.1
164.7	238.9	74.2	65.6	152.5	1.3	0.076	0.044	2.34	132637.4	19.0	3415.4	10.5	2792.9	6.0	0.0	0.0	138845.6
102.1	147.7	45.6	155.0	281.5	5.4	0.038	0.026	--	--	--	--	--	--	--	--	--	--
231.3	327.1	95.8	77.3	126.9	27.0	0.137	0.027	--	--	--	--	--	--	--	--	--	--
173.9	273.3	99.5	65.6	247.4	41.6	0.166	0.023	4.44	170662.2	15.0	988.2	6.0	816.6	5.0	0.0	0.0	172466.9
248.1	369.0	120.9	95.0	242.4	35.1	0.193	0.045	--	--	--	--	--	--	--	--	--	--
809.9	1088.0	278.1	228.8	428.4	137.1	0.623	0.113	--	--	--	--	--	--	--	--	--	--
317.4	461.2	143.7	108.1	225.3	43.6	0.464	0.174	6.89	308881.7	13.0	6751.6	6.0	562.7	1.0	0.0	0.0	316426.2
411.7	613.4	201.1	180.6	404.0	65.4	0.561	0.030	7.35	136398.4	16.0	2880.0	9.0	1851.5	5.0	0.0	0.0	141129.8
217.2	387.9	171.2	87.3	536.0	29.1	0.607	0.029	0.53	--	--	--	--	--	--	--	--	--
236.3	398.3	162.0	87.7	415.3	28.4	--	--	5.66	368539.8	16.0	5134.6	7.0	570.5	1.0	0.0	0.0	374244.9
220.0	328.1	108.1	57.2	63.6	0.0	0.242	0.012	--	525711.1	13.0	4023.1	4.5	5331.2	1.5	0.0	0.0	535065.4
147.1	215.3	95.2	70.3	66.4	2.8	0.257	0.079	--	72117.0	10.5	2362.3	8.0	1806.5	4.0	0.0	0.0	76285.8
301.6	407.5	106.0	202.2	115.7	16.4	0.731	0.459	5.47	111945.6	14.5	869.6	3.5	2010.1	3.5	0.0	0.0	114825.4
144.5	195.9	51.5	124.9	142.0	5.6	0.244	0.103	--	294416.6	14.0	152162.4	14.5	3636.5	5.0	0.0	0.0	301189.0
159.2	216.6	57.3	66.2	92.7	37.6	0.149	0.103	--	223010.4	12.5	1029.9	2.0	436.7	1.0	0.0	0.0	224477.1
174.8	275.0	100.2	59.8	155.9	20.0	0.166	0.023	3.84	389149.9	15.0	3046.5	7.5	10529.5	7.0	0.0	0.0	402725.9
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
346.1	546.7	200.7	97.8	343.1	60.0	0.439	0.086	--	--	--	--	--	--	--	--	--	--
46.5	103.6	57.1	20.9	71.1	14.3	0.175	0.015	2.45	13650.5	13.0	1027.3	11.0	64.3	3.0	0.0	0.0	14742.1
199.8	280.6	80.8	84.6	115.1	15.8	0.992	0.113	2.05	23301.1	9.0	817.5	7.0	51.1	1.0	0.0	0.0	8901.3
126.5	196.3	70.4	33.9	139.0	19.4	0.480	0.048	0.64	--	--	--	--	--	--	--	--	--
161.1	235.4	74.2	55.3	78.9	8.8	--	--	1.53	64843.1	14.0	844.6	6.0	--	--	0.0	0.0	65687.7

asis for STC-5 beginning in July 2000.

EXHIBIT C.1-25

Non-Reactive Phosphorus Data Summary for PSTA Test Cell Periphyton, April 2000 - March 2001

Treatment	Soil	Sampling Date	Moisture %	TP mg/kg	NaHCO3 Pi mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPi mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg
4	PE_limed	6/27/00	--	--	--	--	--	--	--	--
		9/20/00	94.3	447.6	5.19	227.03	221.83	132.1	46.6	92.1
		12/18/00	94.4	645.0	11.28	430.4	419.1	94.4	77.4	47.9
		3/20/01	90.7	867.2	56.06	332.49	276.42	147.78	64.60	129.94
5	SR	6/27/00	95.4	278.4	2.55	173.62	171.08	106.2	15.5	25.4
		9/20/00	93.4	230.6	2.13	133.93	131.80	37.4	29.6	36.7
		12/18/00	92.6	227.6	5.26	171.4	166.2	32.6	10.1	21.5
		3/20/01	93.8	507.4	2.36	279.65	277.28	100.95	42.07	61.68
6	SR	6/27/00	85.0	511.2	1.72	129.63	127.90	306.3	23.7	95.5
		9/20/00	95.3	528.8	2.18	256.09	253.91	304.9	37.2	112.4
		12/18/00	60.7	474.8	3.47	183.1	179.7	254.0	31.5	103.3
		3/20/01	91.2	491.5	2.31	284.19	281.89	120.26	39.03	39.22

Notes:

Data from 6/00 represent composite samples collected from the 1/3 and 2/3 walkways within each Test Cell.

Data from 9/00 represent samples collected from 2/3 walkway within each Test Cell

EXHIBIT C.1-26

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 x 10^6), April 2000 - March 2001

Organism Code	Division Code	Organism	Treatment 4	Treatment 5	Treatment 6
APH DEL	1	APHANOCAPSA DELICATISSIMA	7092	2410	3858
APH INC	1	APHANOCAPSA INCERTA	0	0	1423
APH NUB	1	APHANOCAPSA NUBILUM	5225	0	0
APH PLA	1	APHANOCAPSA PLANCTONICA?	431	0	643
APHA CLA	1	APHANOTHECE CLATHRATA	332	131	146
APHA MIC	1	APHANOTHECE MICROSCOPICA	257	0	0
APHA SMI	1	APHANOTHECE SMITHII	10043	1513	6151
APHA STA	1	APHANOTHECE STAGNINA	242	2235	12394
APHA VAR	1	APHANOTHECE VARIABILIS?	0	251	0
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	0	476	527
CAL EPI	1	CALOTHRIX EPIPHYTICA	116	0	0
CHR DIS	1	CHROOCOCCUS DISPERSUS	402	281	3296
CHR MIN	1	CHROOCOCCUS MINUTUS	184	1000	1637
CHR MINI	1	CHROOCOCCUS MINIMUS	4280	4352	11066
CHR TUR	1	CHROOCOCCUS TURGIDUS	0	0	26
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	112	0	0
CYL STA	1	CYLINDROSPERMUM STAGNALE	405	0	0
G ANA	1	ANABAENA SP	287	0	2612
G CYL	1	CYLINDROSPERMUM SP	790	5988	7019
G GLO	1	GLOEOCAPSA SP	47	2979	648
G LYN SM	1	LYNGBYA SP (SMALL)	17661	0	3742
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	1797	0	0
G OSC SM	1	OSCILLATORIA SP (SMALL)	2185	5001	714
G SCY	1	SCYTONEMA SP?	14873	5992	719
G SYNE	1	SYNECHOCCOCCUS SP	13	9703	14609
GOM APO	1	GOMPHOSPHAERIA APONINA	0	0	264
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	0	0	1743
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	117	1327	2768
LYN EPI	1	LYNGBYA EPIPHYTICA	9156	4974	10259
LYN LAG	1	LYNGBYA LAGERHEIMII	32565	19534	17324
LYN LIM	1	LYNGBYA LIMNETICA	12306	36119	48618
LYN PER	1	LYNGBYA PERELEGANS?	0	0	14
MER GLA	1	MERISMOPEDIA GLAUCA	40	84	0
MER PUN	1	MERISMOPEDIA PUNCTATA	112	0	0
MER TEN	1	MERISMOPEDIA TENUISSIMA	1157	21	850
MIC AER	1	MICROCYSTIS AERUGINOSA	80	0	0
MIC FIR	1	MICROCYSTIS FIRMA	1367	990	1156
OSC AMP	1	OSCILLATORIA AMPHIBIA	46	1336	416
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	31094	32740	26392
OSC FOR	1	OSCILLATORIA FORMOSA	3195	15988	1145
OSC LIM	1	OSCILLATORIA LIMNETICA	8163	20159	8233
OSC TEN	1	OSCILLATORIA TENUIS	266	0	0
OSC WIL	1	OSCILLATORIA WILLEI?	0	2673	0
PHO TEN	1	PHORMIDIUM TENUE	0	327	0
RHA LIN	1	RHABDODERMA LINEARE?	0	450	0
SCH ARE	1	SCHIZOTHRIX ARENARIA?	3289	5807	694
SPI LAX	1	SPIRULINA LAXA	54	8	0
SPI SUB	1	SPIRULINA SUBSALSA	3	796	50
ANK FAL	3	ANKISTRODESMUS FALCATUS	41	0	0
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	63	0	0
ANK SPI	3	ANKISTRODESMUS SPIRALIS	194	17	74
CHA ENS	3	CHARACIUM ENSIFORME	21	0	0
COE MIC	3	COELASTRUM MICROPORUM	0	0	23
COE SPH	3	COELASTRUM SPHAERICUM	23	21	0
COS ANG CO	3	COSMARIUM ANGULOSUM V CONCINNUM	64	0	0
COS BOT	3	COSMARIUM BOTRYTIS	3	0	0
COS GRAN	3	COSMARIUM GRANATUM	13	0	0
COS SUBR	3	COSMARIUM SUBRENIFORME	82	80	2
COS TUB	3	COSMOCLADIUM TUBURCULATUM	0	16	0
CRU API	3	CRUCIGENIA APICULATA	0	0	48
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	0	0	0
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	0	9	0
G CHLA	3	CHLAMYDOMONAS SP	0	0	26
G COS	3	COSMARIUM SP	0	8	0
G MOU	3	MOUGEOTIA SP	0	162	82
G OED	3	OEDOGONIUM SP	70	5	0
G SPI	3	SPIROGYRA SP	16	5	0
G STAU	3	STAURASTRUM SP	20	0	0

EXHIBIT C.1-26

ENR PSTA Test Cell Average Algal Cell Counts (# cells/m^2 x 10^6), April 2000 - March 2001

Organism Code	Division Code	Organism	Treatment		
			4	5	6
GOL RAD	3	GOLENKINIA RADIATA	13	0	0
KIR LUN	3	KIRCHNERIELLA LUNARIS	20	0	0
KIR OBE	3	KIRCHNERIELLA OBESA	41	0	24
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	0	158	0
OOC PAR	3	OOCYSTIS PARVA	178	107	35
OOC SOL	3	OOCYSTIS SOLITARIA	57	0	112
PED BIR	3	PEDIASTRUM BIRADIATUM	165	0	0
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	64	0	94
SCE ACU	3	SCENEDESMUS ACUMINATUS	163	0	0
SCE ARM	3	SCENEDESMUS ARMATUS	0	0	105
SCE BIJ	3	SCENEDESMUS BIJUGA	483	104	353
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	163	0	245
SCE DIM	3	SCENEDESMUS DIMORPHUS	0	0	37
SCE QUA	3	SCENEDESMUS QUADRICAUDA	116	0	128
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	24	75	904
SPO PLA	3	SPONDYLOSIUM PLANUM	21	0	0
STAU TET	3	STAURASTRUM TETRACERUM	0	53	0
TET MIN	3	TETRAEDRON MINIMUM	22	0	121
TET TRI	3	TETRAEDRON TRIGONUM	56	142	90
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	110	63	314
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	13	47	105
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	0	0	4
BRA VIT	4	BRACHYSIRA VITREA	0	0	0
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	0	0	24
CYM MIC	4	CYMBELLA MICROCEPHALA	13	347	68
CYM PUS	4	CYMBELLA PUSILLA	0	0	0
DIP OBL	4	DIPLONEIS OBLONGELLA	0	45	10
DIP OVA	4	DIPLONEIS OVALIS	108	0	29
ENC EVE	4	ENCYONEMA EVERGLADIANUM	103	1431	171
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	82	269	34
EPI ADN	4	EPITHEMIA ADNATA	164	47	53
FRA FAS	4	FRAGILARIA FASCICULATA?	0	180	98
FRA NAN	4	FRAGILARIA NANANA?	0	208	4
FRA SYN	4	FRAGILARIA SYNEGROTESCA	6	517	85
G AMP	4	AMPHORA SP	4	0	0
G NAV SM	4	NAVICULA SP (SMALL)	21	0	0
G NIT	4	NITZSCHIA SP	6	0	50
G NIT ME	4	NITZSCHIA SP (MEDIUM)	0	0	9
G NIT SM	4	NITZSCHIA SP (SMALL)	213	5	8
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	13	45	0
GOM PAR	4	GOMPHONEMA PARVULUM	4	0	35
MAS LANC	4	MASTOGLOIA LANCEOLATA	0	19	2
MAS SMI	4	MASTOGLOIA SMITHII	100	425	133
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	33	690	52
NAV CRY	4	NAVICULA CRYPTOCEPHALA	254	0	54
NAV CRYP	4	NAVICULA CRYPTOTENELLA	218	72	152
NAV POD	4	NAVICULA PODZORSKII	4	0	0
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	8	0	0
NAV RAD	4	NAVICULA RADIOSA	10	0	0
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	0	0	0
NIT AMP	4	NITZSCHIA AMPHIBIA	209	0	0
NIT CON	4	NITZSCHIA CONSTRICTA	8	0	0
NIT FRU	4	NITZSCHIA FRUSTULUM	32	0	0
NIT PAL	4	NITZSCHIA PALEA	41	0	4
NIT PALE	4	NITZSCHIA PALEACEA	45	119	0
NIT PALF	4	NITZSCHIA PALEAFORMIS	0	241	0
NIT SCA	4	NITZSCHIA SCALARIS	0	0	4
NIT SEM	4	NITZSCHIA SEMIROBUSTA	223	1377	600
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	6	28	26
RHO GIBA	4	RHOPALODIA GIBBA	84	10	0
G EUG	10	EUGLENA SP	21	0	0

Codes:

1 = Cyanobacteria (Bluegreens) 7 = Xanthophyceae (Yellow greens)

3 = Chlorophytea (Greens) 10 = Euglenophyta (Euglenoids)

4 = Bacillariophyceae (Diatoms) 11 = Cryptophyta (Cryptomoniads)

5 = Chrysomonodales (Dinobryon) 12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT C.1-27

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April - March 2001

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment		
			4	5	6
APH DEL	1	APHANOCAPSA DELICATISSIMA	0.007	0.002	0.004
APH INC	1	APHANOCAPSA INCERTA	0.000	0.000	0.001
APH NUB	1	APHANOCAPSA NUBILUM	0.021	0.000	0.000
APH PLA	1	APHANOCAPSA PLANCTONICA?	0.003	0.000	0.005
APHA CLA	1	APHANOTHECE CLATHRATA	0.001	0.000	0.000
APHA MIC	1	APHANOTHECE MICROSCOPICA	0.006	0.000	0.000
APHA SMI	1	APHANOTHECE SMITHII	0.060	0.009	0.037
APHA STA	1	APHANOTHECE STAGNINA	0.006	0.054	0.297
APHA VAR	1	APHANOTHECE VARIABILIS?	0.000	0.002	0.000
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	0.000	0.010	0.012
CAL EPI	1	CALOTHRIX EPIPHYTICA	0.004	0.000	0.000
CHR DIS	1	CHROOCOCCUS DISPERSUS	0.006	0.004	0.046
CHR MIN	1	CHROOCOCCUS MINUTUS	0.002	0.011	0.018
CHR MINI	1	CHROOCOCCUS MINIMUS	0.017	0.017	0.044
CHR TUR	1	CHROOCOCCUS TURGIDUS	0.000	0.000	0.007
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	0.001	0.000	0.000
CYL STA	1	CYLINDROSPERMUM STAGNALE	0.032	0.000	0.000
G ANA	1	ANABAENA SP	0.005	0.000	0.050
G CYL	1	CYLINDROSPERMUM SP	0.028	0.210	0.246
G GLO	1	GLOEOCAPSA SP	0.000	0.012	0.003
G LYN SM	1	LYNGBYA SP (SMALL)	0.088	0.000	0.019
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	0.153	0.000	0.000
G OSC SM	1	OSCILLATORIA SP (SMALL)	0.011	0.025	0.004
G SCY	1	SCYTONEMA SP?	20.599	8.299	0.996
G SYNE	1	SYNECHOCCOCCUS SP	0.001	0.621	0.935
GOM APO	1	GOMPHOSPHAERIA APONINA	0.000	0.000	0.007
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	0.000	0.000	0.098
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	0.014	0.157	0.327
LYN EPI	1	LYNGBYA EPIPHYTICA	0.055	0.030	0.062
LYN LAG	1	LYNGBYA LAGERHEIMII	0.195	0.117	0.104
LYN LIM	1	LYNGBYA LIMNETICA	0.308	0.903	1.215
LYN PER	1	LYNGBYA PERELEGANS?	0.000	0.000	0.000
MER GLA	1	MERISMOPEDIA GLAUCA	0.001	0.001	0.000
MER PUN	1	MERISMOPEDIA PUNCTATA	0.000	0.000	0.000
MER TEN	1	MERISMOPEDIA TENUISSIMA	0.001	0.000	0.001
MIC AER	1	MICROCYSTIS AERUGINOSA	0.003	0.000	0.000
MIC FIR	1	MICROCYSTIS FIRMA	0.011	0.008	0.009
OSC AMP	1	OSCILLATORIA AMPHIBIA	0.003	0.085	0.027
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	0.062	0.065	0.053
OSC FOR	1	OSCILLATORIA FORMOSA	0.252	1.263	0.090
OSC LIM	1	OSCILLATORIA LIMNETICA	0.057	0.141	0.058
OSC TEN	1	OSCILLATORIA TENUIS	0.016	0.000	0.000
OSC WIL	1	OSCILLATORIA WILLEI?	0.000	0.056	0.000
PHO TEN	1	PHORMIDIUM TENUE	0.000	0.008	0.000
RHA LIN	1	RHABDODERMA LINEARE?	0.000	0.020	0.000
SCH ARE	1	SCHIZOTHRIX ARENARIA?	0.043	0.075	0.009
SPI LAX	1	SPIRULINA LAXA	0.007	0.001	0.000
SPI SUB	1	SPIRULINA SUBSALSA	0.000	0.050	0.003
ANK FAL	3	ANKISTRODESMUS FALCATUS	0.002	0.000	0.000
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	0.000	0.000	0.000
ANK SPI	3	ANKISTRODESMUS SPIRALIS	0.002	0.000	0.001
CHA ENS	3	CHARACIUM ENSIFORME	0.001	0.000	0.000
COE MIC	3	COELASTRUM MICROPORUM	0.000	0.000	0.002
COE SPH	3	COELASTRUM SPHAERICUM	0.002	0.002	0.000
COS ANG CO	3	COSMARIUM ANGULOSUM V CONCINNUM	0.053	0.000	0.000
COS BOT	3	COSMARIUM BOTRYTIS	0.077	0.000	0.000
COS GRAN	3	COSMARIUM GRANATUM	0.162	0.000	0.000
COS SUBR	3	COSMARIUM SUBRENIFORME	0.021	0.021	0.001
COS TUB	3	COSMOCLADIUM TUBURCULATUM	0.000	0.002	0.000
CRU API	3	CRUCIGENIA APICULATA	0.000	0.000	0.001
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	0.000	0.000	0.000
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	0.000	0.025	0.000
G CHLA	3	CHLAMYDOMONAS SP	0.000	0.000	0.007
G COS	3	COSMARIUM SP	0.000	0.021	0.000
G MOU	3	MOUGEOTIA SP	0.000	0.061	0.031
G OED	3	OEDOGONIUM SP	0.141	0.011	0.000
G SPI	3	SPIROGYRA SP	1.404	0.476	0.000

EXHIBIT C.1-27

ENR PSTA Test Cell Average Algal Biovolume Data (cm^3/m^2), April - March 2001

Organism Code	Division Code	Organism	ENR South Test Cell PSTA Treatment		
			4	5	6
G STAU	3	STAURASTRUM SP	0.026	0.000	0.000
GOL RAD	3	GOLENKINIA RADIATA	0.002	0.000	0.000
KIR LUN	3	KIRCHNERIELLA LUNARIS	0.000	0.000	0.000
KIR OBE	3	KIRCHNERIELLA OBESA	0.000	0.000	0.000
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	0.000	1.270	0.000
OOC PAR	3	OOCYSTIS PARVA	0.004	0.003	0.001
OOC SOL	3	OOCYSTIS SOLITARIA	0.078	0.000	0.152
PED BIR	3	PEDIASTRUM BIRADIATUM	0.022	0.000	0.000
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	0.005	0.000	0.008
SCE ACU	3	SCENEDESMUS ACUMINATUS	0.004	0.000	0.000
SCE ARM	3	SCENEDESMUS ARMATUS	0.000	0.000	0.007
SCE BIJ	3	SCENEDESMUS BIJUGA	0.005	0.001	0.004
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	0.005	0.000	0.008
SCE DIM	3	SCENEDESMUS DIMORPHUS	0.000	0.000	0.001
SCE QUA	3	SCENEDESMUS QUADRICAUDA	0.012	0.000	0.013
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	0.003	0.008	0.102
SPO PLA	3	SPONDYLOSIUM PLANUM	0.001	0.000	0.000
STAU TET	3	STAURASTRUM TETRACERUM	0.000	0.003	0.000
TET MIN	3	TETRAEDRON MINIMUM	0.001	0.000	0.006
TET TRI	3	TETRAEDRON TRIGONUM	0.054	0.138	0.087
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	0.093	0.053	0.266
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	0.002	0.007	0.015
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	0.000	0.000	0.006
BRA VIT	4	BRACHYSIRA VITREA	0.000	0.000	0.000
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	0.000	0.000	0.028
CYM MIC	4	CYMBELLA MICROCEPHALA	0.002	0.059	0.012
CYM PUS	4	CYMBELLA PUSILLA	0.000	0.000	0.000
DIP OBL	4	DIPLONEIS OBLONGELLA	0.000	0.015	0.003
DIP OVA	4	DIPLONEIS OVALIS	0.043	0.000	0.012
ENC EVE	4	ENCYONEMA EVERGLADIANUM	0.019	0.269	0.032
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	0.098	0.325	0.041
EPI ADN	4	EPITHEMIA ADNATA	1.374	0.394	0.445
FRA FAS	4	FRAGILARIA FASCICULATA?	0.000	0.332	0.180
FRA NAN	4	FRAGILARIA NANANA?	0.000	0.079	0.001
FRA SYN	4	FRAGILARIA SYNEGROTESCA	0.006	0.555	0.091
G AMP	4	AMPHORA SP	0.001	0.000	0.000
G NAV SM	4	NAVICULA SP (SMALL)	0.010	0.000	0.000
G NIT	4	NITZSCHIA SP	0.000	0.000	0.003
G NIT ME	4	NITZSCHIA SP (MEDIUM)	0.000	0.000	0.014
G NIT SM	4	NITZSCHIA SP (SMALL)	0.023	0.001	0.001
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	0.029	0.098	0.000
GOM PAR	4	GOMPHONEMA PARVULUM	0.007	0.000	0.062
MAS LANC	4	MASTOGLOIA LANCEOLATA	0.000	0.127	0.016
MAS SMI	4	MASTOGLOIA SMITHII	0.349	1.480	0.464
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	0.053	1.109	0.083
NAV CRY	4	NAVICULA CRYPTOCEPHALA	0.108	0.000	0.023
NAV CRYP	4	NAVICULA CRYPTOTENELLA	0.162	0.053	0.112
NAV POD	4	NAVICULA PODZORSKII	0.009	0.000	0.000
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	0.007	0.000	0.000
NAV RAD	4	NAVICULA RADIOSA	0.041	0.000	0.000
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	0.000	0.000	0.000
NIT AMP	4	NITZSCHIA AMPHIBIA	0.050	0.000	0.000
NIT CON	4	NITZSCHIA CONSTRICTA	0.005	0.000	0.000
NIT FRU	4	NITZSCHIA FRUSTULUM	0.007	0.000	0.000
NIT PAL	4	NITZSCHIA PALEA	0.022	0.000	0.002
NIT PALE	4	NITZSCHIA PALEACEA	0.003	0.007	0.000
NIT PALF	4	NITZSCHIA PALEAFORMIS	0.000	0.206	0.000
NIT SCA	4	NITZSCHIA SCALARIS	0.000	0.000	0.682
NIT SEM	4	NITZSCHIA SEMIROBUSTA	0.131	0.810	0.353
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	0.056	0.262	0.240
RHO GIBA	4	RHOPALODIA GIBBA	2.137	0.265	0.000
G EUG	10	EUGLENA SP	0.266	0.000	0.000

Codes:

1 = Cyanobacteria (Bluegreens)
3 = Chlorophytea (Greens)
4 = Bacillariophyceae (Diatoms)
5 = Chrysomonodates (Dinobryon)
7 = Xanthophyceae (Yellow greens)
10 = Euglenophyta (Euglenoids)
11 = Cryptophyta (Cryptomoniads)
12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT C.1-28

Summary of Macrophyte Biomass Data (g dry/m^2), April 2000 - March 2001

Month	Treatment		
	4	5	6
Apr-00	87	369	23
May-00	25	401	76
Jun-00	160	132	84
Jul-00	270	389	396
Aug-00	466	415	70
Sep-2000	632	612	56
Oct-2000	537	414	--
Nov-2000	551	525	93
Dec-2000	203	449	392
Jan-2001	74	85	45
Feb-2001	186	134	79
Mar-2001	203	143	16
Treatment Average	**283**	**339**	**121**

EXHIBIT C.1-29

Monthly Summaries of PAR Extinction Measurements from the ENR Test Cells, April 2000 - March 2001

Treatment	Month	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	Z (m)	Ext Coeff (m^{-1})
4	Apr-00	0.24	1107.6	788.6	0.11	2.76
	May-00	0.25	2046.9	1684.1	0.13	1.51
	Jun-00	0.30	385.3	134.7	0.18	6.54
	Jul-00	0.29	451.3	145.9	0.17	8.35
	Aug-00	0.28	849.7	142.6	0.15	12.74
	Sep-00	0.36	502.4	22.4	0.23	14.00
	Oct-00	0.31	204.8	32.1	0.19	10.64
	Nov-00	0.30	1419.5	283.4	0.18	12.80
	Dec-00	0.29	1347.8	356.0	0.17	8.28
	Jan-01	0.31	1320.5	574.0	0.19	4.78
	Feb-01	0.26	523.8	304.1	0.14	4.37
	Mar-01	0.25	1478.2	999.5	0.13	3.78
5	Apr-00	0.24	932.5	473.7	0.12	4.30
	May-00	0.22	1438.6	1209.5	0.10	2.44
	Jun-00	0.27	196.7	103.1	0.15	8.18
	Jul-00	0.29	473.2	165.6	0.17	6.75
	Aug-00	0.27	347.1	187.5	0.15	5.03
	Sep-00	0.32	315.6	18.5	0.19	19.45
	Oct-00	0.29	135.6	26.0	0.17	9.91
	Nov-00	0.30	368.4	33.3	0.17	17.09
	Dec-00	0.30	615.0	42.0	0.18	17.86
	Jan-01	0.29	967.7	183.8	0.17	10.77
	Feb-01	0.27	1210.6	488.4	0.15	6.45
	Mar-01	0.31	1540.2	937.4	0.18	2.65
6	Apr-00	0.07	--	--	-0.05	--
	May-00	--	--	--	--	--
	Jun-00	0.43	190.5	91.1	0.31	2.42
	Jul-00	0.51	480.1	145.7	0.39	3.18
	Aug-00	0.56	1751.1	666.0	0.44	2.79
	Sep-00	0.38	789.6	290.0	0.26	3.65
	Oct-00	--	--	--	--	--
	Nov-00	--	--	--	--	--
	Dec-00	--	--	--	--	--
	Jan-01	0.27	1197.8	846.8	0.15	2.16
	Feb-01	0.27	1233.6	903.1	0.14	2.04
	Mar-01	0.30	2057.6	1400.6	0.18	2.16

Notes:

Extinction coefficient = (lnPARsurf - lnPARbot)/z and z = water depth - 0.122 m

PAR in Treatment 4 (Test Cell 13) influenced by macrophyte and submerged aquatic vegetation shading

EXHIBIT C.1-30

Monthly Summaries of Ecosystem Metabolism Data from the ENR Test Cells, April 2000 - March 2001

Treatment	Cell	Month	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Res g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
Monthly			--	--	--	--	--	--	--	--
4	13	Apr-00	--	--	--	--	--	--	--	--
		May-00	0.266	0.957	1.078	0.957	-0.121	0.045	43.2	0.424
		Jun-00	2.987	8.770	8.674	8.770	0.096	0.361	35.0	4.794
		Jul-00	2.308	7.129	7.332	7.129	-0.203	0.306	33.4	4.090
		Aug-00	1.263	3.131	3.177	3.131	-0.046	0.132	28.3	2.117
		Sep-00	-0.076	0.275	0.580	0.275	-0.305	0.024	28.5	0.184
		Oct-00	0.090	0.526	0.727	0.526	-0.202	0.030	20.4	0.493
		Nov-00	-0.076	0.234	0.514	0.234	-0.281	0.021	23.5	0.190
		Dec-00	0.666	1.478	1.608	1.478	-0.130	0.067	18.5	1.533
		Jan-01	0.697	1.735	1.998	1.735	-0.262	0.083	22.8	1.458
		Feb-01	0.274	1.902	2.616	1.902	-0.207	0.109	24.5	1.488
		Mar-01	0.692	3.297	3.491	3.297	-0.194	0.145	23.9	2.638
5	8	Apr-00	--	--	--	--	--	--	--	--
		May-00	2.892	7.716	7.718	7.716	-0.002	0.322	44.9	3.289
		Jun-00	2.376	7.049	7.077	7.049	-0.028	0.295	36.1	3.737
		Jul-00	2.284	6.689	6.709	6.689	-0.020	0.280	23.2	5.527
		Aug-00	1.155	2.821	2.856	2.821	-0.035	0.119	32.1	1.681
		Sep-00	0.576	1.697	1.902	1.697	-0.205	0.079	28.1	1.154
		Oct-00	-0.211	0.142	0.324	0.142	-0.182	0.013	25.3	0.107
		Nov-00	-0.066	0.314	0.321	0.314	-0.006	0.013	20.5	0.293
		Dec-00	-0.316	0.012	0.302	0.012	-0.290	0.013	17.2	0.013
		Jan-01	0.297	0.977	1.254	0.977	-0.277	0.052	21.2	0.881
		Feb-01	0.177	1.251	2.077	1.251	-0.409	0.087	25.7	0.931
		Mar-01	1.157	3.644	3.964	3.644	-0.320	0.165	33.4	2.085
6	3	Apr-00	--	--	--	--	--	--	--	--
		May-00	--	--	--	--	--	--	--	--
		Jun-00	0.922	2.618	2.575	2.618	0.043	0.107	36.0	1.392
		Jul-00	1.753	4.894	4.779	4.894	0.116	0.199	36.3	2.582
		Aug-00	2.636	6.484	6.444	6.484	0.040	0.269	32.5	3.818
		Sep-00	1.959	4.468	4.399	4.468	0.068	0.183	23.2	3.679
		Oct-00	--	--	--	--	--	--	--	--
		Nov-00	--	--	--	--	--	--	--	--
		Dec-00	--	--	--	--	--	--	--	--
		Jan-01	--	--	--	--	--	--	--	--
		Feb-01	0.619	1.772	1.824	1.772	-0.052	0.076	25.5	1.331
		Mar-01	0.518	2.147	2.253	2.147	-0.106	0.094	26.8	1.534

Notes:

Extinction coefficient = (lnPARsurf - lnPARbot)/z and z = water depth - 0.122 m

PAR in Treatment 4 (Test Cell 13) influenced by macrophyte and submerged aquatic vegetation shading

EXHIBIT C.1-31

South PSTA Test Cells Sediment Trap Data - April 2000 - April 2001

Site	Tank	Soil	Treatment	Date Installed	Date Collected	PSTA #	Sediment Volume (ml)	# Days	Wet Accretion ($ml/m^2/y$)	Dry Accretion ($g/m^2/y$)	TP Accretion ($g/m^2/y$)	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Wet Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
STC	13-A	peat_limed	4	7/31/00	10/10/00	258	235	71	78448	15369	4.977	0.742	0 196	174 37	46.04	73.6	323.8	89.3
STC	13-B	peat_limed	4	7/31/00	10/10/00	259	230	71	76779	4338	3.147	0 607	0 056	139 67	12.99	90 7	725.4	77.0
STC	13-C	peat_limed	4	7/31/00	10/10/00	260	240	71	80117	15262	4.814	0.807	0.190	193 67	45.72	76 4	315.5	91.3
STC	13-D	peat_limed	4	7/31/00	10/10/00	261	140	71	46735	1086	0.772	0.420	0.023	58.78	3.25	94.5	711.6	70.9
STC	13-E	peat_limed	4	7/31/00	10/10/00	262	240	71	80117	1288	1.257	0 493	0 016	118 30	3.86	96.7	975.6	67.4
STC	13-F	peat_limed	4	7/31/00	10/10/00	263	240	71	80117	2858	2.367	0.520	0.036	124.88	8.56	93.1	828.2	70.7
STC	3-A	shell	6	7/31/00	10/10/00	246	630	71	210307	1627	1.196	0 217	0.009	136 83	5.47	96.0	654.9	69 2
STC	3-B	shell	6	7/31/00	10/10/00	247	760	71	253704	2331	1.087	0 304	0.009	230 67	6 98	97.0	466.3	57.5
STC	3-C	shell	6	7/31/00	10/10/00	248	525	71	175256	1958	1 925	0.323	0 011	169.77	5.87	96.5	982.9	50.0
STC	3-D	shell	6	7/31/00	10/10/00	249	510	71	170249	1964	0 874	0.348	0.012	177 57	5.88	96.7	444.7	54.8
STC	3-E	shell	6	7/31/00	10/10/00	250	310	71	103485	2486	1.494	0.419	0.024	129.98	7.45	94.3	601.0	70.0
STC	3-F	shell	6	7/31/00	10/10/00	251	170	71	56750	1059	0.795	0.491	0.019	83.54	3.17	96 2	750.3	55.2
STC	8-A	shell	5	7/31/00	10/10/00	252	510	71	170249	2012	1.614	0.342	0 012	174 27	6.03	96.5	802.3	54.1
STC	8-B	shell	5	7/31/00	10/10/00	253	470	71	156896	2502	1.919	0.404	0 016	190.07	7.49	96 1	767.1	53.3
STC	8-C	shell	5	7/31/00	10/10/00	254	160	71	53411	2283	1.632	0.607	0 043	97.13	6.84	93.0	714.7	75.7
STC	8-D	shell	5	7/31/00	10/10/00	255	470	71	156896	3974	2 097	0.465	0.025	218.57	11.90	94.6	527.8	65.1
STC	8-E	shell	5	7/31/00	10/10/00	256	200	71	66764	2798	2.694	0 567	0.042	113 41	8 38	92.6	962.8	77.3
STC	8-F	shell	5	7/31/00	10/10/00	257	640	71	213646	7290	8.139	0.544	0.034	348.47	21.84	93.7	1116.4	61.4
STC	13-B	peat_limed	4	10/24/00	4/25/01	1857	1036	183	134178	4093	1.951	0.486	0.031	503 4	31.6	93.7	476 8	79.5
STC	13-C	peat_limed	4	10/24/00	4/25/01	1858	1327	183	171867	4054	2.464	0.393	0.024	521.8	31.3	94.0	607.9	77.0
STC	13-D	peat_limed	4	10/24/00	4/25/01	1859	1420	183	183912	1982	1 975	0.349	0.011	496	15.3	96.9	996.5	72.1
STC	13-F	peat_limed	4	10/24/00	4/25/01	1861	1445	183	187150	1554	1.305	0.344	0.008	496 7	12	97.6	839.6	67.5
STC	8-A	shell	5	10/24/00	4/25/01	1850	1240	183	160599	2616	1.664	0.413	0.016	512	20.2	96.1	636.1	71.3
STC	8-B	shell	5	10/24/00	4/25/01	1851	910	183	117859	2798	1.091	0.551	0.024	501 8	21.6	95.7	390.0	73.0
STC	8-C	shell	5	10/24/00	4/25/01	1852	780	183	101022	2176	0.886	0.658	0.022	512.9	16.8	96.7	407.3	69.8
STC	8-D	shell	5	10/24/00	4/25/01	1853	588	183	76155	1049	0.782	0.827	0.014	486 5	8.1	98 3	745.1	41.7
STC	8-E	shell	5	10/24/00	4/25/01	1854	610	183	79004	1839	1.611	0.826	0.023	503.8	14.2	97.2	875.7	51.4
STC	8-F	shell	5	10/24/00	4/25/01	1855	980	183	126925	1839	0 633	0.520	0.014	509 5	14.2	97.2	344.3	66.8

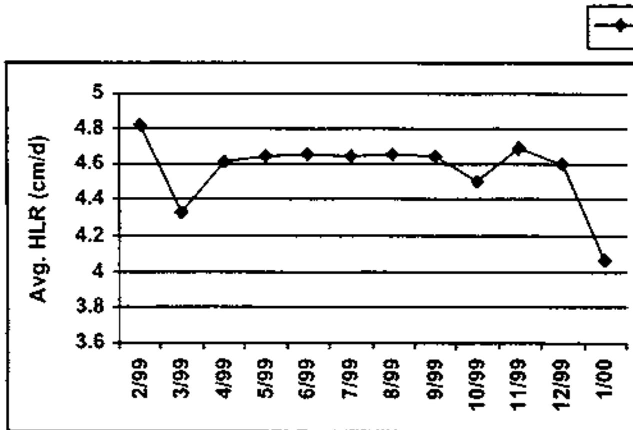
Sample Area = 154 cm^2 (14.0 cm diameter)

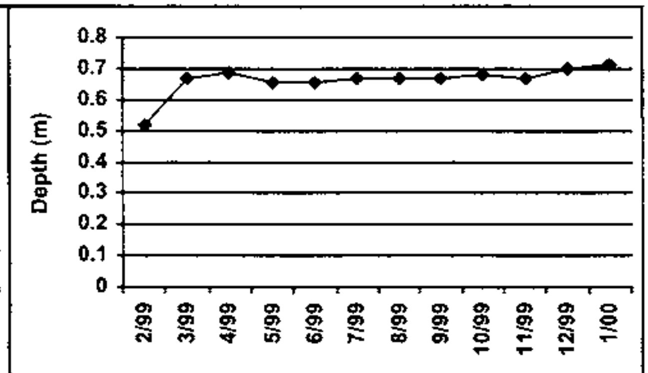
APPENDIX C.2

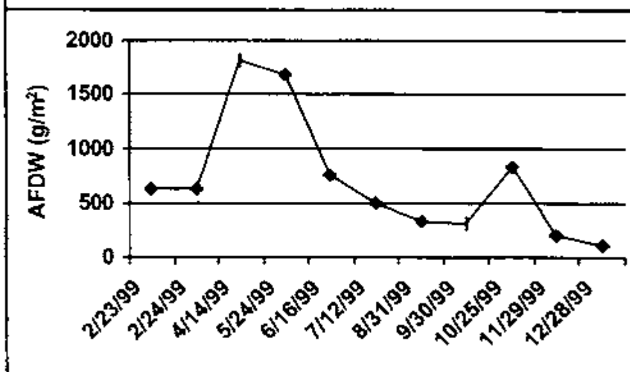
Trend Charts

PSTA Research and Demonstration Project

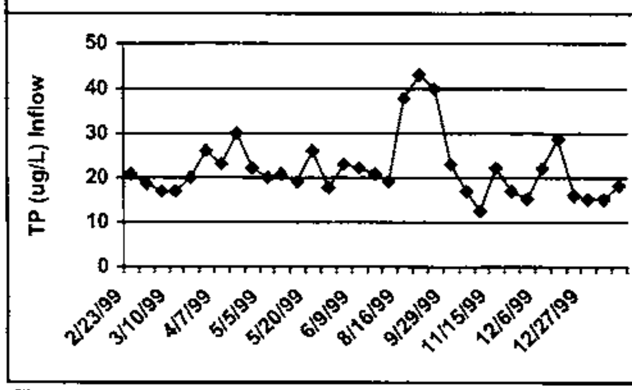
Treatment:	STC-1	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	13	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	peat		

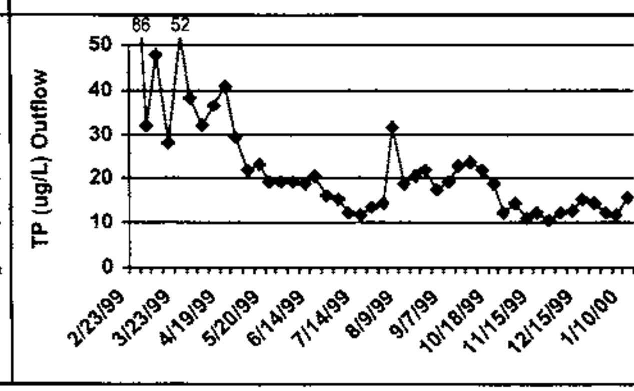






Stem counts not conducted in STCs



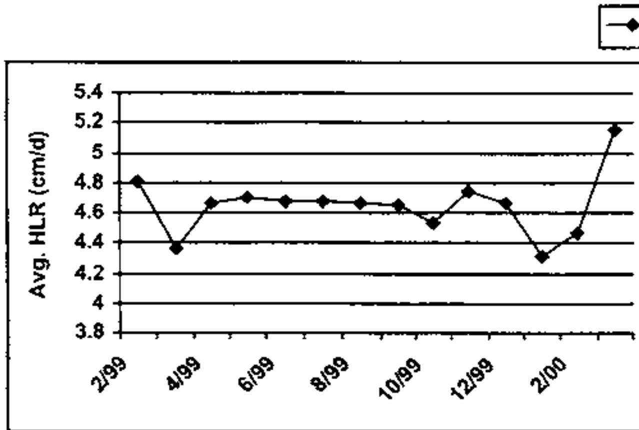


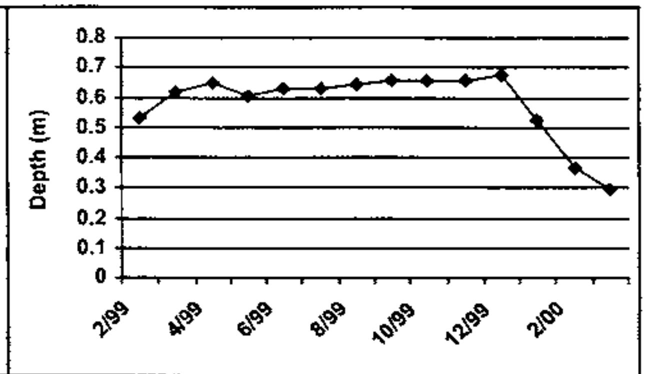
Summary For Period

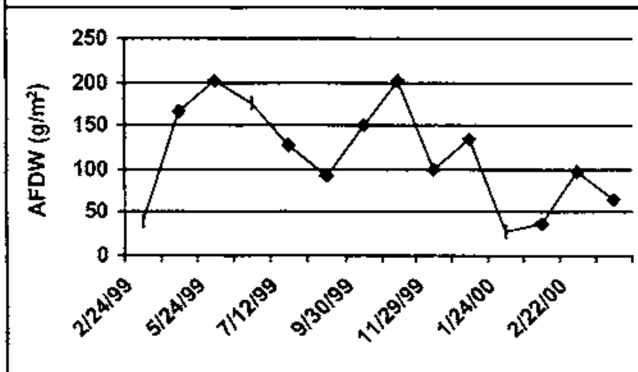
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
13	4.60	0.67	22	23	-0.5
Mean	4.60	0.67	22	23	-0.5

PSTA Research and Demonstration Project

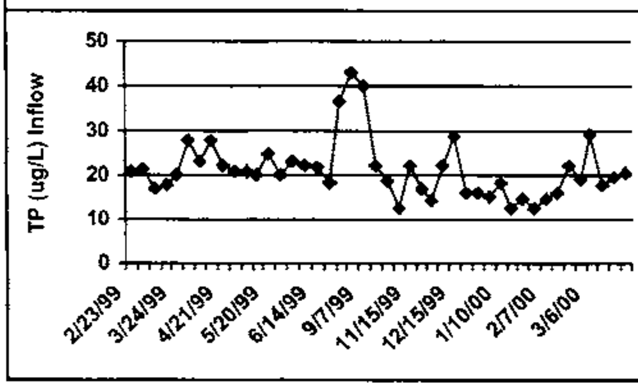
Treatment:	STC-2	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	8	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	shellrock		

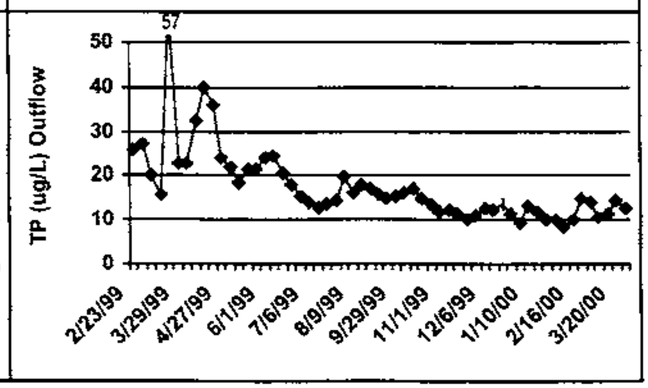






Stem counts not conducted in STCs



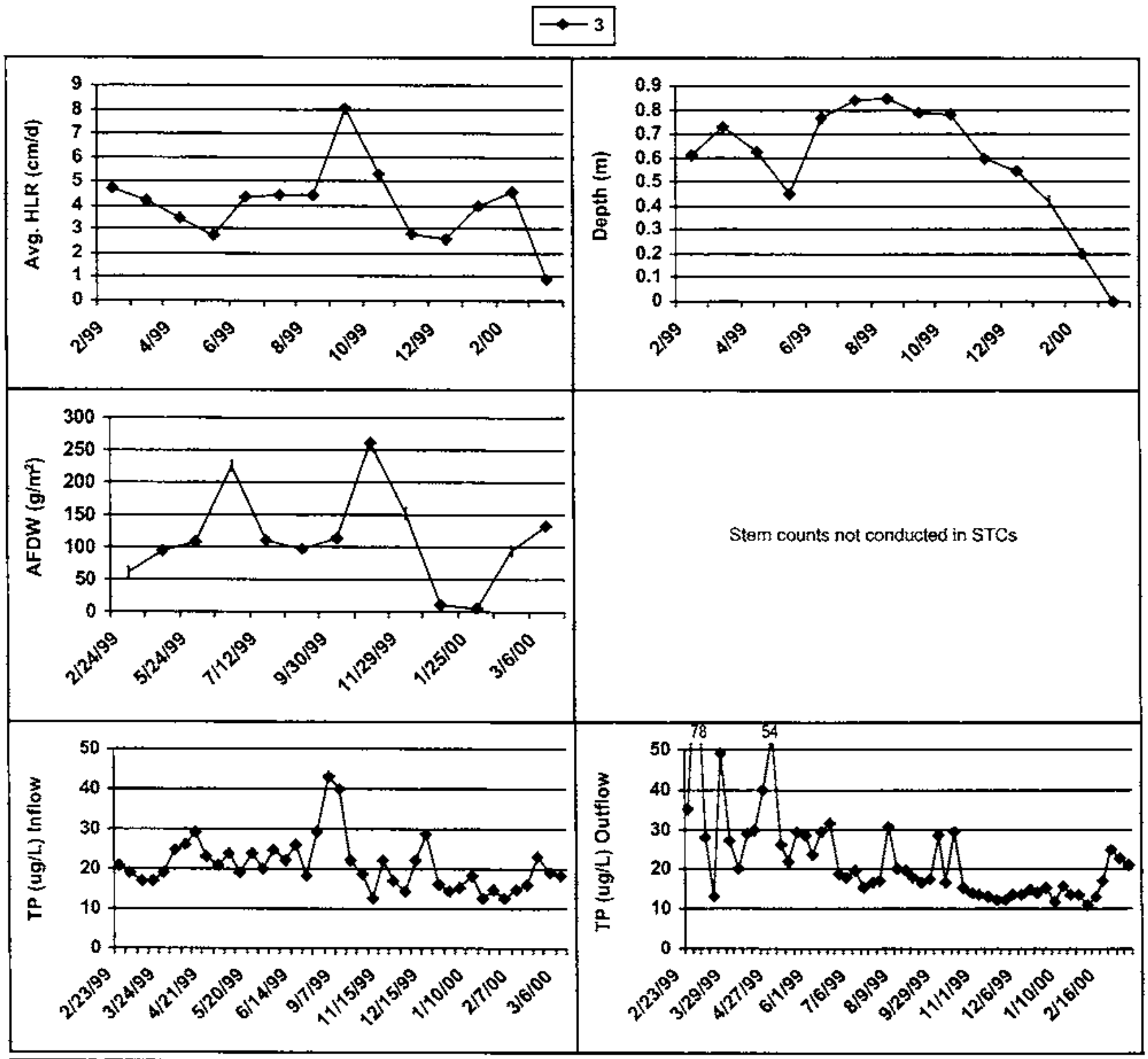


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
8	4.65	0.54	21	18	3.2
Mean	4.65	0.54	21	18	3.2

PSTA Research and Demonstration Project

Treatment:	STC-3	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	3	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	shellrock		

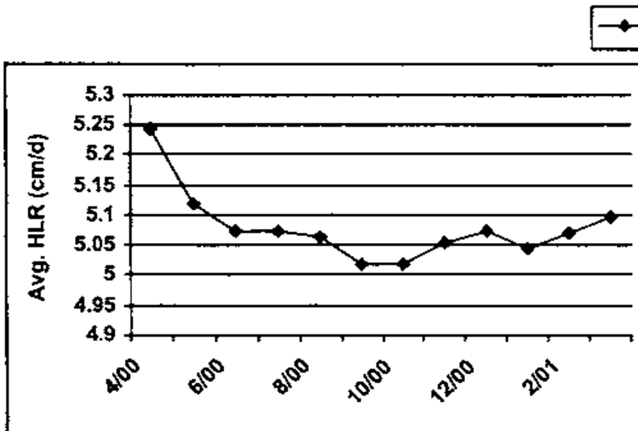


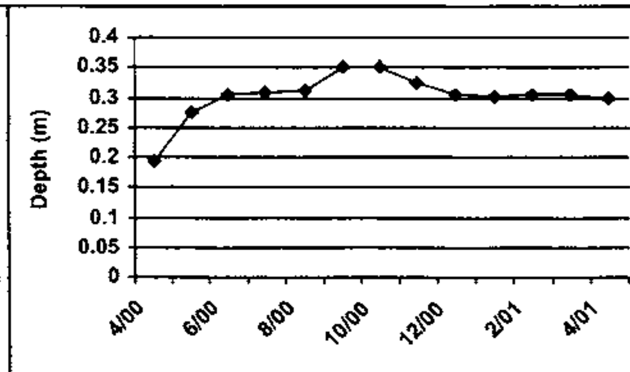
Summary For Period

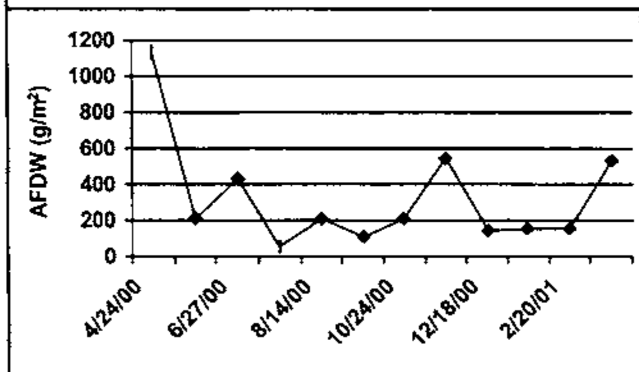
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
3	4.02	0.50	21	22	-1.0
Mean	4.02	0.50	21	22	-1.0

PSTA Research and Demonstration Project

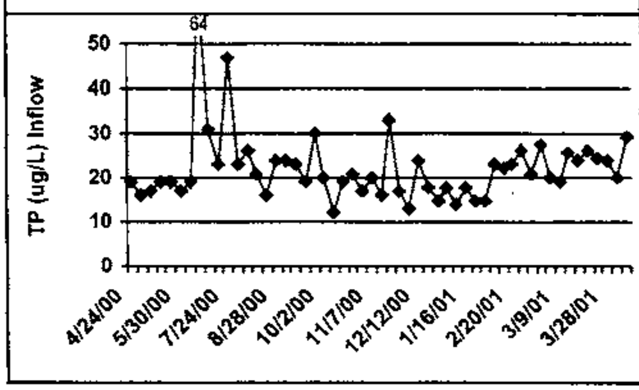
Treatment:	STC-4	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	13	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	peat amended with CaOH		

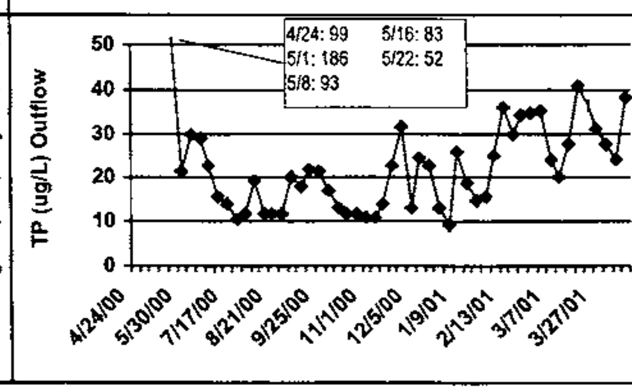






Stem counts not conducted in STCs





Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
13	5.08	0.30	22	29	-5.0
Mean	5.08	0.30	22	29	-5.0

PSTA Research and Demonstration Project

Treatment:	STC-5	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	8	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	shellrock		

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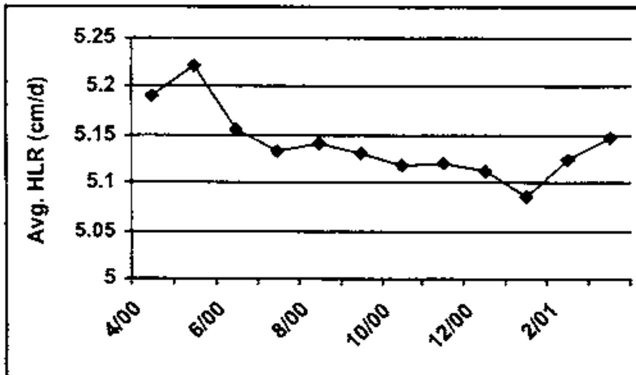
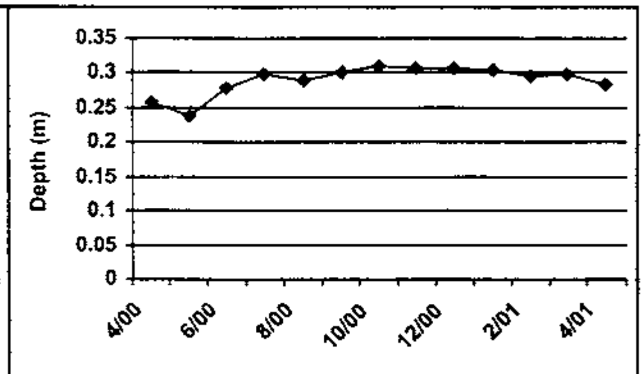
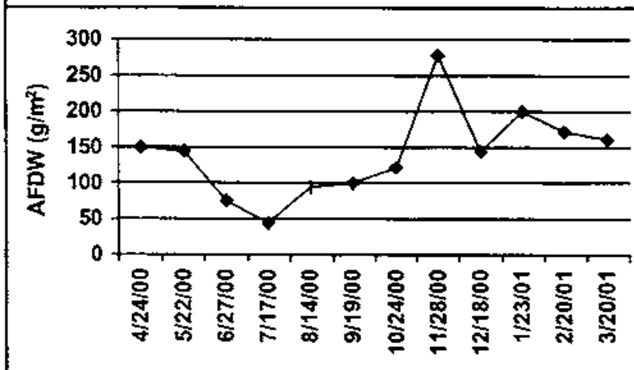
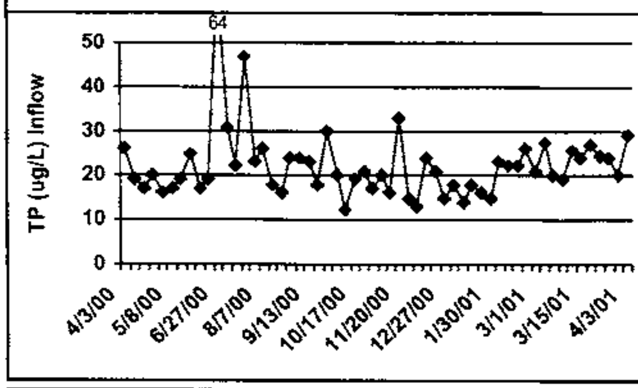
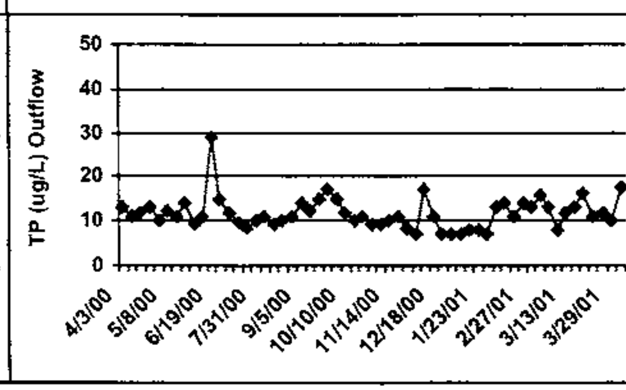






Stem counts not conducted in STCs



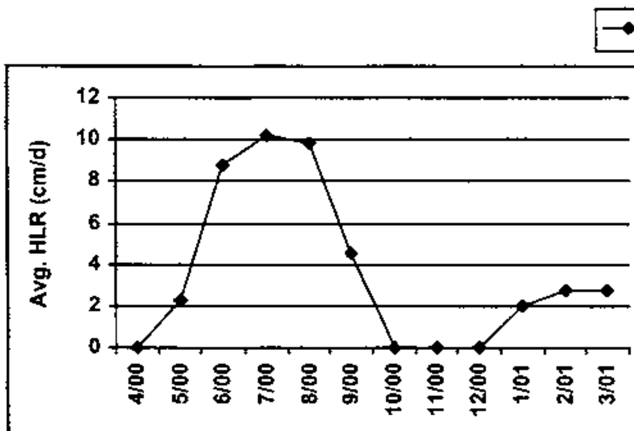


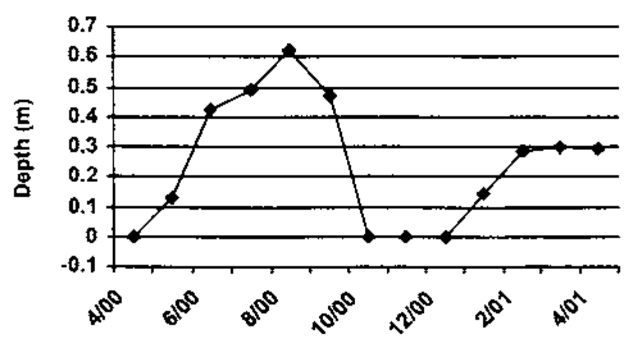
Summary For Period

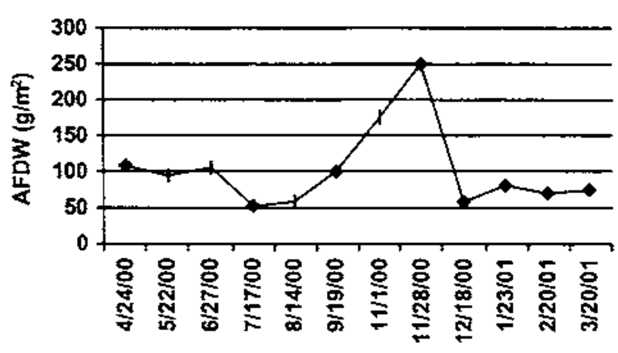
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
8	5.14	0.29	22	12	12.0
Mean	5.14	0.29	22	12	12.0

PSTA Research and Demonstration Project

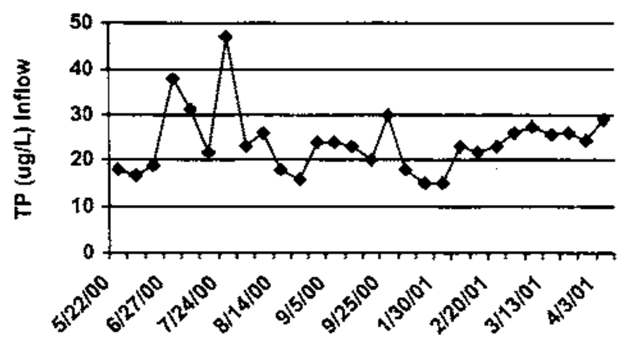
Treatment:	STC-6	**Period:**	2/1/1999	-	4/30/2001
Tank(s)/Cell(s):	3	**Plants:**	yes	**Other:**	
Research Scale:	Test Cell	**Recirculation:**	no		
Mesocosm Size:	28 x 80 m (2240m2)	**Soil:**	shellrock		

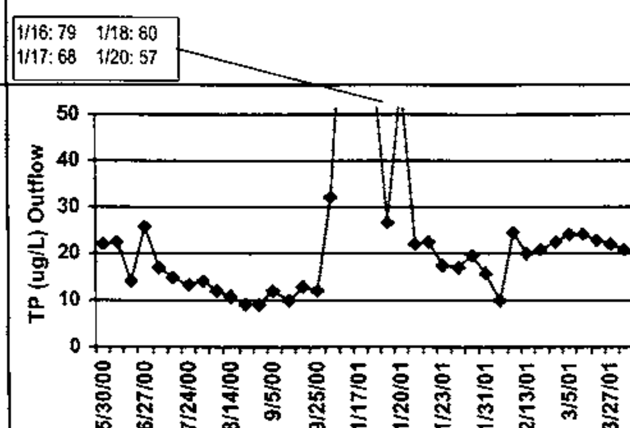






Stem counts not conducted in STCs

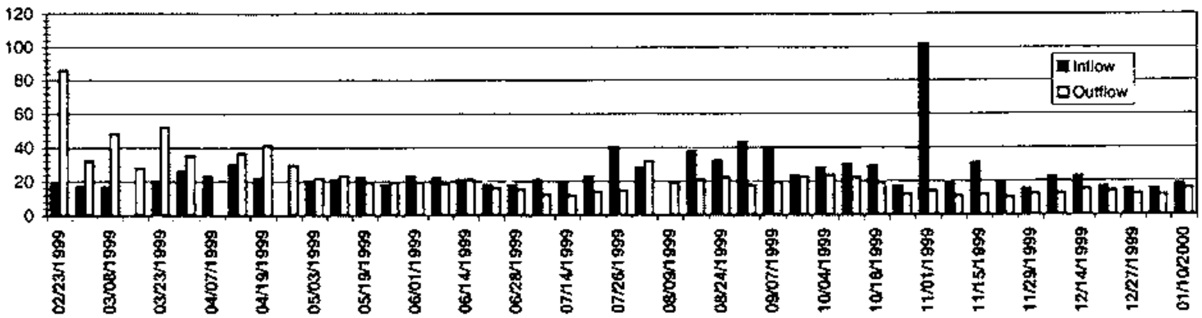




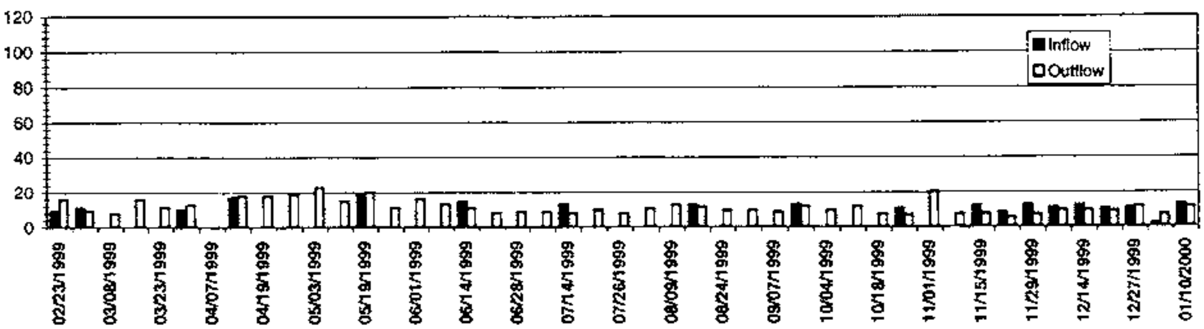
Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
3	3.53	0.25	24	23	0.4
Mean	3.53	0.25	24	23	0.4

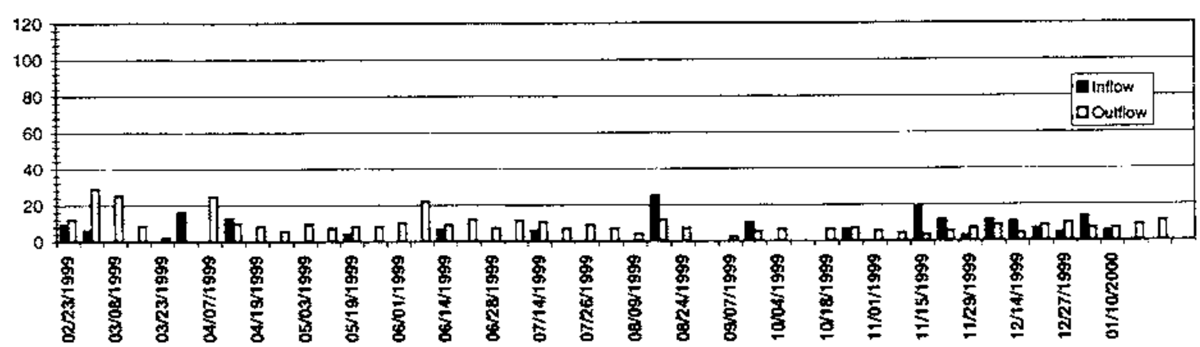
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS



Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.
Outflow data from 4/7/99 are not available.

Exhibit C.2-1
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus forSouth Test Cell Treatment No. 1, February 1999 - March 2000.

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day

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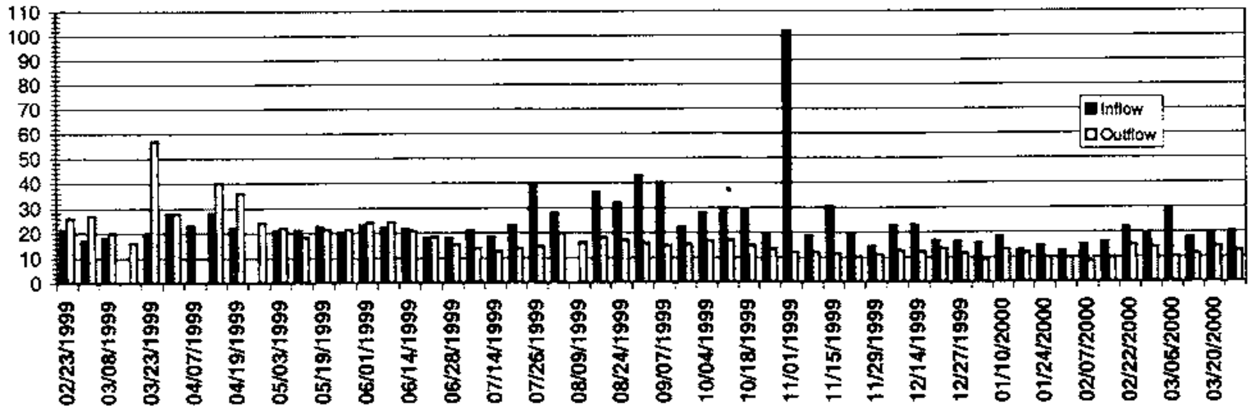
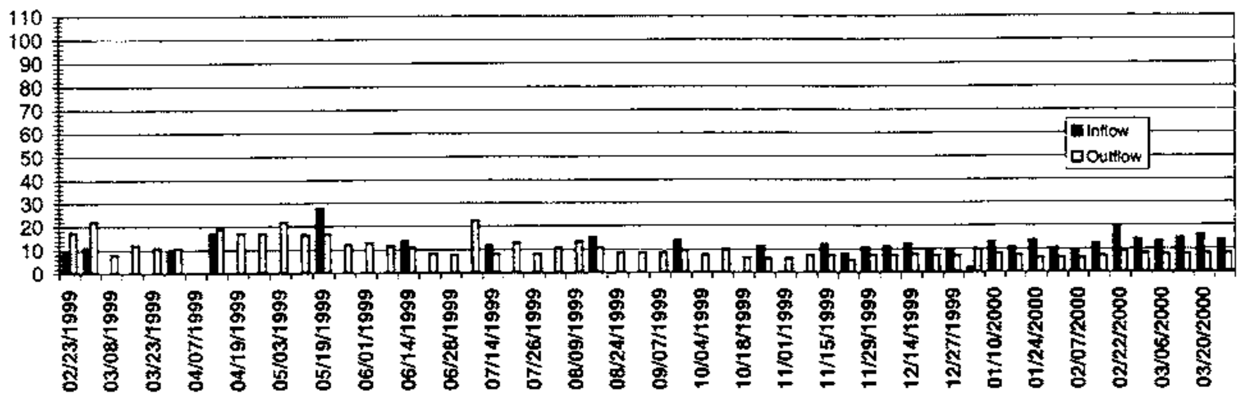
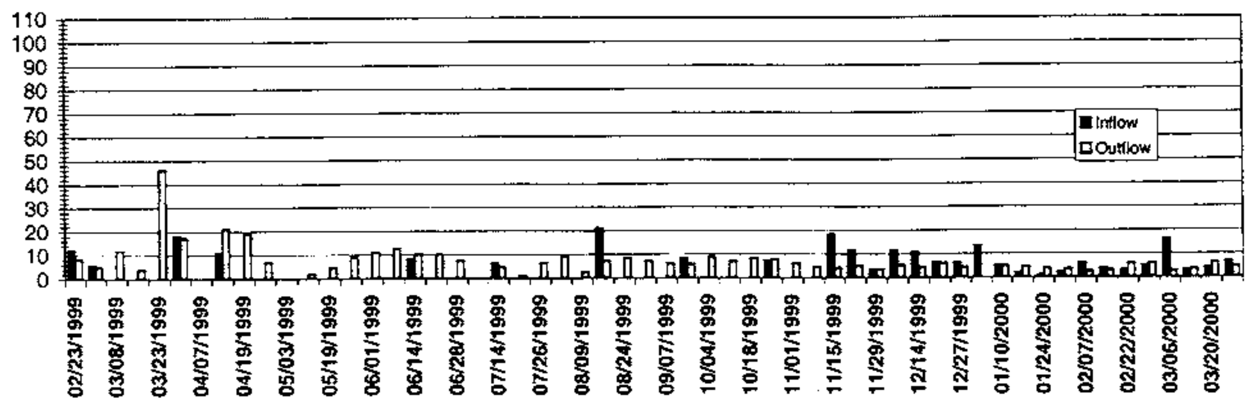
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

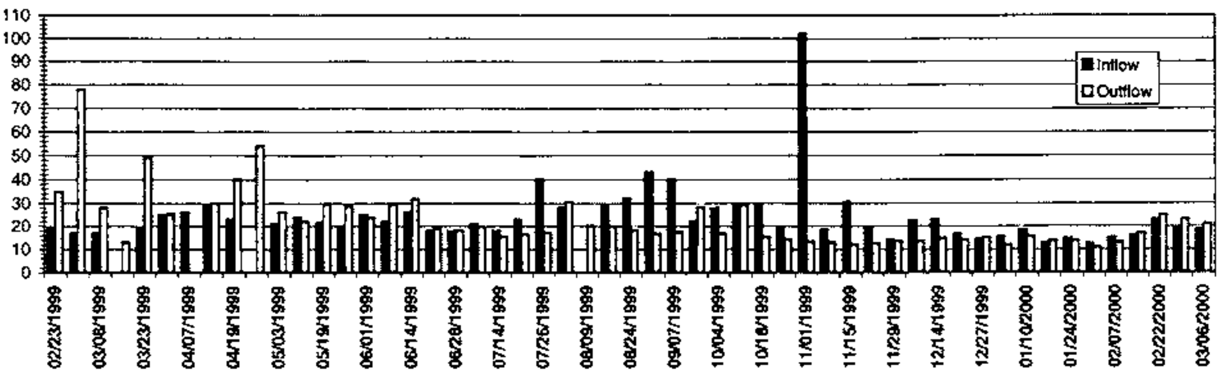


Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.
Outflow data from 4/7/99 are not available.

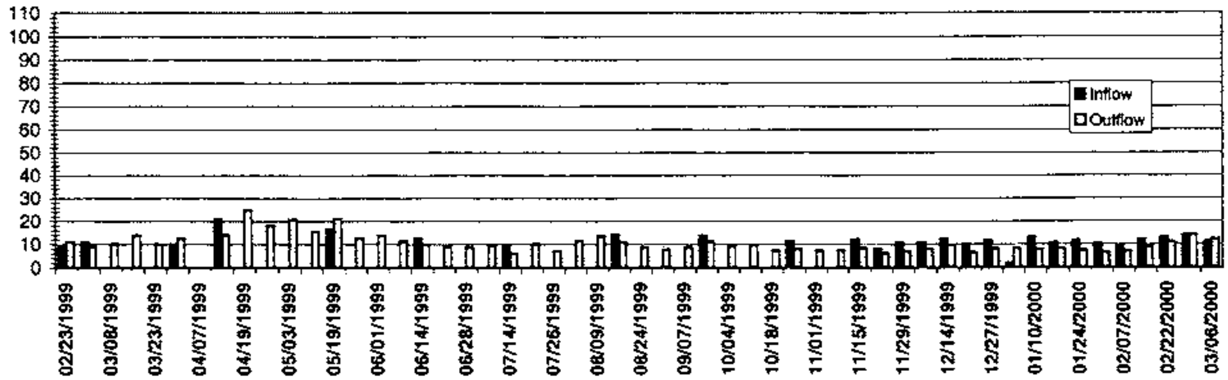
Exhibit C.2-2
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for South Test Cell Treatment No. 2, February 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day

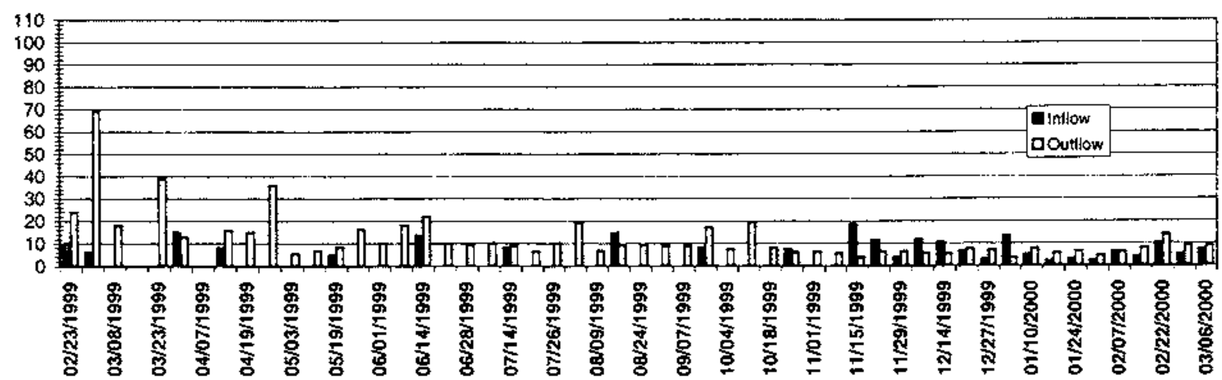
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS



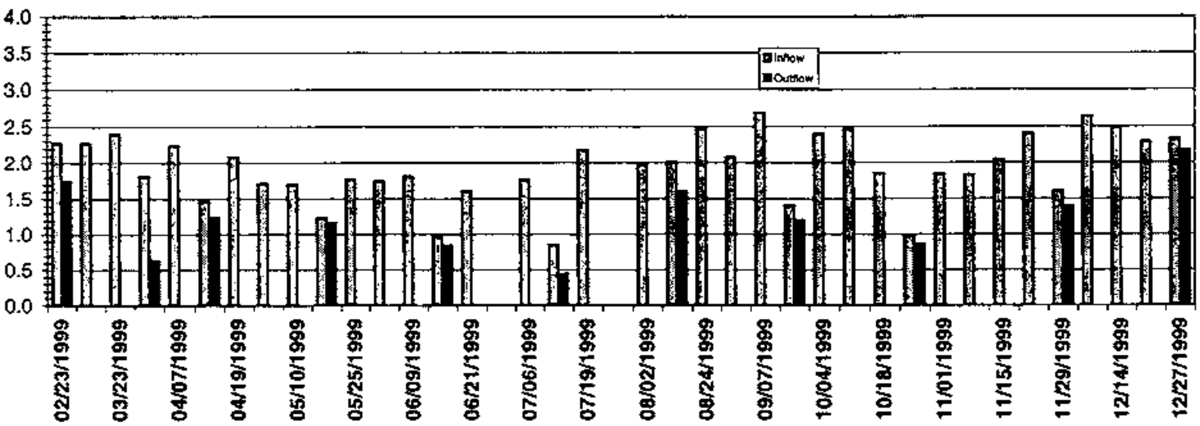
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.
Outflow data from 4/7/99 are not available.

Exhibit C.2-3

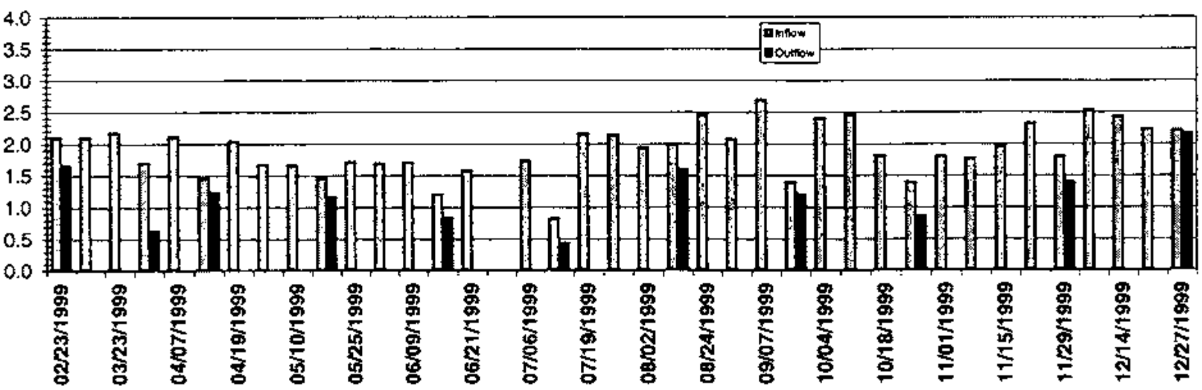
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for South Test Cell Treatment No. 3, February 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 60 cm
HLR: 0 - 12 cm/day

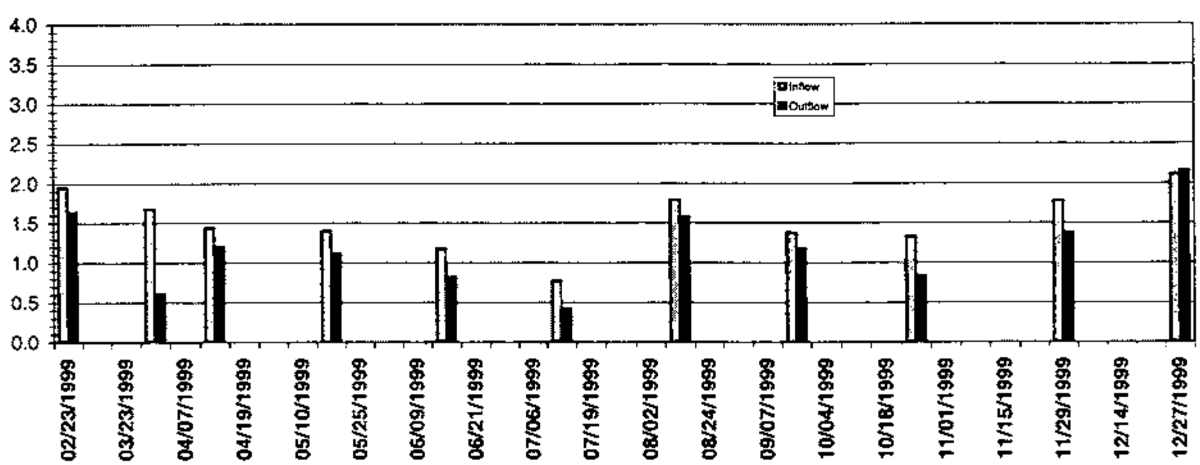
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending. Organic nitrogen data are not available from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit C.2-4

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 1, February 1999 - December 1999.

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day

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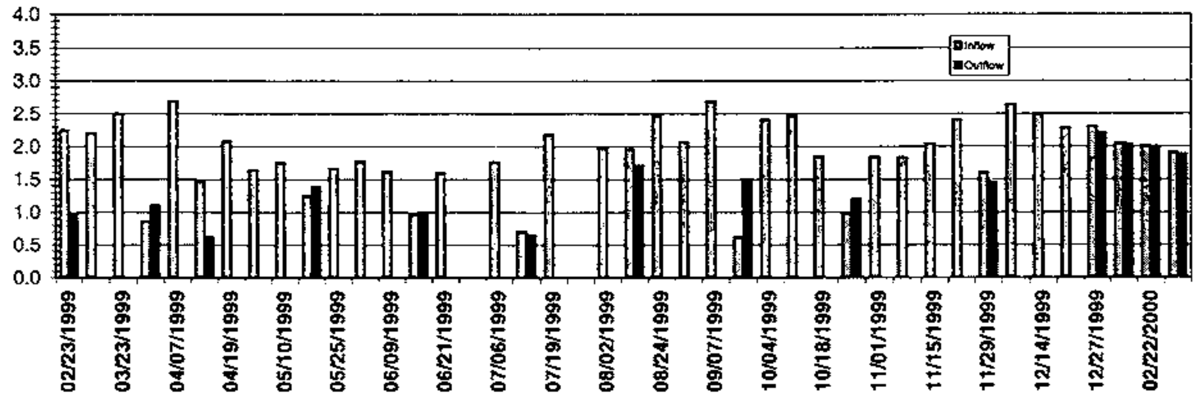
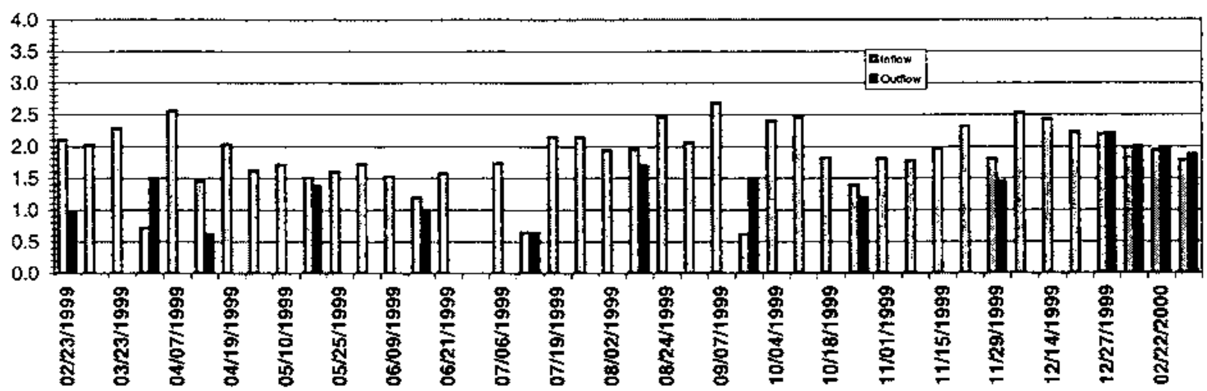
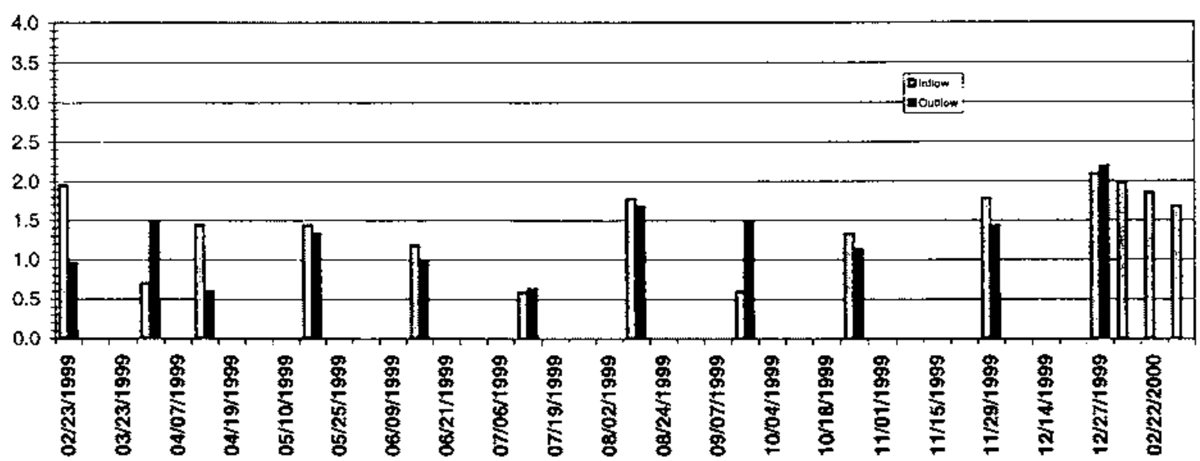
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending. Organic nitrogen data are not available from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

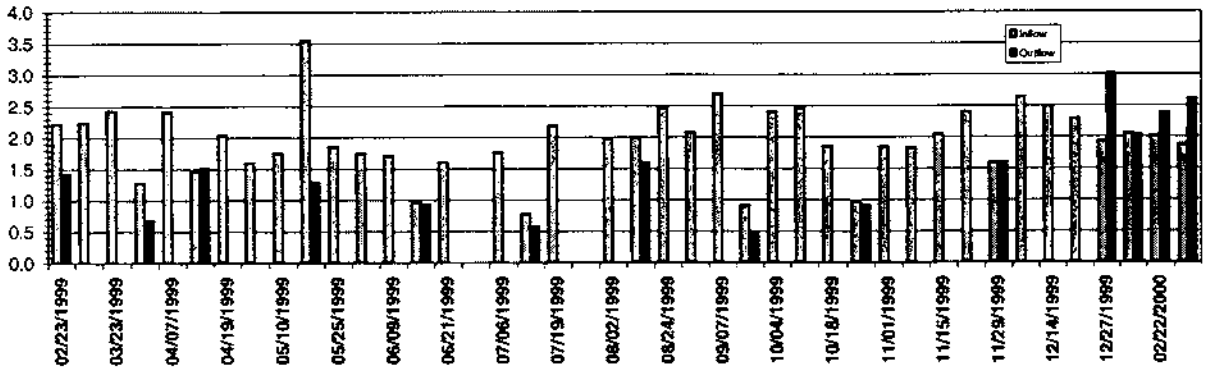
Exhibit C.2-5

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 2, February 1999 - March 2000.

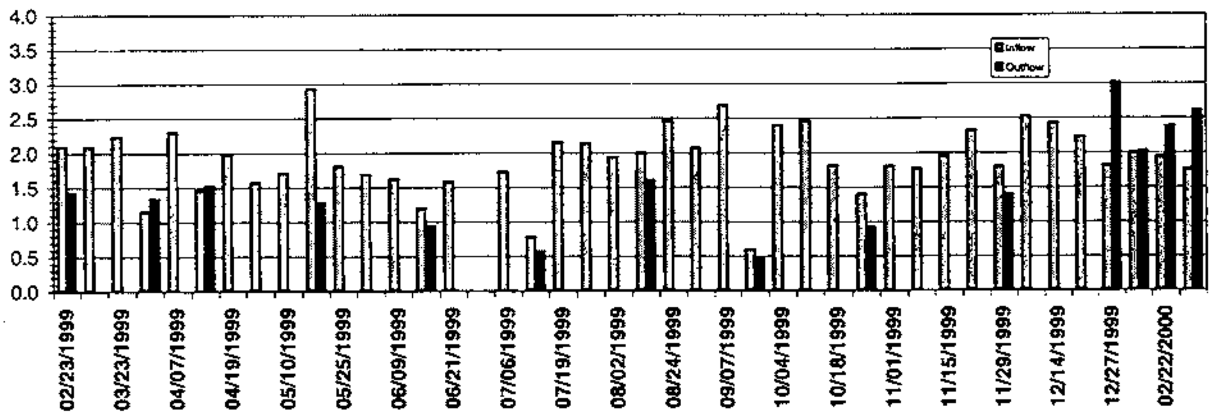
Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day

DFB/17096.xls

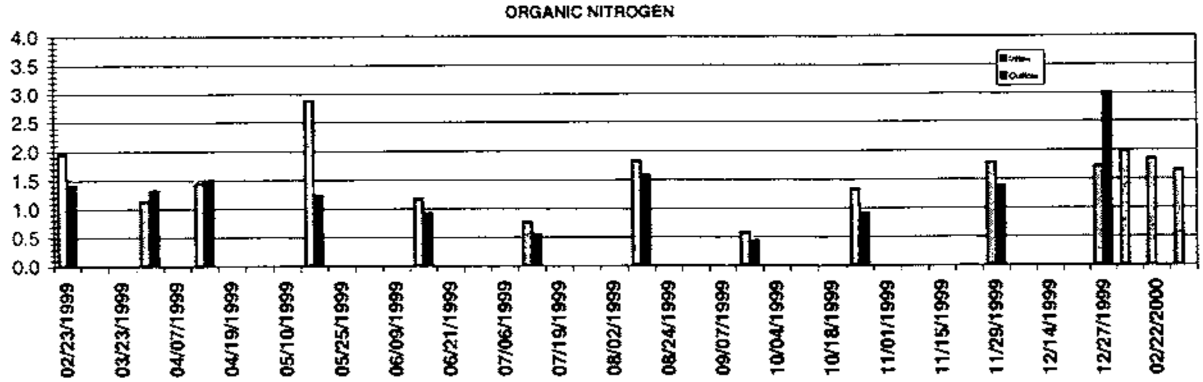
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



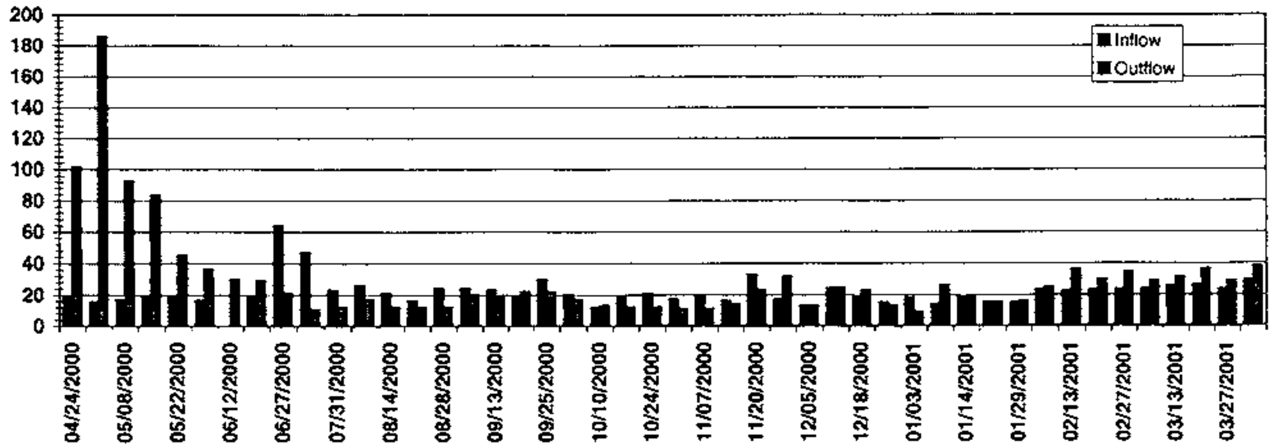
Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending. Organic nitrogen data are not available from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit C.2-6

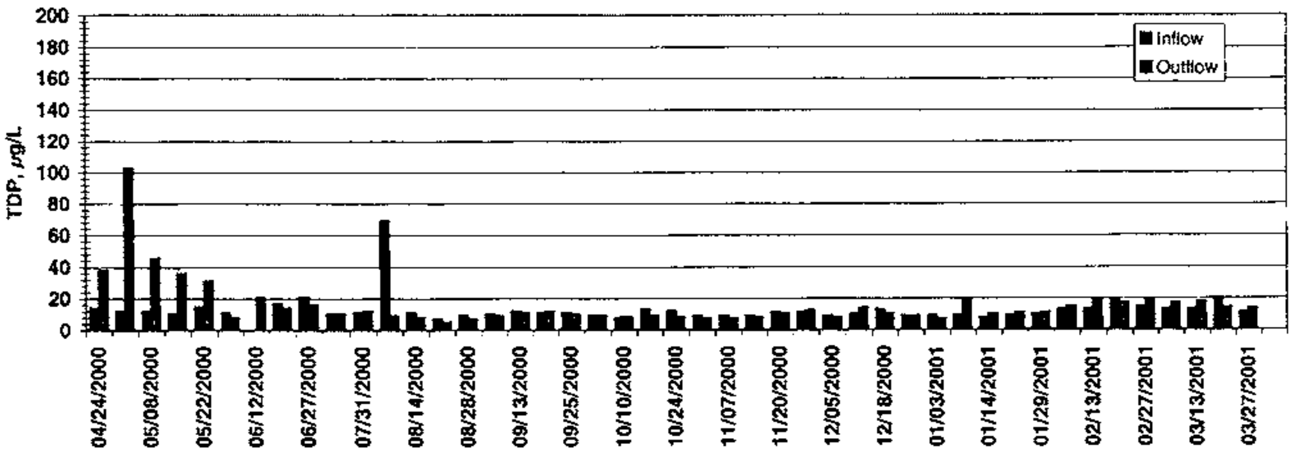
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 3, February 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 60 cm
HLR: 0 - 12 cm/day

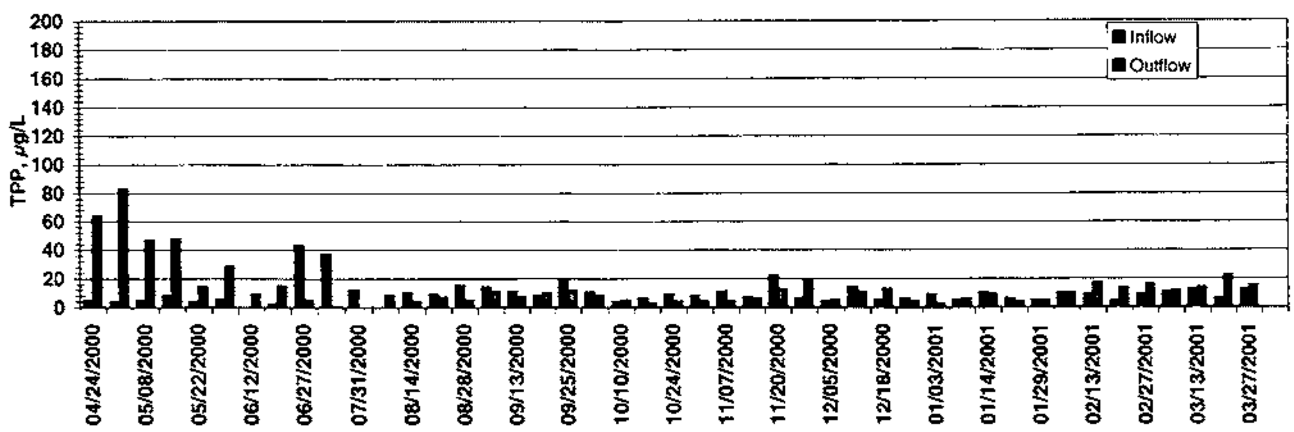
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS



Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.

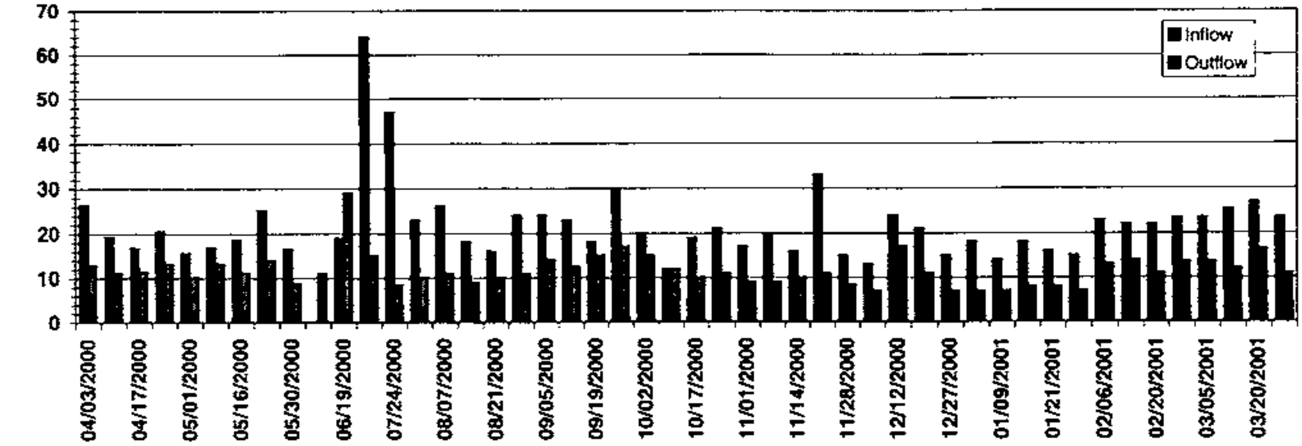
EXHIBIT C.2-7

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for South Test Cell Treatment No. 4, April 2000 - March 2001.

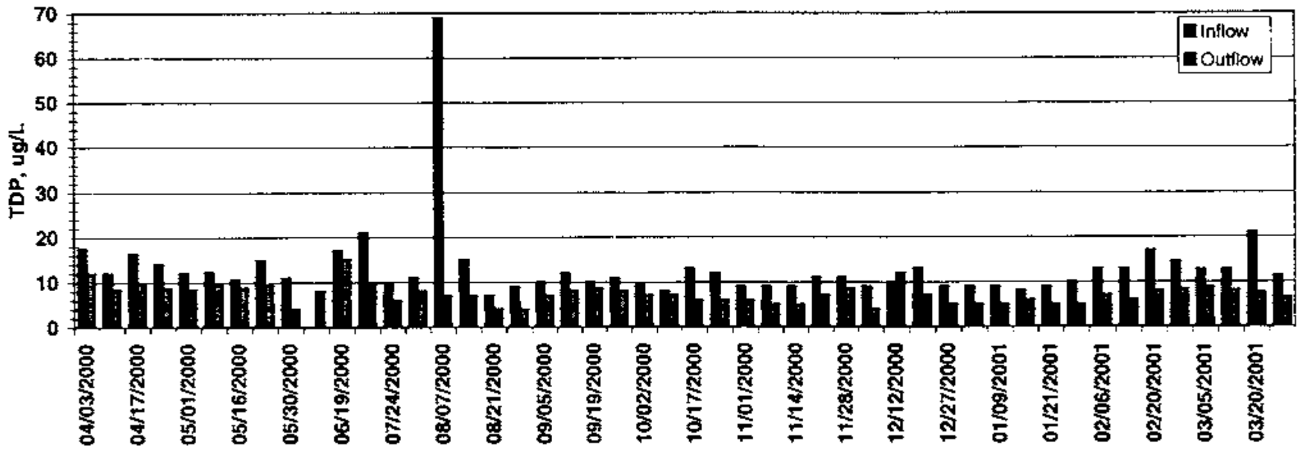
Key Conditions:
Substrate: Peat + Ca
Depth: 30 cm
HLR: 6 cm/day

DFB/17096.xls

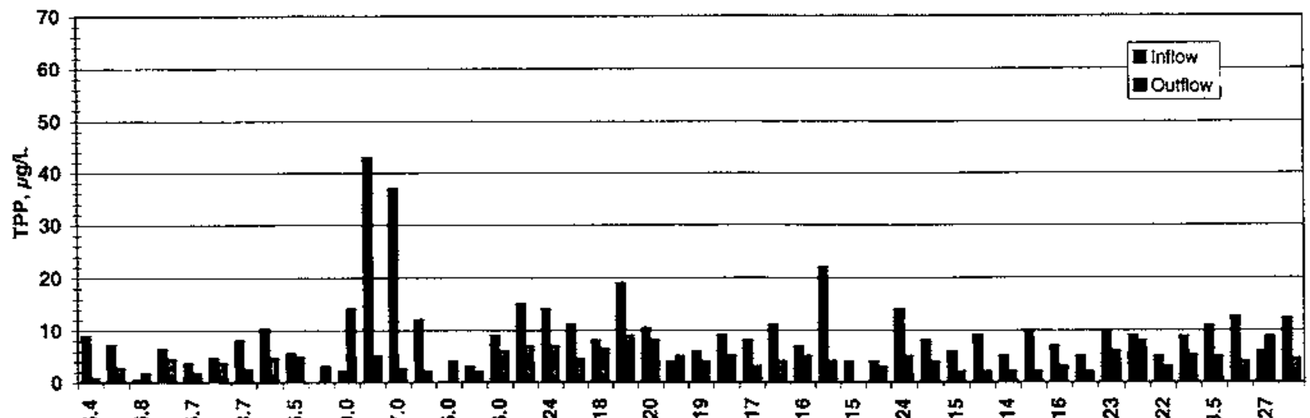
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS



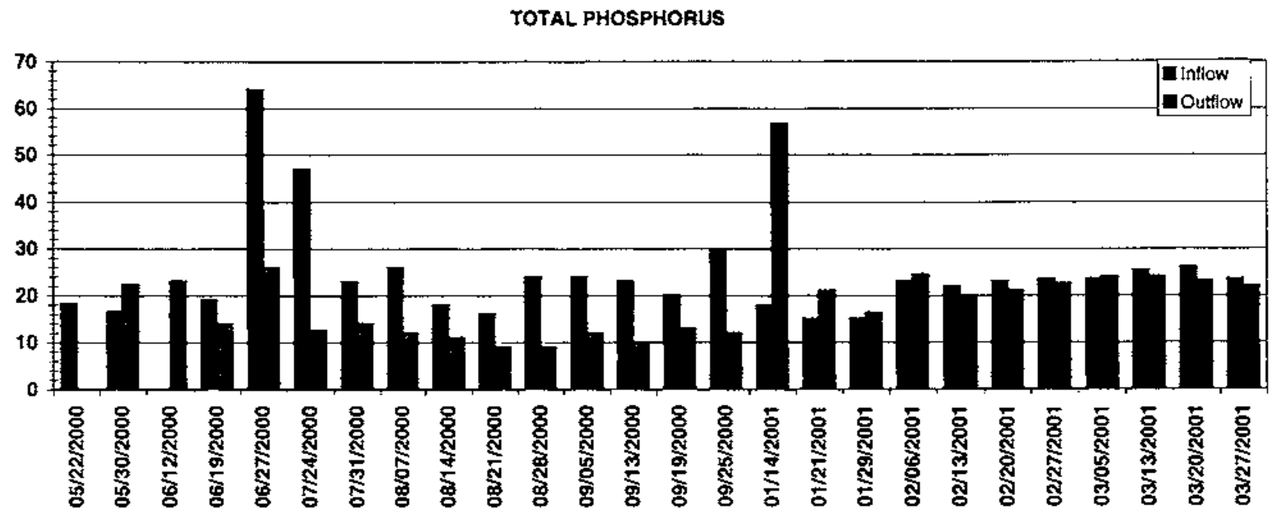
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.

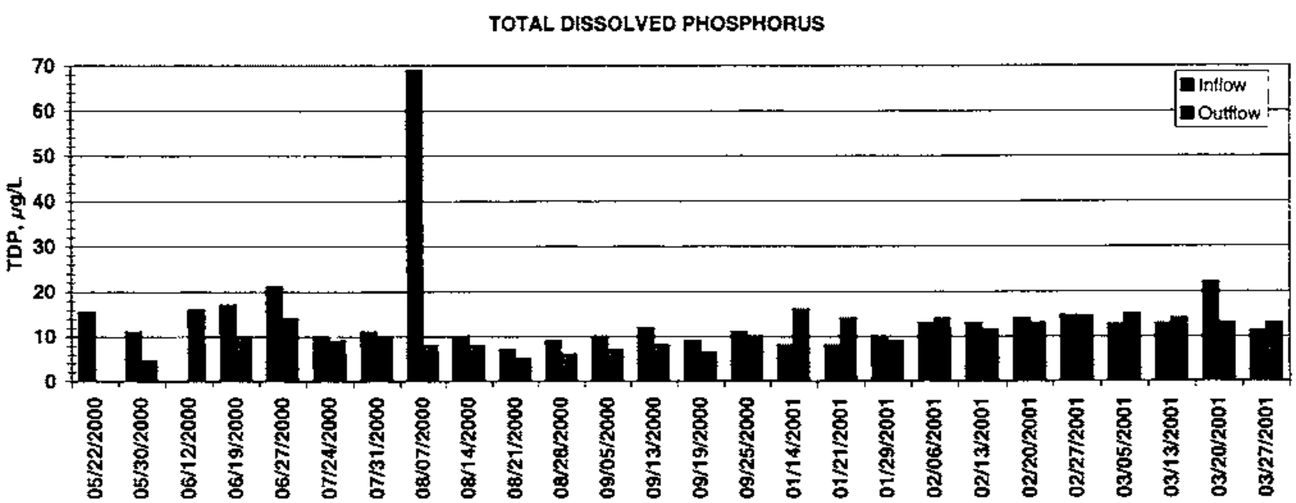
EXHIBIT C.2-8

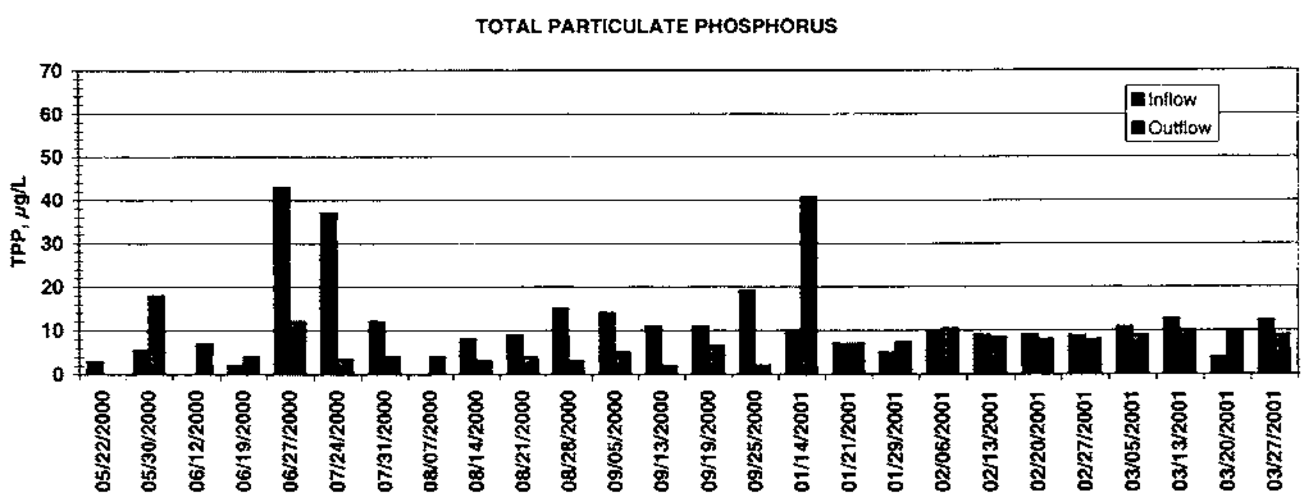
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for South Test Cell Treatment No. 5, April 2000 - March 2001

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day

DFB/17096.xls







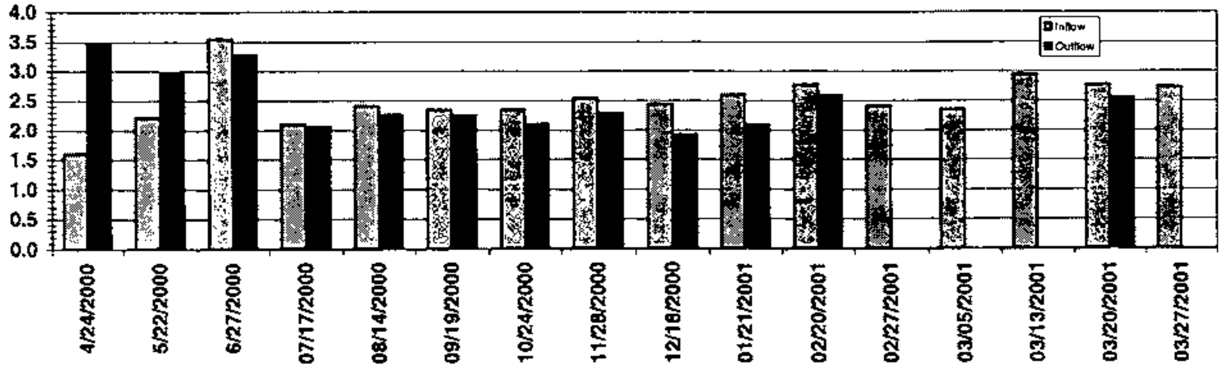
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.
South Test Cell Treatment No. 6 did not receive inflow for the period of October 2000 to December 2000.

EXHIBIT C.2-9

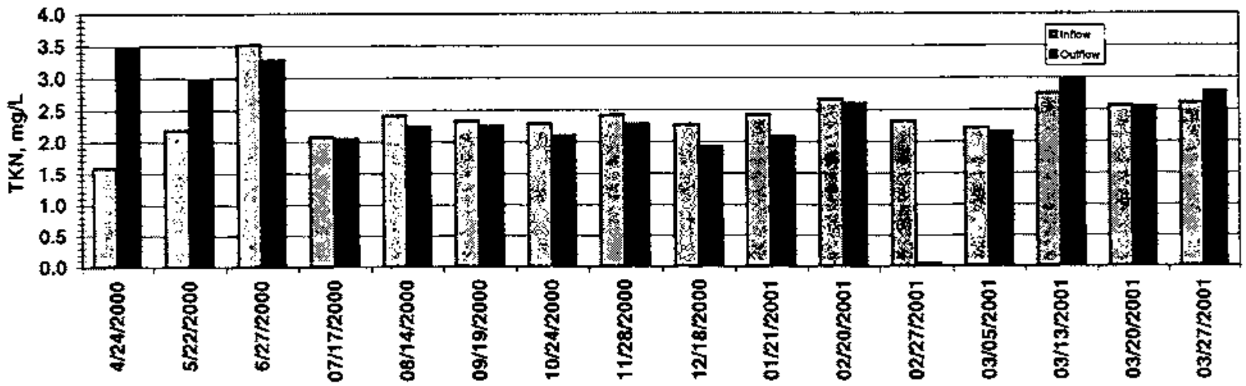
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for South Test Cell Treatment No. 6, April 2000 - March 2001

Key Conditions:
Substrate: Shellrock
Depth: 0 - 30 cm
HLR: 0 - 12 cm/day

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

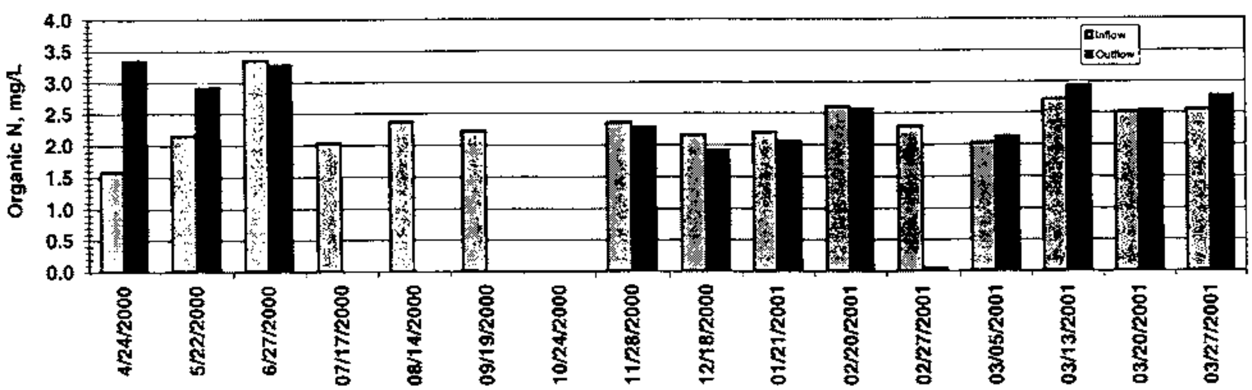


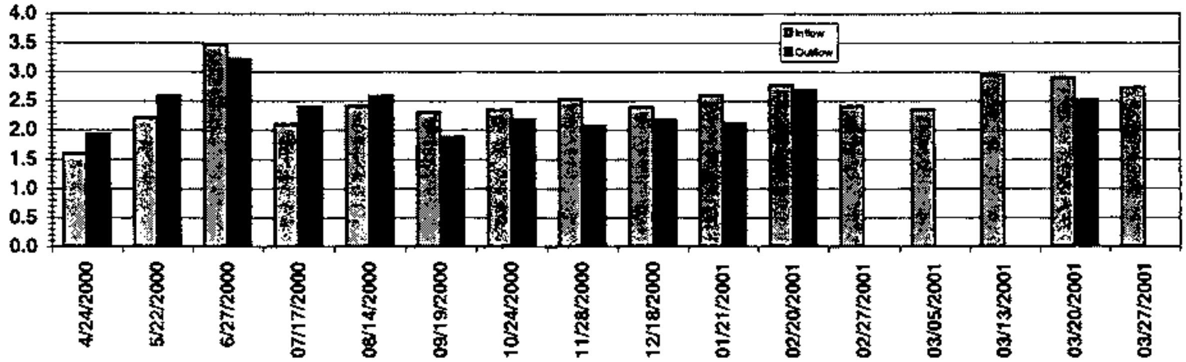
EXHIBIT C.2-10

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 4, April 2000 - March 2001.

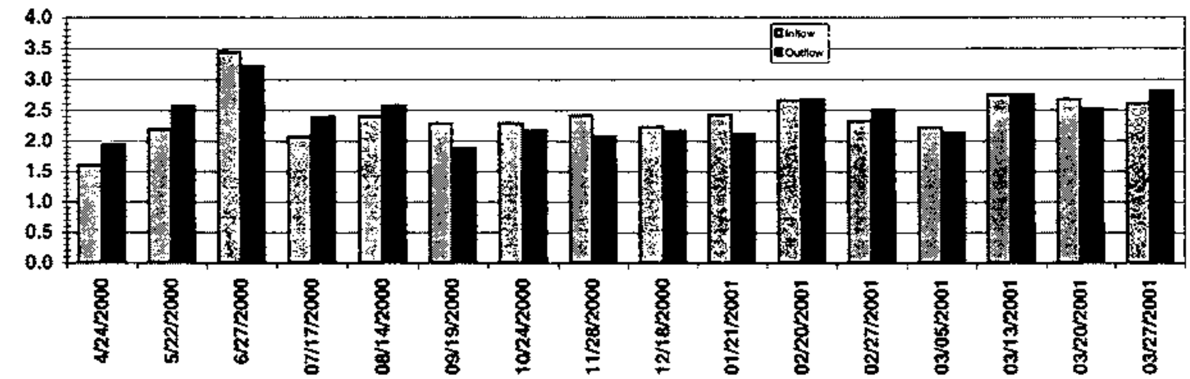
Key Conditions:
Substrate: Peat + Ca
Depth: 30 cm
HLR: 6 cm/day

DFB/17096.xls

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

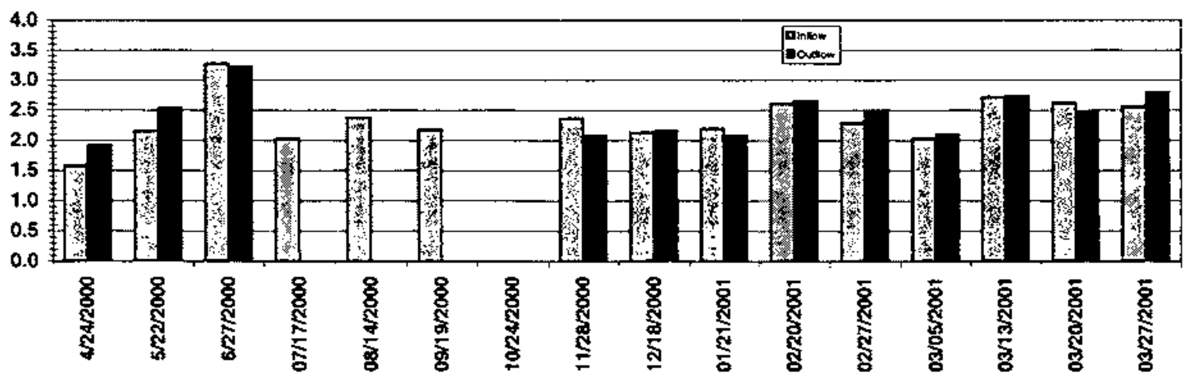
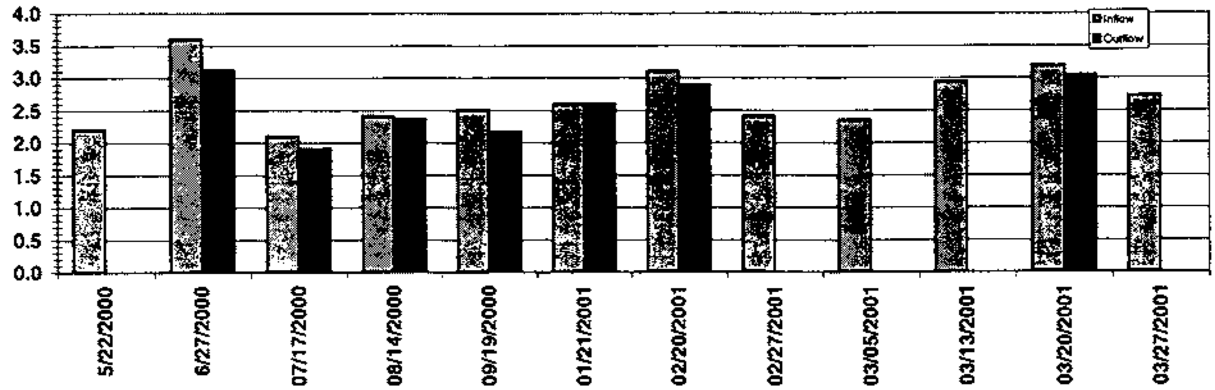


EXHIBIT C.2-11
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 5, April 2000 - March 2001.

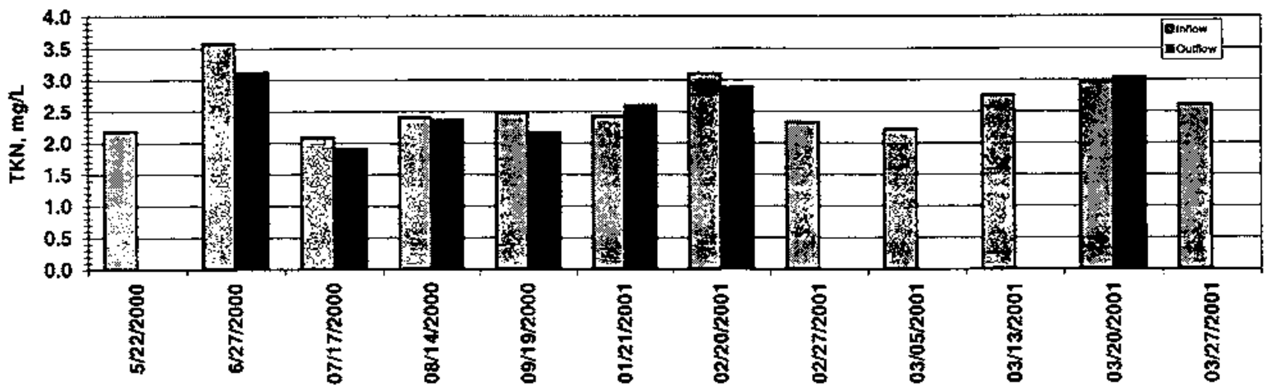
Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day

DFB/17096.xls

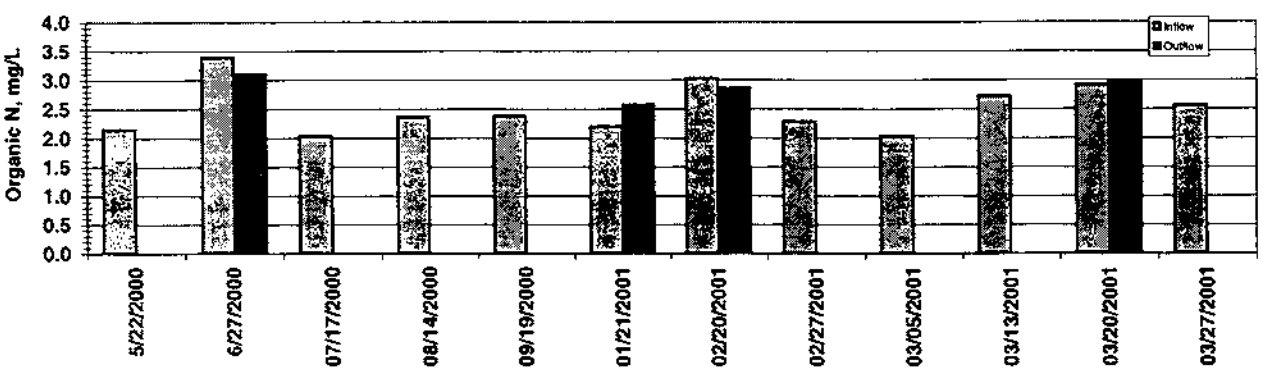
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Treatment in dry down mode; no outflow samples taken from 3/9/00- 5/30/00.
South Test Cell Treatment No. 6 did not receive inflow October 2000 to December, 2000.

EXHIBIT C.2-12

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 6, May 2000 - March 2001.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 30 cm
HLR: 0 - 12 cm/day

APPENDIX C.3

Diel Study

APPENDIX C.3

ENR Test Cells: Diel Study

Diel samples were collected from the PSTA Test Cells on October 5 and 6, 1999. Sample collection began at 16:32 on October 5 and continued at approximately 4-hour intervals until 15:10 on October 6. Samples were collected for TP, DRP, TDP, and TSS from the Head Cell and from the outflow from each of the three PSTA Test Cells. Samples were collected from the outflows of each Test Cell twice (00:00 and 12:00 on October 6) for algae counts and identification and for chlorophyll *a*. This section provides a preliminary summary of some of the data collected during this sampling event.

C.3.1 Phosphorus and TSS Trends

Exhibit C.3-1 illustrates the data trends for TP. Outflow TP from Test Cell 13 was typically higher than inflow concentrations during this period while outflow TP concentrations from Test Cells 3 and 8 were consistently lower. These data indicate that TP concentration exiting the Head Cell and the Test Cells was slightly higher during the night than during the day.

Exhibit C.3-2 illustrates the data trends for TPP. Outflow TPP from Test Cell 13 was consistently higher than inflow concentrations during this period while outflow TPP concentrations from Test Cells 3 and 8 were consistently lower. There was no consistent diel trend in TPP concentration evident during this 24-hour period.

Exhibit C.3-3 illustrates the data trends for TSS. Outflow TSS from all of the PSTA Test Cells was typically higher than inflow concentrations during this period. The high spike recorded for Test Cell 8 illustrates the apparent effect of entraining a small amount of biological tissue into the sample. These data indicate that TSS concentration exiting the Head Cell and the Test Cells was slightly higher during daylight hours than during the night.

Exhibit C.3-4 illustrates the data trends for TDP. Outflow TDP was similar for all of the test cells and typically lower than in the inflow water. There was no consistent diel trend in TDP concentration evident during this 24-hour period.

Exhibit C.3-5 illustrates the data trends for DRP. Outflow DRP was similar for all of the test cells and typically lower than in the inflow water. There was no consistent diel trend in DRP concentration evident during this 24-hour period.

C.3.2 Algal Samples

Test Cell outflow samples averaged 2.8 micrograms per liter (μg/L) of corrected chlorophyll *a* at midnight and 4.0 μg/L at noon. Algal biovolume reflected a similar trend for higher export populations during the day (Exhibit C.3-6). The exported algal cell counts from Treatment 1 (Test Cell 13) were dominated by blue-green (95 percent) species. The cell

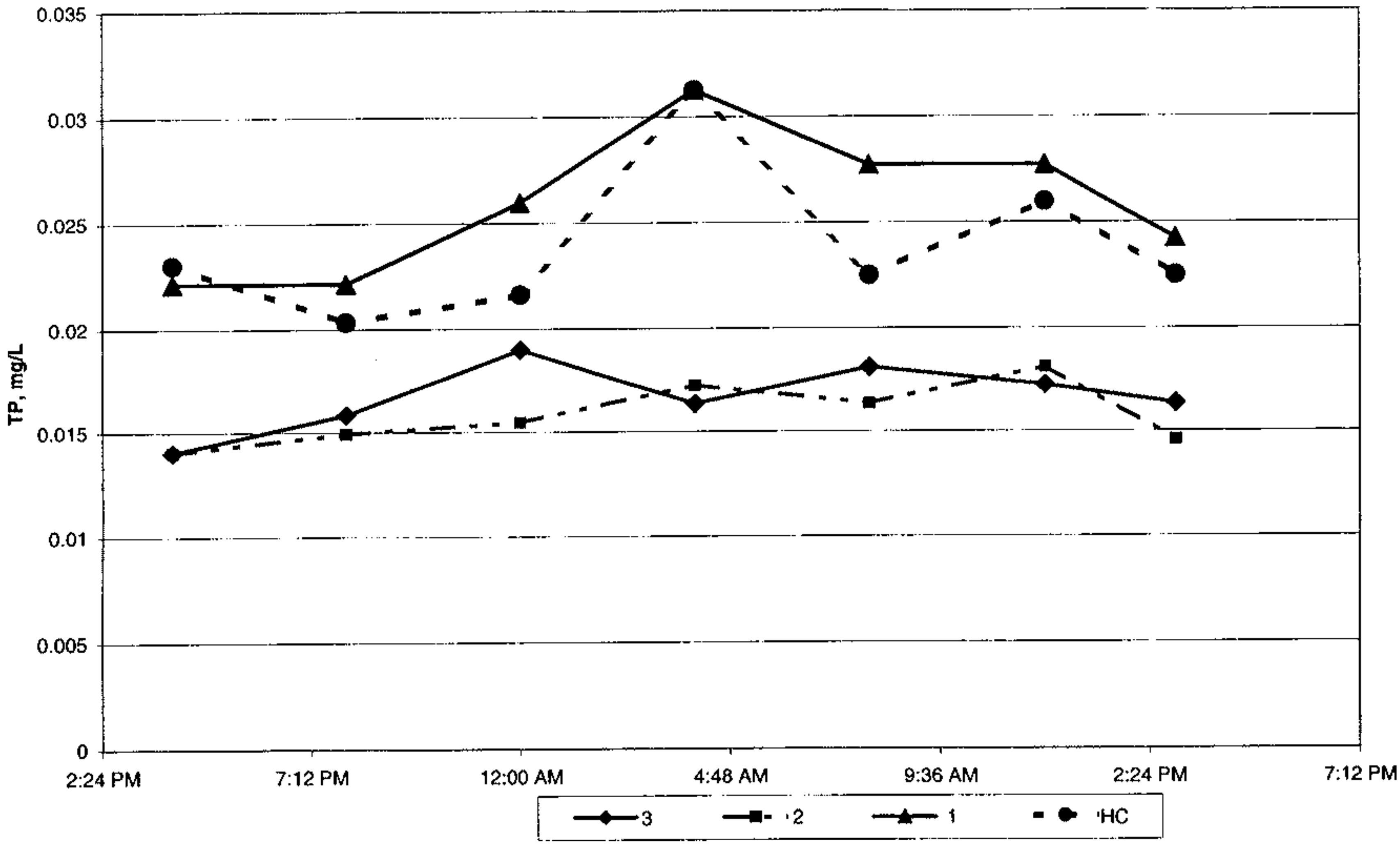


Exhibit C.3-1
Diel Record of TP in the PSTA Test Cell Treatments on October 5-6, 1999

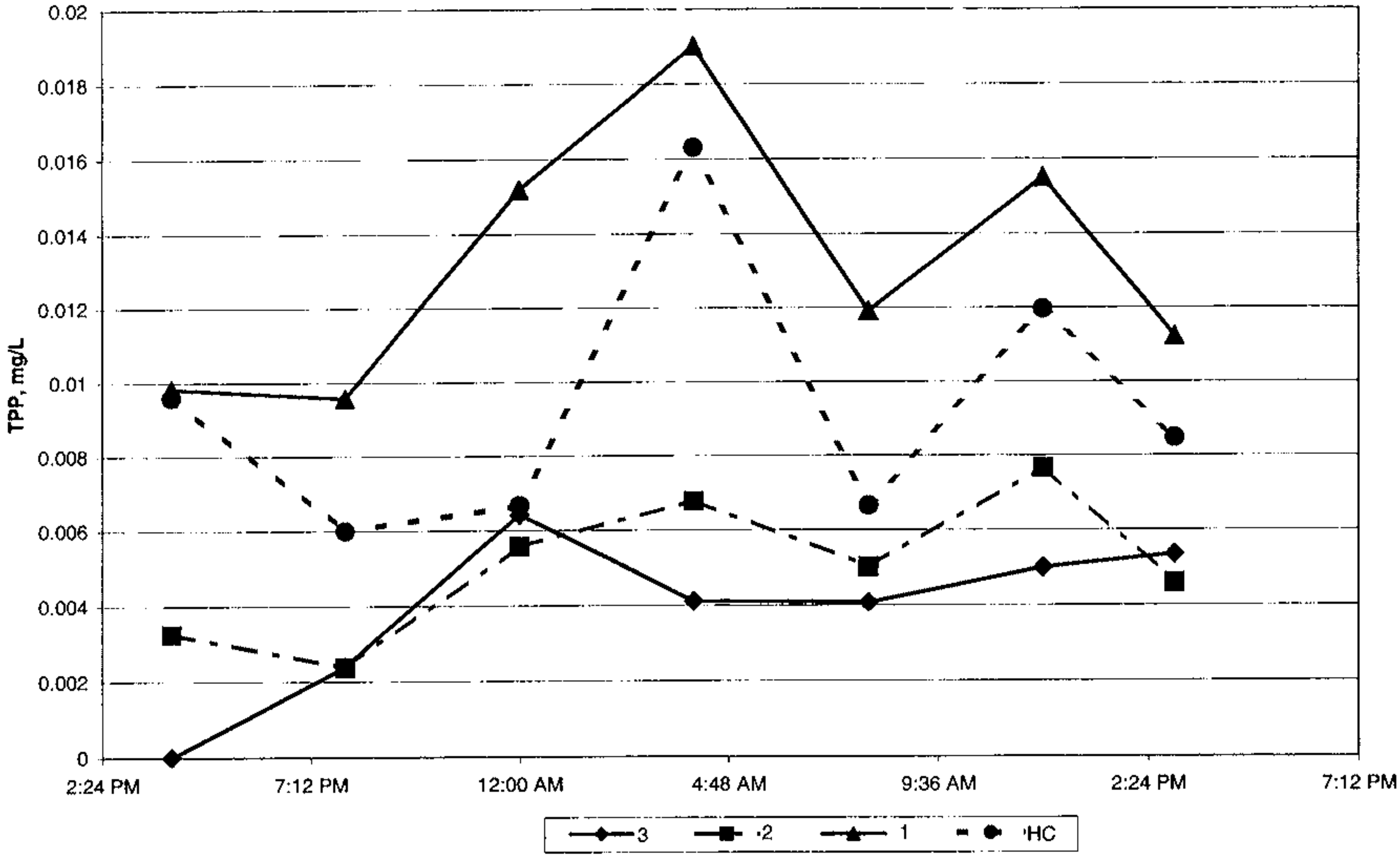


Exhibit C.3-2
Diel Record of TPP in the PSTA Test Cell Treatments on October 5-6, 1999

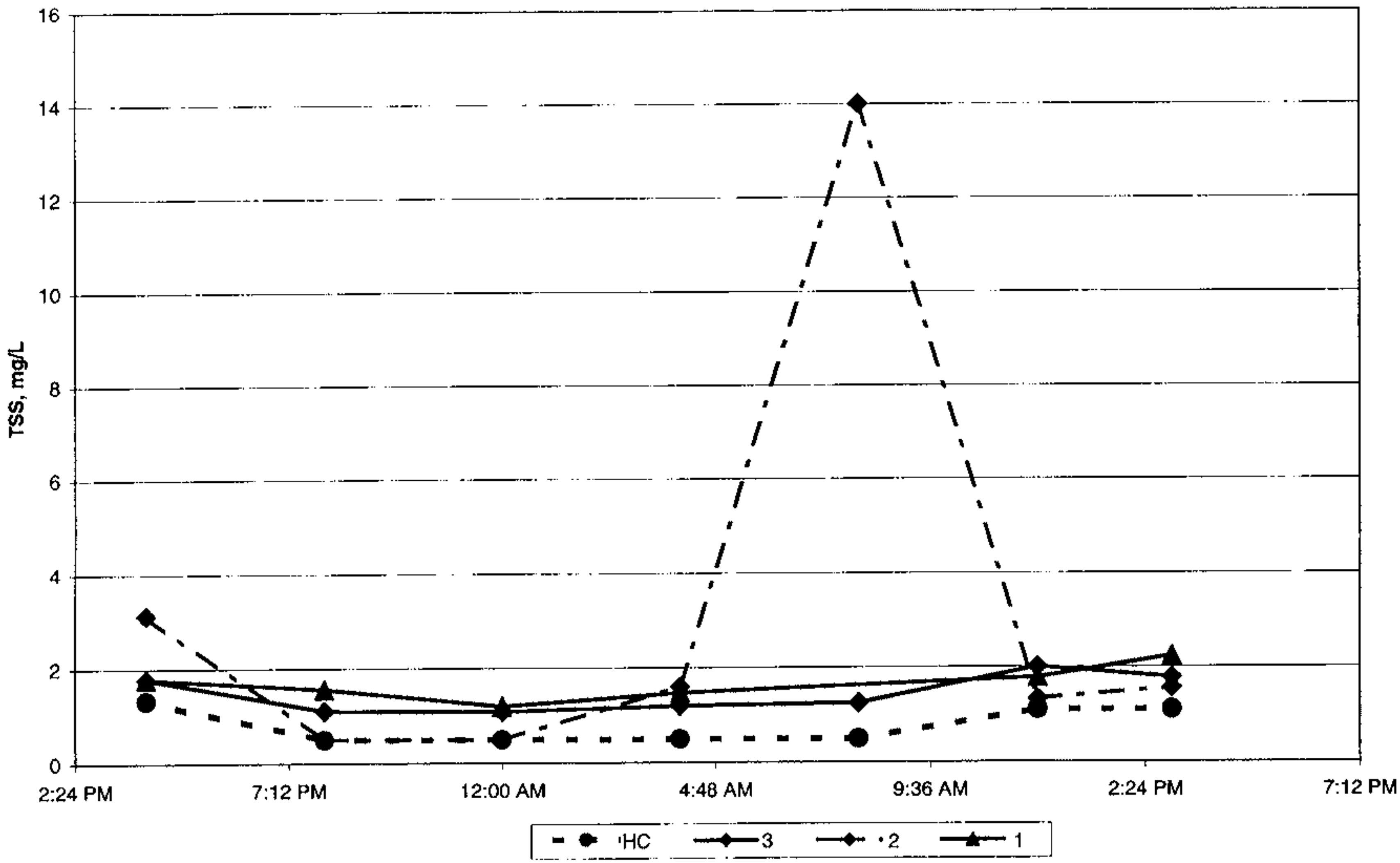


Exhibit C.3-3
Diel Record of TSS in the PSTA Test Cell Treatments on October 5-6, 1999

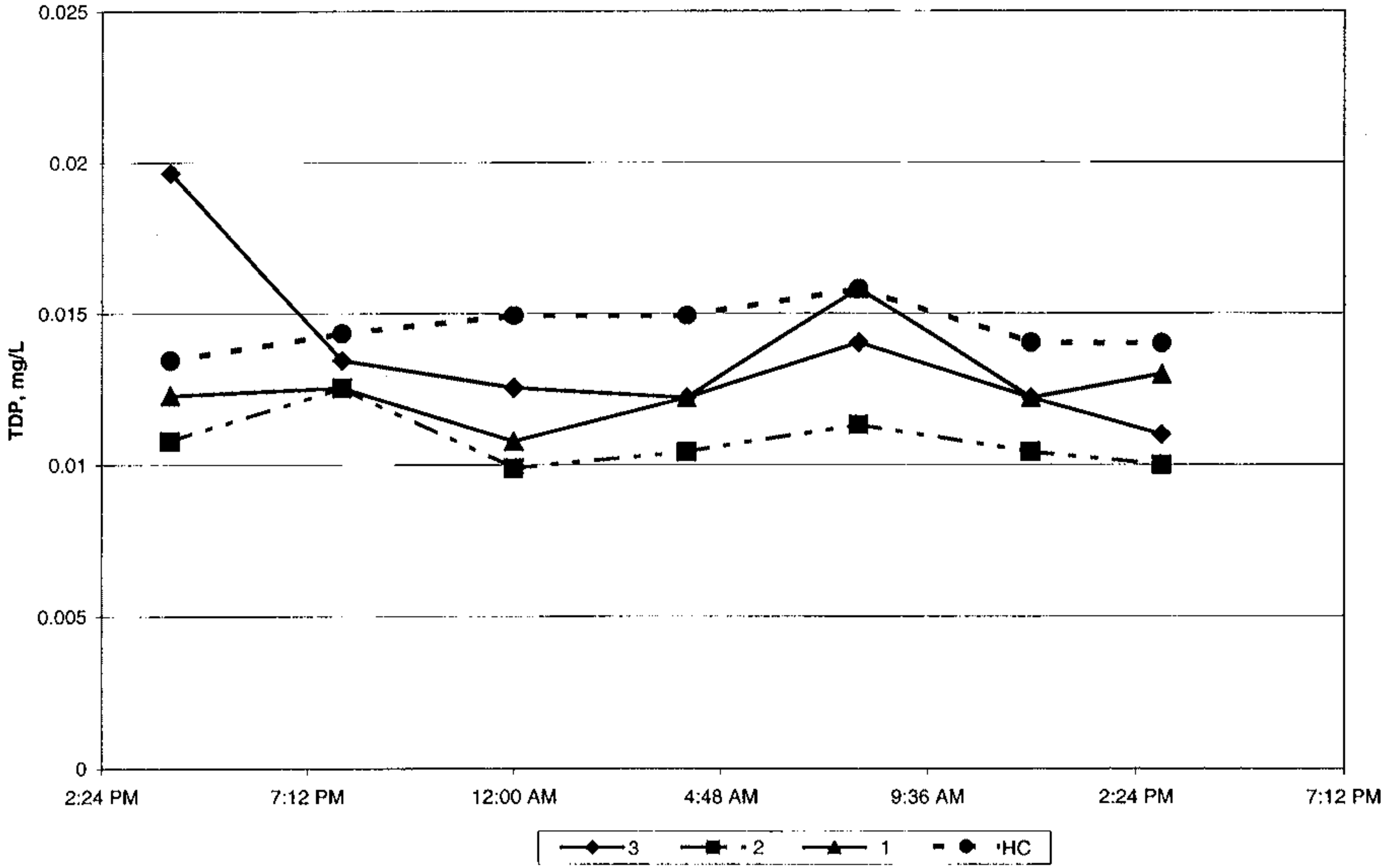


Exhibit C.3-4
Diel Record of TDP in the PSTA Test Cell Treatments on October 5-6, 1999

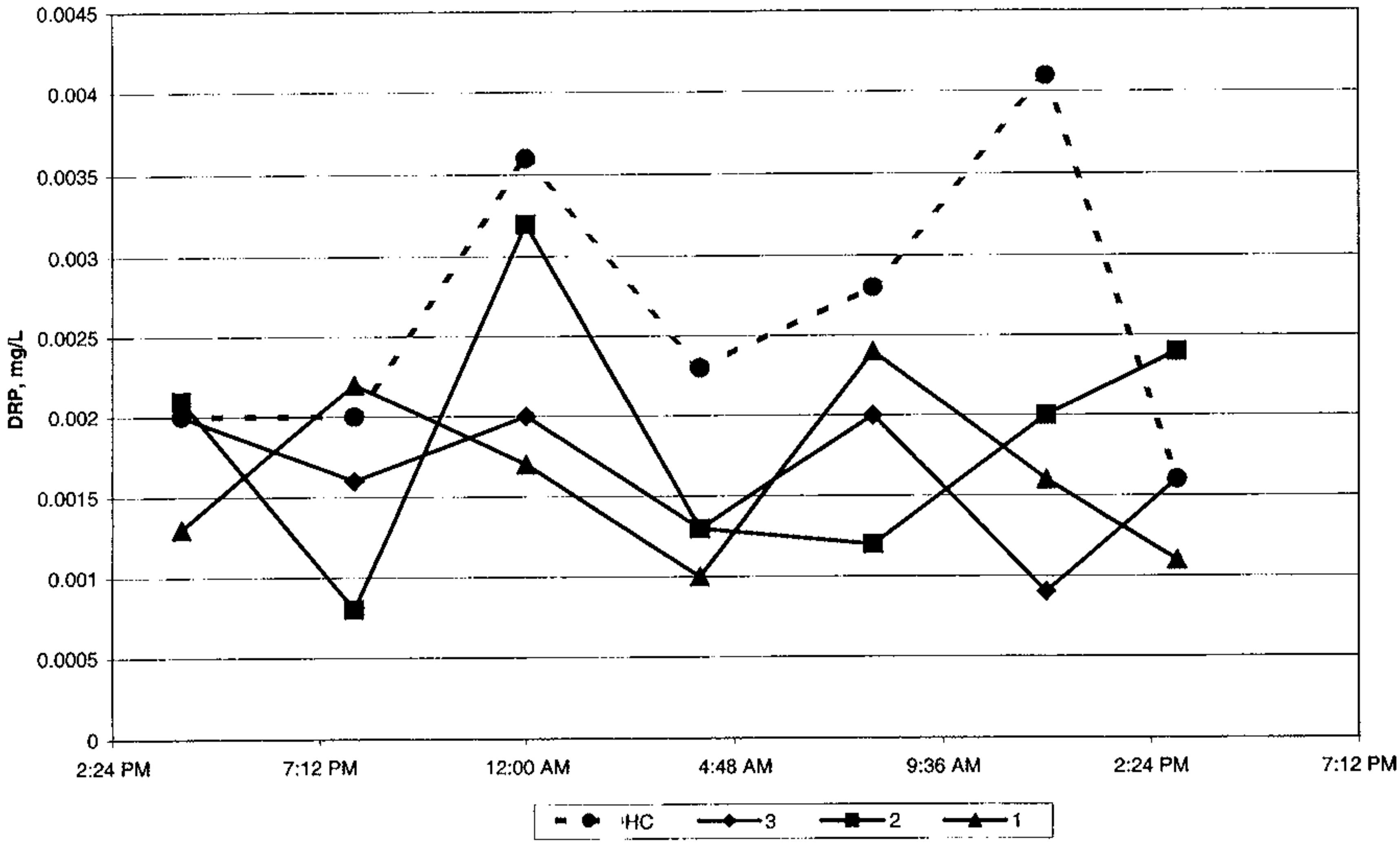


Exhibit C.3-5
Diel Record of DRP in the PSTA Test Cell Treatments on October 5-6, 1999

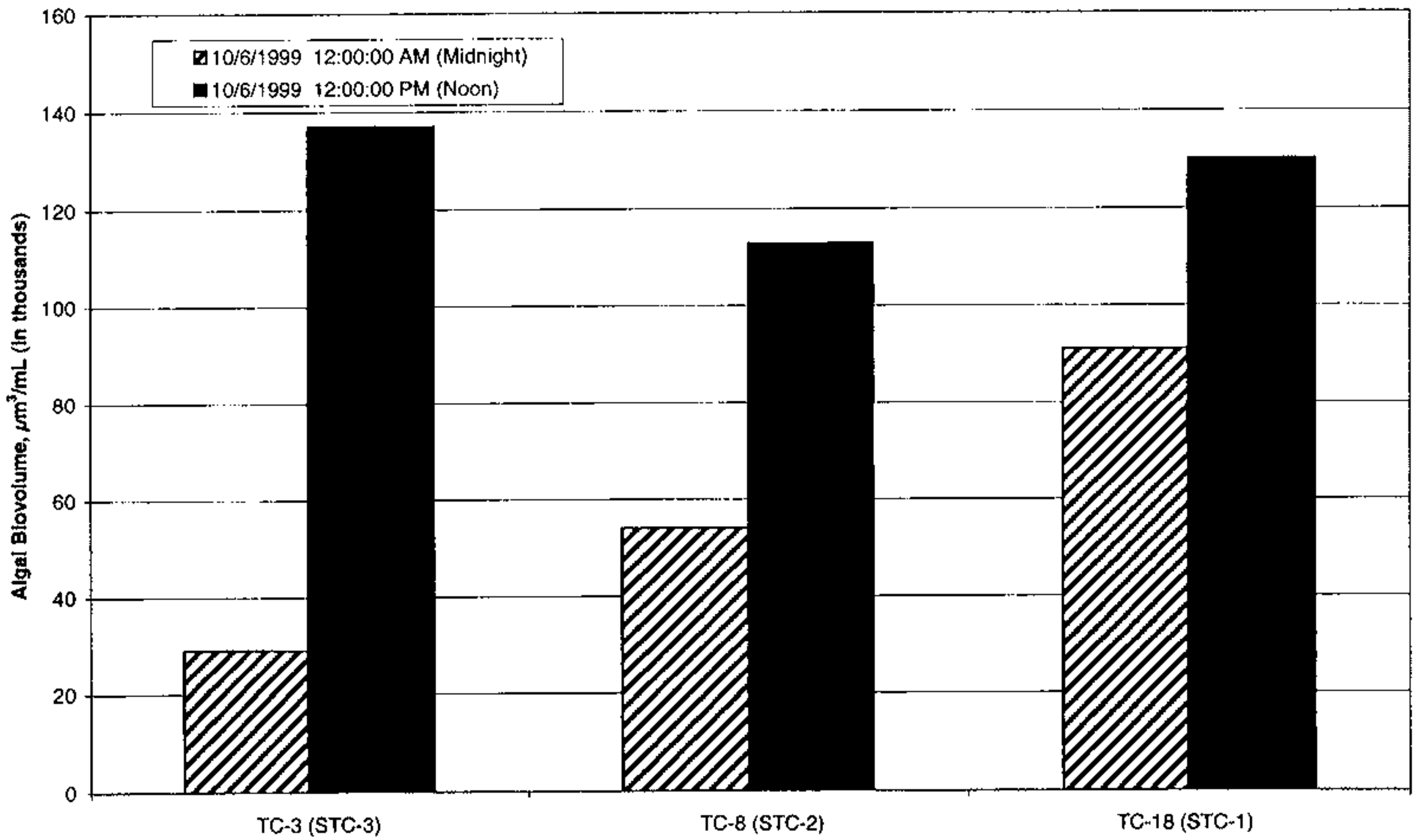


Exhibit C.3-6
Diel Record of Algal Biovolume in the PSTA Test Cell Outflows on October 6, 1999

counts from Treatments 2 and 3 (Test Cells 8 and 3) were dominated by blue-greens (50 percent) and greens (39 percent), respectively.

Exported biovolume from Treatment 1 (Test Cell 13) was dominated by the euglenoid *Euglena* sp., by the blue-green algae *Cylindrospermum* sp. and *Oscillatoria limosa*, and by the green algae *Oocystis solitaria* and *Tetraedron trigonum*. Biovolume exported from Treatment 2 (Test Cell 8) was dominated by the diatom *Cyclotella* sp., the green alga *Tetraedron trigonum*, the diatom *Mastogloia smithii*, and the dinoflagellates *Peridinium inconspicuum* and *P. aciculiferum*. Biovolume exported from Treatment 3 (Test Cell 3) was dominated by the euglenoids *Euglena* sp. and *E. acus*, the dinoflagellates *Peridinium inconspicuum* and *P. aciculiferum*, and the green alga *Tetraedron trigonum*.

APPENDIX D

Porta-PSTAs

APPENDIX D.1

Detailed Data

Phase 1 Data Summaries

EXHIBIT D.1-1

Water Balances for the Porta-PSTA Treatments, April 1999 - March 2000

		Depth	HLR	Inflow		Outflow		Rainfall		ET		ΔSTORAGE	Residual	Residual
Treatment	**Month**	**(m)**	**(cm/d)**	**(m^3/d)**	**(m^3)**	**(m^3/d)**	**(m^3)**	**(in)**	**(m^3)**	**(mm)**	**(m^3)**	**(m^3)**	**(m^3)**	**(% of Inflow**
1	Apr-1999	0.593	4.92	0.295	9.15	0.294	9.13	0.71	0.11	128.92	0.77	-1.012	0.37	3.95
	May-1999	0.668	4.73	0.284	8.79	0.209	6.48	2.09	0.32	137.33	0.82	0.012	1.80	19.73
	Jun-1999	0.669	5.03	0.302	9.36	0.326	10.09	12.54	1.91	104.86	0.63	0.000	0.55	4.91
	Jul-1999	0.665	5.42	0.325	10.08	0.277	8.60	3.18	0.48	136.10	0.82	-0.006	1.15	10.89
	Aug-1999	0.663	5.51	0.331	10.25	0.187	5.80	9.36	1.43	120.04	0.72	0.024	5.13	43.92
	Sep-1999	0.668	7.92	0.475	14.72	0.462	14.33	6.69	1.02	105.39	0.63	0.000	0.78	4.94
	Oct-1999	0.669	10.15	0.609	18.88	0.584	18.09	13.86	2.11	96.96	0.58	0.006	2.31	11.01
	Nov-1999	0.668	9.00	0.540	16.73	0.475	14.73	0.43	0.07	83.91	0.50	-0.027	2.29	13.63
	Dec-1999	0.668	9.98	0.599	18.56	0.589	18.26	1.48	0.23	69.54	0.42	0.012	0.10	0.52
	Jan-2000	0.667	9.07	0.544	16.87	0.488	15.14	1.15	0.18	---	---	-0.006	---	---
2	Apr-1999	0.652	4.74	0.284	8.81	0.306	9.47	0.71	0.11	128.92	0.77	0.006	-1.33	-14.93
	May-1999	0.647	4.74	0.284	8.81	0.279	8.65	2.09	0.32	137.33	0.82	0.009	-0.35	-3.87
	Jun-1999	0.650	5.32	0.319	9.89	0.309	9.59	12.54	1.91	104.86	0.63	0.000	1.59	13.46
	Jul-1999	0.652	5.48	0.329	10.20	0.262	8.11	3.18	0.48	136.10	0.82	-0.012	1.77	16.55
	Aug-1999	0.652	5.36	0.322	9.97	0.209	6.48	9.36	1.43	120.04	0.72	0.018	4.18	36.68
	Sep-1999	0.651	8.18	0.491	15.22	0.397	12.31	6.69	1.02	105.39	0.63	0.018	3.28	20.19
	Oct-1999	0.653	8.81	0.528	16.38	0.541	16.78	13.86	2.11	96.96	0.58	-0.012	1.14	6.15
	Nov-1999	0.656	9.29	0.557	17.28	0.544	16.86	0.43	0.07	83.91	0.50	0.012	-0.03	-0.20
	Dec-1999	0.653	9.29	0.558	17.28	0.524	16.26	1.48	0.23	69.54	0.42	-0.043	0.88	5.02
	Jan-2000	0.653	9.06	0.544	16.85	0.529	16.39	1.15	0.18	---	---	0.012	---	---
3	Apr-1999	0.316	4.57	0.274	8.50	0.387	12.00	0.71	0.11	128.92	0.77	0.000	-4.17	-48.38
	May-1999	0.317	4.66	0.280	8.67	0.235	7.29	2.09	0.32	137.33	0.82	-0.009	1.24	13.81
	Jun-1999	0.318	5.03	0.302	9.36	0.329	10.19	12.54	1.91	104.86	0.63	0.006	0.45	3.99
	Jul-1999	0.319	5.28	0.317	9.81	0.298	9.25	3.18	0.48	136.10	0.82	0.006	0.23	2.22
	Aug-1999	0.314	5.32	0.319	9.90	0.123	3.82	9.36	1.43	120.04	0.72	0.012	6.77	59.77
	Sep-1999	0.318	7.81	0.468	14.52	0.354	10.98	6.69	1.02	105.39	0.63	0.018	3.91	25.14
	Oct-1999	0.319	9.27	0.556	17.23	0.531	16.47	13.86	2.11	96.96	0.58	-0.012	2.30	11.90
	Nov-1999	0.319	8.89	0.534	16.54	0.498	15.43	0.43	0.07	83.91	0.50	-0.037	0.71	4.27
	Dec-1999	0.319	9.87	0.592	18.35	0.585	18.14	1.48	0.23	69.54	0.42	0.000	0.02	0.10
	Jan-2000	0.317	8.54	0.512	15.88	0.501	15.52	1.15	0.18	---	---	-0.043	---	---
	Feb-2000	0.316	8.48	0.509	15.77	0.473	14.67	0.72	0.11	---	---	0.003	---	---
	Mar-2000	0.316	7.45	0.447	13.86	0.415	12.86	4.38	0.67	---	---	0.037	---	---
4	Apr-1999	0.368	5.16	0.310	9.60	0.382	11.85	0.71	0.11	128.92	0.77	-0.006	-2.91	-29.96
	May-1999	0.370	4.89	0.293	9.10	0.355	11.01	2.09	0.32	137.33	0.82	0.006	-2.42	-25.74
	Jun-1999	0.370	5.25	0.315	9.76	0.340	10.54	12.54	1.91	104.86	0.63	0.000	0.50	4.31
	Jul-1999	0.370	5.53	0.332	10.29	0.289	8.97	3.18	0.48	136.10	0.82	0.000	0.98	9.14
	Aug-1999	0.368	5.24	0.314	9.74	0.235	7.29	9.36	1.43	120.04	0.72	0.018	3.13	28.05
	Sep-1999	0.371	7.56	0.454	14.06	0.415	12.86	6.69	1.02	105.39	0.63	-0.006	1.60	10.59
	Oct-1999	0.370	9.58	0.575	17.83	0.577	17.90	13.86	2.11	96.96	0.58	-0.015	1.47	7.38
	Nov-1999	0.371	8.85	0.531	16.45	0.517	16.03	0.43	0.07	83.91	0.50	0.000	-0.01	-0.07
	Dec-1999	0.379	9.60	0.576	17.86	0.590	18.30	1.48	0.23	69.54	0.42	-0.012	-0.63	-3.46
	Jan-2000	0.365	9.52	0.571	17.71	0.596	18.48	1.15	0.18	---	---	-0.018	---	---
	Feb-2000	0.369	8.99	0.539	16.72	0.574	17.79	0.72	0.11	---	---	-0.006	---	---
	Mar-2000	0.367	7.37	0.442	13.72	0.424	13.13	4.38	0.67	---	---	-0.006	---	---
5	Apr-1999	0.652	10.09	0.606	18.77	0.688	21.33	0.71	0.11	128.92	0.77	0.018	-3.24	-17.16
	May-1999	0.652	8.58	0.515	15.96	0.550	17.06	2.09	0.32	137.33	0.82	0.043	-1.64	-10.09
	Jun-1999	0.648	9.48	0.569	17.64	0.590	18.30	12.54	1.91	104.86	0.63	0.000	0.63	3.20
	Jul-1999	0.646	9.77	0.586	18.17	0.566	17.56	3.18	0.48	136.10	0.82	0.018	0.26	1.38
	Aug-1999	0.647	10.72	0.643	19.93	0.469	14.55	9.36	1.43	120.04	0.72	-0.024	6.12	28.63
	Sep-1999	0.645	11.51	0.691	21.41	0.321	9.94	6.69	1.02	105.39	0.63	0.018	11.84	52.78
	Oct-1999	0.650	18.43	1.106	34.29	1.012	31.38	13.86	2.11	96.96	0.58	0.012	4.42	12.15
	Nov-1999	0.651	18.78	1.127	34.93	1.065	33.00	0.43	0.07	83.91	0.50	0.018	1.48	4.22
	Dec-1999	0.650	18.65	1.119	34.68	1.116	34.60	1.48	0.23	69.54	0.42	0.012	-0.12	-0.33
	Jan-2000	0.444	18.65	1.119	34.68	1.097	34.00	1.15	0.18	---	---	-1.798	---	---
	Feb-2000	0.349	18.26	1.096	33.97	1.088	33.73	0.72	0.11	---	---	-0.006	---	---
	Mar-2000	0.347	13.15	0.789	24.46	0.728	22.56	4.38	0.67	---	---	-0.018	---	---
6	Apr-1999	0.541	3.66	0.219	6.80	0.280	8.68	0.71	0.11	128.92	0.77	-1.725	-0.82	-11.86
	May-1999	0.356	2.33	0.140	4.33	0.120	3.72	2.09	0.32	137.33	0.82	0.018	0.08	1.82
	Jun-1999	0.658	6.74	0.404	12.53	0.433	13.43	12.54	1.91	104.86	0.63	0.000	0.38	2.64
	Jul-1999	0.657	8.10	0.486	15.07	0.478	14.82	3.18	0.48	136.10	0.82	0.000	-0.08	-0.52
	Aug-1999	0.656	8.08	0.485	15.03	0.244	7.55	9.36	1.43	120.04	0.72	0.018	8.17	49.64
	Sep-1999	0.658	10.95	0.657	20.36	0.522	16.18	6.69	1.02	105.39	0.63	-0.006	4.58	21.41
	Oct-1999	0.658	6.79	0.408	12.63	0.454	14.07	13.86	2.11	96.96	0.58	0.000	0.09	0.61
	Nov-1999	0.415	4.04	0.242	7.51	0.240	7.43	0.43	0.07	83.91	0.50	-1.811	1.45	19.18
	Dec-1999	0.355	1.80	0.108	3.34	0.123	3.81	1.48	0.23	69.54	0.42	-0.018	-0.64	-17.89
	Jan-2000	0.186	5.34	0.320	9.93	0.351	10.88	1.15	0.18	---	---	-1.201	---	---
	Feb-2000	0.156	4.72	0.283	8.79	0.283	8.76	0.72	0.11	---	---	0.015	---	---
	Mar-2000	0.155	4.00	0.240	7.44	0.255	7.90	4.38	0.67	---	---	0.043	---	---

EXHIBIT D.1-1
Water Balances for the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Month	Depth (m)	HLR (cm/d)	Inflow (m^3/d)	Inflow (m^3)	Outflow (m^3/d)	Outflow (m^3)	Rainfall (in)	Rainfall (m^3)	ET (mm)	ET (m^3)	ΔSTORAGE (m^3)	Residual (m^3)	Residual (% of Inflow)
7	Apr-1999	0.678	4.94	0.296	9.18	0.307	9.52	0.71	0.11	128.92	0.77	0.000	-1.01	-10.87
	May-1999	0.679	5.08	0.305	9.45	0.223	6.92	2.09	0.32	137.33	0.82	0.000	2.02	20.70
	Jun-1999	0.664	4.80	0.288	8.93	0.416	12.91	12.54	1.91	104.86	0.63	0.000	-2.70	-24.90
	Jul-1999	0.371	5.83	0.350	10.85	0.381	11.82	3.18	0.48	136.10	0.82	0.000	-1.31	-11.52
	Aug-1999	0.369	5.64	0.338	10.48	0.302	9.37	9.36	1.43	120.04	0.72	0.000	1.82	15.25
	Sep-1999	0.371	7.21	0.432	13.40	0.173	5.35	6.69	1.02	105.39	0.63	-0.037	8.48	58.77
	Oct-1999	0.368	9.58	0.575	17.82	0.408	12.65	13.86	2.11	96.96	0.58	0.000	6.69	33.59
	Nov-1999	0.367	9.28	0.557	17.26	0.494	15.30	0.43	0.07	83.91	0.50	-0.018	1.54	8.89
	Dec-1999	0.385	8.72	0.523	16.22	0.639	19.81	1.48	0.23	69.54	0.42	-1.024	-2.76	-15.79
	Jan-2000	0.369	9.10	0.546	16.93	0.515	15.98	1.15	0.18	---	---	0.073	---	---
	Feb-2000	0.368	9.05	0.543	16.83	0.546	16.92	0.72	0.11	---	---	0.009	---	---
	Mar-2000	0.366	6.66	0.400	12.39	0.356	11.03	4.38	0.67	---	---	0.000	---	---
8	Apr-1999	0.702	5.65	0.339	10.51	0.346	10.71	0.71	0.11	128.92	0.77	0.000	-0.87	-8.17
	May-1999	0.709	5.20	0.312	9.67	0.165	5.11	2.09	0.32	137.33	0.82	1.939	2.12	21.20
	Jun-1999	0.658	5.23	0.314	9.73	0.256	7.92	12.54	1.91	104.86	0.63	0.000	3.09	26.55
	Jul-1999	0.702	6.44	0.386	11.98	0.265	8.23	3.18	0.48	136.10	0.82	-0.018	3.44	27.57
	Aug-1999	0.702	6.31	0.379	11.74	0.251	7.77	9.36	1.43	120.04	0.72	0.037	4.64	35.26
	Sep-1999	0.700	7.26	0.436	13.50	0.196	6.06	6.69	1.02	105.39	0.63	0.055	7.77	53.52
	Oct-1999	0.707	10.00	0.600	18.59	0.591	18.33	13.86	2.11	96.96	0.58	0.018	1.78	8.58
	Nov-1999	0.704	9.05	0.543	16.84	0.436	13.52	0.43	0.07	83.91	0.50	0.000	2.88	17.06
	Dec-1999	0.706	9.10	0.546	16.92	0.533	16.52	1.48	0.23	69.54	0.42	0.000	0.21	1.25
	Jan-2000	0.704	9.00	0.540	16.74	0.522	16.18	1.15	0.18	---	---	0.000	---	---
9	Apr-1999	0.645	5.39	0.323	10.02	0.346	10.71	0.71	0.11	128.92	0.77	0.000	-1.36	-13.45
	May-1999	0.647	5.27	0.316	9.80	0.230	7.14	2.09	0.32	137.33	0.82	0.037	2.12	20.93
	Jun-1999	0.649	5.07	0.304	9.42	0.267	8.29	12.54	1.91	104.86	0.63	0.000	2.42	21.31
	Jul-1999	0.648	5.38	0.323	10.01	0.226	7.01	3.18	0.48	136.10	0.82	-0.037	2.70	25.76
	Aug-1999	0.645	5.38	0.323	10.00	0.204	6.31	9.36	1.43	120.04	0.72	0.677	3.72	32.52
	Sep-1999	0.648	6.80	0.408	12.65	0.360	11.15	6.69	1.02	105.39	0.63	-0.018	1.91	13.96
	Oct-1999	0.650	8.69	0.521	16.16	0.619	19.18	13.86	2.11	96.96	0.58	0.018	-1.51	-8.25
	Nov-1999	0.651	8.95	0.537	16.64	0.508	15.75	0.43	0.07	83.91	0.50	-0.018	0.47	2.83
	Dec-1999	0.654	9.58	0.575	17.82	0.625	19.37	1.48	0.23	69.54	0.42	0.018	-1.76	-9.77
	Jan-2000	0.649	9.54	0.572	17.74	0.592	18.34	1.15	0.18	---	---	0.000	---	---
	Feb-2000	0.649	9.43	0.566	17.53	0.600	18.59	0.72	0.11	---	---	-0.009	---	---
	Mar-2000	0.562	8.39	0.503	15.60	0.477	14.78	4.38	0.67	---	---	-1.811	---	---
10	Apr-1999	0.648	6.04	0.363	11.24	0.274	8.48	0.71	0.11	128.92	0.77	0.018	2.08	18.29
	May-1999	0.648	4.16	0.250	7.74	0.140	4.35	2.09	0.32	137.33	0.82	0.000	2.89	35.79
	Jun-1999	0.649	4.71	0.283	8.76	0.298	9.25	12.54	1.91	104.86	0.63	0.000	0.80	7.46
	Jul-1999	0.650	5.41	0.325	10.07	0.220	6.81	3.18	0.48	136.10	0.82	-0.018	2.95	27.92
	Aug-1999	0.642	5.35	0.321	9.94	0.217	6.73	9.36	1.43	120.04	0.72	0.073	3.85	33.82
	Sep-1999	0.652	7.33	0.440	13.63	0.263	8.15	6.69	1.02	105.39	0.63	0.055	5.81	39.65
	Oct-1999	0.653	9.99	0.600	18.59	0.569	17.65	13.86	2.11	96.96	0.58	-0.009	2.47	11.96
	Nov-1999	0.655	8.47	0.508	15.75	0.474	14.71	0.43	0.07	83.91	0.50	0.055	0.55	3.47
	Dec-1999	0.656	9.29	0.558	17.29	0.576	17.86	1.48	0.23	69.54	0.42	0.000	-0.76	-4.34
	Jan-2000	0.655	9.54	0.572	17.74	0.568	17.60	1.15	0.18	---	---	0.000	---	---
	Feb-2000	0.652	8.20	0.492	15.24	0.476	14.76	0.72	0.11	---	---	-0.027	---	---
	Mar-2000	0.561	7.15	0.429	13.30	0.388	12.03	4.38	0.67	---	---	-1.847	---	---
11	Apr-1999	0.332	5.02	0.904	28.02	0.706	21.87	0.71	0.32	128.92	2.32	0.219	3.93	13.87
	May-1999	0.337	5.41	0.973	30.17	0.783	24.26	2.09	0.96	137.33	2.47	0.000	4.40	14.12
	Jun-1999	0.338	5.48	0.986	30.56	1.154	35.77	12.54	5.73	104.86	1.89	0.000	-1.36	-3.76
	Jul-1999	0.340	5.63	1.013	31.41	1.064	32.97	3.18	1.45	136.10	2.45	0.000	-2.56	-7.78
	Aug-1999	0.339	5.32	0.958	29.69	1.034	32.06	9.36	4.28	120.04	2.16	0.000	-0.25	-0.74
	Sep-1999	0.342	5.82	1.047	32.46	1.094	33.93	6.69	3.06	105.39	1.90	0.055	-0.36	-1.00
	Oct-1999	0.342	8.51	1.532	47.49	1.526	47.32	13.86	6.34	96.96	1.75	0.055	4.70	8.74
	Nov-1999	0.343	9.78	1.761	54.58	1.755	54.41	0.43	0.20	83.91	1.51	-0.055	-1.09	-1.98
	Dec-1999	0.344	9.45	1.701	52.74	1.617	50.14	1.48	0.68	69.54	1.25	-0.055	2.08	3.89
	Jan-2000	0.344	9.56	1.720	53.33	1.690	52.40	1.15	0.53	---	---	0.000	---	---
	Feb-2000	0.344	9.25	1.666	51.63	1.647	51.05	0.72	0.33	---	---	0.000	---	---
	Mar-2000	0.342	7.60	1.368	42.41	1.288	39.93	4.38	2.00	---	---	0.000	---	---
12	Apr-1999	0.362	5.34	0.960	29.77	0.893	27.68	0.71	0.32	128.92	2.32	0.055	0.05	0.16
	May-1999	0.363	5.87	1.057	32.75	1.115	34.57	2.09	0.96	137.33	2.47	-0.329	-3.00	-8.91
	Jun-1999	0.369	5.52	0.993	30.79	1.160	35.96	12.54	5.73	104.86	1.89	-0.439	-0.89	-2.43
	Jul-1999	0.356	5.70	1.027	31.82	0.971	30.09	3.18	1.45	136.10	2.45	-0.055	0.80	2.39
	Aug-1999	0.353	5.77	1.039	32.22	1.075	33.32	9.36	4.28	120.04	2.16	0.000	1.01	2.78
	Sep-1999	0.354	5.90	1.062	32.93	1.126	34.89	6.69	3.06	105.39	1.90	0.000	-0.80	-2.23
	Oct-1999	0.354	8.79	1.582	49.04	1.502	46.57	13.86	6.34	96.96	1.75	0.000	7.06	12.75
	Nov-1999	0.353	8.82	1.587	49.20	1.483	45.98	0.43	0.20	83.91	1.51	0.000	1.91	3.87
	Dec-1999	0.355	9.95	1.791	55.54	1.788	55.41	1.48	0.68	69.54	1.25	0.055	-0.51	-0.90
	Jan-2000	0.354	9.57	1.723	53.40	1.772	54.94	1.15	0.53	---	---	-0.055	---	---
	Feb-2000	0.353	9.16	1.650	51.14	1.519	47.10	0.72	0.33	---	---	0.000	---	---
	Mar-2000	0.355	8.00	1.441	44.66	1.376	42.65	4.38	2.00	---	---	0.439	---	---

EXHIBIT D.1-2

Monthly Average Values of Selected Field Parameters Collected at the Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April 1999 - March 2000

Parameter	Month	Head Tank Outflow	Treatment 1* (Peat) Outflow	2* (Shellrock) Outflow	3 (Peat) Outflow	4 (Shellrock) Outflow	5 (Shellrock) Outflow	6 (Shellrock-Variable Stage) Outflow	7 (Sand) Outflow	8* (Sand) Outflow	9 (Peat) Outflow	10 (Shellrock) Outflow	11 (Shellrock) Outflow	12 (Peat) Outflow
Water Temp (deg C)	Apr-99	25.58	26.12	24.69	26.76	24.99	27.22	25.59	26.21	26.50	26.39	26.29	27.52	28.08
	May-99	26.67	26.44	26.43	26.11	26.27	27.39	25.33	26.86	27.09	27.48	27.52	27.28	28.71
	Jun-99	27.40	27.77	27.28	27.43	27.57	28.05	27.48	27.22	28.34	26.89	24.60	26.17	26.01
	Jul-99	29.28	30.25	29.43	30.67	29.94	31.10	29.78	31.63	31.11	30.34	30.78	33.34	32.72
	Aug-99	29.02	29.77	30.76	29.65	29.75	30.07	29.15	29.08	28.97	28.66	28.03	28.27	30.42
	Sep-99	29.18	27.56	27.73	27.22	27.75	29.43	27.77	26.70	--	--	26.73	--	--
	Oct-99	26.12	27.20	27.04	27.46	25.71	26.45	26.23	27.18	25.25	26.75	24.04	23.28	21.85
	Nov-99	23.22	22.35	22.13	21.22	22.69	21.79	21.70	21.35	22.70	20.83	22.20	21.60	23.04
	Dec-99	21.66	20.57	19.07	19.55	18.15	18.61	16.36	21.23	21.91	17.30	14.98	16.70	19.43
	Jan-00	19.35	21.79	21.52	20.08	16.90	19.92	18.18	17.30	21.82	15.89	14.07	17.20	18.50
	Feb-00	22.23	--	--	18.02	20.86	19.48	19.11	17.09	--	21.90	20.07	21.31	19.50
	Mar-00	24.00	--	--	22.46	23.33	23.46	22.24	22.91	--	25.65	23.28	24.51	23.36
pH (units)	Apr-99	7.50	8.23	8.49	8.16	8.60	8.27	8.57	8.18	8.13	8.13	8.27	8.17	8.04
	May-99	7.51	8.46	8.82	8.24	8.76	8.22	8.55	8.69	8.66	8.16	8.45	8.70	8.12
	Jun-99	7.42	8.36	8.29	8.23	8.60	8.24	8.41	9.09	8.83	8.09	8.34	8.47	8.13
	Jul-99	7.49	8.21	8.57	7.88	8.44	8.25	8.39	8.70	8.67	8.10	8.16	8.47	7.84
	Aug-99	7.44	8.10	8.45	7.71	8.43	8.23	8.22	8.28	8.35	8.00	8.09	8.21	7.57
	Sep-99	7.32	8.02	8.38	7.51	8.03	8.18	7.82	7.97	--	--	7.88	--	--
	Oct-99	7.53	7.87	8.04	7.53	7.87	7.82	7.99	8.00	8.06	7.85	7.90	7.84	7.62
	Nov-99	7.65	7.86	8.05	7.55	7.95	7.77	8.19	7.77	7.77	7.61	7.65	7.67	7.53
	Dec-99	7.56	7.64	7.97	7.36	6.77	7.75	7.92	7.60	7.69	7.47	7.45	7.55	7.62
	Jan-00	7.60	7.98	7.98	7.53	7.49	7.76	7.63	7.60	8.16	7.66	7.40	7.68	7.34
	Feb-00	7.45	--	--	7.34	7.66	7.69	7.71	7.64	--	7.53	7.65	7.77	7.23
	Mar-00	7.23	--	--	7.23	7.89	7.63	7.53	8.11	--	7.80	7.75	7.82	7.18
Conductivity (µmhos/cm)	Apr-99	973	1250	1282	1070	1192	1176	1301	1345	1151	1442	1460	1154	1130
	May-99	929	997	973	927	806	967	935	868	901	997	1025	827	1152
	Jun-99	823	762	855	668	740	772	719	684	826	936	830	1027	1180
	Jul-99	1042	893	844	966	903	943	849	886	846	915	904	925	1000
	Aug-99	1244	1120	1099	1223	1016	1177	1156	1074	1133	1153	1113	1082	1162
	Sep-99	1228	1157	1074	1393	1172	1097	1149	1154	--	--	1217	--	--
	Oct-99	1271	1261	1122	1379	1149	1192	1133	1210	1192	1069	1017	1057	1210
	Nov-99	1109	1069	1051	1040	1053	1019	1046	1053	1076	1094	1113	1135	1093
	Dec-99	1023	1017	1037	1058	947	1034	1026	969	993	967	956	1035	1052
	Jan-00	980	973	978	952	915	951	903	931	965	990	937	884	963
	Feb-00	897	--	--	887	863	860	859	839	--	924	903	866	863
	Mar-00	903	--	--	884	796	885	870	790	--	886	951	833	818
Salinity (ppt)	Apr-99	0.51	0.66	0.68	0.55	0.63	0.62	0.69	--	--	--	--	--	--
	May-99	0.49	0.52	--	0.49	--	0.51	0.48	0.45	0.47	0.52	0.53	0.43	0.61
	Jun-99	0.43	0.39	0.45	0.33	0.38	0.40	0.37	0.35	0.43	0.49	--	0.54	0.64
	Jul-99	0.55	--	0.44	--	0.47	0.49	0.44	--	--	--	--	--	--
	Aug-99	0.66	--	0.58	0.66	0.52	0.62	0.61	--	0.60	0.61	--	--	--
	Sep-99	0.65	0.61	0.56	0.74	0.62	0.58	0.59	--	--	--	--	--	--
	Oct-99	--	0.67	--	0.77	--	--	--	0.64	0.63	0.55	0.52	0.54	0.60
	Nov-99	--	0.56	--	0.53	--	0.52	--	0.55	0.56	0.57	0.59	0.61	0.57
	Dec-99	--	0.56	--	0.58	--	--	--	0.50	0.51	0.50	0.49	0.61	--
	Jan-00	--	--	--	0.50	0.48	0.50	0.45	0.49	--	0.52	0.49	0.44	0.44
	Feb-00	--	--	--	0.46	0.45	0.45	0.45	0.44	--	0.48	0.47	0.45	0.45
	Mar-00	--	--	--	0.46	0.41	0.46	0.45	0.41	--	0.46	--	0.43	0.42

EXHIBIT D.1-2

Monthly Average Values of Selected Field Parameters Collected at the Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April 1999 - March 2000

Parameter	Month	Head Tank	Treatment											
			1[a]	2[a]	3	4	5	6	7	8[a]	9	10	11	12
			(Peat)	(Shellrock)	(Peat)	(Shellrock)	(Shellrock)	(Shellrock-Variable Stage)	(Sand)	(Sand)	(Peat)	(Shellrock)	(Shellrock)	(Peat)
		Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow
Total Dissolved Solids (g/L)	Apr-99	0.623	0.798	0.822	0.670	0.766	0.760	0.837	--	--	--	--	--	--
	May-99	0.595	0.642	--	0.595	--	0.628	0.594	0.553	0.573	0.634	0.651	0.527	0.745
	Jun-99	0.527	0.488	0.548	0.416	0.472	0.494	0.460	0.438	0.528	0.599	0.530	0.655	0.754
	Jul-99	0.667	0.571	0.541	0.619	0.578	0.604	0.543	0.567	0.541	0.586	0.578	0.592	0.640
	Aug-99	0.796	0.717	0.704	0.783	0.650	0.751	0.740	0.687	0.725	0.738	0.712	0.692	0.744
	Sep-99	0.786	0.740	0.687	0.892	0.750	0.702	0.735	0.739	--	--	0.779	--	--
	Oct-99	0.813	0.807	0.718	0.883	0.735	0.763	0.725	0.774	0.763	0.678	0.651	0.677	0.775
	Nov-99	0.710	0.684	0.673	0.666	0.673	0.652	0.669	0.674	0.689	0.700	0.712	0.726	0.699
	Dec-99	0.655	0.651	0.664	0.677	0.661	0.662	0.689	0.620	0.635	0.621	0.604	0.662	0.673
	Jan-00	0.627	0.623	0.626	0.609	0.586	0.609	0.562	0.595	0.617	0.634	0.600	0.566	0.616
	Feb-00	0.574	--	--	0.567	0.552	0.550	0.552	0.537	--	0.591	0.577	0.554	0.552
	Mar-00	0.578	--	--	0.566	0.510	0.567	0.557	0.506	--	0.567	0.608	0.533	0.524
Dissolved Oxygen Saturation (%)	Apr-99	57.9	89.5	123.9	89.6	123.6	105.4	119.6	--	--	--	--	--	--
	May-99	81.8	102.5	119.2	92.0	118.2	118.4	111.4	116.3	118.7	79.1	98.2	122.3	87.8
	Jun-99	64.0	93.4	113.7	92.2	115.1	100.1	113.1	130.4	120.2	78.6	97.1	116.7	86.7
	Jul-99	41.9	98.4	114.4	94.9	114.4	111.4	104.9	134.7	130.8	76.4	87.8	126.1	85.9
	Aug-99	37.1	97.2	117.8	80.4	121.1	106.6	102.9	121.1	118.1	80.1	86.1	116.6	90.7
	Sep-99	40.4	87.8	107.2	79.3	105.9	116.1	77.4	95.6	--	--	77.8	--	--
	Oct-99	49.4	91.7	117.6	75.4	93.7	89.9	97.3	114.8	102.1	83.6	88.3	110.7	73.4
	Nov-99	55.5	87.8	107.4	81.2	93.3	104.1	96.6	103.3	103.9	74.6	88.1	104.7	68.4
	Dec-99	55.2	85.3	99.1	80.4	113.9	83.7	110.6	103.3	103.2	72.1	98.3	107.5	73.3
	Jan-00	51.7	97.1	112.6	89.7	113.3	104.3	111.1	109.8	118.9	81.7	92.8	104.6	73.4
	Feb-00	55.5	--	--	81.1	110.6	100.3	116.8	125.7	--	63.0	86.9	114.9	67.0
	Mar-00	45.7	--	--	73.5	108.9	100.5	150.0	128.2	--	89.2	85.6	100.0	55.4
Dissolved Oxygen (mg/L)	Apr-99	4.72	7.06	10.40	7.32	10.05	8.39	9.87	7.40	7.11	6.72	7.71	7.79	7.09
	May-99	6.51	8.23	9.88	7.47	9.69	9.29	8.87	9.21	9.39	6.23	7.71	9.53	6.64
	Jun-99	5.05	7.18	8.96	7.19	9.05	7.84	8.91	10.30	9.32	6.26	8.68	9.38	7.00
	Jul-99	3.17	7.25	8.46	6.93	8.62	8.25	8.00	9.86	9.64	5.72	6.54	8.97	6.14
	Aug-99	2.82	7.26	8.74	6.06	9.12	8.05	7.84	9.06	9.01	6.16	6.89	8.68	6.74
	Sep-99	3.07	6.96	8.29	5.94	8.23	8.90	6.13	7.64	--	--	6.18	--	--
	Oct-99	4.00	7.23	9.71	5.92	8.00	7.56	8.07	9.06	8.34	6.66	7.40	9.54	6.03
	Nov-99	4.72	7.49	9.29	7.04	8.04	9.17	8.28	9.29	8.92	6.61	7.71	9.33	5.86
	Dec-99	4.89	7.91	9.08	7.34	8.04	7.66	8.93	9.13	9.01	6.96	9.92	10.42	6.76
	Jan-00	4.77	8.48	10.08	8.15	11.03	9.47	10.19	10.52	10.41	7.87	9.49	9.97	6.63
	Feb-00	4.86	--	--	7.71	9.83	9.37	10.92	11.88	--	5.51	7.86	10.11	6.15
	Mar-00	3.87	--	--	6.32	9.16	8.66	13.85	10.95	--	7.24	7.27	8.34	4.65

[a] PP- 1,-2, and -8 were operated as batch systems from January - March 2000; these data are presented in Appendix D.4.

1[a] (Peat)		2[a] (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)		7 (Sand)		8[a] (Sand)		9 (Peat)		10 (Shellro
[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]
9	0.038	0.044	0.041	0.038	0.030	0.039	0.038	0.039	0.033	0.038	0.037	0.040	0.062	0.037	0.047	0.041	0.031	0.036
8	0.016	0.019	0.022	0.018	0.018	0.019	0.022	0.019	0.022	0.019	0.029	0.019	0.016	0.019	0.022	0.019	0.016	0.019
1	0.015	0.027	0.021	0.021	0.018	0.020	0.019	0.021	0.014	0.020	0.015	0.021	0.027	0.020	0.020	0.021	0.012	0.020
8	0.017	0.013	0.013	0.013	0.014	0.013	0.015	0.013	0.017	0.013	0.013	0.013	0.013	0.013	0.015	0.013	0.014	0.013
0	0.022	0.019	0.016	0.019	0.020	0.019	0.017	0.019	0.020	0.019	0.016	0.019	0.016	0.019	0.022	0.019	0.017	0.019
7	0.017	0.018	0.015	0.017	0.018	0.018	0.018	0.017	0.015	0.018	0.016	0.018	0.016	0.017	0.018	0.017	0.015	0.018
0	0.016	0.020	0.014	0.020	0.016	0.021	0.014	0.020	0.015	0.021	0.016	0.020	0.013	0.020	0.016	0.020	0.016	0.020
5	0.012	0.016	0.011	0.015	0.013	0.015	0.011	0.016	0.014	0.015	0.013	0.015	0.012	0.016	0.017	0.015	0.021	0.016
9	0.015	0.020	0.014	0.020	0.013	0.019	0.013	0.020	0.014	0.019	0.014	0.019	0.013	0.020	0.015	0.020	0.019	0.019
3	0.014	0.023	0.013	0.025	0.013	0.025	0.014	0.025	0.015	0.025	0.014	0.025	0.016	0.023	0.015	0.025	0.017	0.025
	--	--	--	0.035	0.018	0.034	0.018	0.034	0.019	0.034	0.015	0.034	0.019	--	--	0.035	0.021	0.034
	--	--	--	0.035	0.018	0.037	0.017	0.038	0.021	0.040	0.017	0.036	0.015	--	--	0.039	0.028	0.041
8	0.023	0.024	0.028	0.018	0.015	0.019	0.024	0.019	0.017	0.018	0.025	0.020	0.044	0.017	0.031	0.021	0.014	0.017
5	0.004	0.005	0.013	0.005	0.008	0.005	0.011	0.005	0.011	0.005	0.018	0.006	0.005	0.006	0.010	0.006	0.004	0.007
0	0.006	0.016	0.011	0.009	0.009	0.009	0.011	0.010	0.005	0.009	0.007	0.010	0.019	0.009	0.012	0.010	0.003	0.009
4	0.009	0.005	0.006	0.004	0.007	0.005	0.007	0.005	0.010	0.005	0.007	0.004	0.006	0.005	0.009	0.004	0.007	0.005
6	0.013	0.006	0.006	0.006	0.010	0.006	0.008	0.006	0.011	0.006	0.007	0.006	0.006	0.006	0.013	0.006	0.006	0.007
3	0.008	0.003	0.005	0.003	0.007	0.004	0.009	0.003	0.006	0.004	0.007	0.004	0.006	0.002	0.009	0.003	0.006	0.004
8	0.007	0.008	0.005	0.007	0.008	0.008	0.006	0.008	0.007	0.009	0.008	0.008	0.006	0.007	0.006	0.007	0.008	0.008
4	0.006	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.007	0.004	0.006	0.004	0.004	0.005	0.009	0.004	0.013	0.005
4	0.006	0.004	0.005	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.006	0.003	0.004	0.005	0.006	0.005	0.009	0.003
3	0.005	0.003	0.005	0.005	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.004	0.006	0.003	0.005	0.005	0.006	0.004
	--	--	--	0.004	0.007	0.004	0.007	0.004	0.007	0.004	0.006	0.004	0.007	--	--	0.004	0.005	0.004
	--	--	--	0.012	0.007	0.014	0.006	0.013	0.007	0.012	0.004	0.012	0.004	--	--	0.010	0.009	0.013
0	0.015	0.020	0.014	0.020	0.015	0.020	0.013	0.020	0.016	0.020	0.012	0.020	0.018	0.020	0.016	0.020	0.016	0.020
5	0.012	0.014	0.010	0.014	0.010	0.014	0.010	0.013	0.011	0.014	0.011	0.013	0.010	0.013	0.012	0.013	0.012	0.013
1	0.009	0.011	0.010	0.012	0.009	0.011	0.009	0.011	0.009	0.011	0.008	0.010	0.008	0.011	0.008	0.010	0.009	0.011
9	0.007	0.006	0.007	0.009	0.008	0.009	0.007	0.008	0.007	0.009	0.007	0.009	0.007	0.008	0.007	0.008	0.007	0.008
4	0.010	0.013	0.010	0.013	0.010	0.013	0.009	0.013	0.009	0.013	0.009	0.013	0.010	0.013	0.009	0.013	0.011	0.013
4	0.009	0.015	0.009	0.014	0.011	0.014	0.009	0.015	0.009	0.014	0.009	0.014	0.010	0.015	0.009	0.014	0.009	0.014
3	0.009	0.013	0.009	0.013	0.009	0.012	0.008	0.012	0.009	0.012	0.008	0.012	0.008	0.013	0.010	0.013	0.008	0.012
1	0.007	0.011	0.007	0.011	0.007	0.011	0.007	0.011	0.008	0.011	0.007	0.011	0.007	0.011	0.008	0.011	0.008	0.011
6	0.009	0.016	0.009	0.015	0.009	0.015	0.009	0.016	0.010	0.015	0.008	0.016	0.009	0.016	0.009	0.016	0.010	0.016
20	0.009	0.020	0.008	0.020	0.009	0.021	0.008	0.020	0.010	0.021	0.008	0.021	0.010	0.020	0.010	0.020	0.011	0.021
	--	--	--	0.030	0.011	0.029	0.011	0.030	0.012	0.030	0.010	0.030	0.013	--	--	0.030	0.017	0.030
	--	--	--	0.024	0.011	0.023	0.011	0.025	0.013	0.028	0.013	0.024	0.012	--	--	0.029	0.020	0.028
05	0.004	0.005	0.006	0.005	0.003	0.005	0.003	0.005	0.003	0.005	0.003	0.005	0.005	0.005	0.003	0.006	0.004	0.005
03	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003
03	0.002	0.003	0.004	0.003	0.002	0.003	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.002	0.003	0.003	0.003
03	0.002	0.003	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.002	0.003	0.002	0.003	0.002	0.003	0.003	0.003
06	0.002	0.005	0.002	0.005	0.002	0.005	0.001	0.005	0.001	0.005	0.003	0.005	0.001	0.005	0.002	0.005	0.003	0.005
07	0.003	0.008	0.002	0.006	0.004	0.008	0.001	0.009	0.002	0.008	0.002	0.009	0.001	0.008	0.003	0.007	0.003	0.008
05	0.001	0.004	0.001	0.005	0.002	0.004	0.001	0.005	0.001	0.005	0.001	0.005	0.001	0.007	0.002	0.005	0.002	0.003
05	0.002	0.005	0.002	0.005	0.002	0.005	0.001	0.006	0.002	0.005	0.001	0.004	0.001	0.005	0.002	0.005	0.001	0.005
06	0.002	0.006	0.002	0.006	0.002	0.008	0.001	0.006	0.002	0.005	0.001	0.006	0.001	0.006	0.002	0.006	0.002	0.006
	--	--	--	0.010	--	0.010	--	0.010	--	0.010	--	0.010	--	--	--	0.010	--	0.010
	--	--	--	0.013	--	0.013	--	0.013	--	0.013	--	0.013	--	--	--	0.013	--	0.013
	--	--	--	0.009	--	0.009	--	0.009	--	0.011	--	0.009	--	--	--	0.011	--	0.011
15	0.011	0.015	0.009	0.009	0.007	0.015	0.011	0.015	0.013	0.015	0.010	0.015	0.013	0.015	0.013	0.014	0.013	0.014
12	0.009	0.011	0.007	0.005	0.005	0.011	0.008	0.010	0.009	0.011	0.007	0.009	0.008	0.010	0.009	0.010	0.009	0.009
08	0.007	0.007	0.006	0.008	0.008	0.008	0.006	0.008	0.006	0.008	0.008	0.007	0.006	0.008	0.008	0.007	0.006	0.008
05	0.005	0.005	0.005	0.007	0.007	0.005	0.005	0.005	0.005	0.005	0.004	0.005	0.004	0.005	0.004	0.005	0.005	0.005
09	0.008	0.008	0.009	0.011	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.008	0.009	0.008	0.007	0.008	0.009	0.008
05	0.005	0.006	0.007	0.009	0.008	0.005	0.008	0.005	0.006	0.005	0.007	0.005	0.010	0.006	0.006	0.006	0.005	0.005
10	0.008	0.011	0.007	0.010	0.007	0.010	0.007	0.009	0.008	0.009	0.007	0.009	0.006	0.009	0.009	0.010	0.008	0.010
10	0.007	0.010	0.008	0.011	--	0.010	0.008	0.009	0.008	0.010	0.009	0.010	0.008	0.009	0.007	0.010	0.008	0.009
10	0.007	0.011	0.007	0.017	--	0.010	0.006	0.011	0.008	0.010	0.006	0.012	0.009	0.010	0.008	0.011	0.007	0.012
	--	--	--	0.015	--	0.013	--	0.012	--	0.013	--	0.013	--	--	--	0.012	--	0.013
	--	--	--	0.017	--	0.016	--	0.017	--	0.017	--	0.017	--	--	--	0.017	--	0.017
	--	--	--	0.015	--	0.014	--	0.016	--	0.016	--	0.015	--	--	--	0.017	--	0.017

w[b]	1[a] (Peat)	2[a] (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)		7 (Sand)		8[c] (Sand)		9 (Peat)		10 (Shellro
	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]
3	1.04	1.44	0.92	1.48	1.30	1.48	1.10	1.48	0.95	1.48	1.43	1.48	1.73	1.48	1.34	1.48	--	1.48
3	1.07	0.95	1.09	0.82	1.00	0.88	1.41	0.61	0.86	0.92	1.19	0.92	0.97	0.91	0.92	0.90	0.84	0.82
9	0.45	0.89	0.72	0.89	0.52	0.89	0.65	0.89	0.47	0.89	0.57	0.89	0.57	0.89	0.53	0.89	0.80	0.89
9	0.50	1.09	0.65	1.09	0.46	1.09	0.49	1.09	0.60	1.09	0.45	1.09	0.44	1.09	0.63	1.09	0.80	1.09
6	1.74	1.46	1.84	1.46	1.15	1.46	1.62	1.46	1.64	1.46	1.58	1.46	1.63	1.46	1.82	1.46	1.67	1.46
9	1.73	1.60	1.71	2.03	1.77	1.76	1.27	1.84	2.02	1.69	1.25	1.61	1.23	2.42	1.57	1.97	2.00	1.68
2	0.90	0.82	0.76	0.82	0.63	0.82	0.66	0.82	0.83	0.82	0.75	0.82	0.53	0.82	0.72	0.82	0.89	0.82
0	1.73	1.60	1.30	1.60	1.57	1.60	1.28	1.60	1.20	1.60	1.40	1.60	1.60	1.60	1.40	1.60	1.70	1.60
9	1.33	1.81	2.09	0.95	0.98	1.95	2.20	1.84	1.94	2.02	2.48	1.98	2.27	1.90	1.38	1.62	1.70	1.89
	--	--	--	1.78	1.63	1.78	--	1.78	1.66	1.78	--	1.78	--	--	--	1.78	1.73	1.78
	--	--	--	1.32	1.33	1.32	1.32	1.32	1.69	1.32	1.39	1.32	1.52	--	--	1.32	1.38	1.32
	--	--	--	1.88	1.84	1.90	1.85	1.98	2.11	1.86	1.82	1.80	1.71	--	--	1.81	2.05	1.72
1	1.04	1.41	0.92	1.41	1.20	1.41	1.06	1.41	0.95	1.41	1.33	1.41	1.55	1.41	1.34	1.41	1.60	1.41
3	1.07	0.85	1.09	0.72	0.97	0.78	1.41	0.51	0.86	0.81	1.19	0.83	0.97	0.84	0.92	0.83	0.78	0.75
3	0.45	0.83	0.55	0.83	0.52	0.83	0.55	0.83	0.47	0.83	0.55	0.83	0.57	0.83	0.53	0.83	0.80	0.83
4	0.50	0.94	0.65	0.94	0.46	0.94	0.49	0.94	0.60	0.94	0.45	0.94	0.44	0.94	0.63	0.94	0.80	0.94
6	1.74	1.36	1.84	1.36	1.15	1.36	1.62	1.36	1.61	1.36	1.58	1.36	1.63	1.36	1.82	1.36	1.67	1.36
7	1.73	1.60	1.71	1.97	1.77	1.74	1.27	1.84	2.02	1.67	1.25	1.61	1.23	2.42	1.57	1.90	2.00	1.68
2	0.84	0.82	0.76	0.82	0.63	0.82	0.66	0.82	0.83	0.82	0.75	0.82	0.53	0.82	0.72	0.82	0.89	0.82
0	1.73	1.50	1.27	1.50	1.57	1.50	1.28	1.50	1.20	1.50	1.40	1.50	1.60	1.50	1.40	1.50	1.70	1.50
4	1.33	1.75	2.09	0.90	0.98	1.93	2.20	1.78	1.94	2.00	2.48	1.96	2.27	1.83	1.37	1.50	1.67	1.87
	--	--	--	1.74	1.63	1.74	--	1.74	1.66	1.74	--	1.74	--	--	--	1.74	1.72	1.74
	--	--	--	1.27	1.33	1.27	1.32	1.27	1.69	1.27	1.39	1.27	1.52	--	--	1.27	1.38	1.27
	--	--	--	1.86	1.84	1.85	1.84	1.95	2.11	1.80	1.82	1.76	1.71	--	--	1.79	2.03	1.68
68	0.025	0.047	0.025	0.068	0.044	0.068	0.053	0.068	0.025	0.068	0.109	0.068	0.182	0.068	0.025	0.068	--	0.068
05	0.025	0.100	0.025	0.098	0.025	0.101	0.025	0.106	0.025	0.107	0.025	0.087	0.025	0.069	0.025	0.069	0.061	0.075
54	0.025	0.054	0.148	0.054	0.025	0.054	0.117	0.054	0.025	0.054	0.025	0.054	0.025	0.054	0.025	0.054	0.025	0.054
75	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075	0.025	0.075
04	0.025	0.104	0.025	0.104	0.025	0.104	0.025	0.104	0.049	0.104	0.025	0.104	0.025	0.104	0.025	0.104	0.025	0.104
36	0.025	0.025	0.025	0.063	0.025	0.036	0.025	0.025	0.025	0.034	0.025	0.025	0.025	0.025	0.025	0.068	0.025	0.025
25	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
71	0.025	0.071	0.046	0.071	0.025	0.071	0.025	0.071	0.025	0.071	0.025	0.071	0.025	0.071	0.025	0.071	0.025	0.071
07	0.002	0.058	0.002	0.051	0.002	0.017	0.002	0.064	0.009	0.022	0.002	0.020	0.002	0.071	0.010	0.115	0.028	0.016
	--	--	--	0.038	0.002	0.038	--	0.038	0.002	0.038	--	0.038	--	--	--	0.038	0.008	0.038
	--	--	--	0.051	0.002	0.051	0.006	0.051	0.002	0.051	0.002	0.051	0.002	--	--	0.051	0.002	0.051
	--	--	--	0.019	0.002	0.056	0.007	0.032	0.002	0.065	0.002	0.039	0.002	--	--	0.022	0.021	0.038
20	0.046	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.053	0.020	0.020	0.020	0.020	0.020	0.020	0.020
20	0.020	0.084	0.020	0.020	0.020	0.020	0.029	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
20	0.020	0.020	0.046	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.042	0.020
20	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
20	0.033	0.020	0.020	0.020	0.033	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.067	0.020
20	0.020	0.020	0.020	0.020	0.020	0.055	0.020	0.020	0.020	0.055	0.020	0.055	0.020	0.020	0.020	0.020	0.087	0.055
69	0.020	0.069	0.020	0.069	0.020	0.069	0.020	0.069	0.020	0.069	0.031	0.069	0.020	0.069	0.020	0.069	0.096	0.069
20	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.140	0.020
60	0.039	0.073	0.059	0.060	0.049	0.045	0.035	0.060	0.071	0.047	0.059	0.039	0.068	0.083	0.047	0.042	0.204	0.037
	--	--	--	0.002	--	0.002	--	0.002	--	0.002	--	0.002	--	--	--	0.002	--	0.002
	--	--	--	0.030	--	0.030	--	0.030	--	0.030	--	0.030	--	--	--	0.030	--	0.030
	--	--	--	0.102	--	0.102	--	0.102	--	0.102	--	0.102	--	--	--	0.102	--	0.102
9	1.00	1.39	0.90	1.39	1.18	1.39	1.04	1.39	0.93	1.39	1.28	1.39	1.53	1.39	1.32	1.39	1.58	1.39
1	1.05	0.76	1.07	0.70	0.95	0.76	1.38	0.49	0.84	0.79	1.17	0.81	0.95	0.82	0.90	0.81	0.76	0.73
1	0.43	0.81	0.50	0.81	0.50	0.81	0.53	0.81	0.45	0.81	0.53	0.81	0.55	0.81	0.51	0.81	0.76	0.81
2	0.48	0.92	0.63	0.92	0.44	0.92	0.47	0.92	0.58	0.92	0.43	0.92	0.42	0.92	0.61	0.92	0.78	0.92
4	1.71	1.34	1.82	1.34	1.12	1.34	1.60	1.34	1.59	1.34	1.56	1.34	1.61	1.34	1.80	1.34	1.60	1.34
5	1.71	1.58	1.69	1.95	1.75	1.68	1.25	1.82	2.00	1.62	1.23	1.55	1.21	2.40	1.55	1.88	1.91	1.62
5	0.82	0.75	0.74	0.75	0.61	0.75	0.64	0.75	0.81	0.75	0.72	0.75	0.51	0.75	0.70	0.75	0.79	0.75
8	1.71	1.48	1.25	1.48	1.55	1.48	1.26	1.48	1.18	1.48	1.38	1.48	1.58	1.48	1.38	1.48	1.56	1.48
9	1.29	1.68	2.03	0.84	0.93	1.89	2.17	1.72	1.87	1.95	2.42	1.92	2.20	1.75	1.32	1.46	1.47	1.83
	--	--	--	1.73	--	1.73	--	1.73	--	1.73	--	1.73	--	--	--	1.73	--	1.73
	--	--	--	1.24	--	1.24	--	1.24	--	1.24	--	1.24	--	--	--	1.24	--	1.24
	--	--	--	1.76	--	1.75	--	1.84	--	1.69	--	1.66	--	--	--	1.69	--	1.58

	1[a] (Peat)	2[a] (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)		7 (Sand)		8[a] (Sand)		9 (Peat)		10 (Shellro
[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]	Outflow	Inflow[b]
	33.5	29.6	34.1	23.0	32.6	23.0	35.0	23.0	29.9	23.0	37.5	23.0	29.6	23.0	28.6	23.0	30.0	23.0
	27.0	22.4	30.2	21.6	26.0	22.2	29.5	21.9	24.3	21.8	33.7	21.4	23.9	21.2	24.7	21.2	23.7	21.5
	20.0	18.4	19.9	18.4	20.6	18.4	19.8	18.4	19.7	18.4	19.3	18.4	21.8	18.4	21.9	18.4	18.7	18.4
	28.3	32.0	28.4	32.0	30.6	32.0	32.7	32.0	29.2	32.0	29.9	32.0	35.5	32.0	26.5	32.0	27.4	32.0
	29.3	33.0	32.5	33.0	28.4	33.0	32.5	33.0	34.4	33.0	32.2	33.0	33.8	33.0	32.4	33.0	28.7	33.0
	38.0	39.8	38.4	40.8	38.7	38.3	35.1	40.6	39.9	38.7	36.9	40.3	38.3	41.5	36.6	41.2	38.5	40.8
	32.3	36.0	32.7	36.0	31.3	36.0	27.3	36.0	33.7	36.0	29.8	36.0	26.0	36.0	32.0	36.0	33.0	36.0
	35.0	35.0	35.3	35.0	35.0	35.0	35.5	35.0	35.0	35.0	38.0	35.0	34.0	35.0	34.0	35.0	35.0	35.0
	30.2	27.5	32.8	25.2	27.6	29.4	32.1	27.3	30.1	30.3	40.4	34.5	32.2	28.2	31.9	26.0	31.2	27.4
	--	--	--	41.0	38.3	41.0	--	41.0	29.0	41.0	--	41.0	--	--	--	41.0	44.0	41.0
	--	--	--	25.0	31.5	25.0	27.9	25.0	26.8	25.0	27.4	25.0	24.3	--	--	25.0	32.3	25.0
	--	--	--	32.3	31.1	27.4	27.5	26.8	31.9	26.5	28.5	25.8	29.0	--	--	32.7	30.7	26.0
	10.0	5.0	8.0	2.0	5.3	2.0	7.0	2.0	5.0	2.0	4.7	2.0	8.0	2.0	2.0	2.0	18.0	2.0
	5.3	2.0	13.0	2.0	5.3	2.0	5.0	6.0	5.0	2.0	3.3	9.0	2.0	4.0	12.0	2.0	10.0	14.0
	4.0	2.0	10.7	2.0	6.7	2.0	15.0	2.0	14.0	2.0	12.7	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	6.7	4.0	4.7	4.0	6.7	4.0	8.7	4.0	2.7	4.0	6.7	4.0	4.0	4.0	8.0	4.0	6.0	4.0
	2.5	1.0	1.9	1.0	1.3	1.0	2.9	1.0	2.5	1.0	3.1	1.0	1.0	1.0	3.2	1.0	2.4	1.0
	3.7	2.9	2.4	1.9	1.9	2.8	2.5	0.8	1.4	2.8	2.9	2.9	3.5	2.0	3.3	2.0	3.3	3.3
	1.2	1.4	0.7	1.4	0.5	1.4	1.4	1.4	0.7	1.4	1.6	1.4	0.8	1.4	1.2	1.4	1.0	1.4
	1.3	1.2	2.4	1.2	0.5	1.2	0.7	1.2	3.1	1.2	1.9	1.2	1.0	1.2	2.4	1.2	1.6	1.2
	0.9	0.5	0.5	0.5	1.4	0.8	2.2	0.5	0.5	0.9	1.1	0.5	0.5	0.5	0.5	0.5	2.4	1.6
	--	--	--	1.1	0.5	1.1	0.9	1.1	0.7	1.1	0.7	1.1	0.5	--	--	1.1	0.5	1.1
	--	--	--	2.8	0.9	2.8	1.3	2.8	1.2	2.8	2.3	2.8	1.6	--	--	2.8	1.6	2.8
	--	--	--	0.7	2.4	0.8	1.2	1.1	1.2	1.1	1.8	0.5	4.0	--	--	0.5	1.0	0.9
2	46.1	34.8	36.5	38.1	44.8	38.1	33.9	38.1	41.9	38.1	32.9	38.1	44.0	38.1	43.0	38.1	52.6	38.1
6	36.9	40.4	28.4	38.7	35.5	40.4	27.4	38.3	34.4	39.9	27.7	36.8	30.0	36.7	29.1	36.8	44.3	36.7
2	39.3	47.2	30.0	47.2	45.2	47.2	32.2	47.2	37.1	47.2	39.1	47.2	27.5	47.2	34.4	47.2	38.5	47.2
0	46.7	54.0	36.0	54.0	55.3	54.0	37.8	54.0	41.3	54.0	42.6	54.0	31.8	54.0	31.0	54.0	52.0	54.0
6	47.0	51.6	33.7	51.6	53.5	51.6	35.3	51.6	44.0	51.6	39.8	51.6	36.7	51.6	30.0	51.6	49.2	51.6
7	73.0	79.2	56.7	90.3	78.7	81.2	47.8	87.4	57.8	80.4	58.9	76.7	35.1	88.3	55.0	90.0	60.0	76.9
0	53.3	60.0	41.7	60.0	54.3	60.0	36.0	60.0	53.0	60.0	41.8	60.0	32.5	60.0	46.0	60.0	53.0	60.0
0	70.3	72.0	54.3	72.0	74.3	72.0	58.7	72.0	60.7	72.0	56.0	72.0	58.0	72.0	59.0	72.0	73.0	72.0
9	63.6	68.3	60.0	59.7	65.4	64.7	58.8	68.4	66.7	64.0	53.7	65.0	58.0	68.0	66.6	57.8	60.8	63.0
	--	--	--	57.0	59.0	57.0	50.0	57.0	58.0	57.0	52.3	57.0	48.0	--	--	57.0	56.0	57.0
	--	--	--	57.0	59.7	57.0	50.0	57.0	55.0	57.0	50.3	57.0	51.0	--	--	57.0	57.0	57.0
	--	--	--	54.3	62.3	60.0	52.0	50.0	55.3	58.7	47.3	62.0	47.0	--	--	55.0	53.0	61.0
0	199	171	173	170	199	170	156	170	183	170	147	170	209	170	198	170	230	170
4	165	167	129	165	141	164	112	168	141	167	113	160	145	163	147	165	189	162
9	154	169	120	169	155	169	121	169	134	169	132	169	119	169	126	169	153	169
0	189	220	154	220	215	220	150	220	180	220	144	220	147	220	148	220	194	220
9	184	199	151	199	198	199	159	199	183	199	177	199	167	199	143	199	189	199
6	244	279	223	286	250	272	191	279	207	278	220	279	168	280	185	286	226	280
4	197	224	160	224	202	224	142	224	194	224	157	224	132	224	182	224	170	224
0	220	230	192	230	231	230	205	230	209	230	191	230	197	230	211	230	230	230
1	236	217	207	218	234	221	213	227	222	221	200	200	211	216	221	223	235	221
	--	--	--	230	213	230	187	230	203	230	197	230	190	--	--	230	220	230
	--	--	--	190	200	190	173	190	187	190	170	190	170	--	--	190	200	190
	--	--	--	190	213	210	190	177	197	210	177	210	170	--	--	200	210	210

ystems from January - March 2000; these data are presented in Appendix D.4.

EXHIBIT D.1-4
Period-of-Record, Quarterly, and Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	TP (mg/L) Inflow	TP (mg/L) Outflow	q_in (cm/d)	MB_TP ($g/m^2/y$) Inflow	MB_TP ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Period of Record									
1	1999-2000	0.020	0.018	7.24	0.501	0.407	0.094	18.74	2.67
2	1999-2000	0.021	0.017	7.13	0.522	0.394	0.128	24.49	5.21
3	1999-2000	0.026	0.018	7.30	0.671	0.423	0.247	36.89	9.98
4	1999-2000	0.026	0.016	7.50	0.689	0.436	0.253	36.68	12.47
5	1999-2000	0.023	0.016	14.02	1.193	0.839	0.354	29.67	12.23
6	1999-2000	0.022	0.016	5.58	0.436	0.315	0.121	27.70	5.00
7	1999-2000	0.026	0.017	7.38	0.682	0.419	0.263	38.61	10.50
8	1999-2000	0.020	0.020	7.38	0.520	0.429	0.091	17.45	-0.60
9	1999-2000	0.023	0.019	7.65	0.653	0.526	0.128	19.56	5.45
10	1999-2000	0.022	0.016	7.44	0.615	0.392	0.223	36.28	9.52
11	1999-2000	0.025	0.020	7.66	0.704	0.524	0.180	25.57	7.33
12	1999-2000	0.025	0.020	7.66	0.696	0.534	0.162	23.29	7.22
Quarterly									
1	Qtr-3	0.038	0.038	5.00	0.714	0.820	-0.106	-14.79	0.20
	Qtr-4	0.017	0.016	5.01	0.300	0.269	0.031	10.43	0.87
	Qtr-5	0.019	0.019	7.79	0.550	0.431	0.119	21.59	0.53
	Qtr-6	0.018	0.014	9.46	0.604	0.423	0.181	30.03	10.36
2	Qtr-3	0.044	0.041	5.54	0.898	0.890	0.007	0.80	1.45
	Qtr-4	0.019	0.018	5.11	0.351	0.308	0.043	12.36	0.92
	Qtr-5	0.019	0.015	7.36	0.513	0.334	0.180	35.00	7.02
	Qtr-6	0.019	0.013	9.25	0.596	0.408	0.189	31.63	13.09
3	Qtr-3	0.038	0.030	4.65	0.669	0.595	0.074	11.01	4.08
	Qtr-4	0.017	0.016	4.87	0.306	0.287	0.020	6.39	0.91
	Qtr-5	0.019	0.018	7.39	0.511	0.355	0.156	30.46	1.22
	Qtr-6	0.020	0.013	9.09	0.661	0.410	0.251	38.02	14.10
	Qtr-7	0.035	0.018	7.90	1.025	0.489	0.536	52.30	19.03
4	Qtr-3	0.039	0.038	5.10	0.739	0.788	-0.049	-6.68	0.67
	Qtr-4	0.017	0.018	5.19	0.320	0.360	-0.040	-12.59	-1.40
	Qtr-5	0.019	0.016	7.42	0.524	0.399	0.125	23.82	4.31
	Qtr-6	0.020	0.012	9.32	0.683	0.436	0.247	36.14	16.14
	Qtr-7	0.035	0.018	7.96	1.026	0.516	0.510	49.72	20.19
5	Qtr-3	0.039	0.033	10.40	1.467	1.313	0.154	10.51	6.40
	Qtr-4	0.017	0.018	9.15	0.571	0.556	0.016	2.73	-1.86
	Qtr-5	0.019	0.017	13.54	0.966	0.658	0.308	31.90	4.79
	Qtr-6	0.020	0.015	18.63	1.368	0.973	0.396	28.91	21.82
	Qtr-7	0.036	0.020	14.67	1.950	1.011	0.939	48.16	31.27
6	Qtr-3	0.038	0.037	3.81	0.547	0.575	-0.027	-4.97	0.37
	Qtr-4	0.017	0.020	5.63	0.329	0.319	0.011	3.26	-3.09
	Qtr-5	0.019	0.016	8.64	0.601	0.408	0.193	32.12	5.85
	Qtr-6	0.020	0.014	3.72	0.284	0.195	0.089	31.48	5.27
	Qtr-7	0.036	0.016	4.62	0.602	0.277	0.325	54.00	13.75
7	Qtr-3	0.040	0.062	5.42	0.791	1.197	-0.407	-51.46	-8.66
	Qtr-4	0.017	0.017	5.15	0.315	0.338	-0.023	-7.31	0.26
	Qtr-5	0.019	0.015	7.29	0.507	0.257	0.250	49.37	6.19
	Qtr-6	0.020	0.014	9.13	0.665	0.458	0.207	31.13	12.37
	Qtr-7	0.035	0.017	7.42	0.953	0.456	0.498	52.18	18.89
8	Qtr-3	0.037	0.047	5.60	0.759	0.964	-0.204	-26.92	-4.74
	Qtr-4	0.017	0.019	5.90	0.355	0.240	0.115	32.45	-1.81
	Qtr-5	0.019	0.019	7.84	0.546	0.427	0.119	21.85	-0.27
	Qtr-6	0.019	0.016	9.04	0.600	0.460	0.140	23.26	5.69
9	Qtr-3	0.041	0.031	6.18	0.906	0.712	0.194	21.41	6.36
	Qtr-4	0.017	0.014	5.28	0.326	0.212	0.115	35.11	3.59
	Qtr-5	0.019	0.016	6.93	0.477	0.412	0.065	13.55	3.60
	Qtr-6	0.020	0.019	9.40	0.693	0.654	0.039	5.62	2.18
	Qtr-7	0.036	0.023	9.83	1.330	0.865	0.465	34.98	15.97
10	Qtr-3	0.036	0.027	7.74	0.903	0.744	0.159	17.59	8.04
	Qtr-4	0.017	0.016	4.85	0.304	0.218	0.086	28.42	1.14
	Qtr-5	0.019	0.014	7.54	0.533	0.329	0.204	38.29	8.85
	Qtr-6	0.020	0.014	9.02	0.666	0.445	0.222	33.26	12.75
	Qtr-7	0.036	0.018	8.17	1.084	0.498	0.586	54.09	21.78
11	Qtr-3	0.040	0.059	5.22	0.771	1.053	-0.282	-36.55	-7.20
	Qtr-4	0.018	0.021	5.43	0.354	0.432	-0.078	-22.03	-2.91
	Qtr-5	0.019	0.017	6.54	0.454	0.420	0.034	7.47	2.72
	Qtr-6	0.020	0.014	9.60	0.698	0.466	0.232	33.20	13.29
	Qtr-7	0.036	0.020	8.16	1.093	0.578	0.515	47.10	17.35
12	Qtr-3	0.037	0.037	5.44	0.716	0.751	-0.035	-4.87	-0.18
	Qtr-4	0.017	0.019	5.68	0.357	0.419	-0.062	-17.36	-2.06
	Qtr-5	0.019	0.020	6.82	0.475	0.491	-0.016	-3.42	-0.82
	Qtr-6	0.020	0.014	9.44	0.687	0.494	0.193	28.10	11.04
	Qtr-7	0.035	0.020	8.40	1.093	0.591	0.502	45.92	17.19

EXHIBIT D.1-4

Period-of-Record, Quarterly, and Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

		TP (mg/L)		q_in	MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(cm/d)	Inflow	Outflow	($g/m^2/y$)	(%)	(m/y)
Monthly									
1	Apr-99	0.038	0.038	5.00	0.714	0.820	-0.106	-14.79	0.20
	May-99	0.018	0.016	4.63	0.303	0.224	0.079	26.10	2.15
	Jun-99	0.021	0.015	4.96	0.363	0.324	0.039	10.84	5.50
	Jul-99	0.013	0.017	5.36	0.251	0.262	-0.011	-4.34	-5.07
	Aug-99	0.020	0.022	5.87	0.412	0.306	0.106	25.76	-2.79
	Sep-99	0.017	0.017	8.07	0.504	0.478	0.026	5.15	0.26
	Oct-99	0.020	0.016	10.05	0.745	0.576	0.169	22.65	9.44
	Nov-99	0.015	0.012	8.99	0.505	0.351	0.154	30.48	7.07
	Dec-99	0.019	0.015	10.14	0.722	0.541	0.181	25.02	10.14
	Jan-00	0.023	0.014	9.07	0.629	0.307	0.322	51.26	16.96
2	Apr-99	0.044	0.041	5.54	0.898	0.890	0.007	0.80	1.45
	May-99	0.019	0.022	4.50	0.311	0.345	-0.034	-11.07	-2.93
	Jun-99	0.027	0.021	5.32	0.510	0.425	0.085	16.64	4.51
	Jul-99	0.013	0.013	5.36	0.259	0.195	0.064	24.79	0.79
	Aug-99	0.019	0.016	5.58	0.387	0.189	0.198	51.15	3.93
	Sep-99	0.018	0.015	8.51	0.558	0.481	0.076	13.70	6.34
	Oct-99	0.020	0.014	8.99	0.649	0.465	0.184	28.33	12.49
	Nov-99	0.016	0.011	9.25	0.526	0.371	0.155	29.43	10.96
	Dec-99	0.020	0.014	9.29	0.676	0.466	0.210	31.07	11.72
	Jan-00	0.023	0.013	9.06	0.628	0.357	0.272	43.26	19.54
3	Apr-99	0.038	0.030	4.65	0.669	0.595	0.074	11.01	4.08
	May-99	0.018	0.018	4.55	0.311	0.242	0.069	22.10	0.44
	Jun-99	0.021	0.018	4.89	0.373	0.393	-0.020	-5.34	3.10
	Jul-99	0.013	0.014	5.17	0.241	0.248	-0.007	-3.05	-1.94
	Aug-99	0.019	0.020	5.77	0.393	0.241	0.152	38.61	-0.89
	Sep-99	0.017	0.018	7.87	0.492	0.367	0.125	25.38	-1.59
	Oct-99	0.020	0.016	9.19	0.668	0.492	0.176	26.33	7.10
	Nov-99	0.015	0.013	8.86	0.503	0.376	0.126	25.14	6.64
	Dec-99	0.020	0.013	9.86	0.711	0.480	0.232	32.58	13.30
	Jan-00	0.025	0.013	8.71	0.780	0.387	0.392	50.29	20.20
	Feb-00	0.035	0.016	8.79	1.121	0.548	0.573	51.13	20.63
	Mar-00	0.035	0.016	7.01	0.929	0.430	0.499	53.71	17.32
4	Apr-99	0.039	0.038	5.10	0.739	0.788	-0.049	-6.68	0.67
	May-99	0.019	0.022	4.70	0.319	0.411	-0.092	-28.82	-2.75
	Jun-99	0.020	0.019	5.38	0.387	0.461	-0.073	-18.92	1.06
	Jul-99	0.013	0.015	5.53	0.264	0.250	0.014	5.26	-2.36
	Aug-99	0.019	0.017	5.54	0.374	0.267	0.108	28.81	1.51
	Sep-99	0.018	0.018	7.77	0.512	0.483	0.030	5.77	0.53
	Oct-99	0.021	0.014	9.50	0.720	0.512	0.208	28.91	13.78
	Nov-99	0.015	0.011	8.87	0.497	0.341	0.156	31.39	11.73
	Dec-99	0.019	0.013	9.62	0.677	0.462	0.215	31.77	14.04
	Jan-00	0.025	0.014	9.54	0.873	0.510	0.363	41.54	20.98
	Feb-00	0.034	0.016	8.88	1.087	0.606	0.481	44.27	20.25
	Mar-00	0.037	0.017	7.04	0.965	0.426	0.539	55.85	19.63
5	Apr-99	0.039	0.033	10.40	1.467	1.313	0.154	10.51	6.40
	May-99	0.019	0.022	8.54	0.585	0.614	-0.029	-4.93	-5.29
	Jun-99	0.021	0.014	9.32	0.707	0.516	0.191	27.01	14.04
	Jul-99	0.013	0.017	9.65	0.456	0.522	-0.066	-14.58	-9.09
	Aug-99	0.019	0.020	10.64	0.739	0.532	0.207	28.04	-1.87
	Sep-99	0.017	0.015	11.73	0.738	0.370	0.368	49.91	6.78
	Oct-99	0.020	0.015	18.08	1.364	0.936	0.428	31.40	18.49
	Nov-99	0.016	0.014	18.68	1.069	0.940	0.129	12.07	5.90
	Dec-99	0.020	0.014	18.49	1.326	0.956	0.370	27.93	21.59
	Jan-00	0.025	0.015	18.68	1.701	1.019	0.683	40.12	34.30
	Feb-00	0.034	0.019	17.89	2.224	1.231	0.994	44.67	38.04
	Mar-00	0.038	0.021	11.45	1.676	0.792	0.885	52.78	24.45
6	Apr-99	0.038	0.037	3.81	0.547	0.575	-0.027	-4.97	0.37
	May-99	0.019	0.029	2.28	0.156	0.204	-0.047	-30.25	-3.54
	Jun-99	0.020	0.015	6.62	0.475	0.397	0.078	16.46	7.46
	Jul-99	0.013	0.013	8.24	0.393	0.395	-0.001	-0.37	-0.93
	Aug-99	0.019	0.016	8.47	0.582	0.283	0.299	51.43	4.49
	Sep-99	0.018	0.016	10.94	0.717	0.555	0.162	22.54	4.88
	Oct-99	0.021	0.016	7.14	0.537	0.454	0.084	15.54	7.21
	Nov-99	0.015	0.013	3.89	0.217	0.190	0.028	12.73	2.61
	Dec-99	0.019	0.014	1.77	0.122	0.098	0.024	19.80	1.81
	Jan-00	0.025	0.014	5.12	0.481	0.277	0.203	42.31	11.59
	Feb-00	0.034	0.015	4.64	0.570	0.252	0.318	55.80	13.58
	Mar-00	0.040	0.017	4.58	0.666	0.327	0.339	50.93	14.02

EXHIBIT D.1-4

Period-of-Record, Quarterly, and Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

		TP (mg/L)		q_in	MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(cm/d)	Inflow	Outflow	($g/m^2/y$)	(%)	(m/y)
7	Apr-99	0.040	0.062	5.42	0.791	1.197	-0.407	-51.46	-8.66
	May-99	0.019	0.016	4.97	0.342	0.207	0.134	39.31	3.07
	Jun-99	0.021	0.027	4.57	0.337	0.675	-0.338	-100.20	-4.54
	Jul-99	0.013	0.013	5.76	0.272	0.267	0.004	1.55	0.51
	Aug-99	0.019	0.016	5.67	0.390	0.233	0.157	40.29	3.33
	Sep-99	0.018	0.016	7.13	0.466	0.198	0.268	57.51	3.18
	Oct-99	0.020	0.013	9.44	0.683	0.330	0.353	51.68	14.29
	Nov-99	0.015	0.012	9.25	0.516	0.351	0.165	32.01	8.53
	Dec-99	0.019	0.013	8.63	0.608	0.532	0.075	12.42	11.04
	Jan-00	0.025	0.016	9.40	0.861	0.506	0.354	41.17	15.97
	Feb-00	0.034	0.019	8.14	0.996	0.570	0.426	42.76	16.77
	Mar-00	0.036	0.015	6.70	0.911	0.342	0.569	62.49	20.58
8	Apr-99	0.037	0.047	5.60	0.759	0.964	-0.204	-26.92	-4.74
	May-99	0.019	0.022	5.06	0.349	0.133	0.216	62.01	-2.75
	Jun-99	0.020	0.020	5.27	0.383	0.335	0.048	12.63	0.49
	Jul-99	0.013	0.015	7.22	0.341	0.249	0.091	26.77	-4.30
	Aug-99	0.019	0.022	6.44	0.443	0.391	0.053	11.92	-3.39
	Sep-99	0.017	0.018	7.03	0.414	0.164	0.250	60.39	-1.93
	Oct-99	0.020	0.016	10.00	0.741	0.604	0.137	18.51	7.72
	Nov-99	0.016	0.017	8.93	0.529	0.470	0.059	11.09	-2.06
	Dec-99	0.020	0.015	9.20	0.683	0.462	0.220	32.28	10.58
	Jan-00	0.023	0.015	9.00	0.624	0.403	0.221	35.39	14.44
9	Apr-99	0.041	0.031	6.18	0.906	0.712	0.194	21.41	6.36
	May-99	0.019	0.016	5.15	0.356	0.220	0.135	38.07	2.78
	Jun-99	0.021	0.012	5.35	0.394	0.250	0.144	36.64	10.18
	Jul-99	0.013	0.014	5.35	0.246	0.177	0.069	28.13	-2.10
	Aug-99	0.019	0.017	5.72	0.386	0.289	0.097	25.14	2.10
	Sep-99	0.017	0.015	6.16	0.434	0.349	0.085	19.64	3.14
	Oct-99	0.020	0.016	8.65	0.602	0.598	0.003	0.51	6.13
	Nov-99	0.015	0.021	8.92	0.498	0.669	-0.171	-34.44	-10.30
	Dec-99	0.020	0.019	9.84	0.737	0.696	0.042	5.64	2.62
	Jan-00	0.025	0.017	9.51	0.852	0.605	0.247	29.01	13.60
	Feb-00	0.035	0.021	8.99	1.135	0.687	0.448	39.49	17.20
	Mar-00	0.039	0.028	11.51	1.719	1.220	0.499	29.02	13.37
10	Apr-99	0.036	0.027	7.74	0.903	0.744	0.159	17.59	8.04
	May-99	0.019	0.015	4.18	0.295	0.095	0.199	67.59	3.63
	Jun-99	0.020	0.020	5.06	0.376	0.404	-0.028	-7.54	0.18
	Jul-99	0.013	0.014	5.36	0.260	0.170	0.091	34.77	-1.32
	Aug-99	0.019	0.014	5.80	0.405	0.242	0.163	40.18	6.30
	Sep-99	0.018	0.014	7.47	0.489	0.256	0.233	47.70	6.55
	Oct-99	0.020	0.013	9.77	0.726	0.471	0.256	35.20	14.41
	Nov-99	0.016	0.012	8.49	0.497	0.344	0.153	30.78	9.47
	Dec-99	0.019	0.013	9.13	0.638	0.436	0.202	31.73	13.40
	Jan-00	0.025	0.016	9.46	0.858	0.552	0.305	35.61	15.00
	Feb-00	0.034	0.017	8.12	1.001	0.479	0.522	52.13	20.65
	Mar-00	0.041	0.019	8.28	1.250	0.535	0.715	57.23	23.83
11	Apr-99	0.040	0.059	5.22	0.771	1.053	-0.282	-36.55	-7.20
	May-99	0.020	0.031	5.27	0.381	0.553	-0.172	-45.05	-8.88
	Jun-99	0.021	0.018	5.53	0.420	0.430	-0.010	-2.32	3.06
	Jul-99	0.013	0.015	5.50	0.261	0.344	-0.083	-31.68	-3.48
	Aug-99	0.019	0.020	5.39	0.370	0.419	-0.048	-13.09	-1.01
	Sep-99	0.017	0.014	5.86	0.355	0.354	0.001	0.39	3.82
	Oct-99	0.020	0.015	8.32	0.609	0.456	0.153	25.14	9.68
	Nov-99	0.016	0.012	9.69	0.548	0.416	0.132	24.04	9.50
	Dec-99	0.019	0.014	9.54	0.680	0.468	0.212	31.16	10.88
	Jan-00	0.025	0.015	9.56	0.862	0.514	0.348	40.32	17.59
	Feb-00	0.034	0.019	9.40	1.176	0.653	0.522	44.42	19.64
	Mar-00	0.038	0.021	6.93	1.011	0.503	0.507	50.22	14.95
12	Apr-99	0.037	0.037	5.44	0.716	0.751	-0.035	-4.87	-0.18
	May-99	0.019	0.023	5.90	0.407	0.515	-0.109	-26.76	-4.19
	Jun-99	0.020	0.018	5.54	0.406	0.415	-0.009	-2.16	2.35
	Jul-99	0.013	0.017	5.59	0.260	0.352	-0.093	-35.66	-6.25
	Aug-99	0.019	0.022	5.76	0.394	0.470	-0.075	-19.09	-3.59
	Sep-99	0.017	0.019	5.92	0.373	0.516	-0.143	-38.38	-2.03
	Oct-99	0.020	0.016	8.60	0.627	0.506	0.121	19.30	6.04
	Nov-99	0.015	0.013	8.82	0.491	0.394	0.097	19.75	5.18
	Dec-99	0.020	0.016	10.03	0.720	0.584	0.136	18.93	8.55
	Jan-00	0.025	0.015	9.58	0.856	0.540	0.317	36.97	16.98
	Feb-00	0.035	0.020	9.28	1.190	0.622	0.568	47.75	19.30
	Mar-00	0.036	0.020	7.51	0.996	0.561	0.436	43.75	15.14

EXHIBIT D.1-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	TN (mg/L) Inflow	TN (mg/L) Outflow	q_in (cm/d)	MB_TN ($g/m^2/y$) Inflow	MB_TN ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Period of Record									
1	1999-2000	1.240	1.172	7.24	32.755	28.979	3.776	11.53	1.44
2	1999-2000	1.304	1.270	7.13	33.909	31.142	2.767	8.16	0.65
3	1999-2000	1.568	1.491	7.30	41.793	37.481	4.312	10.32	1.30
4	1999-2000	1.638	1.600	7.50	44.836	44.806	0.029	0.07	0.65
5	1999-2000	1.392	1.308	14.02	71.225	64.051	7.174	10.07	3.12
6	1999-2000	1.431	1.323	5.58	29.170	25.365	3.805	13.05	1.55
7	1999-2000	1.532	1.741	7.38	41.248	43.781	-2.534	-6.14	-3.32
8	1999-2000	1.396	1.146	7.38	37.621	25.465	12.156	32.31	4.85
9	1999-2000	1.394	1.415	7.65	38.915	38.978	-0.063	-0.16	-0.42
10	1999-2000	1.401	1.278	7.44	38.057	31.012	7.045	18.51	2.37
11	1999-2000	1.650	1.671	7.66	46.118	46.815	-0.697	-1.51	-0.37
12	1999-2000	1.575	1.494	7.66	44.053	42.188	1.865	4.23	1.48
Quarterly									
1	Qtr-3	1.480	1.044	5.00	27.036	28.046	-1.010	-3.74	7.88
	Qtr-4	0.935	0.673	5.01	17.081	11.574	5.507	32.24	5.82
	Qtr-5	1.422	1.460	7.79	40.426	35.621	4.806	11.89	-0.69
	Qtr-6	1.345	1.532	9.46	46.418	48.960	-2.541	-5.48	-4.32
2	Qtr-3	1.440	0.922	5.54	29.137	17.141	11.996	41.17	8.66
	Qtr-4	0.978	0.795	5.11	18.237	14.086	4.151	22.76	3.77
	Qtr-5	1.294	1.437	7.36	34.743	32.839	1.904	5.48	-2.60
	Qtr-6	1.707	1.692	9.25	57.601	55.515	2.086	3.62	0.29
3	Qtr-3	1.480	1.300	4.65	25.123	30.621	-5.498	-21.88	2.63
	Qtr-4	0.932	0.617	4.87	16.564	10.725	5.838	35.25	7.25
	Qtr-5	1.437	1.183	7.39	38.773	24.721	14.052	36.24	4.66
	Qtr-6	1.443	1.392	9.09	47.868	44.067	3.801	7.94	1.16
	Qtr-7	1.600	1.583	7.90	46.134	43.409	2.725	5.91	0.29
4	Qtr-3	1.480	1.097	5.10	27.556	25.523	2.033	7.38	6.27
	Qtr-4	0.952	0.877	5.19	18.044	18.040	0.005	0.03	1.63
	Qtr-5	1.448	1.186	7.42	39.185	30.246	8.939	22.81	5.23
	Qtr-6	1.775	1.742	9.32	60.402	60.517	-0.115	-0.19	0.65
	Qtr-7	1.612	1.585	7.96	46.825	45.705	1.121	2.39	0.48
5	Qtr-3	1.480	0.947	10.40	56.179	39.614	16.565	29.49	17.84
	Qtr-4	0.863	0.641	9.15	28.847	21.834	7.013	24.31	10.04
	Qtr-5	1.372	1.496	13.54	67.820	59.283	8.537	12.59	-3.83
	Qtr-6	1.739	1.602	18.63	118.254	106.318	11.935	10.09	5.52
	Qtr-7	1.648	1.856	14.67	88.260	94.578	-6.317	-7.16	-6.20
6	Qtr-3	1.480	1.427	3.81	20.606	24.307	-3.701	-17.96	0.56
	Qtr-4	0.964	0.757	5.63	19.803	15.235	4.569	23.07	4.91
	Qtr-5	1.414	1.196	8.64	44.620	29.819	14.800	33.17	4.74
	Qtr-6	1.798	1.938	3.72	24.417	27.859	-3.442	-14.09	-1.05
	Qtr-7	1.590	1.603	4.62	26.817	28.165	-1.348	-5.03	-0.14
7	Qtr-3	1.480	1.730	5.42	29.260	32.330	-3.070	-10.49	-3.00
	Qtr-4	0.964	0.657	5.15	18.122	13.105	5.016	27.68	7.43
	Qtr-5	1.373	1.130	7.29	36.529	20.431	16.099	44.07	4.34
	Qtr-6	1.785	1.935	9.13	59.467	63.847	-4.380	-7.37	-2.68
	Qtr-7	1.560	1.615	7.42	42.238	40.553	1.685	3.99	-0.90
8	Qtr-3	1.480	1.340	5.60	30.241	28.172	2.069	6.84	2.06
	Qtr-4	0.961	0.695	5.90	20.713	9.768	10.945	52.84	5.76
	Qtr-5	1.567	1.370	7.84	44.834	31.808	13.026	29.05	3.48
	Qtr-6	1.750	1.390	9.04	57.771	40.871	16.900	29.25	7.19
9	Qtr-3	1.480	---	6.18	33.363	---	---	---	---
	Qtr-4	0.958	0.816	5.28	18.470	11.884	6.587	35.66	2.72
	Qtr-5	1.417	1.520	6.93	35.859	39.265	-3.406	-9.50	-1.80
	Qtr-6	1.665	1.710	9.40	57.101	59.589	-2.488	-4.36	-0.92
	Qtr-7	1.565	1.715	9.83	56.154	62.328	-6.174	-10.99	-3.31
10	Qtr-3	1.480	1.490	7.74	41.822	24.800	17.023	40.70	-0.15
	Qtr-4	0.932	0.758	4.85	16.509	9.518	6.991	42.35	3.14
	Qtr-5	1.408	1.073	7.54	38.729	24.766	13.963	36.05	6.66
	Qtr-6	1.755	1.773	9.02	57.780	57.527	0.252	0.44	-0.34
	Qtr-7	1.520	1.515	8.17	45.338	43.012	2.325	5.13	0.10
11	Qtr-3	1.480	1.595	5.22	28.217	22.821	5.396	19.12	-1.25
	Qtr-4	0.934	0.905	5.43	18.521	17.704	0.818	4.41	0.61
	Qtr-5	1.407	1.390	6.54	33.583	35.143	-1.560	-4.65	0.29
	Qtr-6	1.612	1.658	9.60	56.459	56.524	-0.065	-0.11	-0.99
	Qtr-7	1.730	1.810	8.16	51.538	51.528	0.010	0.02	-1.32
12	Qtr-3	1.480	1.590	5.44	29.382	28.785	0.597	2.03	-1.36
	Qtr-4	0.973	0.752	5.68	20.160	16.541	3.619	17.95	5.51
	Qtr-5	1.347	1.250	6.82	33.546	31.771	1.775	5.29	1.87
	Qtr-6	1.628	1.318	9.44	56.083	44.878	11.205	19.98	7.26
	Qtr-7	1.625	1.655	8.40	49.810	47.913	1.897	3.81	-0.55

EXHIBIT D.1-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

		TN (mg/L)		q_in	MB_TN ($g/m^2/y$)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(cm/d)	Inflow	Outflow	($g/m^2/y$)	(%)	(m/y)
Monthly									
1	Apr-99	1.480	1.044	5.00	27.036	28.046	-1.010	-3.74	7.88
	May-99	0.829	1.067	4.63	13.991	15.137	-1.146	-8.19	-3.92
	Jun-99	0.886	0.450	4.96	16.038	10.553	5.484	34.20	14.10
	Jul-99	1.090	0.503	5.36	21.313	8.332	12.982	60.91	13.95
	Aug-99	1.460	1.743	5.87	31.265	24.570	6.695	21.41	-3.15
	Sep-99	1.987	1.733	8.07	58.494	46.598	11.896	20.34	3.84
	Oct-99	0.820	0.903	10.05	30.076	32.551	-2.475	-8.23	-3.52
	Nov-99	1.600	1.733	8.99	52.482	50.618	1.864	3.55	-2.48
	Dec-99	1.090	1.330	10.14	40.332	47.855	-7.523	-18.65	-7.26
2	Apr-99	1.440	0.922	5.54	29.137	17.141	11.996	41.17	8.66
	May-99	0.948	1.085	4.50	15.567	18.415	-2.848	-18.29	-2.26
	Jun-99	0.866	0.722	5.32	17.208	15.608	1.600	9.30	4.22
	Jul-99	1.090	0.650	5.36	21.309	10.577	10.732	50.36	9.26
	Aug-99	1.460	1.837	5.58	29.762	21.153	8.609	28.93	-3.66
	Sep-99	1.602	1.713	8.51	49.750	52.281	-2.530	-5.09	-2.07
	Oct-99	0.820	0.760	8.99	26.921	25.236	1.685	6.26	2.51
	Nov-99	1.600	1.297	9.25	54.006	42.607	11.399	21.11	7.00
	Dec-99	1.813	2.087	9.29	61.503	68.713	-7.210	-11.72	-4.69
3	Apr-99	1.480	1.300	4.65	25.123	30.621	-5.498	-21.88	2.63
	May-99	0.820	0.998	4.55	13.619	14.279	-0.660	-4.85	-3.04
	Jun-99	0.886	0.520	4.89	15.827	11.395	4.432	28.00	10.61
	Jul-99	1.090	0.460	5.17	20.549	8.021	12.528	60.96	15.65
	Aug-99	1.460	1.151	5.77	30.743	13.364	17.380	56.53	3.88
	Sep-99	2.030	1.767	7.87	58.293	38.799	19.494	33.44	3.52
	Oct-99	0.820	0.630	9.19	27.501	20.155	7.346	26.71	8.64
	Nov-99	1.600	1.567	8.86	51.742	47.590	4.152	8.02	0.66
	Dec-99	0.953	0.980	9.86	34.300	34.235	0.065	0.19	-0.98
	Jan-00	1.775	1.630	8.71	56.402	49.392	7.009	12.43	2.65
	Feb-00	1.320	1.327	8.79	42.356	40.962	1.394	3.29	-0.16
	Mar-00	1.880	1.840	7.01	48.089	44.080	4.008	8.34	0.53
4	Apr-99	1.480	1.097	5.10	27.556	25.523	2.033	7.38	6.27
	May-99	0.880	1.413	4.70	15.090	29.972	-14.882	-98.62	-9.09
	Jun-99	0.886	0.645	5.38	17.409	16.295	1.114	6.40	7.13
	Jul-99	1.090	0.494	5.53	21.998	8.509	13.488	61.32	14.80
	Aug-99	1.460	1.623	5.54	29.517	24.894	4.624	15.66	-1.89
	Sep-99	1.755	1.272	7.77	49.766	37.607	12.158	24.43	9.33
	Oct-99	0.820	0.663	9.50	28.432	23.317	5.115	17.99	7.40
	Nov-99	1.600	1.283	8.87	51.828	40.902	10.926	21.08	7.09
	Dec-99	1.950	2.200	9.62	68.442	78.658	-10.216	-14.93	-4.27
	Jan-00	1.775	---	9.54	61.790	---	---	---	---
	Feb-00	1.320	1.323	8.88	42.784	44.232	-1.448	-3.39	-0.08
	Mar-00	1.903	1.847	7.04	48.908	44.775	4.133	8.45	0.75
5	Apr-99	1.480	0.947	10.40	56.179	39.614	16.565	29.49	17.84
	May-99	0.614	0.855	8.54	19.135	28.628	-9.493	-49.61	-10.71
	Jun-99	0.886	0.471	9.32	30.128	17.485	12.643	41.97	22.44
	Jul-99	1.090	0.597	9.65	38.389	19.764	18.625	48.52	20.59
	Aug-99	1.460	1.640	10.64	56.678	47.034	9.644	17.02	-3.92
	Sep-99	1.837	2.020	11.73	78.663	42.593	36.070	45.85	-3.04
	Oct-99	0.820	0.827	18.08	54.098	51.762	2.336	4.32	-0.52
	Nov-99	1.600	1.200	18.68	109.073	78.349	30.724	28.17	19.20
	Dec-99	1.843	1.943	18.49	124.389	129.207	-4.818	-3.87	-3.54
	Jan-00	1.775	1.663	18.68	121.053	111.973	9.081	7.50	4.40
	Feb-00	1.320	1.690	17.89	86.210	108.424	-22.214	-25.77	-16.00
	Mar-00	1.977	2.105	11.45	82.585	79.483	3.101	3.76	-2.50
6	Apr-99	1.480	1.427	3.81	20.606	24.307	-3.701	-17.96	0.56
	May-99	0.916	1.187	2.28	7.618	8.663	-1.044	-13.71	-2.02
	Jun-99	0.886	0.569	6.62	21.399	15.855	5.544	25.91	11.55
	Jul-99	1.090	0.454	8.24	32.768	13.177	19.591	59.79	25.92
	Aug-99	1.460	1.580	8.47	45.147	27.393	17.753	39.32	-1.91
	Sep-99	1.689	1.253	10.94	67.437	43.124	24.313	36.05	11.08
	Oct-99	0.820	0.753	7.14	21.355	20.602	0.753	3.53	2.26
	Nov-99	1.600	1.400	3.89	22.697	20.936	1.761	7.76	1.95
	Dec-99	2.020	2.477	1.77	13.024	15.921	-2.896	-22.24	-1.31
	Jan-00	1.775	---	5.12	33.147	---	---	---	---
	Feb-00	1.320	1.387	4.64	22.372	23.350	-0.978	-4.37	-0.83
	Mar-00	1.860	1.820	4.58	31.065	34.620	-3.555	-11.44	0.39

EXHIBIT D.1-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	TN (mg/L) Inflow	TN (mg/L) Outflow	q_in (cm/d)	MB_TN ($g/m^2/y$) Inflow	MB_TN ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
7	Apr-99	1.480	1.730	5.42	29.260	32.330	-3.070	-10.49	-3.00
	May-99	0.917	0.966	4.97	16.620	13.116	3.503	21.08	-0.83
	Jun-99	0.886	0.568	4.57	14.790	17.208	-2.418	-16.35	10.45
	Jul-99	1.090	0.437	5.76	22.927	9.239	13.687	59.70	19.27
	Aug-99	1.460	1.630	5.67	30.224	24.560	5.664	18.74	-1.97
	Sep-99	1.605	1.230	7.13	41.750	14.414	27.336	65.47	5.02
	Oct-99	0.820	0.530	9.44	28.257	14.107	14.150	50.07	13.33
	Nov-99	1.600	1.600	9.25	54.020	47.724	6.296	11.65	0.00
	Dec-99	1.980	2.270	8.63	62.376	85.424	-23.047	-36.95	-4.72
	Jan-00	1.775	---	9.40	60.913	---	---	---	---
	Feb-00	1.320	1.520	8.14	39.219	44.329	-5.110	-13.03	-4.15
	Mar-00	1.800	1.710	6.70	43.993	36.007	7.986	18.15	1.17
8	Apr-99	1.480	1.340	5.60	30.241	28.172	2.069	6.84	2.06
	May-99	0.908	0.922	5.06	16.782	9.238	7.545	44.96	-0.22
	Jun-99	0.886	0.532	5.27	17.053	8.777	8.276	48.53	9.12
	Jul-99	1.090	0.630	7.22	28.705	10.638	18.066	62.94	11.85
	Aug-99	1.460	1.820	6.44	34.297	33.095	1.202	3.50	-4.59
	Sep-99	2.420	1.570	7.03	62.061	14.613	47.448	76.45	7.56
	Oct-99	0.820	0.720	10.00	29.939	26.254	3.685	12.31	4.75
	Nov-99	1.600	1.400	8.93	52.168	37.712	14.456	27.71	3.98
	Dec-99	1.900	1.380	9.20	63.767	44.020	19.748	30.97	10.47
9	Apr-99	1.480	---	6.18	33.363	---	---	---	---
	May-99	0.899	0.844	5.15	16.906	11.830	5.079	30.04	1.04
	Jun-99	0.886	0.804	5.35	17.312	17.138	0.174	1.01	1.98
	Jul-99	1.090	0.800	5.35	21.298	9.388	11.910	55.92	4.84
	Aug-99	1.460	1.670	5.72	30.478	28.612	1.865	6.12	-2.55
	Sep-99	1.970	2.000	6.16	44.293	46.282	-1.989	-4.49	-0.34
	Oct-99	0.820	0.890	8.65	25.883	33.866	-7.982	-30.84	-2.85
	Nov-99	1.600	1.700	8.92	52.093	52.122	-0.029	-0.06	-1.92
	Dec-99	1.620	1.700	9.84	58.201	65.217	-7.016	-12.05	-1.79
	Jan-00	1.775	1.730	9.51	61.639	62.665	-1.026	-1.66	0.91
	Feb-00	1.320	1.380	8.99	43.314	46.454	-3.140	-7.25	-1.48
	Mar-00	1.810	2.050	11.51	76.050	85.493	-9.443	-12.42	-5.21
10	Apr-99	1.480	1.490	7.74	41.822	24.800	17.023	40.70	-0.15
	May-99	0.821	0.996	4.18	12.533	8.507	4.027	32.13	-2.30
	Jun-99	0.886	0.822	5.06	16.378	17.282	-0.904	-5.52	1.48
	Jul-99	1.090	0.455	5.36	21.326	5.620	15.706	73.65	13.94
	Aug-99	1.460	1.410	5.80	30.912	23.744	7.169	23.19	0.66
	Sep-99	1.675	1.140	7.47	45.649	19.931	25.718	56.34	8.61
	Oct-99	0.820	0.670	9.77	29.227	23.489	5.738	19.63	7.14
	Nov-99	1.600	1.600	8.49	49.570	46.463	3.107	6.27	0.00
	Dec-99	1.890	2.040	9.13	62.983	70.455	-7.472	-11.86	-2.59
	Jan-00	1.775	1.680	9.46	61.315	57.396	3.919	6.39	1.89
	Feb-00	1.320	1.370	8.12	39.122	38.741	0.381	0.97	-1.08
	Mar-00	1.720	1.660	8.28	51.955	47.503	4.452	8.57	1.04
11	Apr-99	1.480	1.595	5.22	28.217	22.821	5.396	19.12	-1.25
	May-99	0.825	0.903	5.27	15.876	12.838	3.038	19.14	-1.51
	Jun-99	0.886	0.813	5.53	17.892	19.005	-1.112	-6.22	1.87
	Jul-99	1.090	1.000	5.50	21.881	22.028	-0.147	-0.67	1.81
	Aug-99	1.460	1.390	5.39	28.730	28.905	-0.175	-0.61	0.99
	Sep-99	1.940	1.880	5.86	41.466	45.317	-3.850	-9.29	0.71
	Oct-99	0.820	0.900	8.32	24.902	28.333	-3.431	-13.78	-2.88
	Nov-99	1.600	1.400	9.69	56.570	49.097	7.473	13.21	4.70
	Dec-99	1.460	1.850	9.54	50.835	59.898	-9.063	-17.83	-7.95
	Jan-00	1.775	1.725	9.56	61.907	59.453	2.453	3.96	0.99
	Feb-00	1.320	1.730	9.40	45.283	58.451	-13.168	-29.08	-9.21
	Mar-00	2.140	1.890	6.93	54.091	43.754	10.337	19.11	3.01
12	Apr-99	1.480	1.590	5.44	29.382	28.785	0.597	2.03	-1.36
	May-99	0.942	1.020	5.90	20.300	23.064	-2.764	-13.62	-1.76
	Jun-99	0.886	0.750	5.54	17.918	17.527	0.391	2.18	3.65
	Jul-99	1.090	0.485	5.59	22.243	9.884	12.359	55.56	16.51
	Aug-99	1.460	1.265	5.76	30.717	25.986	4.731	15.40	2.98
	Sep-99	1.760	1.540	5.92	38.051	40.659	-2.607	-6.85	3.21
	Oct-99	0.820	0.945	8.60	25.744	29.312	-3.568	-13.86	-4.43
	Nov-99	1.600	0.813	8.82	51.485	24.460	27.025	52.49	21.10
	Dec-99	1.510	1.510	10.03	55.303	54.930	0.373	0.67	0.00
	Jan-00	1.775	1.630	9.58	62.053	58.956	3.098	4.99	3.03
	Feb-00	1.320	1.390	9.28	44.727	43.852	0.875	1.96	-1.69
	Mar-00	1.930	1.920	7.51	52.922	50.598	2.324	4.39	0.14

NA = Not available

EXHIBIT D.1-6

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data for the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Density (g/cm³)	Solids (%)	Bulk Den (g/cm³)	Vol Solids (%)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
Period of Record									
1	1999-2000	1.15	26.46	0.31	65.13	207.7	116.6	8664.4	75400.0
2	1999-2000	1.84	71.28	1.31	3.45	1044.1	950.4	60.4	3394.0
3	1999-2000	0.96	24.14	0.23	56.47	177.0	108.3	5763.7	60988.9
4	1999-2000	1.80	73.83	1.33	3.25	963.4	952.2	51.4	2780.6
5	1999-2000	1.91	67.11	1.28	--	984.8	932.1	61.8	3484.0
6	1999-2000	1.91	75.64	1.44	--	974.7	965.7	90.3	2679.2
7	1999-2000	1.76	75.63	1.33	1.00	27.8	11.5	23.9	1407.9
8	1999-2000	1.76	70.58	1.25	0.00	23.8	12.7	174.6	2244.7
9	1999-2000	1.16	25.48	0.30	42.50	205.7	115.8	4350.0	70133.3
10	1999-2000	1.93	73.12	1.41	2.00	940.8	931.6	61.1	2873.3
11	1999-2000	1.82	70.84	1.30	4.40	925.4	915.7	55.9	10773.3
12	1999-2000	0.98	27.77	0.26	65.10	207.4	143.7	5639.0	58866.7
Quarterly									
1	Qtr-3	1.37	39.50	0.56	--	370.4	287.4	--	--
	Qtr-4	1.10	20.99	0.23	65.13	168.6	98.4	9600.0	63133.3
	Qtr-5	1.12	28.40	0.32	--	219.8	114.2	9866.7	51333.3
	Qtr-6	1.20	27.40	0.32	--	194.1	90.5	6526.7	111733.3
	Qtr-7	--	--	--	--	--	--	--	--
2	Qtr-3	1.87	68.50	1.28	--	868.3	836.1	--	--
	Qtr-4	1.81	68.38	1.24	3.45	954.0	828.2	17.5	1806.0
	Qtr-5	1.82	73.39	1.33	--	1024.4	961.7	75.0	4633.3
	Qtr-6	1.90	72.92	1.38	--	1252.3	1134.5	74.3	3213.3
	Qtr-7	--	--	--	--	--	--	--	--
3	Qtr-3	1.16	28.50	0.33	--	187.9	111.5	--	--
	Qtr-4	1.10	21.18	0.24	56.47	221.9	151.6	3086.7	27200.0
	Qtr-5	1.09	28.97	0.32	--	212.7	100.5	7583.3	45833.3
	Qtr-6	1.14	19.84	0.23	--	167.1	93.9	8410.0	109933.3
	Qtr-7	1.17	21.83	0.26	--	218.6	108.5	--	--
4	Qtr-3	1.95	67.00	1.31	--	903.4	912.1	--	--
	Qtr-4	1.73	66.06	1.12	3.25	932.2	810.2	17.6	1993.3
	Qtr-5	1.83	74.52	1.37	--	1034.2	937.0	67.6	2648.3
	Qtr-6	1.96	76.50	1.50	--	1132.7	1090.9	50.0	3700.0
	Qtr-7	2.01	68.17	1.37	--	984.5	1020.6	--	--
5	Qtr-3	1.90	65.33	1.24	--	999.7	973.5	--	--
	Qtr-4	1.84	65.44	1.21	--	969.7	881.9	21.7	2045.3
	Qtr-5	1.81	66.02	1.21	--	918.3	814.0	110.0	3666.7
	Qtr-6	1.98	71.18	1.41	--	1015.8	1017.9	53.8	4740.0
	Qtr-7	2.05	66.00	1.35	--	1067.0	1063.1	--	--
6	Qtr-3	1.89	77.67	1.46	--	911.7	909.9	--	--
	Qtr-4	1.82	74.14	1.35	--	950.9	883.4	21.9	1217.7
	Qtr-5	1.86	75.50	1.40	--	979.6	939.3	195.3	3503.3
	Qtr-6	1.95	76.36	1.49	--	1020.0	1087.0	53.7	3316.7
	Qtr-7	2.05	76.00	1.56	--	970.4	988.4	--	--
7	Qtr-3	1.86	77.00	1.43	--	16.6	13.1	--	--
	Qtr-4	1.81	71.33	1.29	1.00	22.6	14.3	5.0	33.6
	Qtr-5	1.76	74.93	1.32	--	29.5	16.3	64.0	2490.0
	Qtr-6	1.90	78.33	1.49	--	40.2	9.0	5.0	1700.0
	Qtr-7	1.90	70.50	1.34	--	26.0	15.4	--	--
8	Qtr-3	1.86	70.00	1.30	--	19.7	16.1	--	--
	Qtr-4	1.60	62.97	1.03	0.00	14.6	11.1	2.0	3875.0
	Qtr-5	1.83	77.50	1.42	--	31.6	16.0	510.0	2200.0
	Qtr-6	1.84	71.90	1.32	--	27.9	8.6	11.8	659.0
	Qtr-7	--	--	--	--	--	--	--	--
9	Qtr-3	1.08	24.00	0.26	--	206.3	104.7	--	--
	Qtr-4	1.10	22.80	0.25	42.50	171.2	93.9	2300.0	69700.0
	Qtr-5	1.13	30.18	0.34	--	222.9	114.9	4600.0	45000.0
	Qtr-6	1.18	24.10	0.28	--	216.3	155.0	6150.0	95700.0
	Qtr-7	1.30	25.25	0.33	--	215.2	96.8	--	--
10	Qtr-3	1.94	66.00	1.28	--	1060.0	987.3	--	--
	Qtr-4	1.86	71.63	1.33	2.00	1014.0	894.0	19.4	1850.0
	Qtr-5	1.86	77.23	1.44	--	1006.0	949.5	105.0	2870.0
	Qtr-6	1.96	75.27	1.48	--	788.5	898.3	59.0	3900.0
	Qtr-7	2.05	69.50	1.42	--	902.3	983.3	--	--
11	Qtr-3	1.88	72.00	1.35	--	972.9	968.6	--	--
	Qtr-4	1.81	78.97	1.43	4.40	917.9	872.6	34.5	26000.0
	Qtr-5	1.90	76.23	1.45	--	888.3	850.0	48.0	2600.0
	Qtr-6	1.96	75.00	1.47	--	1083.3	1056.1	52.8	3720.0
	Qtr-7	1.95	61.50	1.20	--	963.3	989.6	--	--
12	Qtr-3	1.13	29.50	0.33	--	224.6	142.7	--	--
	Qtr-4	1.11	29.22	0.33	65.10	183.4	119.6	5410.0	34200.0
	Qtr-5	1.14	28.17	0.32	--	212.9	119.8	6700.0	58000.0
	Qtr-6	1.16	15.30	0.18	--	165.4	101.0	7965.0	84400.0
	Qtr-7	1.15	18.00	0.21	--	215.6	115.8	--	--

EXHIBIT D.1-6

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data for the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Density (g/cm³)	Solids (%)	Bulk Den (g/cm³)	Vol Solids (%)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
Monthly		--	--	--	--	--	--	--	--
1	Apr-99	1.37	39.50	0.56	--	370.4	287.4	--	--
	May-99	1.09	31.67	0.35	--	180.0	92.7	9600.0	63133.3
	Jun-99	1.10	14.67	0.16	65.13	208.9	105.5	--	--
	Jul-99	1.12	16.63	0.18	--	117.0	97.1	--	--
	Aug-99	1.12	26.70	0.30	--	269.8	156.3	--	--
	Sep-99	1.11	30.20	0.34	--	183.3	100.1	9866.7	51333.3
	Oct-99	1.12	28.30	0.32	--	206.2	86.1	--	--
	Nov-99	1.17	33.13	0.38	--	152.1	85.5	--	--
	Dec-99	1.22	21.67	0.26	--	236.0	95.4	6526.7	111733.3
	Jan-00	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--
2	Apr-99	1.87	68.50	1.28	--	868.3	836.1	--	--
	May-99	1.78	63.00	1.12	--	1052.1	932.5	17.5	1806.0
	Jun-99	1.83	69.33	1.27	3.45	804.3	682.6	--	--
	Jul-99	1.81	71.00	1.28	--	1038.4	904.3	--	--
	Aug-99	1.80	78.67	1.42	--	1019.7	949.0	--	--
	Sep-99	1.78	74.77	1.33	--	970.1	944.0	75.0	4633.3
	Oct-99	1.88	66.73	1.25	--	1083.2	991.9	--	--
	Nov-99	1.90	68.50	1.31	--	1028.5	1048.0	--	--
	Dec-99	1.89	77.33	1.46	--	1476.0	1220.9	74.3	3213.3
	Jan-00	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--
3	Apr-99	1.16	28.50	0.33	--	187.9	111.5	--	--
	May-99	1.12	26.33	0.30	--	183.5	88.8	3086.7	27200.0
	Jun-99	1.07	20.00	0.21	56.47	205.1	100.1	--	--
	Jul-99	1.12	17.20	0.19	--	277.0	266.0	--	--
	Aug-99	0.99	22.30	0.22	--	226.8	98.8	--	--
	Sep-99	1.12	28.73	0.32	--	201.1	112.7	7583.3	45833.3
	Oct-99	1.18	35.87	0.42	--	210.2	90.0	--	--
	Nov-99	1.13	24.70	0.28	--	176.3	82.2	--	--
	Dec-99	1.15	16.67	0.19	--	219.4	83.2	8410.0	109933.3
	Jan-00	1.15	18.17	0.21	--	105.7	116.2	--	--
	Feb-00	1.20	25.00	0.30	--	252.3	92.0	--	--
	Mar-00	1.13	18.67	0.21	--	185.0	124.9	--	--
4	Apr-99	1.95	67.00	1.31	--	903.4	912.1	--	--
	May-99	1.80	68.33	1.23	--	927.3	794.9	17.6	1993.3
	Jun-99	1.69	78.17	1.32	3.25	902.3	764.8	--	--
	Jul-99	1.68	51.67	0.82	--	967.0	870.8	--	--
	Aug-99	1.77	74.17	1.31	--	1050.8	943.4	--	--
	Sep-99	1.91	81.08	1.55	--	1031.2	903.4	67.6	2648.3
	Oct-99	1.82	68.30	1.26	--	1021.6	975.5	--	--
	Nov-99	1.94	72.67	1.41	--	1184.3	1115.7	--	--
	Dec-99	1.90	76.17	1.44	--	1263.0	1194.4	50.0	3700.0
	Jan-00	2.03	80.67	1.64	--	951.0	962.6	--	--
	Feb-00	2.00	67.67	1.35	--	1008.9	1001.7	--	--
	Mar-00	2.02	68.67	1.39	--	960.0	1039.4	--	--
5	Apr-99	1.90	65.33	1.24	--	999.7	973.5	--	--
	May-99	1.86	72.67	1.35	--	970.8	840.4	21.7	2045.3
	Jun-99	1.85	67.33	1.25	--	960.4	907.1	--	--
	Jul-99	1.82	56.33	1.02	--	981.0	889.8	--	--
	Aug-99	1.73	64.50	1.15	--	833.2	752.7	--	--
	Sep-99	1.88	74.33	1.40	--	859.8	746.2	110.0	3666.7
	Oct-99	1.81	59.23	1.08	--	1081.4	965.7	--	--
	Nov-99	1.94	73.87	1.43	--	1057.2	996.0	--	--
	Dec-99	1.96	66.00	1.29	--	998.7	1084.2	53.8	4740.0
	Jan-00	2.03	73.67	1.50	--	991.5	973.4	--	--
	Feb-00	2.03	62.00	1.26	--	1045.2	965.9	--	--
	Mar-00	2.07	70.00	1.45	--	1088.8	1160.2	--	--
6	Apr-99	1.89	77.67	1.46	--	911.7	909.9	--	--
	May-99	1.80	72.67	1.31	--	1001.2	878.5	21.9	1217.7
	Jun-99	1.86	75.00	1.39	--	934.7	901.3	--	--
	Jul-99	1.79	74.77	1.34	--	922.4	864.4	--	--
	Aug-99	1.84	74.33	1.37	--	1018.9	974.2	--	--
	Sep-99	1.88	75.93	1.42	--	917.2	849.4	195.3	3503.3
	Oct-99	1.86	76.23	1.42	--	1002.8	994.3	--	--
	Nov-99	1.97	73.90	1.46	--	1145.3	1147.1	--	--
	Dec-99	1.92	77.33	1.49	--	991.7	1166.0	53.7	3316.7
	Jan-00	1.97	77.83	1.53	--	922.9	947.8	--	--
	Feb-00	1.97	79.33	1.56	--	945.9	873.9	--	--
	Mar-00	2.13	72.67	1.55	--	994.8	1102.9	--	--

EXHIBIT D.1-6

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data for the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Density (g/cm^3)	Solids (%)	Bulk Den (g/cm^3)	Vol Solids (%)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
7	Apr-99	1.86	77.00	1.43	--	16.6	13.1	--	--
	May-99	1.80	77.00	1.39	--	12.1	7.9	5.0	33.6
	Jun-99	1.86	70.00	1.30	1.00	31.9	22.1	--	--
	Jul-99	1.76	67.00	1.18	--	23.8	12.8	--	--
	Aug-99	1.70	78.00	1.33	--	23.9	14.9	--	--
	Sep-99	1.81	78.80	1.43	--	47.6	31.1	64.0	2490.0
	Oct-99	1.78	68.00	1.21	--	17.2	2.8	--	--
	Nov-99	1.84	77.00	1.42	--	54.4	12.9	--	--
	Dec-99	1.87	78.00	1.46	--	38.0	4.0	5.0	1700.0
	Jan-00	2.00	80.00	1.60	--	28.1	10.2	--	--
	Feb-00	1.80	68.00	1.22	--	32.1	19.6	--	--
	Mar-00	2.00	73.00	1.46	--	20.0	11.2	--	--
8	Apr-99	1.86	70.00	1.30	--	19.7	16.1	--	--
	May-99	1.59	56.50	0.90	--	11.2	7.0	2.0	3875.0
	Jun-99	1.84	81.40	1.50	0.00	20.7	13.4	--	--
	Jul-99	1.36	51.00	0.69	--	12.0	13.0	--	--
	Aug-99	1.75	79.00	1.38	--	21.3	13.3	--	--
	Sep-99	1.87	78.40	1.47	--	46.9	31.8	510.0	2200.0
	Oct-99	1.87	75.10	1.40	--	26.6	2.8	--	--
	Nov-99	1.82	69.80	1.27	--	18.9	12.4	--	--
	Dec-99	1.85	74.00	1.37	--	36.8	4.7	11.8	659.0
	Jan-00	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--
9	Apr-99	1.08	24.00	0.26	--	206.3	104.7	--	--
	May-99	1.15	28.00	0.32	--	182.5	94.2	2300.0	69700.0
	Jun-99	1.11	27.30	0.30	42.50	203.6	90.4	--	--
	Jul-99	1.04	13.10	0.14	--	127.7	97.1	--	--
	Aug-99	1.07	24.10	0.26	--	246.6	130.7	--	--
	Sep-99	1.19	31.00	0.37	--	205.7	110.0	4600.0	45000.0
	Oct-99	1.12	35.45	0.40	--	216.3	103.9	--	--
	Nov-99	1.13	19.30	0.22	--	337.6	197.9	--	--
	Dec-99	1.11	32.00	0.36	--	203.0	111.0	6150.0	95700.0
	Jan-00	1.30	21.00	0.27	--	108.4	156.2	--	--
	Feb-00	1.20	24.50	0.29	--	232.9	73.2	--	--
	Mar-00	1.40	26.00	0.36	--	197.5	120.3	--	--
10	Apr-99	1.94	66.00	1.28	--	1060.0	987.3	--	--
	May-99	1.86	77.00	1.43	--	918.1	823.7	19.4	1850.0
	Jun-99	1.84	63.90	1.18	2.00	1025.2	892.7	--	--
	Jul-99	1.88	74.00	1.39	--	1098.9	965.6	--	--
	Aug-99	1.80	78.00	1.40	--	1038.6	946.6	--	--
	Sep-99	1.93	81.00	1.56	--	1007.7	951.9	105.0	2870.0
	Oct-99	1.86	72.70	1.35	--	971.7	950.1	--	--
	Nov-99	1.87	74.80	1.40	--	553.7	597.0	--	--
	Dec-99	1.92	76.00	1.46	--	784.8	1067.9	59.0	3900.0
	Jan-00	2.10	75.00	1.58	--	1026.9	1030.0	--	--
	Feb-00	2.00	70.00	1.40	--	724.8	816.2	--	--
	Mar-00	2.10	69.00	1.45	--	1079.8	1150.3	--	--
11	Apr-99	1.88	72.00	1.35	--	972.9	968.6	--	--
	May-99	1.75	78.00	1.37	--	969.2	991.3	34.5	26000.0
	Jun-99	1.85	76.90	1.42	4.40	897.1	841.1	--	--
	Jul-99	1.84	82.00	1.51	--	887.3	785.4	--	--
	Aug-99	1.87	77.00	1.44	--	828.5	913.7	--	--
	Sep-99	1.91	79.30	1.51	--	901.6	776.0	48.0	2600.0
	Oct-99	1.93	72.40	1.40	--	934.8	860.4	--	--
	Nov-99	1.88	79.00	1.49	--	1013.0	1016.6	--	--
	Dec-99	1.90	74.00	1.41	--	1280.9	1192.0	52.8	3720.0
	Jan-00	2.10	72.00	1.51	--	956.0	959.8	--	--
	Feb-00	2.00	67.00	1.34	--	1021.7	1048.6	--	--
	Mar-00	1.90	56.00	1.06	--	904.8	930.6	--	--
12	Apr-99	1.13	29.50	0.33	--	224.6	142.7	--	--
	May-99	1.14	39.00	0.44	--	184.3	93.5	5410.0	34200.0
	Jun-99	1.05	19.00	0.20	65.10	207.9	121.8	--	--
	Jul-99	1.15	29.65	0.34	--	158.0	143.6	--	--
	Aug-99	1.08	32.30	0.35	--	212.4	138.2	--	--
	Sep-99	1.16	21.90	0.25	--	200.8	97.5	6700.0	58000.0
	Oct-99	1.17	30.30	0.35	--	225.6	123.6	--	--
	Nov-99	1.16	10.30	0.12	--	142.7	92.0	--	--
	Dec-99	1.23	28.00	0.34	--	268.3	108.5	7965.0	84400.0
	Jan-00	1.10	7.60	0.08	--	85.2	102.5	--	--
	Feb-00	1.20	24.00	0.29	--	204.2	113.5	--	--
	Mar-00	1.10	12.00	0.13	--	227.1	118.0	--	--

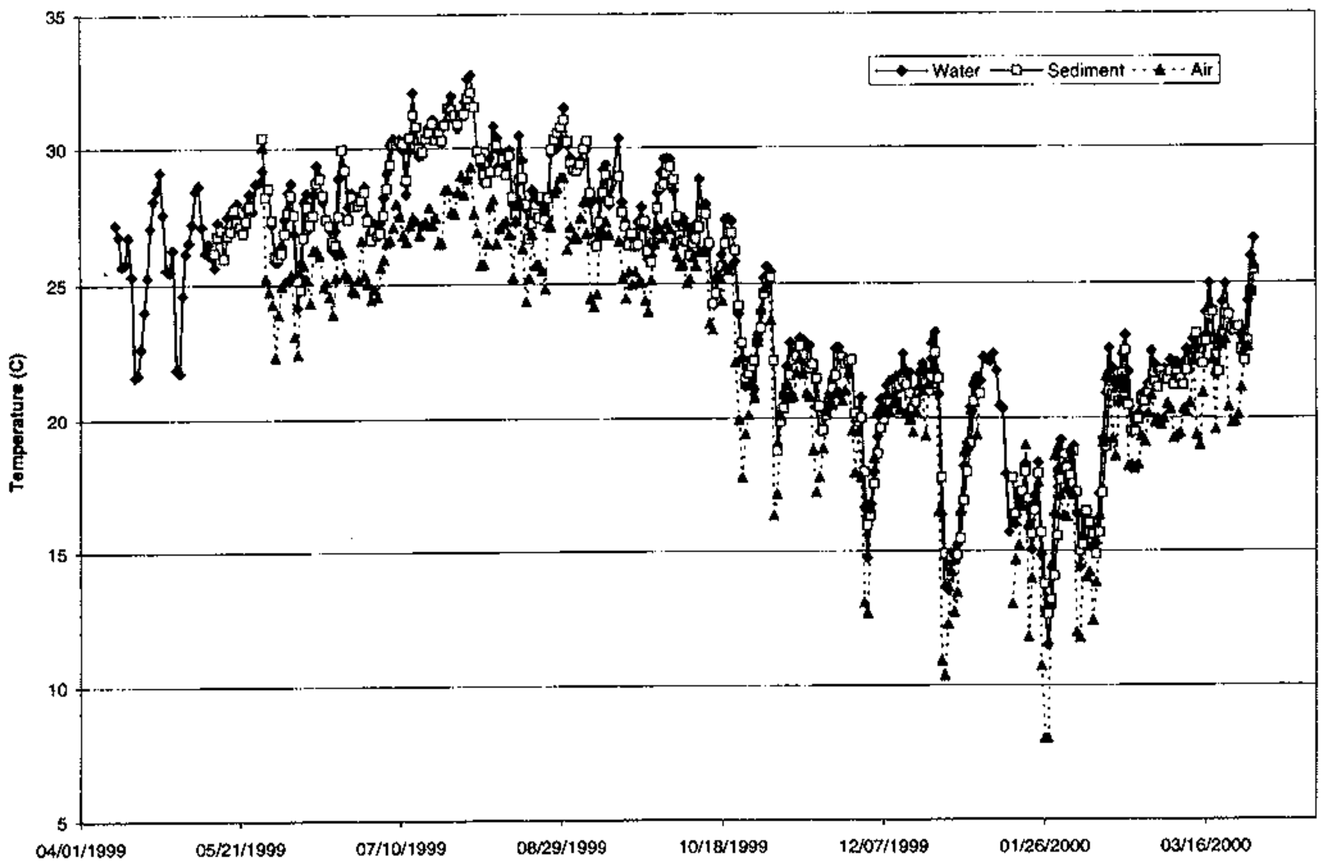


EXHIBIT D.1-7
Daily Average Temperatures in the Air, Water and Sediments of the Porta-PSTA Treatments, April 1999 - March 2000

EXHIBIT D.1-6

Non-Reactive Phosphorus Data Summary for Porta-PSTA Sediments, April 1999- March 2000

Treatmemt	Soil	Date	Moisture %	TP mg/kg	NaHCO3 PI mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPI mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg
1	PE	6/21/99	--	205.0	5.08	20.13	15.05	71.5	18.7	40.1
1	PE	6/21/99	--	165.5	3.87	10.64	6.77	63.0	8.7	34.4
1	PE	9/29/99	68.04	218.8	5.53	13.50	7.97	67.2	0.4	47.7
1	PE	12/15/99	68.7	138.3	3.04	11.09	8.05	95.8	-3.87	51.86
1	PE	3/15/00	67.3	204.0	1.34	12.07	10.73	80.0	9.2	43.0
2	SR	6/21/99	--	937.2	3.97	6.74	2.76	1007.8	-15.1	45.5
2	SR	9/29/99	27.32	859.5	2.50	3.76	1.27	825.3	-2.7	37.4
2	SR	12/14/99	22.2	793.0	2.10	1.97	-0.13	839.6	-26.63	47.14
2	SR	3/14/00	22.4	769.9	2.97	5.28	2.30	876.5	-27.7	34.7
3	PE	6/21/99	--	253.7	5.26	14.99	9.74	80.8	9.8	45.3
3	PE	9/29/99	77.47	221.1	5.58	20.05	14.47	86.1	-4.4	67.2
3	PE	12/15/99	73.7	226.4	1.13	18.79	17.66	114.5	-2.22	68.69
3	PE	3/15/00	71.1	216.1	3.48	12.30	8.81	86.6	8.0	49.8
4	SR	6/21/99	--	787.1	4.36	4.91	0.55	1026.8	-0.2	48.3
4	SR	9/20/99	26.09	623.8	3.70	3.51	-0.19	772.3	5.6	40.2
4	SR	12/13/99	21.2	925.1	2.37	2.45	0.09	1022.3	-24.25	41.94
4	SR	12/13/99	20.7	915.0	2.32	2.77	0.45	914.0	-28.16	28.71
4	SR	3/13/00	20.1	783.3	3.32	4.58	1.26	1004.9	-35.5	45.8
4	SR	3/13/00	19.4	961.5	2.62	4.76	2.14	1028.9	-32.4	45.1
5	SR	9/29/99	29.42	783.6	1.11	4.12	3.00	933.3	-3.4	42.9
5	SR	12/14/99	21.5	1232.0	2.54	1.77	-0.77	1041.5	-35.82	35.40
5	SR	3/14/00	20.6	1043.0	2.93	6.59	3.66	1020.3	-34.1	28.7
6	SR	9/20/99	27.10	779.8	0.60	4.08	3.48	698.8	16.7	61.9
6	SR	12/13/99	20.3	953.1	2.61	2.45	-0.15	1054.3	-34.22	42.00
6	SR	3/13/00	21.6	784.0	2.48	4.86	2.38	987.8	-30.9	46.1
7	SA	6/23/99	--	11.9	2.54	1.79	-0.75	4.0	1.9	7.2
7	SA	9/20/99	14.40	36.6	1.87	2.08	0.21	6.0	0.7	7.0
7	SA	12/13/99	23.1	37.8	1.06	1.40	0.34	1.6	1.60	37.11
7	SA	3/13/00	21.7	24.9	1.36	2.33	0.96	5.7	1.7	7.6
8	SA	6/23/99	--	12.2	2.66	8.78	6.12	3.7	5.7	5.5
8	SA	9/29/99	24.30	28.0	0.28	2.10	1.82	6.6	0.5	6.0
8	SA	12/14/99	26.6	25.6	1.18	1.37	0.19	1.5	1.83	6.60
8	SA	12/14/99	25.8	27.6	0.23	1.62	1.39	-0.1	0.87	2.50
8	SA	3/14/00	22.0	25.0	1.27	3.11	1.84	5.6	1.4	5.3
9	PE	6/23/99	--	221.3	4.62	11.11	6.50	61.4	23.7	23.5
9	PE	9/29/99	65.57	263.7	8.25	15.94	7.69	95.0	-5.0	50.8
9	PE	12/15/99	70.2	180.6	4.07	12.70	8.62	77.8	4.54	66.08
9	PE	3/15/00	70.6	227.9	7.61	16.24	8.63	107.2	1.8	73.5
10	SR	6/23/99	--	937.8	3.88	6.05	2.17	929.8	-0.2	38.5
10	SR	9/20/99	24.98	948.4	3.87	3.82	-0.05	857.6	-1.2	47.6
10	SR	9/20/99	23.65	863.0	3.22	4.32	1.10	943.3	-3.4	47.9
10	SR	12/13/99	24.6	953.1	2.75	2.04	-0.71	999.9	-38.40	37.41
10	SR	3/13/00	21.8	1171.8	3.98	5.59	1.61	1106.8	-36.6	45.2
11	SR	6/23/99	--	1033.8	2.96	3.55	0.59	896.2	-5.6	45.6
11	SR	9/29/99	35.32	899.6	3.95	4.96	1.00	1121.2	-14.5	43.8
11	SR	9/29/99	20.71	948.4	3.84	3.79	-0.05	927.6	3.1	41.2
11	SR	12/14/99	21.7	994.0	2.52	2.52	-0.01	1070.1	-37.86	37.34
11	SR	3/14/00	24.5	968.7	1.90	6.56	4.66	834.2	-23.3	8.9
12	PE	6/23/99	--	186.4	6.05	16.87	10.82	95.5	18.1	39.5
12	PE	9/29/99	76.86	292.9	6.69	20.46	13.77	151.4	-3.1	64.3
12	PE	9/29/99	67.80	194.6	4.74	16.39	11.65	116.7	-4.5	53.8
12	PE	12/15/99	59.8	73.0	2.91	7.16	4.25	106.0	-5.53	40.14
12	PE	12/15/99	62.0	175.3	3.53	7.34	3.80	136.7	-9.10	52.83
12	PE	3/15/00	76.4	261.1	3.48	16.82	13.34	110.9	4.9	71.7

Tank	Soil	Treat	Date Installed	Date Collected	PSTA #	Sediment Volume (ml)	# Days	Accretion (ml/m2/y)	Accretion (g/m2/y)	TP Accretion (g/m2/y)	Density (g/cm3)	Density (g/cm3)	Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
9	peat	1	07/26/1999	10/07/1999	3129	36	73	11688	584	0.292	ND	ND	ND	ND	ND	ND	ND
9	peat	1	07/26/1999	10/07/1999	3130	42	73	13636	682	0.341	ND	ND	ND	ND	ND	ND	ND
9	peat	1	07/23/1999	11/08/1999	3592	53	108	11631	198	0.080	0.922	0.017	48.85	0.9	98.2	404.9	43.3
9	peat	1	11/08/1999	02/17/2000	5387	54	101	12672	317	0.153	1.021	0.025	55.13	1.35	97.6	481.8	47.0
11	peat	1	07/23/1999	11/08/1999	3593	48	108	10534	483	0.234	0.924	0.046	44.35	2.2	95	484.8	38
11	peat	1	11/08/1999	02/17/2000	5389	18	101	4224	171	0.068	1.122	0.041	20.2	0.73	96.4	394.5	40.2
12	peat	3	07/23/1999	10/28/1999	3580	16	97	3909	98	0.060	0.701	0.025	11.22	0.4	96.8	618.7	32.7
12	peat	3	10/28/1999	02/17/2000	5390	20	112	4232	129	0.058	1.041	0.030	20.81	0.61	97.1	451.7	28.5
14	peat	3	07/23/1999	10/26/1999	3579	4.7	95	1173	25	0.012	1.000	0.021	4.7	0.1	97.4	ND	30.2
14	peat	3	07/23/1999	10/28/1999	3575	6	97	1466	24	0.015	0.390	0.017	2.34	0.1	94.9	622.6	ND
14	peat	3	10/28/1999	02/17/2000	5392	38	112	8042	269	0.148	1.022	0.033	38.82	1.27	96.7	551.7	44.1
17	peat	3	07/23/1999	11/08/1999	3596	100	108	21946	417	0.309	1.194	0.019	119.44	1.9	98.4	742	32.8
17	peat	3	11/08/1999	02/17/2000	5395	24	101	5632	120	0.088	1.034	0.021	24.82	0.51	97.9	738.1	30.1
18	peat	1	07/23/1999	11/11/1999	3597	36	111	7687	512	0.274	0.920	0.067	33.11	2.4	92.6	535	41.5
18	peat	1	11/11/1999	02/17/2000	5396	18	98	4353	172	0.103	1.079	0.039	19.42	0.71	96.3	600.1	45.9
21	peat	9	07/23/1999	11/11/1999	3600	16	111	3416	214	0.139	0.913	0.063	14.61	1	93.5	653	49.9
21	peat	9	11/11/1999	02/17/2000	5399	26	98	6288	220	0.195	1.083	0.035	28.16	0.91	96.8	886.7	43.6
24	peat	12	07/23/1999	10/28/1999	3581	38	97	9285	269	0.121	1.003	0.029	38.13	1.1	97	451.9	27.7
24	peat	12	07/23/1999	10/28/1999	3582	22	97	5376	49	0.041	0.922	0.009	20.29	0.2	99.2	843.9	ND
24	peat	12	10/28/1999	02/17/2000	5403	28	112	5925	83	0.037	1.075	0.014	30.11	0.39	98.7	448.4	27.6
24	peat	12	10/28/1999	02/17/2000	5404	48	112	10158	44	0.082	0.304	0.004	14.6	0.21	98.6	1844.9	NS
19	sand	7	07/23/1999	11/11/1999	3598	100	111	21353	3480	0.118	0.983	0.163	98.31	16.3	83.4	34	96.9
19	sand	7	11/11/1999	02/17/2000	5397	34	98	8223	235	0.001	1.064	0.029	36.85	0.97	97.4	3.7	70.1
20	sand	8	07/23/1999	11/11/1999	3599	6.5	111	1388	43	0.025	0.777	0.031	5.05	0.2	95.6	579.2	67.3
20	sand	8	11/11/1999	02/17/2000	5398	7	98	1693	92	0.030	0.969	0.054	6.78	0.38	94.4	328.8	88.2
1	shell	6	07/23/1999	11/01/1999	3583	72	101	16896	1596	1.147	0.689	0.094	49.6	6.8	86.3	718.7	85.5
1	shell	6	11/01/1999	02/17/2000	5379	11.5	108	2524	195	0.254	0.984	0.077	11.32	0.89	92.1	1300.9	71.6
2	shell	5	07/23/1999	11/01/1999	3584	82	101	19243	375	0.178	0.636	0.020	52.13	1.6	96.9	473.1	65.6
2	shell	5	11/01/1999	02/17/2000	5380	70	108	15362	516	0.712	0.883	0.034	61.84	2.35	96.2	1380.5	68.6
3	shell	4	07/23/1999	10/26/1999	3576	250	95	62372	5613	3.640	0.923	0.090	230.8	22.5	90.3	648.5	83.6
3	shell	4	10/26/1999	02/17/2000	5381	50	114	10395	840	1.229	0.877	0.081	43.84	4.04	90.8	1463.2	81.2
4	shell	2	07/23/1999	11/04/1999	3587	90	104	20511	638	0.230	0.988	0.031	88.95	2.8	96.8	360.8	71.6
4	shell	2	11/08/1999	02/17/2000	5382	9	101	2112	120	0.175	0.953	0.057	8.58	0.51	94.1	1459.5	65.8
5	shell	4	07/23/1999	10/26/1999	3577	170	95	42413	7709	5.450	1.008	0.182	171.4	30.9	82	707	92.8
5	shell	4	10/26/1999	02/17/2000	5383	290	114	60293	8124	6.787	0.980	0.135	284.12	39.08	86.2	835.4	89.3
6	shell	6	07/23/1999	11/04/1999	3588	22	104	5014	296	0.166	0.856	0.059	18.84	1.3	92.9	561.1	66.6
6	shell	6	11/08/1999	02/17/2000	5384	7	101	1643	195	0.178	1.054	0.119	7.38	0.83	88.8	914.1	72.7
7	shell	2	07/23/1999	11/08/1999	3590	210	108	46086	966	0.293	0.532	0.021	111.8	4.4	96	303.4	70.1
7	shell	2	11/08/1999	02/17/2000	5385	18	101	4224	141	0.071	0.955	0.033	17.19	0.6	96.5	504.3	56.2
8	shell	2	07/26/1999	10/07/1999	3127	42	73	13636	682	0.341	ND	ND	ND	ND	ND	ND	ND
8	shell	2	07/26/1999	10/07/1999	3128	42	73	13636	682	0.341	ND	ND	ND	ND	ND	ND	ND
8	shell	2	07/23/1999	11/08/1999	3591	60	108	13167	549	0.216	0.981	0.042	58.83	2.5	95.7	393.1	60.7
8	shell	2	11/08/1999	02/17/2000	5386	14	101	3285	169	0.093	0.904	0.051	12.66	0.72	94.3	552.0	61.3
10	shell	4	07/23/1999	10/26/1999	3578	190	95	47403	1397	0.552	0.651	0.029	123.6	5.6	95.5	395.2	74.7
10	shell	4	10/26/1999	02/17/2000	5388	96	114	19959	1694	1.132	0.951	0.085	91.34	8.15	91.1	668.2	84.9
13	shell	5	07/23/1999	11/08/1999	3594	29	108	6364	351	0.187	0.987	0.065	28.62	1.6	94.4	531.5	64.9
13	shell	5	11/08/1999	02/17/2000	5391	18	101	4224	242	0.207	1.027	0.057	18.48	1.03	94.4	855.9	59.3
15	shell	6	07/23/1999	11/04/1999	3589	100	104	22790	752	0.259	0.718	0.033	71.79	3.3	95.3	344.4	70
15	shell	6	11/08/1999	02/17/2000	5393	32	101	7509	277	0.141	0.879	0.037	28.14	1.18	95.8	508.1	63.0
16	shell	5	07/23/1999	11/08/1999	3595	130	108	28529	988	0.282	0.848	0.035	110.26	4.5	95.9	285.9	65.7
16	shell	5	11/08/1999	02/17/2000	5394	56	101	13141	598	0.358	1.026	0.046	57.46	2.55	95.6	598.6	62.5
22	shell	10	07/23/1999	11/11/1999	3601	56	111	11957	235	0.213	0.641	0.020	35.91	1.1	96.9	904.9	74.8
22	shell	10	11/11/1999	02/17/2000	5400	74	98	17897	203	0.185	0.587	0.011	43.47	0.84	98.1	911.9	65.3
23	shell	11	07/23/1999	11/01/1999	3585	270	101	63360	4529	3.963	0.916	0.071	247.36	19.3	92.2	875	86.7
23	shell	11	07/23/1999	11/01/1999	3586	205	101	48107	1830	1.134	0.146	0.038	30.02	7.8	74.1	619.4	85.3
23	shell	11	11/01/1999	02/17/2000	5401	26	108	5706	239	0.064	1.029	0.042	26.76	1.09	95.9	267.3	67.4
23	shell	11	11/01/1999	02/17/2000	5402	28	108	6145	715	0.328	1.728	0.116	48.38	3.26	93.3	459.2	91.3

Notes:

Sample Area = 154 cm^2 (14.0 cm diameter)

ND = not determined

Assume BD = 0.05 g/cm^3 when not determined

Assume TP = 0.05% when not determined

= estimated (no notes)

EXHIBIT D.1-10

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover	No. Stems/ m^2
Period of Record										
1	1999 - 2000	4%	4%	11%	0%	12%	7%	22%	30%	40.09
2	1999 - 2000	3%	0%	3%	0%	7%	3%	9%	12%	4.79
3	1999 - 2000	3%	2%	45%	0%	3%	5%	48%	52%	203.32
4	1999 - 2000	26%	0%	4%	0%	1%	26%	6%	32%	20.57
5	1999 - 2000	1%	1%	6%	0%	0%	2%	7%	9%	21.60
6	1999 - 2000	5%	0%	3%	0%	5%	5%	8%	14%	13.45
7	1999 - 2000	14%	1%	1%	0%	0%	15%	2%	17%	3.81
8	1999 - 2000	2%	0%	1%	0%	1%	2%	2%	4%	1.33
9	1999 - 2000	0%	1%	0%	0%	0%	1%	1%	2%	0.00
10	1999 - 2000	1%	0%	0%	0%	2%	2%	2%	3%	0.00
11	1999 - 2000	18%	0%	5%	0%	0%	18%	5%	23%	27.27
12	1999 - 2000	0%	0%	54%	0%	2%	0%	56%	56%	221.42
Quarterly										
1	Qtr-3	0%	0%	1%	0%	3%	0%	4%	4%	3.83
	Qtr-4	0%	0%	3%	0%	4%	0%	7%	7%	3.82
	Qtr-5	2%	9%	14%	0%	22%	7%	32%	39%	72.57
	Qtr-6	16%	10%	27%	0%	20%	26%	47%	73%	94.14
	Qtr-7	--	--	--	--	--	--	--	--	--
2	Qtr-3	0%	0%	1%	0%	3%	0%	4%	4%	1.42
	Qtr-4	0%	0%	1%	0%	1%	0%	2%	3%	1.37
	Qtr-5	5%	0%	3%	0%	8%	5%	11%	16%	7.03
	Qtr-6	4%	0%	4%	0%	16%	4%	20%	25%	10.39
	Qtr-7	--	--	--	--	--	--	--	--	--
3	Qtr-3	1%	0%	6%	0%	5%	1%	11%	12%	6.06
	Qtr-4	2%	2%	24%	0%	3%	4%	26%	30%	87.88
	Qtr-5	3%	5%	67%	0%	2%	8%	69%	77%	360.50
	Qtr-6	5%	1%	66%	1%	3%	6%	70%	76%	259.83
	Qtr-7	3%	1%	51%	0%	2%	4%	53%	57%	348.64
4	Qtr-3	2%	0%	2%	0%	5%	2%	7%	8%	0.67
	Qtr-4	4%	0%	2%	0%	0%	5%	2%	7%	4.04
	Qtr-5	33%	0%	6%	0%	1%	33%	7%	40%	22.62
	Qtr-6	53%	1%	7%	0%	1%	54%	9%	63%	38.80
	Qtr-7	15%	0%	3%	0%	1%	15%	4%	20%	40.75
5	Qtr-3	4%	0%	1%	0%	2%	4%	3%	8%	2.67
	Qtr-4	0%	0%	1%	0%	1%	1%	2%	3%	3.20
	Qtr-5	2%	0%	6%	0%	0%	1%	6%	8%	23.13
	Qtr-6	1%	1%	13%	0%	0%	2%	13%	15%	45.76
	Qtr-7	2%	6%	9%	0%	0%	8%	9%	17%	41.38
6	Qtr-3	2%	0%	3%	0%	2%	2%	5%	7%	0.44
	Qtr-4	4%	0%	2%	0%	1%	4%	2%	6%	1.94
	Qtr-5	8%	0%	2%	0%	1%	8%	3%	11%	11.22
	Qtr-6	4%	0%	6%	0%	11%	4%	16%	21%	23.38
	Qtr-7	8%	0%	4%	0%	14%	8%	18%	26%	52.04
7	Qtr-3	1%	0%	1%	0%	3%	1%	4%	5%	1.50
	Qtr-4	8%	0%	1%	0%	0%	8%	1%	9%	0.53
	Qtr-5	27%	1%	1%	0%	0%	28%	1%	29%	2.08
	Qtr-6	21%	3%	2%	0%	0%	23%	2%	25%	7.00
	Qtr-7	4%	3%	3%	0%	0%	7%	3%	10%	11.83
8	Qtr-3	1%	0%	1%	0%	3%	1%	4%	5%	1.50
	Qtr-4	3%	0%	1%	0%	1%	4%	2%	6%	0.57
	Qtr-5	2%	0%	1%	0%	0%	2%	1%	3%	1.33
	Qtr-6	0%	0%	2%	0%	0%	1%	2%	2%	3.17
	Qtr-7	--	--	--	--	--	--	--	--	--
9	Qtr-3	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Qtr-4	0%	0%	0%	0%	1%	0%	1%	1%	0.00
	Qtr-5	0%	2%	0%	0%	0%	2%	0%	2%	0.00
	Qtr-6	0%	1%	0%	1%	0%	1%	1%	2%	0.00
	Qtr-7	0%	3%	0%	0%	0%	3%	0%	3%	0.00
10	Qtr-3	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Qtr-4	0%	0%	1%	0%	0%	0%	1%	1%	0.00
	Qtr-5	0%	1%	0%	0%	0%	1%	0%	1%	0.00
	Qtr-6	2%	1%	0%	0%	1%	2%	2%	4%	0.00
	Qtr-7	4%	0%	0%	0%	6%	4%	6%	10%	0.00
11	Qtr-3	2%	0%	3%	0%	0%	2%	3%	5%	1.00
	Qtr-4	7%	0%	3%	0%	0%	7%	3%	10%	2.74
	Qtr-5	30%	0%	8%	0%	0%	30%	8%	37%	18.43
	Qtr-6	33%	1%	8%	0%	0%	34%	8%	42%	46.76
	Qtr-7	7%	1%	3%	0%	0%	7%	3%	10%	85.78
12	Qtr-3	0%	0%	8%	0%	18%	0%	25%	25%	4.44
	Qtr-4	0%	0%	25%	0%	1%	0%	26%	26%	55.53
	Qtr-5	0%	1%	86%	0%	0%	1%	86%	87%	555.56
	Qtr-6	0%	1%	77%	0%	0%	1%	77%	78%	361.96
	Qtr-7	0%	0%	54%	0%	0%	0%	54%	54%	296.50

EXHIBIT D.1-10

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover	No. Stems/ m^2
Monthly										
1	Apr-99	0%	0%	1%	0%	3%	0%	4%	4%	3.83
	May-99	0%	0%	2%	0%	1%	0%	4%	4%	0.33
	Jun-99	0%	0%	2%	0%	3%	0%	5%	5%	2.03
	Jul-99	0%	0%	4%	0%	6%	0%	9%	10%	7.36
	Aug-99	0%	0%	8%	0%	12%	1%	20%	21%	23.75
	Sep-99	--	--	--	--	38%	0%	38%	38%	--
	Oct-99	3%	17%	21%	0%	18%	20%	39%	59%	170.22
	Nov-99	20%	21%	35%	0%	24%	41%	59%	100%	127.78
	Dec-99	12%	0%	20%	0%	15%	12%	36%	47%	60.50
	Jan-00	--	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--	--
2	Apr-99	0%	0%	1%	0%	3%	0%	4%	4%	1.42
	May-99	0%	0%	2%	0%	1%	0%	3%	3%	0.72
	Jun-99	0%	0%	2%	0%	0%	0%	3%	3%	1.03
	Jul-99	1%	0%	1%	0%	1%	1%	1%	2%	2.03
	Aug-99	3%	0%	1%	0%	1%	3%	2%	5%	4.36
	Sep-99	5%	0%	6%	0%	10%	5%	16%	20%	9.42
	Oct-99	6%	0%	3%	0%	12%	6%	15%	21%	10.78
	Nov-99	6%	1%	6%	0%	15%	6%	21%	28%	10.28
	Dec-99	2%	0%	2%	0%	18%	2%	20%	22%	10.50
	Jan-00	--	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--	--
3	Apr-99	1%	0%	6%	0%	5%	1%	11%	12%	6.06
	May-99	1%	0%	15%	0%	2%	1%	17%	18%	9.11
	Jun-99	0%	0%	29%	0%	2%	1%	31%	32%	56.36
	Jul-99	4%	3%	26%	0%	3%	7%	29%	35%	158.78
	Aug-99	3%	9%	77%	0%	2%	12%	79%	91%	264.44
	Oct-99	3%	1%	58%	0%	1%	4%	59%	63%	456.56
	Nov-99	8%	3%	91%	2%	8%	11%	100%	111%	369.22
	Dec-99	5%	0%	52%	0%	1%	5%	53%	58%	166.83
	Jan-00	2%	0%	54%	0%	2%	2%	56%	58%	243.44
	Feb-00	4%	0%	51%	0%	3%	4%	54%	58%	443.11
	Mar-00	1%	2%	51%	0%	1%	3%	53%	56%	254.17
4	Apr-99	2%	0%	2%	0%	5%	2%	7%	8%	0.67
	May-99	1%	0%	2%	0%	1%	1%	3%	4%	0.33
	Jun-99	0%	0%	2%	0%	0%	0%	2%	2%	2.61
	Jul-99	12%	1%	1%	0%	0%	12%	1%	13%	7.33
	Aug-99	26%	0%	2%	0%	0%	26%	2%	28%	12.25
	Sep-99	37%	0%	8%	0%	1%	37%	9%	45%	26.58
	Oct-99	33%	1%	7%	0%	1%	34%	8%	42%	40.72
	Nov-99	63%	2%	14%	1%	1%	65%	16%	80%	39.22
	Dec-99	59%	0%	3%	0%	1%	59%	4%	64%	35.61
	Jan-00	38%	0%	3%	0%	2%	38%	6%	44%	41.56
	Feb-00	23%	0%	3%	0%	1%	23%	3%	27%	37.44
	Mar-00	8%	0%	3%	0%	2%	8%	5%	13%	44.06
5	Apr-99	4%	0%	1%	0%	2%	4%	3%	8%	2.67
	May-99	1%	0%	2%	0%	2%	1%	4%	4%	1.28
	Jun-99	0%	0%	3%	0%	0%	0%	3%	3%	2.22
	Jul-99	1%	0%	1%	0%	0%	1%	1%	2%	4.86
	Aug-99	1%	0%	2%	0%	0%	1%	2%	3%	13.83
	Sep-99	2%	1%	6%	0%	0%	1%	6%	8%	21.83
	Oct-99	2%	0%	10%	0%	0%	2%	11%	12%	52.33
	Nov-99	1%	0%	13%	0%	0%	2%	14%	15%	35.67
	Dec-99	1%	0%	4%	0%	0%	1%	5%	6%	36.78
	Jan-00	1%	1%	20%	0%	0%	2%	21%	23%	64.83
	Feb-00	2%	3%	15%	0%	0%	5%	15%	19%	39.39
	Mar-00	1%	9%	4%	0%	0%	11%	4%	15%	43.33
6	Apr-99	2%	0%	3%	0%	2%	2%	5%	7%	0.44
	May-99	2%	0%	2%	0%	1%	2%	2%	4%	0.17
	Jun-99	0%	0%	1%	0%	0%	0%	1%	1%	0.86
	Jul-99	7%	0%	2%	0%	1%	7%	3%	10%	3.92
	Aug-99	22%	0%	2%	0%	1%	22%	3%	25%	8.31
	Sep-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Oct-99	1%	0%	4%	0%	1%	2%	6%	7%	20.78
	Nov-99	3%	0%	7%	0%	10%	3%	17%	21%	18.17
	Dec-99	3%	0%	3%	0%	9%	3%	11%	14%	20.72
	Jan-00	7%	0%	7%	0%	14%	7%	21%	28%	35.17
	Feb-00	6%	0%	4%	0%	15%	6%	20%	26%	50.42
	Mar-00	10%	0%	4%	0%	13%	10%	16%	26%	53.67

EXHIBIT D.1-10

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover	No. Stems/ m^2
7	Apr-99	1%	0%	1%	0%	3%	1%	4%	5%	1.50
	May-99	1%	0%	1%	0%	1%	1%	2%	3%	0.50
	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.25
	Jul-99	24%	0%	1%	0%	0%	24%	1%	25%	0.83
	Aug-99	36%	0%	1%	0%	0%	36%	1%	37%	1.00
	Oct-99	19%	1%	1%	0%	0%	20%	1%	21%	4.17
	Nov-99	46%	8%	1%	0%	0%	53%	1%	55%	6.67
	Dec-99	11%	0%	1%	0%	0%	11%	1%	12%	4.83
	Jan-00	6%	0%	2%	0%	0%	6%	2%	8%	9.50
	Feb-00	5%	0%	3%	0%	0%	5%	3%	8%	9.67
	Mar-00	3%	6%	3%	0%	0%	9%	3%	12%	14.00
8	Apr-99	1%	0%	1%	0%	3%	1%	4%	5%	1.50
	May-99	1%	0%	1%	0%	3%	1%	4%	5%	0.33
	Jun-99	0%	0%	1%	0%	0%	0%	1%	1%	0.50
	Jul-99	9%	1%	1%	0%	0%	10%	1%	11%	0.75
	Aug-99	3%	0%	1%	0%	0%	3%	1%	4%	1.00
	Oct-99	1%	1%	1%	0%	0%	2%	1%	3%	2.00
	Nov-99	0%	0%	2%	0%	0%	1%	2%	2%	2.67
	Dec-99	0%	0%	2%	0%	0%	0%	2%	2%	3.67
	Jan-00	--	--	--	--	--	--	--	--	--
	Feb-00	--	--	--	--	--	--	--	--	--
	Mar-00	--	--	--	--	--	--	--	--	--
9	Apr-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	May-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Jul-99	1%	0%	0%	0%	3%	1%	3%	4%	0.00
	Aug-99	0%	1%	0%	0%	0%	1%	0%	1%	0.00
	Oct-99	0%	2%	0%	0%	0%	3%	0%	3%	0.00
	Nov-99	0%	0%	0%	2%	0%	0%	2%	3%	0.00
	Dec-99	0%	0%	0%	0%	1%	1%	1%	2%	0.00
	Jan-00	0%	2%	0%	0%	0%	2%	0%	2%	0.00
	Feb-00	0%	3%	0%	0%	0%	3%	0%	3%	0.00
	Mar-00	0%	3%	0%	0%	0%	3%	0%	3%	0.00
10	Apr-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	May-99	0%	0%	3%	0%	0%	0%	3%	3%	0.00
	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
	Jul-99	0%	0%	0%	0%	1%	0%	1%	1%	0.00
	Aug-99	0%	1%	0%	0%	0%	1%	0%	1%	0.00
	Oct-99	1%	1%	0%	0%	0%	2%	0%	2%	0.00
	Nov-99	1%	2%	0%	1%	0%	3%	1%	3%	0.00
	Dec-99	1%	0%	0%	0%	1%	1%	1%	2%	0.00
	Jan-00	2%	0%	0%	0%	3%	2%	3%	5%	0.00
	Feb-00	3%	0%	0%	0%	2%	3%	2%	5%	0.00
	Mar-00	5%	0%	0%	0%	11%	5%	11%	15%	0.00
11	Apr-99	2%	0%	3%	0%	0%	2%	3%	5%	1.00
	May-99	1%	0%	3%	0%	0%	1%	3%	4%	0.28
	Jun-99	1%	1%	2%	0%	0%	2%	2%	4%	1.31
	Jul-99	18%	0%	3%	0%	0%	18%	3%	21%	5.42
	Aug-99	46%	0%	7%	0%	0%	46%	7%	53%	11.28
	Oct-99	13%	0%	8%	0%	0%	13%	8%	22%	32.72
	Nov-99	38%	3%	18%	0%	0%	40%	18%	58%	50.72
	Dec-99	38%	0%	5%	0%	0%	38%	5%	42%	26.33
	Jan-00	24%	0%	3%	0%	0%	24%	3%	27%	63.22
	Feb-00	11%	0%	3%	0%	0%	11%	3%	14%	135.50
	Mar-00	3%	1%	3%	0%	0%	4%	3%	7%	36.06
12	Apr-99	0%	0%	8%	0%	18%	0%	25%	25%	4.44
	May-99	0%	0%	8%	0%	1%	0%	9%	9%	7.33
	Jun-99	0%	0%	31%	0%	0%	0%	31%	31%	29.61
	Jul-99	0%	0%	38%	0%	1%	0%	39%	39%	105.56
	Aug-99	0%	0%	93%	0%	0%	0%	93%	93%	555.56
	Oct-99	0%	1%	79%	0%	0%	1%	79%	80%	--
	Nov-99	0%	2%	86%	0%	1%	2%	87%	89%	537.14
	Dec-99	0%	0%	83%	0%	0%	0%	83%	83%	104.11
	Jan-00	0%	0%	63%	0%	0%	0%	63%	63%	269.44
	Feb-00	0%	0%	63%	0%	0%	0%	63%	63%	308.00
	Mar-00	0%	0%	46%	0%	0%	0%	46%	46%	285.00

1101.1	565.4	535.3	92.5	66.9	24.5	0.298	0.087	10.59	20353.0	10.9	2232.1	14.6	1061.7	4.4	14.9	0.5	23658.4
741.2	554.9	188.8	110.0	70.2	3.3	0.313	0.130	1.23	96524.8	14.8	4718.2	10.4	1280.5	4.5	21.0	0.6	102537.4
733.0	327.1	405.9	65.6	106.8	33.0	0.322	0.084	6.96	64453.3	13.2	2041.2	12.3	1334.9	4.9	27.9	0.6	67839.4
641.2	535.6	117.9	155.4	104.4	4.5	0.674	0.162	1.24	156306.4	13.9	5120.7	9.0	14731.0	3.3	8.7	0.1	172888.0
659.9	517.1	142.8	122.3	80.2	6.0	0.430	0.116	1.60	156714.7	13.6	5411.3	9.4	16510.7	3.8	7.7	0.5	178859.7
586.0	468.2	119.9	113.8	51.6	4.5	0.346	0.136	0.66	183238.3	15.5	3605.4	9.8	5164.5	3.8	53.4	0.4	189016.7
662.5	513.8	148.8	94.9	145.7	3.9	0.152	0.019	0.99	361954.7	16.3	8116.6	9.6	2975.0	3.8	14.3	0.1	372868.5
665.0	475.1	189.9	70.4	104.2	6.2	0.135	0.014	1.63	298395.2	16.8	3451.2	8.1	5559.4	4.7	55.5	0.3	307443.8
1640.5	1034.6	917.8	179.8	96.1	62.7	0.555	0.165	16.07	5568.7	2.5	1085.2	15.4	262.6	2.4	48.5	0.8	6960.7
713.0	541.6	170.8	123.6	38.9	1.3	0.395	0.242	0.68	10292.4	7.8	4546.4	16.5	1099.2	4.3	42.9	0.7	15964.1
792.0	660.6	131.3	166.2	119.2	4.1	1.055	0.413	1.94	221636.2	14.1	6038.5	8.3	1963.4	4.5	7.2	0.4	200067.4
656.6	321.1	362.6	57.5	63.1	22.2	0.259	0.084	5.23	19413.9	10.3	1338.7	11.7	572.8	4.2	14.0	0.9	21335.4
613.3	248.1	365.2	106.4	23.6	7.4	0.269	0.092	--	3589.3	7.0	1204.7	16.5	154.5	5.0	7.8	0.5	4956.2
843.3	463.5	379.8	71.9	66.9	26.7	0.225	0.074	8.57	19244.0	10.2	2228.7	18.6	542.1	3.8	21.7	0.7	22036.5
1650.9	814.1	836.1	111.1	72.8	30.1	0.419	0.119	16.12	24449.7	12.0	2423.9	11.2	1135.4	4.4	0.0	0.0	28009.1
752.2	419.5	332.7	90.1	75.2	14.6	0.208	0.044	0.02	22012.6	12.0	2321.6	12.3	2518.4	5.5	17.1	0.5	26869.6
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119.1	100.9	18.2	76.2	17.1	0.3	0.178	0.060	--	7026.4	12.5	1823.7	11.5	409.5	7.0	10.6	0.5	9270.3
948.2	726.2	226.2	164.1	75.7	1.2	0.505	0.212	1.02	51491.9	13.5	3625.6	12.8	936.9	5.0	11.7	0.4	56066.4
955.2	692.1	266.2	95.1	79.9	4.3	0.264	0.109	2.22	100950.7	16.7	5662.5	9.4	1311.2	5.0	9.4	0.2	107933.8
351.7	272.2	79.5	71.5	66.2	5.7	0.178	0.068	0.38	179762.6	14.3	5723.3	8.2	1982.8	2.2	24.8	0.7	187493.4
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826.8	297.7	529.1	105.3	27.3	16.6	0.374	0.103	--	1726.2	5.0	1172.9	20.3	392.2	5.3	10.6	0.7	3301.9
912.1	388.0	524.0	82.5	80.0	19.1	0.305	0.080	4.92	6547.4	10.0	1959.2	20.9	169.1	3.3	11.3	0.6	8687.1
599.4	339.0	260.6	52.4	43.3	18.6	0.158	0.028	4.21	17883.8	16.1	767.7	12.4	381.4	5.2	4.8	0.3	19037.0
265.1	148.9	116.3	29.5	69.1	14.1	0.083	0.014	1.77	53924.0	15.9	1252.8	9.8	736.9	4.6	16.1	0.3	55929.8
1238.8	512.4	726.5	102.8	154.9	53.0	0.635	0.168	--	134212.4	16.0	4036.3	9.7	4518.0	5.0	0.0	0.0	142766.7
190.0	163.1	26.9	81.1	25.6	0.2	0.238	0.035	--	8048.2	9.3	2231.7	9.3	408.7	5.7	3.1	0.3	10691.7
562.2	432.2	130.1	117.2	55.8	0.4	0.400	0.096	0.80	42635.8	12.8	3068.0	11.7	573.6	3.4	0.0	0.0	46277.4
772.5	602.2	170.9	124.7	66.6	1.1	0.529	0.139	0.67	44654.5	15.2	2959.9	10.7	509.3	2.6	11.9	0.2	48131.7
634.4	533.0	101.4	251.4	143.1	1.6	0.501	0.172	0.86	181727.1	11.9	5547.9	7.9	74373.7	4.1	0.0	0.0	260711.8
968.9	883.0	85.8	148.2	68.1	2.3	2.580	0.313	--	302132.0	17.0	7788.1	9.8	1106.8	2.2	0.0	0.0	311026.9
160.2	136.3	23.9	93.9	26.9	0.3	0.232	0.077	--	10241.7	4.7	1929.0	11.7	387.5	3.7	2.9	0.7	12561.1
808.7	624.5	184.1	145.9	41.5	3.5	0.481	0.150	0.81	43889.5	12.9	2236.2	10.9	583.6	4.6	7.4	0.3	46708.3
907.2	680.5	226.7	116.2	62.4	8.4	0.414	0.135	3.23	49572.1	15.6	2106.4	9.3	1013.7	4.0	6.7	0.3	52696.6
418.0	341.0	77.0	87.4	104.7	8.1	0.246	0.067	0.77	156912.1	13.1	4788.3	7.4	62002.0	3.4	8.6	0.7	224590.7
678.3	565.2	113.0	162.6	154.7	5.6	0.753	0.131	--	559606.6	16.7	17806.9	9.3	3471.2	2.8	0.0	0.0	580684.7
102.2	86.8	15.4	48.1	11.2	5.6	0.132	0.041	--	12484.9	10.7	1825.2	14.3	171.1	5.3	3.8	0.3	14485.0
722.1	581.0	141.5	138.6	60.4	6.8	0.446	0.189	0.69	55832.2	15.7	4238.2	14.0	895.2	3.8	8.6	0.4	60970.3
859.2	659.8	199.4	104.6	10.0	3.7	0.338	0.184	0.84	30179.5	15.1	1053.3	9.2	1020.6	3.4	27.3	0.6	32273.2
397.4	329.4	68.1	101.5	77.9	4.4	0.303	0.082	0.55	325921.1	16.0	3386.5	6.8	12938.8	4.1	1.0	0.1	330113.1
463.7	378.7	85.0	141.6	88.6	2.3	0.381	0.112	--	475288.0	17.3	7702.7	6.8	8619.5	2.8	212.5	0.3	491822.6
46.5	36.3	10.2	39.6	13.2	0.4	0.082	0.011	--	18421.0	6.0	2242.0	15.0	1428.4	8.0	0.0	0.0	22091.4
421.6	321.7	99.9	43.5	84.3	0.9	0.163	0.017	1.19	88203.0	18.7	8426.7	14.0	2838.8	6.0	0.0	0.0	99468.5
1141.6	830.3	311.3	127.5	259.9	4.3	0.290	0.024	0.62	429850.4	17.3	8024.1	7.7	7127.3	5.3	0.0	0.0	445001.8
454.0	340.2	113.8	78.6	133.0	3.8	0.147	0.002	0.26	394940.2	17.7	6907.7	8.3	161.7	2.3	0.0	0.0	402009.7
430.0	362.1	67.9	103.4	116.5	0.0	0.121	0.016	--	338417.5	17.0	11179.3	11.5	2568.7	1.0	0.0	0.0	352165.4
46.2	32.0	14.1	43.5	12.4	4.6	0.048	0.008	--	8133.5	10.0	3527.3	15.0	627.7	1.0	0.0	0.0	12288.5
725.3	508.4	216.8	52.0	80.5	12.4	0.205	0.025	1.12	170976.1	17.0	5821.1	12.3	10956.8	5.7	227.4	1.0	187829.9
838.6	594.6	244.0	73.3	107.2	4.6	0.112	0.007	3.29	152968.0	17.3	2260.1	5.7	4487.8	6.0	57.6	0.5	159754.3
623.4	467.2	156.1	107.1	181.3	0.2	0.110	0.012	0.47	852795.3	19.0	1645.0	2.0	1536.5	3.0	0.0	0.0	855976.8
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1697.7	575.2	1122.5	250.8	22.4	0.3	0.593	0.187	--	10691.3	2.0	1795.5	13.0	298.8	5.0	0.0	0.0	12785.6
1878.1	788.3	1089.7	177.0	100.7	64.5	0.637	0.116	23.68	191.1	0.7	883.9	21.3	188.6	1.3	2.4	0.3	1265.9
1531.1	1689.4	782.4	161.0	74.5	51.1	0.565	0.150	8.47	3329.6	2.7	605.8	15.0	92.7	2.0	29.6	1.3	4057.7
699.1	313.4	375.6	160.0	36.1	31.7	0.305	0.141	--	5127.4	2.0	429.2	12.0	62.1	1.5	26.3	1.0	5631.9
2415.9	1045.1	1370.7	196.4	229.4	145.3	0.645	0.274	--	14873.9	5.5	2407.2	11.5	811.1	4.0	181.3	1.0	18273.5
224.7	198.1	26.6	120.5	13.8	0.4	0.293	0.241	--	3938.7	6.0	1623.4	15.0	258.0	5.0	0.0	0.0	5820.1
855.2	584.4	268.9	98.3	26.0	1.3	0.332	0.158	1.17	6890.6	8.3	3466.1	18.7	1061.6	5.7	0.0	0.0	11418.4
734.2	561.5	172.7	84.3	17.2	3.5	0.288	0.159	0.96	5648.6	9.0	1854.2	16.3	495.6	4.3	14.5	0.3	8012.9
338.0	241.4	96.7	52.4	28.2	0.2	0.143	0.079	0.29	13650.8	8.0	3280.8	13.0	414.5	3.3	41.4	1.0	17387.6
1274.3	1069.8	204.5	328.7	119.2	0.4	1.080	0.739	--	20500.0	6.0	13565.1	19.5	3508.6	3.5	145.2	1.0	37646.3
210.5	182.9	27.6	103.4	15.5	0.2	0.331	0.131	--	3391.3	9.0	583.9	15.0	136.5	6.0	9.8	1.0	4121.5
691.3	587.4	103.9	138.7	15.6	3.1	0.603	0.397	0.76	6821.9	11.3	958.2	6.7	196.7	4.0	0.0	0.0	7976.9
663.7	523.4	140.2	109.4	73.0	1.3	0.438	0.207	0.86	48838.8	13.0	3705.7	7.3	434.3	4.7	19.3	0.7	52998.1
911.0	801.2	109.7	202.7	150.5	7.1	2.781	1.244	0.39	334748.5	14.3	8321.6	6.7	271.4	2.3	2.2	0.3	343343.7
895.5	794.9	100.6	281.4	98.0	9.7	1.778	0.229	--	280018.4	14.0	10546.6	11.0	2314.4	4.5	0.0	0.0	54676.1
915.4	320.6	594.7	113.5	24.4	3.6	0.308	0.124	--	1214.4	3.0	733.3	21.0	93.4	5.0	26.6	1.0	2067.6
1474.1	571.9	901.3	112.7	52.0	6.7	0.377	0.155	19.02	7254.2	8.3	1259.7	17.7	106.1	1.7	27.1	1.0	8647.1
566.2	346.0	220.2	48.2	39.4	9.2	0.151	0.020	1.73	27278.0	14.3	1782.6	7.7	905.0	4.3	21.7	0.8	29983.0
203.3	124.4	79.1	16.8	48.2	12.7	0.067	0.012	0.03	22598.0	12.0	553.1	9.0	214.4	3.0	0.7	1.0	23365.7
255.0	130.3	124.6	23.4	37.7	39.6	0.144	0.037	--	18073.2	6.5	1739.1	9.5	684.3	4.5	0.0	0.0	20496.7

1526.0	695.8	829.9	138.9	156.7	76.5	0.487	0.178	8.57	7793.6	8.3	2822.6	21.3	443.2	4.0	53.1	1.3	11112.4
520.0	329.0	191.0	28.3	25.3	9.5	0.110	0.026	--	3879.9	8.3	1082.0	18.0	261.7	3.7	12.0	0.7	5235.7
573.9	390.2	183.7	48.5	30.8	2.4	0.077	0.018	--	46058.5	14.0	2781.5	16.3	921.5	3.7	0.0	0.0	49761.4
1117.4	617.0	500.4	108.0	87.6	36.4	0.260	0.066	--	26393.6	12.7	3015.5	13.7	859.3	5.0	0.0	0.0	30268.3
1822.6	864.8	957.8	115.3	57.2	26.0	0.585	0.197	16.12	25840.8	13.3	2028.3	10.0	940.0	3.3	0.0	0.0	28809.1
2012.6	960.5	1050.0	109.9	73.7	28.0	0.412	0.095	--	21114.6	10.0	2228.1	10.0	1607.0	5.0	0.0	0.0	24949.7
1000.4	558.1	442.2	119.5	98.7	19.4	0.275	0.058	--	28673.5	13.7	2750.3	13.0	3245.8	5.7	20.6	0.3	34690.1
7.6	3.6	4.0	1.8	4.9	0.0	0.007	0.001	0.02	2029.8	7.0	1035.5	10.0	336.0	5.0	6.8	1.0	3408.1
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119.1	100.9	18.2	76.2	17.1	0.3	0.178	0.080	--	7026.4	12.5	1823.7	11.5	409.5	7.0	10.6	0.5	9270.3
789.5	475.0	312.2	72.5	32.8	0.7	0.230	0.185	1.02	21202.9	11.0	3737.0	14.0	545.7	5.0	11.0	0.5	25496.7
543.6	445.2	98.3	83.4	29.5	0.4	0.263	0.137	--	37138.0	12.7	2673.4	11.7	187.1	2.7	19.1	0.3	40017.7
1458.8	1174.6	296.8	305.7	150.6	2.5	0.930	0.306	--	86038.5	16.0	4504.1	13.0	1947.5	7.3	4.8	0.3	92494.9
836.1	663.7	181.6	125.6	122.1	2.7	0.299	0.140	--	142815.9	17.7	12863.6	10.7	1294.9	6.3	28.3	0.7	157002.5
777.9	628.6	149.3	97.1	41.8	6.1	0.282	0.099	2.22	82665.0	15.0	1974.5	6.7	1630.2	4.0	0.0	0.0	86269.7
1251.6	783.9	467.7	62.6	75.8	4.1	0.211	0.089	--	77371.3	17.3	2149.5	11.0	1008.4	4.7	0.0	0.0	80529.2
475.5	362.4	113.2	47.9	12.4	0.8	0.070	0.035	--	19935.2	12.0	821.3	8.7	168.9	3.0	49.5	1.3	20974.9
227.8	182.1	45.8	95.1	120.1	10.5	0.286	0.101	0.38	339590.0	16.7	10625.3	7.7	3796.6	1.3	0.0	0.0	354011.8
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826.8	297.7	529.1	105.3	27.3	16.6	0.374	0.103	--	1726.2	5.0	1172.9	20.3	392.2	5.3	10.6	0.7	3301.9
1241.1	490.9	750.2	71.8	117.5	31.4	0.336	0.121	4.92	5407.5	8.3	3051.5	22.3	344.2	5.0	8.1	0.3	8811.3
521.5	248.8	272.7	77.1	74.2	14.3	0.212	0.029	--	5153.4	11.3	1864.2	23.7	42.9	2.3	14.1	0.7	7074.7
973.7	424.5	549.2	98.6	48.2	11.6	0.355	0.076	--	9081.4	10.3	961.9	16.7	120.3	2.7	11.7	0.7	10175.3
708.7	363.0	346.6	76.0	56.6	18.6	0.238	0.044	--	12860.1	15.0	1176.3	17.0	424.7	5.3	0.0	0.0	14461.1
491.2	333.5	157.6	46.1	36.5	25.3	0.127	0.021	4.21	18728.4	16.3	608.9	12.0	340.2	6.3	7.3	0.3	19684.8
598.4	320.6	277.4	35.1	36.8	11.8	0.109	0.021	--	22062.8	17.0	518.0	8.3	379.4	4.0	4.8	0.3	22965.0
446.6	247.2	199.4	45.7	52.6	14.3	0.121	0.019	--	21184.6	14.0	878.7	9.3	502.2	6.0	34.3	0.3	22599.8
124.8	70.6	54.1	21.3	100.5	7.0	0.038	0.007	1.77	82154.5	19.0	1851.5	11.5	960.1	3.0	0.0	0.0	84966.0
177.3	102.7	74.5	18.9	64.7	18.7	0.075	0.015	--	67843.0	15.8	1227.8	9.2	822.8	4.3	8.6	0.3	69902.2
1247.5	463.4	784.2	100.0	196.0	37.5	0.492	0.162	--	156241.0	17.3	2256.4	5.3	6556.8	3.0	0.0	0.0	165054.2
1230.1	561.3	668.8	105.7	113.7	68.6	0.778	0.175	--	112183.9	14.7	5816.3	14.0	2479.2	7.0	0.0	0.0	120479.3
190.0	163.1	26.9	81.1	25.6	0.2	0.238	0.035	--	8048.2	9.3	2231.7	9.3	408.7	5.7	3.1	0.3	10691.7
482.8	313.4	169.5	65.3	39.1	0.7	0.252	0.173	0.80	17890.8	13.0	3869.8	12.3	202.9	4.3	0.0	0.0	21963.5
425.1	329.1	96.0	120.4	77.5	0.2	0.310	0.109	--	43913.8	13.3	3409.0	11.7	771.5	2.7	0.0	0.0	48094.3
778.8	654.2	124.7	166.0	50.8	0.2	0.640	0.005	--	66102.8	12.0	1925.1	11.0	746.3	3.3	0.0	0.0	68774.3
876.7	722.0	155.0	203.3	91.6	1.1	0.678	0.062	--	53935.7	15.3	5727.1	11.3	804.6	3.7	0.0	0.0	60467.5
660.3	561.2	99.1	107.0	21.8	1.7	0.534	0.147	0.67	32516.5	13.3	1749.0	11.3	306.9	2.7	23.9	0.3	34596.2
780.6	523.3	258.5	63.7	86.6	0.5	0.375	0.208	--	47511.4	17.0	1403.6	9.3	416.3	1.3	0.0	0.0	49331.3
549.5	420.9	128.6	101.5	70.4	0.2	0.283	0.099	--	61023.6	12.7	2691.7	9.3	283.9	2.3	0.0	0.0	63999.2
976.4	867.0	109.4	424.9	205.5	0.0	0.824	0.394	1.29	456628.5	14.0	10103.2	8.2	1442.6	1.7	0.0	0.0	468174.3
377.4	311.1	66.3	112.0	153.4	4.7	0.396	0.025	0.14	27529.1	9.0	3848.8	6.2	221394.8	8.3	0.0	0.0	249961.9
392.3	335.0	57.3	106.0	76.9	0.0	0.279	0.275	--	275597.7	16.7	6483.1	9.3	713.8	1.3	0.0	0.0	282794.7
1545.4	1431.0	114.4	179.8	59.4	4.6	4.306	0.341	--	328666.2	17.3	9093.2	10.3	1499.7	3.0	0.0	0.0	339259.2
190.0	163.1	26.9	81.1	25.6	0.2	0.238	0.035	--	8048.2	9.3	2231.7	9.3	408.7	5.7	3.1	0.3	10691.7
482.8	313.4	169.5	65.3	39.1	0.7	0.252	0.173	0.80	17890.8	13.0	3869.8	12.3	202.9	4.3	0.0	0.0	21963.5
425.1	329.1	96.0	120.4	77.5	0.2	0.310	0.109	--	43913.8	13.3	3409.0	11.7	771.5	2.7	0.0	0.0	48094.3
778.8	654.2	124.7	166.0	50.8	0.2	0.640	0.005	--	66102.8	12.0	1925.1	11.0	746.3	3.3	0.0	0.0	68774.3
876.7	722.0	155.0	203.3	91.6	1.1	0.678	0.062	--	53935.7	15.3	5727.1	11.3	804.6	3.7	0.0	0.0	60467.5
660.3	561.2	99.1	107.0	21.8	1.7	0.534	0.147	0.67	32516.5	13.3	1749.0	11.3	306.9	2.7	23.9	0.3	34596.2
780.6	523.3	258.5	63.7	86.6	0.5	0.375	0.208	--	47511.4	17.0	1403.6	9.3	416.3	1.3	0.0	0.0	49331.3
549.5	420.9	128.6	101.5	70.4	0.2	0.283	0.099	--	61023.6	12.7	2691.7	9.3	283.9	2.3	0.0	0.0	63999.2
976.4	867.0	109.4	424.9	205.5	0.0	0.824	0.394	1.29	456628.5	14.0	10103.2	8.2	1442.6	1.7	0.0	0.0	468174.3
377.4	311.1	66.3	112.0	153.4	4.7	0.396	0.025	0.14	27529.1	9.0	3848.8	6.2	221394.8	8.3	0.0	0.0	249961.9
392.3	335.0	57.3	106.0	76.9	0.0	0.279	0.275	--	275597.7	16.7	6483.1	9.3	713.8	1.3	0.0	0.0	282794.7
1545.4	1431.0	114.4	179.8	59.4	4.6	4.306	0.341	--	328666.2	17.3	9093.2	10.3	1499.7	3.0	0.0	0.0	339259.2
102.2	86.8	15.4	48.1	11.2	5.6	0.132	0.041	--	12484.9	10.7	1825.2	14.3	171.1	5.3	3.8	0.3	14485.0
340.3	263.3	76.9	50.2	28.3	0.2	0.182	0.105	0.69	30265.9	15.3	3161.5	14.0	731.8	4.3	8.7	0.3	34167.8
907.6	734.3	174.5	198.1	83.6	4.8	0.692	0.415	--	79733.4	15.0	4970.7	15.0	864.3	3.3	0.0	0.0	85568.5
918.3	745.3	173.0	167.7	69.2	15.4	0.465	0.047	--	57497.4	16.7	4582.3	13.0	1089.4	3.7	5.7	0.3	63174.8
1167.1	987.6	179.4	212.6	9.5	5.7	0.819	0.411	--	21896.9	13.7	914.1	8.7	1549.6	3.3	6.1	0.3	24366.7
548.9	451.1	97.8	53.2	10.6	4.0	0.140	0.079	0.84	41178.2	15.7	1149.8	7.7	655.7	4.7	35.6	0.3	43019.3
965.0	610.3	354.7	48.0	9.8	1.2	0.122	0.062	--	27463.5	16.0	1096.0	11.3	856.4	2.3	17.7	0.7	29433.7
388.3	303.9	84.3	68.0	12.6	0.2	0.186	0.104	--	24262.8	16.3	574.4	8.0	166.5	3.7	3.0	0.3	25131.9
599.3	517.6	81.7	170.9	163.9	1.2	0.420	0.129	0.96	830728.5	15.0	7196.9	5.0	1155.5	1.7	0.0	0.0	839080.9
204.7	166.6	38.2	65.7	57.1	11.8	0.304	0.013	0.14	122772.0	16.7	2388.3	7.3	37494.4	7.0	0.0	0.0	126126.3
440.3	353.1	87.2	135.0	104.6	0.0	0.272	0.186	--	503507.1	18.7	6401.3	6.3	8525.6	1.3	216.4	0.3	518650.5
487.1	404.3	82.9	148.1	72.5	4.5	0.491	0.037	--	447068.9	16.0	9004.0	7.3	8713.3	4.3	208.5	0.3	464994.8

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.4	[illegible]	0.020	1.19	81320.2	16.0	[illegible]	16.0	1647.4	7.0	0.0	0.0	69722.6
298.8	221.2	77.6	38.3	95.8	0.2	0.168	0.014	--	84484.2	19.0	8846.2	12.0	3333.3	4.0	0.0	0.0	96663.8
359.2	345.4	113.8	49.1	107.4	2.1	0.153	0.012	--	118804.5	21.0	9879.0	14.0	3335.6	7.0	0.0	0.0	132019.0
046.4	805.9	240.5	175.5	421.1	4.5	0.347	0.021	--	164572.6	18.0	6235.8	11.0	2032.9	7.0	0.0	0.0	172841.2
276.6	221.6	55.0	20.2	15.2	4.8	0.097	0.007	0.62	73264.3	15.0	260.1	4.0	1039.6	5.0	0.0	0.0	74564.0
101.8	1463.5	638.3	186.9	343.3	3.6	0.425	0.044	--	1051714.2	19.0	17576.4	8.0	18309.5	4.0	0.0	0.0	1087600.1
247.1	929.7	317.4	209.1	336.0	0.2	0.384	0.003	--	1028089.3	18.0	17994.6	6.0	0.0	0.0	0.0	0.0	1046083.9
61.5	49.5	12.0	12.4	35.6	0.9	0.027	0.002	0.38	80302.9	17.0	1234.3	8.0	342.8	5.0	0.0	0.0	81880.1
53.4	41.5	12.0	14.2	27.4	10.3	0.030	0.002	0.15	76428.5	18.0	1494.2	11.0	142.3	2.0	0.0	0.0	78065.0
370.7	295.4	75.3	85.7	90.2	0.0	0.090	0.019	--	144445.1	20.0	7112.3	12.0	258.6	1.0	0.0	0.0	151816.1
489.3	428.8	60.5	121.0	142.9	0.0	0.152	0.013	--	532389.8	14.0	15246.3	11.0	4878.7	1.0	0.0	0.0	552514.8
46.2	32.0	14.1	43.5	12.4	4.6	0.048	0.008	--	8133.5	10.0	3527.3	15.0	627.7	1.0	0.0	0.0	12288.5
692.6	365.7	326.5	30.4	37.7	3.9	0.112	0.025	1.12	54304.1	11.0	5145.6	13.0	2996.7	11.0	0.0	0.0	62446.4
654.7	510.6	144.1	47.8	53.7	0.4	0.179	0.018	--	161180.3	18.0	5034.7	13.0	1198.9	3.0	0.0	0.0	167413.9
828.8	648.8	179.9	77.9	150.2	32.8	0.323	0.034	--	297444.0	22.0	7263.1	11.0	28674.8	3.0	227.4	1.0	333629.3
738.9	572.2	166.7	81.1	167.4	8.0	0.073	0.006	--	116662.3	18.0	5739.1	10.0	8368.7	7.0	0.0	0.0	130770.1
632.9	489.4	143.6	60.2	52.6	1.2	0.146	0.009	3.29	162819.1	20.0	466.2	3.0	2911.6	5.0	0.0	0.0	166196.8
144.1	722.2	421.9	78.7	101.5	4.8	0.119	0.005	--	179422.7	14.0	574.9	4.0	2183.1	6.0	115.1	1.0	182295.6
787.4	588.7	198.7	117.7	204.6	0.4	0.191	0.015	--	466239.7	21.0	2601.4	3.0	3073.1	6.0	0.0	0.0	471914.1
459.3	345.8	113.6	96.5	157.9	0.0	0.030	0.008	0.47	1239350.9	17.0	688.6	1.0	0.0	0.0	0.0	0.0	1240039.5
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697.7	575.2	1122.5	250.8	22.4	0.3	0.593	0.187	--	10691.3	2.0	1795.5	13.0	298.8	5.0	0.0	0.0	12785.6
084.9	860.1	1224.8	167.1	200.9	129.6	0.664	0.250	23.68	0.0	0.0	560.1	21.0	7.1	1.0	7.1	1.0	574.3
817.2	1119.6	1697.5	296.2	72.2	34.0	1.085	0.052	--	0.0	0.0	853.1	19.0	0.0	0.0	0.0	0.0	853.1
732.1	385.2	346.9	67.6	29.0	30.1	0.162	0.046	--	573.3	2.0	1238.4	24.0	558.7	3.0	0.0	0.0	2370.4
126.8	941.4	1185.4	198.0	59.6	46.2	0.641	0.214	--	5600.8	2.0	488.1	14.0	0.0	0.0	18.8	1.0	6107.8
229.2	2558.8	551.9	163.1	91.8	56.0	0.496	0.163	8.47	3140.1	3.0	790.8	17.0	168.1	3.0	50.2	1.0	4149.2
539.2	698.7	840.5	121.8	54.8	46.2	0.559	0.073	--	1247.8	3.0	538.6	14.0	109.9	3.0	19.9	2.0	1916.1
309.5	567.0	722.3	162.0	67.5	61.8	0.565	0.262	--	72.2	1.0	224.8	12.0	45.2	2.0	0.0	0.0	342.2
88.8	59.8	29.0	158.1	4.7	1.6	0.046	0.020	--	10182.6	3.0	633.6	12.0	79.0	1.0	26.3	1.0	10921.6
298.6	1825.1	2473.5	331.3	442.7	259.3	1.027	0.451	--	27300.0	9.0	4589.9	14.0	1491.5	5.0	343.9	1.0	33725.2
533.2	265.2	268.0	61.4	16.2	31.3	0.263	0.097	--	2447.8	2.0	224.4	9.0	130.8	3.0	18.7	1.0	2821.7
224.7	198.1	26.6	120.5	13.8	0.4	0.293	0.241	--	3938.7	6.0	1623.4	15.0	258.0	5.0	0.0	0.0	5820.1
308.5	729.4	573.5	93.7	27.9	0.4	0.353	0.259	1.17	14702.9	9.0	4535.6	15.0	1608.2	4.0	0.0	0.0	20846.7
551.5	445.7	105.8	79.7	24.3	0.4	0.251	0.054	--	3695.7	9.0	4567.5	21.0	1191.3	8.0	0.0	0.0	9454.6
705.5	578.1	127.4	121.5	25.9	3.2	0.391	0.162	--	2273.2	7.0	1295.3	20.0	385.4	5.0	0.0	0.0	3954.0
830.4	707.9	122.5	154.5	19.6	2.2	0.560	0.341	--	3408.0	11.0	1678.5	18.0	583.3	7.0	0.0	0.0	5669.8
544.6	446.4	98.2	51.1	6.0	4.0	0.136	0.047	0.96	3481.3	11.0	474.9	14.0	203.9	4.0	0.0	0.0	4160.0
827.4	530.2	297.2	47.4	25.9	4.2	0.169	0.089	--	10056.4	5.0	3409.3	17.0	699.5	2.0	43.5	1.0	14208.8
672.0	465.1	207.0	107.5	28.6	0.3	0.337	0.209	--	17004.0	8.0	4912.0	13.0	0.0	0.0	0.0	0.0	21916.0
63.2	52.1	11.1	12.8	41.8	0.0	0.035	0.012	0.42	23247.4	13.0	4525.9	14.0	617.2	4.0	0.0	0.0	28390.6
278.9	207.0	71.9	37.0	14.1	0.3	0.056	0.015	0.15	700.9	3.0	404.6	12.0	626.3	6.0	124.3	3.0	1856.2
190.2	998.0	192.2	310.5	124.2	0.4	0.804	0.685	--	10094.4	6.0	7540.3	18.0	1069.0	3.0	0.0	0.0	18703.7
358.5	1141.7	216.8	346.8	114.2	0.4	1.355	0.792	--	30905.5	6.0	19589.9	21.0	5948.3	4.0	145.2	1.0	56588.9
210.5	182.9	27.6	103.4	15.5	0.2	0.331	0.131	--	3391.3	9.0	583.9	15.0	136.5	6.0	9.8	1.0	4121.5
383.8	310.5	73.3	47.4	8.3	0.3	0.186	0.138	0.76	6313.7	11.0	1114.2	11.0	245.0	5.0	0.0	0.0	7672.9
191.1	1034.5	156.6	284.1	24.8	0.2	1.249	0.853	--	4447.5	11.0	789.3	7.0	175.6	2.0	0.0	0.0	5412.4
499.0	417.3	81.7	84.7	13.9	8.9	0.375	0.199	--	9704.6	12.0	971.1	8.0	169.7	5.0	0.0	0.0	10845.4
052.5	896.3	156.2	229.0	194.1	0.2	0.954	0.504	--	109369.4	17.0	8585.2	7.0	924.2	4.0	0.0	0.0	118878.8
390.9	322.6	68.3	59.9	12.3	1.1	0.199	0.085	0.86	18662.5	10.0	1554.8	9.0	263.8	7.0	29.2	1.0	20510.3
547.6	351.5	196.1	39.4	12.5	2.5	0.162	0.031	--	18484.6	12.0	977.1	6.0	114.9	3.0	28.6	1.0	19605.2
282.0	217.8	64.2	34.6	11.0	0.2	0.036	0.018	--	5879.4	14.0	866.2	10.0	125.6	6.0	6.6	1.0	6877.8
229.9	1118.7	111.2	539.6	244.9	0.1	6.945	3.360	0.39	623806.7	17.0	17213.4	6.0	688.6	1.0	0.0	0.0	641708.7
220.9	1067.2	153.7	118.3	195.5	21.1	1.363	0.354	--	374559.4	12.0	6885.4	4.0	0.0	0.0	0.0	0.0	381444.8
679.4	591.7	87.7	177.1	75.8	0.0	1.776	0.338	--	50820.9	16.0	5237.2	12.0	969.8	7.0	0.0	0.0	57027.8
111.6	998.2	113.4	385.7	120.2	19.4	1.781	0.119	--	509215.8	12.0	15856.1	10.0	3659.0	2.0	0.0	0.0	52324.4
915.4	320.6	594.7	113.5	24.4	3.6	0.308	0.124	--	1214.4	3.0	733.3	21.0	93.4	5.0	26.6	1.0	2067.6
970.4	1057.1	1910.4	194.8	53.9	7.8	0.667	0.336	19.02	46.9	1.0	315.1	19.0	5.8	1.0	17.5	2.0	385.3
571.0	264.9	306.1	59.5	63.4	0.2	0.181	0.054	--	15222.6	15.0	2324.3	19.0	286.7	2.0	63.8	1.0	17897.5
881.0	393.7	487.3	83.9	38.7	12.1	0.285	0.075	--	6493.0	9.0	1139.8	15.0	25.8	2.0	0.0	0.0	7658.7
561.7	349.0	212.7	65.6	33.2	11.4	0.158	0.029	--	17289.2	12.0	1687.5	7.0	494.6	2.0	0.0	0.0	19471.4
371.6	258.5	113.1	31.3	53.1	9.3	0.129	0.018	1.73	44980.6	18.0	2094.0	10.0	1570.5	7.0	52.2	2.0	48697.3
765.3	430.5	334.8	47.8	31.9	6.9	0.167	0.014	--	19564.3	13.0	1566.3	6.0	649.8	4.0	0.0	0.0	21780.4
340.3	208.0	132.3	33.6	66.8	12.9	0.122	0.016	--	47460.8	12.0	825.7	2.0	385.9	4.0	0.0	0.0	48672.4
0.4	0.4	0.4	0.1	1.0	0.2	0.002	0.000	0.03	1147.3	11.0	12.3	11.0	2.0	2.0	0.7	1.0	1162.3
269.2	164.8	104.4	--	76.9	24.9	0.076	0.019	--	19185.8	13.0	821.4	14.0	255.1	3.0	0.0	0.0	20262.2
4.3	2.5	1.8	0.3	2.9	0.0	0.006	0.004	--	6821.4	5.0	71.2	5.0	32.3	2.0	0.0	0.0	6924.8
505.6	258.1	247.5	46.6	72.5	79.2	0.283	0.070	--	29325.1	8.0	3407.1	14.0	1336.3	7.0	0.0	0.0	34068.5

EXHIBIT D.1-12

Non-Reactive Phosphorus Data Summary for Porta-PSTA Periphyton, April 1999 - March 2000

Treatmemt	Soil	Date	Moisture %	TP mg/kg	NaHCO3 Pi mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPI mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg	Comments
1	PE	6/15/99	--	320.0	5.46	75.10	69.70	159.9	98.8	86.7	See Footnote
1	PE	10/8/99	95.1	243.1	1.26	58.75	57.49	29.1	52.96	17.75	
1	PE	12/15/99	95.9	203.0	2.10	135.63	133.53	36.3	4.45	33.81	
1	PE	3/15/00	96.2	239.7	2.27	126.71	124.44	99.3	48.5	64.2	
2	SR	10/8/99	90.9	457.1	1.04	53.98	52.94	448.6	-23.13	55.33	
2	SR	12/14/99	93.2	159.2	2.28	59.56	57.27	30.3	-0.90	21.63	
2	SR	3/14/00	94.6	493.9	1.91	80.60	78.69	326.2	15.9	54.1	
3	PE	6/22/99	--	331.5	2.55	60.80	58.30	141.0	33.7	--	See Footnote
3	PE	10/8/99	94.3	246.6	2 43	171.28	168.85	48.8	18.94	35.02	
3	PE	12/15/99	95.4	211.9	2.23	183.65	181.41	41.8	14.25	50.71	
3	PE	12/15/99	96.2	197.2	2.63	160.52	157.89	36.8	-0.98	44.80	
3	PE	3/15/00	94.2	452.8	2.54	239.30	236.77	81.7	65.5	58.4 .	
4	SR	10/8/99	79.6	277.7	0.56	15.23	14.67	265.0	-5.80	16.21	
4	SR	12/13/99	88.5	770.7	1.26	26.18	24.92	336.2	15.09	36.45	
4	SR	12/13/99	83 1	1143.9 .	1.73	9.95	8.22	641.3	-23.71	63.19	
5	SR	10/8/99	92 0	470.6	1.02	58.86	57.84	324.7	-17.16	43.98	
5	SR	12/14/99	92 9	443.9	2.22	97.81	95.59	254.5	7 72	54.94	
5	SR	3/14/00	94 0	452.3	1.66	125.68	124.02	272.5	43.5	43.1	
6	SR	10/8/99	88.5	392.1	0.85	32.64	31.79	290.9	-15.47	30.64	
6	SR	12/13/99	86.8	716.3	1.03	33.93	32.90	336.1	-8.01	30.04	
6	SR	3/13/00	88.7	509.4	1.35	53.17	51.82	362.7	11.9	25.1	
7	SA	10/8/99	72.3	35.2	0.42	21.05	20.63	3.1	10.10	9.88	
7	SA	10/8/99	68.5	35.7	0.35	12.29	11.94	3.4	5.16	5.53	
7	SA	12/13/99	80.2	73.4	0.49	23.63	23.14	0.8	1.90	13.99	
7	SA	3/13/00	92.1	489 4	1.62	81.67	80.05	259.1	32.7	39.8	
7	SA	3/13/00	80.5	84.8	0 74	37.34	36.60	31.4	19.1	14.5	
8	SA	12/14/99	81.3	134.0	0.98	48.19	47.21	14.8	27.42	19.74	
8	SA	3/14/00	88.8	72.9	1.16	109.30	108.15	68.2	47.8	30.6	
9	PE	6/23/99	--	327.6	3.64	53.60	50.00	134.1	-0 1	--	See Footnote
9	PE	10/8/99	96 9	345.3	2.60	186.22	183.62	48.7	3.85	51.29	
9	PE	12/15/99	94.1	130.8	1.70	62.39	60.70	7.2	11.43	17.30	
10	SR	10/8/99	97.0	308.1	2.69	110.30	107.60	60.3	-3.41	39.56	
10	SR	12/13/99	95.0	224.2	1.99	81.50	79.50	47.8	4.70	21.17	
10	SR	3/13/00	86.5	109.0	0.95	47.82	46.87	53.1	21.6	15.0	
11	SR	6/23/99	--	1125.5	1 43	63.30	61.80	290.2	-2.1	--	See Footnote
11	SR	10/6/99	79.8	788.4	0.84	17.72	16.88	697.1	-26.55	100.32	
11	SR	12/14/99	81.0	1181.2	1.01	25.64	24.63	541.0	-9.22	44.72	
11	SR	12/14/99	92.5	446.1	2.98	64.09	61.11	470 7	-33.56	71.47	
11	SR	3/14/00	86.8	525.4	1.09	77.53	76.44	294.9	11.5	29.6	
12	PE	6/23/99	--	316.1	3.60	100.10	96.50	210.9	-94.7	105.0	See Footnote
12	PE	10/8/99	95.4	650.5	4.50	485.58	481.07	100.4	87.92	78.28	

Notes:

From Comment section in Report NO. 99-9

Several problems were encountered in analyzing periphyton samples for reactive and non reactive phosphorus forms

1) Water samples provided to us contained small amounts of periphyton.

2) On a dry weight basis, < 100 mg of sample was available for all analysis.

3) Use of small samples (< 20-mg dry weight basis) in sequential extraction scheme results in serious carryover effects This results in unrealistic values for each of the P fractions.

This problem was reported to Dr. R L. Knight. Recommendation was made to provide a larger sample of bulk periphyton for analysis.

Data reported in Report 99-9 for periphyton P fractionation should be treated with caution. Our recommendation is not to use these data in developing nay conclusions from the experiment.

EXHIBIT D.1-13

Summary of Macrophyte Biomass Data for the Porta-PSTA Treatments, April 1999 - March 2000

	Treatment (Porta-PSTA Mesocosm)																				
	1			2			3			4			5			6			8	11	12
Month	**9**	**11**	**18**	**4**	**7**	**8**	**12**	**14**	**17**	**3**	**5**	**10**	**2**	**13**	**16**	**1**	**6**	**15**	**20**	**23**	**24**
Jul-1999	0	0	0	0	0	0	161	0	43	0	0	0	0	0	0	0	0	0	0	0	0
Aug-1999	0	191	0	0	6	0	221	53	77	0	132	0	0	47	0	0	0	0	0	67	39
Sep-1999	0	0	0	0	0	0	123	149	19	0	3	0	0	0	0	43	0	0	0	0	98
Oct-1999	0	341	0	14	8	0	146	523	346	0	35	13	18	0	0	3	0	60	0	0	180
Nov-1999	0	291	631	146	97	25	680	291	146	0	97	49	25	0	25	0	0	0	25	49	437
Dec-1999	9	44	199	0	35	104	296	175	359	3	52	125	0	47	34	45	0	4	0	269	254
Jan-2000	0	0	0	0	0	0	523	109	240	--	--	--	47	14	45	--	0	--	0	11	237
Feb-2000	0	0	0	0	0	0	112	210	93	5	27	20	58	51	100	0	34	95	0	64	108
Mar-2000	69	131	122	39	0	47	355	171	179	15	6	0	6	0	186	71	0	15	6	338	234
Cell Average	**9**	**111**	**106**	**22**	**17**	**19**	**291**	**187**	**167**	**3**	**44**	**26**	**17**	**18**	**43**	**20**	**4**	**22**	**3**	**89**	**176**
Treatment Average	75			19			215			24			26			15					

Notes:

All values are in units of g dry/m²

sion de	Organism	1			2			3			4			5			6			7	8	9	1
		PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20	PP-21	PP-
4	ACHNANTHES CHILENSIS V SUBAEQUALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	166.1	17
4	ACHNANTHES EXIGUA	--	--	--	--	--	--	--	--	--	--	--	--	9.4	--	--	--	--	--	109.6	116.7	229.6	-
4	ACHNANTHIDIUM MINUTISSIMUM	70.7	200.3	161.9	121.4	37.9	25.2	43.6	182.2	124.7	35.8	63.7	107.0	461.0	146.2	700.3	91.9	924.4	34.9	867.7	1113.3	129.4	28
4	AMPHORA ACUTIUSCULA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	AMPHORA HOLSATICA	--	--	57.7	--	--	14.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15.2	-
4	AMPHORA LINEOLATA?	64.9	194.1	31.8	93.7	150.7	291.9	128.9	40.4	140.8	88.9	998.4	249.4	--	84.1	5.5	50.3	122.5	52.3	--	--	19.6	65
4	AMPHORA OVALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	AMPHORA OVALIS V AFFINIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	29.0	--	--	-
4	AMPHIPLEURA PELLUCIDA	--	--	--	--	--	--	--	14.2	17.7	--	--	--	--	--	--	--	--	--	29.0	--	19.6	-
4	AMPHORA SABINIANA?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	517.3	--	114.8	-
4	AMPHORA VENETA	--	--	30.2	--	--	--	--	--	--	--	--	--	--	421.6	--	--	--	--	158.1	455.5	--	-
1	ANABAENA OSCILLARIOIDES	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4080.5	1554.8	--	-
3	ANKISTRODESMUS FALCATUS	--	--	140.3	--	454.6	--	68.0	25.4	--	17.8	3756.9	121.4	10.6	107.6	220.9	31.2	23.0	25.5	90.2	473.2	17.8	-
3	ANKISTRODESMUS NANNOSELENE	168.5	56.3	35.4	116.9	67.6	47.8	60.7	243.0	167.2	--	369.7	748.3	36.4	161.5	56.3	52.9	70.5	--	29.0	461.8	--	47
3	ANKISTRODESMUS SPIRALIS	37.8	86.9	75.7	64.4	66.0	106.2	26.5	40.9	51.2	50.5	106.8	50.1	237.9	164.0	28.0	59.4	43.7	125.6	125.2	164.0	16.9	35
1	APHANOCAPSA CONFERTA	4541.4	1813.5	--	--	--	--	352.5	--	--	--	--	--	--	5441.3	--	--	84394.1	--	--	--	--	-
1	APHANOCAPSA DELICATISSIMA	825.9	8374.1	1218.6	7423.8	13213.0	2815.7	5000.9	2280.5	10453.0	2077.2	3714.4	8080.4	23158.5	12006.4	9639.4	6752.2	13934.3	19523.4	24356.8	10288.5	--	-
1	APHANOCAPSA ELACHISTA	--	--	--	--	3705.7	--	699.7	--	--	3486.8	--	--	--	--	--	--	--	--	--	--	--	-
1	APHANOCAPSA GREVILLEI	--	--	--	--	--	--	--	8229.2	--	--	--	--	--	--	--	--	3753.5	--	--	--	--	27
1	APHANOCAPSA INCERTA	492.4	--	--	--	9142.5	1511.4	--	--	--	--	--	--	--	--	--	2057.3	--	--	6153.6	--	--	-
1	APHANOCAPSA PLANCTONICA?	--	2553.3	--	--	4088.5	4391.1	595.6	510.2	--	1293.1	2621.8	4948.4	41547.9	669.7	--	1411.5	1085.3	--	20135.8	1837.7	--	47
1	APHANOTHECE CLATHRATA	493.7	--	--	4513.8	6869.5	1498.3	382.6	1612.9	--	6802.8	54531.5	1566.9	22400.2	5226.2	2006.9	1514.6	14240.4	10386.9	4092.3	10923.9	--	-
1	APHANOTHECE MICROSCOPICA	--	--	--	--	--	--	1188.1	407.6	--	--	--	--	--	--	--	--	--	--	--	--	--	-
1	APHANOTHECE NIDULANS	--	--	830.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
1	APHANOTHECE SAXICOLA	--	--	--	--	785.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
1	APHANOTHECE SMITHII	613.7	2246.2	1090.3	3465.6	5662.9	6547.7	1356.5	2599.6	1883.9	19176.2	19778.3	5375.3	6455.3	10486.8	17065.3	22978.4	20983.7	2742.2	11020.2	13956.6	1147.0	161
1	APHANOTHECE STAGNINA	6387.7	1519.0	18681.4	9143.3	18760.1	19201.9	3455.0	3294.1	1573.7	11266.8	8249.7	17419.4	19003.4	19164.4	24988.8	25640.5	36055.3	37042.2	14729.2	22933.9	110.9	205
1	APHANOTHECE STAGNINA?	1601.5	2902.2	4729.6	2465.6	15329.6	1496.3	1399.9	4068.6	792.6	3014.5	2254.9	2949.0	869.7	2036.8	3113.4	1333.8	5594.4	1582.0	10124.8	4792.8	--	-
1	APHANOTHECE VARIABILIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2169.2	--	--	-
1	APHANIZOMENON FLOS-AQUAE	612.8	1738.1	--	--	5224.6	--	--	1508.7	--	--	--	6875.5	--	1028.6	--	--	--	316.8	2348.4	7086.3	--	-
1	ARTHROSPIRA GOMONTIANA?	--	--	--	--	--	--	--	--	195.0	--	--	239.5	--	--	455.9	--	--	--	--	--	--	-
1	ARTHROSPIRA GOMONTIANA?	--	--	--	--	11738.4	--	1542.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
1	ARTHROSPIRA JENNERI	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	245.5	--	--	--	--	--	-
1	ARTHROSPIRA TENUIS?	--	--	--	--	--	--	--	--	870.7	--	--	919.3	--	--	--	--	--	--	--	--	--	-
4	AULACOSEIRA ITALICA V TENUISSIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.0	--	--	--	--	--	--	-
1	AULOSIRA LAXA?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	23992.7	--	--	-
4	BACILLARIA PARADOXA	--	--	--	--	--	--	--	68.6	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	BOTRYOCOCCUS SUDETICUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	BRACHYSIRA VITREA	112.3	71.7	58.4	120.4	56.3	--	--	25.9	12.7	--	102.6	--	9.4	--	16.7	--	--	25.5	--	100.1	111.6	53
4	CAPONEA CARIBBEA	--	67.1	--	--	--	--	113.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CHARACIUM ENSIFORME	28.8	--	--	--	--	504.4	--	182.2	--	--	--	--	55.9	--	--	--	--	--	--	--	--	-
3	CHLOROCOCCUM HUMICOLA	123.0	80.6	--	--	264.8	--	--	--	48.8	27.3	267.8	--	5.3	--	--	--	11.3	--	--	--	--	-
1	CHROOCOCCUS DISPERSUS	378.7	1731.7	2364.1	2008.7	4234.2	3465.5	739.9	1558.3	422.9	8338.3	17332.9	1561.0	6308.7	4810.2	8223.2	2049.0	3807.5	3240.9	9976.8	8661.7	--	73
1	CHROOCOCCUS DISPERSUS V MINOR	1076.7	432.1	1335.8	--	1191.6	2534.7	--	416.7	487.0	1060.5	2052.5	2021.8	544.4	1658.1	263.8	6230.2	1895.2	1775.7	10249.8	1798.8	--	241
1	CHROOCOCCUS DISTANS	--	870.0	--	--	--	--	--	--	--	--	294.4	--	56.5	--	--	--	--	--	--	--	--	-
1	CHROOCOCCUS LIMNETICUS	173.8	--	211.5	--	--	158.6	74.3	279.0	97.3	--	--	--	71.9	1114.7	348.7	--	--	678.8	357.6	199.7	--	-
1	CHROOCOCCUS MINUTUS	505.6	119.7	241.2	286.1	1496.1	320.3	364.2	332.6	91.0	2148.2	1226.4	360.5	1525.1	660.2	3934.9	869.4	1133.2	1050.4	5217.0	3405.6	36.8	11
1	CHROOCOCCUS MINIMUS	335.8	2017.0	2245.3	3749.8	14716.2	1789.4	802.2	1330.9	1265.4	1469.5	6941.6	2290.4	5428.0	3255.9	3997.3	5215.6	6382.3	5343.5	11060.5	14803.7	5735.2	64
1	CHROOCOCCUS PLANCTONICUS	--	--	--	--	--	--	--	485.9	--	--	--	--	--	898.1	--	687.7	1109.3	--	--	--	--	-
1	CHROOCOCCUS PRESCOTTII	--	--	--	--	452.5	--	906.9	--	--	--	--	--	201.3	234.5	55.9	--	6752.1	453.9	7930.2	2598.9	--	72
1	CHROOCOCCUS TURGIDUS	63.1	142.6	145.4	233.0	312.5	228.0	225.9	160.3	55.7	51.9	156.8	183.3	283.5	682.7	--	139.3	384.9	104.5	254.7	570.3	--	11
3	CLOSTERIUM ACEROSUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CLOSTERIUM ACUTUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CLOSTERIUM DIANAE	--	--	--	--	--	--	22.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CLOSTERIUM INCURVUM	--	--	--	--	--	--	113.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CLOSTERIUM LUNULA V MASSARTII	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	CLOSTERIUM PARVULUM	--	--	--	--	--	121.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	COCCONEIS PLACENTULA	--	--	--	--	--	--	--	--	14.1	--	--	--	--	--	--	--	--	--	--	--	--	-
4	COCCONEIS PLACENTULA V EUGLYPTA	--	--	--	--	--	--	--	--	15.5	--	--	--	--	--	--	--	--	--	--	--	--	-
4	COCCONEIS PLACENTULA V LINEATA	8.4	26.9	--	--	--	--	--	25.9	449.4	--	--	--	19.6	60.7	--	--	--	--	29.0	--	74.8	14
1	COELOSPHAERIUM KUETZINGIANUM	--	--	--	--	--	--	--	--	--	--	--	1276.9	--	--	--	--	--	--	--	--	--	-
3	COELASTRUM MICROPORUM	--	--	447.2	--	226.9	--	92.2	--	--	--	--	--	2160.6	--	--	--	1834.2	--	29.0	--	--	20
3	COELASTRUM SPHAERICUM	89.9	421.6	--	--	214.3	75.5	--	--	--	106.0	--	194.5	78.8	--	29.7	--	92.4	--	1026.3	4878.7	--	23
3	COSMARIUM ANGULOSUM V CONCINNUM	--	13.8	--	--	--	--	--	--	--	--	--	--	--	--	--	50.2	--	27.6	--	29.8	--	-
3	COSMARIUM BACCATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM BLYTTII V HOFFII?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	18
3	COSMARIUM BOTRYTIS	--	--	--	--	--	--	--	--	14.0	--	--	20.5	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM CONTRACTUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	COSCINODISCUS GRANII	--	--	--	--	--	--	--	--	--	243.0	36.6	--	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM GRANATUM	--	--	--	54.4	--	--	--	--	--	--	--	--	--	--	--	68.6	--	--	--	236.2	--	-
3	COSMARIUM IMPRESSULUM	--	--	--	--	--	--	--	--	28.7	--	--	--	--	--	--	--	--	--	--	236.2	--	20
3	COSMARIUM MONILIFORME	--	--	--	--	226.9	--	--	--	--	--	--	--	--	--	--	--	114.9	--	--	--	--	-
3	COSMARIUM NITIDULUM V JAVANICUM	--	--	--	116.9	362.0	--	--	--	--	--	--	--	--	--	--	--	229.1	--	--	--	--	-
3	COSMARIUM ORBICULATUM	--	52.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM ORNATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM ORTHOSTICHUM	--	--	--	--	--	--	--	--	--	--	--	10.4	--	--	--	--	--	--	--	--	--	-
3	COSMARIUM POKORNYANUM	--	--	--	--	--	--	--	--	--	--	--	--	18.1	--	--	--	--	--	--	--	--	-
3	COSMARIUM PORTIANUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	135.4	--	--	-

aston ode	Organism	1			2			3			4			5			6			7	8	9	
		PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20	PP-21	PP
3	COSMARIUM TRILOBULATUM	--	--	--	116.9	--	--	--	25.9	24.3	--	--	--	25.2	51.6	--	--	--	26.0	--	--	--	
3	COSMOCLADIUM TUBURCULATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	COSMARIUM UNDULATUM V MINUTUM	--	--	--	--	--	--	--	--	24.3	--	--	--	--	--	--	--	--	--	--	--	--	
3	COSMARIUM VENUSTUM V EXCAVATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	CRUCIGENIA APICULATA	--	414.8	695.5	--	--	--	--	--	--	111.3	--	--	--	--	--	--	--	--	--	--	--	5
3	CRUCIGENIA CRUCIFERA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	CRUCIGENIA QUADRATA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	CRUCIGENIA TETRAPEDIA	--	133.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
11	CRYPTOMONAS EROSA	15.5	--	--	54.4	--	--	--	103.0	--	--	71.6	--	--	26.6	5.5	--	--	67.2	--	--	--	7
11	CRYPTOMONAS OVATA	--	--	--	--	--	9.2	--	--	14.5	--	--	--	--	--	--	--	--	--	--	115.1	--	5
4	CYCLOTELLA MENEGHINIANA	64.9	25.6	29.6	121.4	22.0	--	19.4	--	297.3	9.2	--	68.8	15.4	55.6	--	35.9	--	--	--	--	15.7	5
4	CYLINDROTHECA CLOSTERIUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25.5	--	--	--	5
1	CYLINDROSPERMUM MINUTUM?	--	--	--	--	--	2446.2	--	--	--	1457.7	--	--	--	--	--	--	--	--	--	--	1376.7	
1	CYLINDROSPERMUM MUSCICOLA?	--	--	--	--	--	--	--	--	--	640.5	--	--	--	--	--	--	--	--	--	--	--	
1	CYLINDROSPERMUM STAGNALE	--	--	--	--	--	--	1920.2	--	7287.1	--	--	--	--	--	--	--	--	4232.2	--	--	--	
4	CYMBELLA ASPERA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14.9	
4	CYMBELLA MICROCEPHALA	18.6	71.2	93.9	60.9	165.1	70.9	206.5	66.8	84.5	27.1	207.9	107.3	418.3	60.7	369.7	95.0	300.6	284.1	391.1	363.5	55.4	14
4	CYMBELLA MINUTA V PSEUDOGRACILIS	154.2	53.7	29.6	77.0	110.5	229.2	24.0	53.2	18.8	84.2	183.9	145.5	372.3	110.5	45.3	270.2	79.9	27.3	128.2	119.8	7.1	
4	DENTICULA KUETZINGII	--	27.2	--	--	--	--	--	--	126.5	--	--	--	--	--	--	--	64.6	--	--	239.6	96.8	2
3	DICTYOSPHAERIUM PULCHELLUM	--	--	55.6	--	--	2429.6	--	--	--	--	--	--	--	--	--	49.2	1294.3	--	--	--	--	
5	DINOBRYON CYLINDRICUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	31.2	--	--	--	--	--	
5	DINOBRYON SERTULARIA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	344.6	--	--	--	--	--	
4	DIPLONEIS ELLIPTICA	--	--	--	--	--	--	--	57.1	5.9	--	--	--	--	--	--	--	11.3	--	--	--	--	
4	DIPLONEIS OBLONGELLA	29.5	66.7	166.0	--	690.5	14.4	245.7	97.3	161.3	121.4	--	129.2	--	37.0	--	76.3	79.9	27.6	71.1	--	109.9	7
4	DIPLONEIS OVALIS	50.8	80.6	49.6	94.9	120.9	98.4	149.6	54.6	88.7	18.3	352.4	64.6	--	161.5	--	34.5	177.4	53.1	609.9	--	27.2	6
4	DIPLONEIS PARMA	--	--	--	--	--	--	--	--	--	--	--	--	9.4	--	--	--	--	--	--	--	--	
4	DIPLONEIS SMITHII	--	--	431.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	ELAKATOTHRIX GELATINOSA	--	--	--	--	227.8	145.2	--	--	--	--	--	--	--	--	168.4	--	47.0	--	--	235.8	--	
4	ENCYONEMA EVERGLADIANUM	241.5	376.8	177.9	702.7	3767.1	1337.8	212.4	247.1	265.1	1242.5	4945.6	1080.0	1853.2	814.9	3158.6	502.5	1973.9	1430.9	1737.6	939.3	109.8	15
4	ENCYONEMA HEBRIDICA	--	--	--	--	--	--	--	14.2	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	ENCYONEMA LUNATUM	113.6	114.9	564.0	--	176.4	45.1	85.5	127.9	164.2	106.0	79.0	140.6	19.6	167.5	23.9	146.0	300.4	25.8	29.0	29.8	149.7	7
4	ENCYONEMA MINUTUM	--	27.2	29.6	--	57.7	--	14.5	--	14.0	--	--	--	--	--	--	36.7	--	--	119.5	--	15.2	
4	ENCYONEMA MUELLERI	--	--	--	--	--	--	--	--	--	--	141.3	--	--	--	--	--	--	--	--	--	--	
4	ENCYONEMA SILESIACUM	28.8	52.5	--	--	--	--	22.5	81.1	14.1	--	--	--	--	--	649.2	36.6	--	53.1	--	--	--	1
4	ENCYONEMA SILESIACUM V ELEGANS	--	33.3	216.1	--	--	121.4	--	60.7	--	--	--	--	--	60.7	1868.9	--	--	609.9	609.9	--	--	13
4	EPITHEMIA ADNATA	--	33.3	--	--	--	--	--	--	--	--	--	--	--	--	--	34.1	--	--	--	--	--	
3	EUASTRUM ABRUPTUM F MINOR	--	--	--	--	--	55.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	EUASTRUM BIDENTATUM	--	--	--	116.9	--	--	--	--	--	115.3	--	--	--	--	--	121.4	--	--	128.2	--	--	
3	EUASTRUM CORNUBIENSE V MEDIANUM	58.6	--	--	79.2	--	--	--	89.5	--	--	--	30.5	350.8	--	--	--	55.2	52.9	52.7	281.6	--	5
3	EUASTRUM TURNERI V STRICTUM	--	--	--	--	--	--	--	75.8	--	--	--	16.2	--	--	--	--	--	--	--	--	--	
1	EUCAPSIS MINOR	--	--	--	--	--	--	--	--	--	--	--	--	--	1877.8	--	--	--	2257.2	--	--	--	
3	EUDORINA ELEGANS	--	--	--	--	--	--	923.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
10	EUGLENA ACUS	--	80.6	--	--	--	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	9.9	
10	EUGLENA OXYURIS V MINOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	EUNOTIA PECTINALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	EUNOTIA PECTINALIS V MINOR	--	--	--	--	--	--	67.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	FRAGILARIA CAPUCINA	--	--	--	120.4	--	--	--	68.6	--	27.7	127.2	--	18.2	--	--	28.4	55.2	--	--	--	--	
4	FRAGILARIA CAPUCINA V GRACILIS	461.7	38.9	--	--	56.3	688.6	--	--	--	76.5	26.2	142.3	--	13.3	110.6	243.3	111.1	--	--	--	19.9	7
4	FRAGILARIA CROTONENSIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	FRAGILARIA DELICATISSIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12.0	--	--	--	--	--	--	2
4	FRAGILARIA FAMELICA	73.8	148.7	119.0	58.3	366.3	267.6	56.2	94.6	80.1	115.3	848.9	125.0	38.8	--	31.9	162.0	160.8	131.1	93.8	49.8	--	4
4	FRAGILARIA FASCICULATA?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	FRAGILARIA NANANA?	648.1	--	--	121.4	609.9	--	113.5	68.6	--	407.8	--	1375.1	993.5	--	609.9	--	--	282.2	340.5	--	--	31
3	FRANCEIA OVALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	28.0	--	--	--	59.4	49.8	--	
4	FRAGILARIA SYNEGROTESCA	263.6	167.4	112.7	104.4	235.1	195.1	146.0	230.2	161.0	207.4	1054.4	367.1	372.9	209.0	1194.9	338.3	350.9	228.8	435.0	390.1	111.5	49
4	FRAGILARIA TENERA	--	--	--	--	--	--	--	28.4	11.8	--	--	--	--	334.9	3.5	--	--	76.9	--	--	--	
4	FRAGILARIA ULNA	--	--	--	--	57.7	--	23.7	25.2	291.4	--	--	28.5	--	--	--	--	--	--	29.0	59.6	12.0	
4	ACHNANTHES SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	AMPHORA SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	ANABAENA SP	--	1185.4	--	765.7	1579.8	1895.6	198.5	551.6	--	--	2701.3	371.4	3842.6	--	1294.5	558.4	6272.3	2417.5	7465.7	2771.8	--	61
1	ANABAENOPSIS SP	--	--	139.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	APHANOCAPSA SP	--	--	--	--	--	--	--	--	6121.1	--	--	--	--	--	--	--	--	13618.3	--	--	--	
1	APHANOTHECE SP	--	--	--	--	3242.2	170.9	855.5	--	--	1132.5	--	--	--	--	--	599.1	906.9	1435.9	--	--	--	15
3	BULBOCHAETE SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
11	CHILOMONAS SP	--	--	--	--	--	--	--	--	--	--	--	--	9.2	--	--	--	--	--	--	--	--	
3	CHLORELLA SP	--	54.8	--	--	--	--	92.2	--	--	--	--	--	9.2	--	--	--	--	--	--	--	--	
3	CHLAMYDOMONAS SP	--	--	--	--	--	21.3	45.2	--	--	--	--	--	--	--	--	54.6	--	--	--	--	--	5
3	CHLOROGONIUM SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.6	--	--	--	--	--	--	
1	CHROOCOCCUS SP	89.9	135.1	--	--	--	--	200.7	104.1	23.6	91.4	--	113.0	54.8	518.1	7.6	--	18177.2	769.3	238.2	--	--	11
11	CHROOMONAS SP	--	--	--	--	--	--	--	--	--	--	--	--	--	13.3	--	--	--	--	--	--	--	12
3	CLOSTERIUM SP	--	--	--	18.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	COSMARIUM SP	56.8	20.4	--	--	226.9	--	--	62.3	--	17.8	26.2	--	--	--	--	--	--	--	29.0	29.8	--	
11	CRYPTOMONAS SP	--	--	--	--	56.8	28.2	--	--	--	--	--	--	--	35.4	--	--	9.1	--	--	--	--	
4	CYCLOTELLA SP	--	--	--	--	--	--	--	--	--	--	--	--	--	13.3	--	--	207.6	--	--	--	--	
1	CYLINDROSPERMUM SP	3006.7	4937.9	2409.8	3920.0	15663.2	11174.0	8081.7	3733.8	15101.1	16116.4	6465.6	10248.6	10471.1	5770.5	10268.2	3330.8	6586.2	8227.9	9281.2	15079.4	996.1	17
4	CYMBELLA SP	--	--	--	--	12.2	--	--	--	23.6	--	--	--	--	--	--	73.7	--	--	--	--	--	
4	DIPLONEIS SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	EUASTRUM SP	--	--	--	--	--	--	21.9	--	--	--	--	--	55.9	--	--	--	--	--	--	--	--	

Division Code	Organism	1			2			3			4			5			6			7	8	9	
		PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20	PP-21	P
3	GLOEOCYSTIS SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	96.4	--	413.0	--	--	--	--	
1	GLOEOTHECE SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	137.1	--	--	--	--	--	
1	GOMPHOSPHAERIA SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	GYROSIGMA SP	56.8	27.7	--	--	--	--	--	14.2	17.7	--	--	--	--	--	--	--	--	25.5	--	--	4186.8	
1	LYNGBYA SP	307.4	--	--	--	245.6	--	11.5	--	--	173.6	1071.6	--	--	14512.1	--	--	113.5	4153.7	1165.6	358.9	--	
1	LYNGBYA SP (MEDIUM)	--	--	--	--	--	--	--	--	--	--	10510.0	--	--	--	--	--	--	2006.0	--	1195.0	--	
1	LYNGBYA SP (SMALL)	--	--	890.8	4615.9	29693.6	5381.3	5550.4	1764.7	187.2	98261.2	20870.7	12032.2	17765.1	5899.6	4571.0	31592.8	4583.6	8432.6	4621.9	22758.0	--	4
3	MESOTAENIUM SP?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	MICROCYSTIS SP	--	--	--	--	--	--	--	--	--	--	684.1	--	--	--	--	--	--	--	--	--	--	
3	MOUGEOTIA SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	34.3	--	--	
4	NAVICULA SP	--	41.0	--	--	--	--	--	--	17.7	--	--	--	5.3	--	--	--	--	--	--	--	--	
4	NAVICULA SP (SMALL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14.9	
4	NITZSCHIA SP	92.5	--	--	--	24.4	42.6	--	28.4	41.6	96.7	187.4	121.6	25.6	111.9	7.6	73.7	11.3	25.5	174.9	209.2	149.7	1
4	NITZSCHIA SP (MEDIUM)	56.8	52.5	29.6	--	--	--	47.6	56.8	--	28.5	--	--	--	--	28.0	54.6	--	--	--	609.9	21.8	3
4	NITZSCHIA SP (SMALL)	37.1	79.1	8.9	--	--	70.5	110.1	25.9	503.0	121.4	243.5	30.5	19.6	112.5	31.5	72.3	23.5	337.6	116.1	--	32.9	5
3	OEDOGONIUM SP	3135.4	135.1	--	--	--	--	--	199.7	48.8	--	--	106.3	--	--	--	--	--	--	642.5	--	114.8	2
3	OOCYSTIS SP	--	27.7	--	--	--	--	--	--	--	--	--	--	--	55.6	--	--	--	--	--	--	--	
1	OSCILLATORIA SP	184.4	--	--	--	367.8	1004.9	--	427.6	35.4	--	723.4	2550.6	--	--	55.8	2456.0	--	1794.7	2623.1	268.8	6504.5	5
1	OSCILLATORIA SP (MEDIUM)	3095.0	1811.0	167.6	3533.5	7752.5	4526.1	1919.5	148.9	963.6	1214.8	1227.5	2352.2	9425.6	1469.4	--	2656.3	924.6	2338.2	2439.3	3597.6	--	
1	OSCILLATORIA SP (SMALL)	1056.8	1524.2	1207.3	4558.0	11141.9	10121.7	6585.7	2436.0	4429.8	16924.9	32629.7	2156.0	7822.5	3982.9	9805.7	3584.0	6161.9	4941.0	9057.0	12781.4	1388.4	4
12	PERIDINIUM SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PINNULARIA SP	15.5	--	--	--	--	--	--	28.4	5.9	--	--	--	--	--	--	--	11.3	--	--	--	--	
3	PLEUROTAENIUM SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	SCYTONEMA SP?	2622.3	--	--	7521.6	2505.1	--	16097.5	7342.0	812.5	55523.2	13472.2	9251.9	35803.7	62.9	--	485.9	--	--	--	5006.5	--	
3	SPIROGYRA SP	--	--	--	--	--	--	--	100.9	25.5	--	--	--	--	--	--	--	--	--	68.6	--	458.7	
3	STAURASTRUM SP	--	--	--	--	--	--	14.5	--	17.6	--	--	--	--	--	--	--	--	--	--	--	--	
3	TETRAEDRON SP	--	--	--	--	--	--	--	--	--	--	--	--	10.6	--	--	--	--	--	--	--	--	
3	ULOTHRIX SP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	GLOEOCAPSA AERUGINOSA	--	--	--	--	48.9	--	--	--	--	--	267.8	--	--	--	--	--	--	--	--	599.6	--	
1	GLOEOTHECE LINEARIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3641.5	--	
1	GLOEOCAPSA PUNCTATA	--	--	--	--	--	--	--	--	112.4	--	--	--	--	--	--	--	--	--	--	--	--	
1	GLOEOCAPSA RUPESTRIS	--	--	--	--	--	--	--	--	--	--	--	--	674.0	--	--	--	--	--	--	--	--	
3	GOLENKINIA RADIATA	--	--	--	--	12.2	--	23.0	--	--	--	--	--	9.4	--	--	--	--	--	--	--	--	
4	GOMPHONEMA AFFINE V INSIGNE	--	--	--	--	56.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	GOMPHOSPHAERIA APONINA	--	2583.9	1929.7	5768.7	--	1539.3	7055.7	5072.1	3394.4	--	--	778.5	--	--	264.6	2202.7	1292.2	--	--	--	1147.0	
4	GOMPHONEMA DICHOTOMUM	--	--	--	--	24.4	--	--	--	--	--	--	--	--	--	--	--	11.3	--	--	--	--	
4	GOMPHONEMA GRACILE	--	--	--	--	--	--	--	--	--	--	--	--	--	111.9	--	--	--	--	--	--	--	
4	GOMPHONEMA INTRICATUM V VIBRIO	43.6	29.1	29.6	121.4	--	--	33.9	64.6	51.6	--	--	135.7	--	8.5	--	121.4	64.6	--	--	--	7.1	3
4	GOMPHONEMA PARVULUM	--	--	--	--	120.9	--	--	42.6	152.1	--	--	--	--	--	307.7	12.2	--	--	59.4	--	--	1
7	GONIOCHLORIS MUTICA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	GYROSIGMA ACUMINATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	GYROSIGMA NODIFERUM	--	116.1	29.0	--	--	--	28.8	25.2	33.9	--	--	--	--	--	--	--	--	--	--	--	16.9	
4	GYROSIGMA OBSCURUM?	71.4	54.0	132.7	--	--	--	24.2	--	63.4	--	--	--	--	--	--	121.4	--	--	--	--	122.3	
4	GYROSIGMA SPENCERI V CURVULA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	HANTZSCHIA VIVAX	--	43.2	--	--	--	--	--	61.8	15.5	--	--	--	--	--	--	--	--	--	--	--	--	
1	JOHANNESBAPTISTIA PELLUCIDA	1290.7	2246.6	5512.0	2045.5	940.9	--	2331.4	2043.0	930.5	1863.1	1597.0	629.8	--	1769.1	5486.6	14002.6	2977.9	2273.6	4394.6	12370.4	--	
3	KIRCHNERIELLA LUNARIS	15.5	--	--	--	--	21.3	68.6	--	33.6	--	--	687.6	9.4	--	--	60.2	356.8	--	--	351.6	7.1	
3	KIRCHNERIELLA OBESA	--	--	--	--	1381.0	--	--	--	115.2	--	--	--	--	--	--	--	--	--	--	173.9	--	
1	LEMMERMANNIELLA PALLIDA	--	5020.0	11573.0	--	33143.6	--	--	--	--	--	--	--	--	2915.5	--	1943.7	--	--	--	--	--	
1	LYNGBYA AERUGINEO-CARULEA?	--	--	496.0	1946.5	--	--	3767.8	2110.2	--	12656.7	4998.5	7677.5	30492.0	3441.0	46820.2	563.6	--	--	21445.8	5201.2	--	22
1	LYNGBYA AESTUARII	1400.7	--	--	--	--	--	--	9032.5	3109.0	6283.9	3310.9	--	--	--	--	--	--	--	--	--	--	
1	LYNGBYA BIRGEI	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10302.8	--	--	
1	LYNGBYA EPIPHYTICA	--	--	--	--	--	--	--	--	--	3093.8	18719.3	4859.1	--	81797.4	--	12876.6	--	--	14659.4	23783.7	--	
1	LYNGBYA LAGERHEIMII	2163.0	3946.9	4467.9	6995.4	14747.9	16673.9	8298.1	2608.0	3561.9	2445.2	10914.1	5711.8	9720.6	10444.1	13337.6	6772.6	11062.5	9246.8	82137.9	81696.5	--	4
1	LYNGBYA LIMNETICA	388.4	--	3238.7	20661.5	93137.7	43946.7	7932.6	7464.2	11886.2	177577.2	212816.2	85044.4	131937.3	62970.7	85828.7	66960.2	168343.0	151579.7	79714.4	171618.0	--	5
1	LYNGBYA LIMNETICA?	865.1	--	1211.0	25340.2	16088.4	4644.5	450.7	484.1	--	16777.7	5657.9	1310.7	935.5	6120.1	3406.0	2368.6	4508.9	7218.6	15195.0	17961.4	--	
1	LYNGBYA PERELEGANS?	--	--	--	--	--	1232.6	--	--	--	--	6224.8	2277.2	4878.7	880.4	--	--	2293.2	12782.7	12735.1	--	--	
1	LYNGBYA SUBTILIS	--	--	--	--	--	--	22.5	--	--	--	--	--	--	222.8	--	--	--	--	--	--	--	
4	MASTOGLOIA LANCEOLATA	69.1	134.1	59.4	164.7	233.8	254.5	83.7	77.9	65.3	230.4	640.5	170.4	322.6	212.0	217.6	142.2	232.2	147.5	391.0	138.6	19.5	4
4	MASTOGLOIA SMITHII	366.3	234.8	212.4	634.0	1269.0	1088.4	344.1	264.2	243.2	1433.8	4671.2	982.0	1590.1	760.4	1337.6	448.2	758.7	776.4	2187.5	705.9	68.5	4
4	MASTOGLOIA SMITHII V LACUSTRIS	72.2	143.7	206.3	529.4	1736.9	1411.0	112.9	187.2	195.4	1944.3	2448.5	1656.1	2187.8	444.8	1102.5	360.2	742.5	1180.3	1217.2	616.7	39.4	2
1	MERISMOPEDIA DUPLEX	--	--	--	--	--	--	--	--	--	--	--	1034.2	--	--	--	292.2	--	--	--	--	--	
1	MERISMOPEDIA GLAUCA	159.0	980.7	990.3	273.5	1280.9	563.0	281.4	319.7	289.1	601.5	515.5	1687.7	689.3	1172.9	238.2	10611.9	746.6	584.0	1626.7	5401.9	--	1
1	MERISMOPEDIA PUNCTATA	223.9	1685.0	--	--	9085.5	--	350.1	--	112.4	106.0	623.5	--	--	1895.5	173.3	861.5	835.6	559.5	1021.3	--	--	1
1	MERISMOPEDIA TENUISSIMA	299.6	1685.8	1784.7	273.5	81.6	414.1	214.0	547.7	332.4	1943.7	748.2	452.0	--	2205.3	2221.9	727.0	1940.0	760.8	1238.1	1387.5	--	5
1	MICROCYSTIS AERUGINOSA	1230.8	--	--	1094.1	1147.2	2244.5	301.3	--	--	2076.9	1205.4	1651.8	28760.8	8322.2	384.1	3713.3	2713.2	3184.0	4894.5	7358.1	--	3
1	MICROCYSTIS FIRMA	1873.7	2499.8	1685.4	1572.7	3008.3	3137.6	1856.6	2553.4	6867.9	5684.8	1536.3	1338.9	1542.4	2859.0	8299.6	1561.1	8226.2	3415.0	5285.7	5977.8	--	3
1	MICROCYSTIS FLOS-AQUAE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	MICROCYSTIS INCERTA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1117.6	--	--	--	--	--	
3	MICRASTERIAS PINNATIFIDA	--	52.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2145.7	3197.6	--	
1	MICROCYSTIS SMITHII	137.8	--	--	--	--	--	1140.4	--	--	755.6	--	--	--	--	--	--	--	--	--	--	--	
4	NAVICULA CRYPTOCEPHALA	40.2	20.4	29.6	150.7	149.4	56.9	62.5	--	41.6	72.8	114.8	46.2	309.5	--	649.2	76.7	161.9	96.0	205.7	5976.5	62.9	1
4	NAVICULA CRYPTOTENELLA	68.4	133.6	249.2	92.8	229.8	144.6	46.0	80.2	76.5	47.1	174.9	84.8	38.2	111.5	177.3	85.1	145.1	299.6	259.1	115.1	88.1	1
4	NAVICULA CUSPIDATA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.8	
4	NAVICULA PLACENTA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NAVICULA PODZORSKII	98.6	165.4	63.9	121.4	--	116.9	101.0	76.8	25.5	--	--	54.1	609.9	57.6	--	121.4	55.2	--	--	--	--	
4	NAVICULA PUPULA V CAPITATA	89.9	128.3	59.1	121.4	--	--	48.3	46.2	--	--	--	--	--	--	--	--	--	--	--	--	74.8	2
4	NAVICULA PUPULA V RECTANGULARIS	44.7	--	59.4	--	--	--	35.0	--	61.3	--	--	--	--	--	--	--	--	--	--	--	24.2	
4	NAVICULA RADIOSA	[illegible]	[illegible]																				

sion ode	Organism	1			2			3			4			5			6			7	8	9	1
		PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20	PP-21	PF
4	NEIDIUM AFFINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA ACICULARIS	--	--	--	--	--	--	--	--	--	--	63.7	--	--	--	--	--	--	--	56.1	29.8	--	
4	NITZSCHIA AMPHIBIA	8.8	27.2	--	--	--	14.4	14.5	--	674.6	--	--	--	18.1	--	--	--	--	--	--	--	18.7	
4	NITZSCHIA ANGUSTATA	--	--	--	--	--	--	23.7	62.7	14.1	--	--	--	--	--	--	--	--	--	--	--	15.2	
4	NITZSCHIA CONSTRICTA	59.8	22.6	59.1	--	44.0	29.7	13.4	22.8	20.1	21.1	63.7	22.3	49.9	55.6	13.7	51.3	17.4	25.5	--	29.8	17.3	5
4	NITZSCHIA DENTICULA?	--	108.2	445.0	--	--	--	38.3	104.1	48.8	--	--	--	--	--	47.8	--	--	--	--	--	43.5	
4	NITZSCHIA DISSIPATA	--	--	--	--	12.2	--	34.5	--	5.9	--	--	24.2	--	111.9	1 7	51.3	--	282.2	--	29.8	--	2
4	NITZSCHIA FONTICOLA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA FRUSTULUM	8.8	--	--	--	--	--	395.6	--	--	258.6	--	--	5.3	--	--	--	--	--	298.3	49.8	21.3	25
4	NITZSCHIA GRACILIS	--	--	--	--	--	--	14.5	--	14.0	--	--	--	50.4	--	--	--	--	83.0	--	--	--	29
4	NITZSCHIA GRACILIFORMIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14.9	
4	NITZSCHIA HUNGARICA?	6.8	--	--	--	--	--	--	--	--	--	--	16.2	--	--	--	--	64.6	--	--	--	19.5	
4	NITZSCHIA IGNORATA	--	--	--	--	--	--	23.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20
4	NITZSCHIA LEVIDENSIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA MICROCEPHALA	15.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15.2	
4	NITZSCHIA NANA	--	81.5	30.2	--	57.7	--	18.5	--	14.0	--	--	--	9.4	--	--	--	126.3	--	129.3	--	32.1	17
4	NITZSCHIA OBTUSA	--	--	--	--	--	--	--	--	14.0	--	--	--	--	--	--	--	--	--	--	--	--	59
4	NITZSCHIA PALEA	25.6	41.7	30.2	70.3	45.3	223.0	30.6	55.1	31 1	678.1	103.8	69.5	320.7	146.1	58.1	29 8	77.6	68.7	89.4	--	47.0	54
4	NITZSCHIA PALEA V DEBILIS	--	--	--	--	--	--	--	156.3	--	--	--	--	--	--	--	--	--	52.3	--	--	--	
4	NITZSCHIA PALEACEA	15.3	205.6	54.0	87.9	363.0	104.2	58.6	28.2	13.4	295.4	1423.4	442.2	436.5	135.6	465.1	95 0	211 2	833.5	898.2	394 7	51.3	25
4	NITZSCHIA PALEAFORMIS	78.8	387.1	88.4	193 9	687 7	313.0	58.3	85.3	68.8	390.0	567.5	135.1	159.0	474.0	94.1	392.9	382 9	471.3	1167 5	782.9	18.8	41
4	NITZSCHIA PARVULA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA REVERSA?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
4	NITZSCHIA SEMIROBUSTA	937.3	792.1	349.1	161.4	108.6	251.7	208.6	185.8	349.8	41.8	272.1	147.2	193.4	87.2	370 0	216.1	615.8	35.3	671.0	351.1	163.9	58
4	NITZSCHIA SERIATA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA SERPENTIRAPHE	31.0	--	57.7	73.0	324.6	266.6	22.5	94.0	42.0	66.2	36.6	40.4	68.9	166.3	207.6	25.5	78.3	52.9	783.2	239 6	--	3
4	NITZSCHIA SIGMOIDEA	--	--	--	--	--	--	--	51.7	145.9	--	--	--	--	--	--	--	--	--	--	--	--	
4	NITZSCHIA VERMICULARIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	NODULARIA SPUMIGENA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	OEDOGONIUM PUNCTATOSTRIATUM	2916.2	--	--	121.4	--	--	--	446.5	--	--	--	--	1662.3	--	--	--	--	606.8	--	--	--	69
3	OOCYSTIS LACUSTRIS	--	--	--	--	--	--	--	--	--	--	--	--	16.2	--	--	25.5	--	--	--	--	--	
3	OOCYSTIS PARVA	48.3	--	119.0	87.6	--	79.1	61.3	37.3	97.3	9.2	49.1	68.9	16.0	60.7	342.9	--	46 3	659.1	286.2	469.8	71.5	10
3	OOCYSTIS SOLITARIA	155.1	56.2	--	582.8	--	--	21.9	46 4	--	--	230.5	13.3	16.1	35.9	28 6	87 6	64 6	53.1	--	357 0	30.4	16
7	OPHIOCYTIUM CAPITATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	OSCILLATORIA AMPHIBIA	296.2	8420.7	363.4	1188.5	2422.2	783.5	1440.2	3293.3	225.2	7062.1	42947.3	827 2	21423 1	10217.8	4991.0	636.0	--	6841.5	4382 4	8981.1	1245.7	41
1	OSCILLATORIA AMPHIGRANULATA	274.3	--	--	--	1768.1	56.5	--	--	--	--	1470.9	--	3629.1	--	2037 0	270.4	--	--	2052 9	7282.4	--	21
1	OSCILLATORIA ANGUSTISSIMA	1476.8	6467.0	995.1	13506 3	25247 1	17512.8	4980 4	7873.4	4130.4	51561.4	90333.8	9122.4	38909.1	12609 3	21347.5	11373.3	35802.2	31472.3	35492.7	37459.8	2681.4	25
1	OSCILLATORIA FORMOSA	975.3	778.8	2348.5	6981.7	9364.0	4775.3	1933 7	3074.3	916.6	26659.7	35029.8	8482.2	21589.1	15021 8	22743.3	3191.5	12569.8	11042.1	12399.8	14988.9	5737.3	10
1	OSCILLATORIA GEMINATA	--	--	--	--	--	--	--	--	--	--	669.7	--	--	--	--	--	362.7	--	--	--	--	
1	OSCILLATORIA GRANULATA	--	--	--	--	--	--	--	--	--	--	--	--	388.3	--	--	1655.0	--	--	--	--	--	
1	OSCILLATORIA LACUSTRIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	OSCILLATORIA LEMMERMANNI	--	--	--	--	--	--	--	416.7	--	--	--	--	--	4154.4	--	--	--	--	--	--	--	
1	OSCILLATORIA LIMNETICA	3745.7	1707.2	10551.7	17142.8	61028.2	27951.5	9638.5	9512.5	10129.2	153819.0	330864.6	31798.2	62533.6	22275.2	104360.2	7399.8	42710.1	104326.7	40005.5	68909.9	2779 9	18
1	OSCILLATORIA LIMNETICA?	4023.4	4081.4	1090.4	9433.6	24888.0	6791.5	1651.8	1808 5	1394 9	6583.6	13376.9	3435.5	3340.8	14063.1	7956 1	1254.0	3142.4	5826.8	40592.1	27077.1	1032 4	32
1	OSCILLATORIA LIMOSA	--	1859.7	--	--	5511.4	--	--	--	--	--	4207.2	8149.7	2847 5	938.9	--	--	--	--	19626.2	9456.9	--	94
1	OSCILLATORIA PRINCEPS	--	--	--	4086.2	3192.1	2112.6	--	--	--	1721.5	7500.4	--	--	--	--	--	--	--	--	4594.9	--	
1	OSCILLATORIA PROLIFICA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	OSCILLATORIA QUADRIPUNCTULATA	--	381 5	--	--	--	691.7	437.3	--	422.1	414.0	--	--	--	785 6	--	--	--	--	--	--	--	
1	OSCILLATORIA TENUIS	--	--	--	--	--	--	--	--	--	--	--	331.4	--	--	--	--	--	--	--	--	--	
1	OSCILLATORIA WILLEI?	--	--	--	--	--	--	--	3879.5	2040.2	--	--	--	--	10811.6	--	--	--	28052.2	--	--	--	
3	PEDIASTRUM OBTUSUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	233.0	--	--	
3	PEDIASTRUM TETRAS	--	--	--	--	--	--	--	--	--	--	1131.6	--	--	--	--	--	--	907 8	--	--	--	
3	PEDIASTRUM TETRAS V TETRAODON	--	--	247.6	--	--	--	--	104 1	--	--	--	61.4	--	--	--	--	247.6	--	--	478.4	--	
1	PELOGLOEA BACILLIFERA	--	--	--	--	--	--	--	--	--	--	--	--	--	8757 5	--	--	--	--	--	--	--	
12	PERIDINIUM ACICULIFERUM	--	--	--	--	--	--	--	--	--	--	--	--	9 2	--	--	--	--	--	--	--	--	
12	PERIDINIUM INCONSPICUUM	6.8	--	61.7	--	--	55.8	--	--	--	--	--	--	9.2	--	--	21 3	--	--	--	227.4	--	
12	PERIDINIUM PUSILLUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
12	PERIDINIUM PUSILUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PINNULARIA ABAUJENSIS V SUBUNDULATA	--	--	29.6	--	--	--	12.4	--	13.6	--	--	--	--	--	--	--	--	--	--	--	41 2	
4	PINNULARIA BICEPS	--	31.7	--	--	--	--	13 0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PINNULARIA RUTTNERI	--	--	216.1	--	--	--	--	--	291.4	--	--	--	--	--	--	--	--	--	--	--	229 6	
4	PINNULARIA SOCIALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PINNULARIA STREPTORAPHE	--	--	--	--	--	--	--	28 2	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PINNULARIA VIRIDIS	--	--	--	--	--	--	--	--	25.5	--	--	--	--	--	--	25.5	--	--	--	--	18.8	
4	PINNULARIA VIRIDULA V MINOR	--	--	--	--	--	--	--	49 7	--	--	--	--	--	--	--	--	--	--	--	--	12.9	
4	PLAGIOTROPIS LEPIDOPTERA	15.5	--	88.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	32.1	
4	PLEUROSIGMA DELICATULUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4	PLEUROSIGMA SALINARUM V BOYERI	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	QUADRIGULA CHODATI	--	35.1	--	--	--	--	--	--	--	--	--	--	--	--	96.4	--	--	--	--	--	74.8	
3	QUADRIGULA LACUSTRIS	--	--	--	--	--	--	--	--	31.1	--	--	--	--	--	3889.5	--	--	--	--	--	--	
3	RADIOFILUM IRREGULARE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
3	RADIOCOCCUS NIMBATUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
1	RHABDODERMA LINEARE?	1184.4	368.3	--	12026.3	1219.7	850.3	6202.5	26083 2	520.4	258.6	--	--	3895 1	2057.3	18065.7	319 4	--	5135.0	--	--	--	
4	RHOPALODIA GIBBERULA V VANHEURCKII	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	239 6	--	5
4	RHOPALODIA GIBBA V VENTRICOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	93.8	49 8	--	
4	RHOPALODIA GIBBA	55.8	56.5	29.6	24.6	72.2	60.6	12 4	37.3	--	78.8	77.1	62.8	34 3	150.7	238.4	80 3	103.5	114.9	385.9	208.9	--	10
3	SCENEDESMUS ACUMINATUS	--	--	--	--	--	--	--	--	62.5	--	--	--	--	234 5	--	--	--	--	--	199.7	--	
3	SCENEDESMUS ARMATUS	86.5	--	--	--	--	28.7	--	--	--	--	--	--	--	421 6	--	--	--	--	208.0	100 1	--	

sion de	Organism	1			2			3			4			5			6			7	8	9	1
		PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20	PP-21	PP
9	SCENEDESMUS DIMORPHUS	--	--	120.2	117.3	24.4	--	--	--	--	--	277.0	79.2	--	--	47.8	--	--	--	297.0	--	--	-
3	SCENEDESMUS OBLIQUUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	SCENEDESMUS QUADRICAUDA	65.8	1943.5	91.7	--	--	--	--	--	--	116.0	--	32.3	71.9	701.1	172.5	34.1	--	--	256.3	159.8	298.8	11
3	SCENEDESMUS SEMIPULCHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	SCENEDESMUS SOLI?	--	--	--	--	--	--	--	101.8	--	--	--	53.3	--	58.5	--	--	--	--	--	--	--	72
3	SCENEDESMUS SUBSPICATUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
1	SCHIZOTHRIX ARENARIA?	1032.6	234.2	--	10447.1	60374.0	5830.9	7569.0	5431.3	6412.9	--	159490.6	517.3	22583.8	2915.5	176853.3	41381.0	35042.6	22072.3	15429.8	91475.8	--	-
1	SCHIZOTHRIX CALCICOLA	--	--	--	--	--	--	--	--	--	--	--	--	--	414.8	--	--	--	--	--	--	--	-
9	SCHROEDERIA SETIGERA	8.8	--	--	52.2	119.6	--	--	--	--	--	--	--	--	--	53.8	--	--	--	--	119.8	37.4	-
1	SCYTONEMA HOFMANII?	--	--	--	--	--	--	--	--	--	--	--	--	--	4911.5	--	--	--	--	--	--	--	-
1	SNOWELLA LACUSTRIS	--	2165.2	1593.6	961.3	5038.0	1144.8	622.3	--	7565.8	4153.8	1018.7	1697.6	505.8	5974.2	3532.4	1430.8	73.1	2622.6	2093.9	5357.0	--	-
3	SPHAEROCYSTIS SCHROERTERI	675.5	147.9	160.7	481.0	4669.2	733.9	3022.6	324.8	650.6	704.5	1943.1	992.5	2000.4	568.8	1916.3	1524.8	9101.4	6731.5	2689.5	9374.2	345.5	44
1	SPIRULINA LAXA	2689.2	--	--	68.4	--	--	--	--	--	--	318.7	2645.7	157.8	469.6	--	1079.3	340.1	--	--	--	--	-
1	SPIRULINA MAJOR	--	--	--	--	--	28.7	68.6	--	--	28.5	--	--	--	--	--	129.3	--	332.5	129.3	--	--	-
1	SPIRULINA SUBSALSA	206.5	565.2	729.1	264.7	604.8	962.5	328.8	280.5	176.0	561.9	3233.8	797.6	332.9	314.0	2031.7	431.2	723.4	511.0	979.4	200.8	--	33
3	SPIRULINA SUBTILISSIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
9	SPONDYLOSIUM PLANUM	--	--	--	16.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	STAURONEIS PHOENICENTERON F GRACILIS	--	27.2	--	--	--	--	--	--	14.0	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM CYCLACANTHUM V AMERICANUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM GRACILE	6.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM HEXACERUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM LEPTOCLADUM V INSIGNE	--	--	--	--	--	--	--	--	--	--	--	16.2	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM LEPTOCLADUM V SINUATUM	--	--	30.2	59.8	28.4	--	53.2	--	--	--	--	--	--	--	--	18.4	137.6	--	--	--	--	-
3	STAURASTRUM MANFELDTII V FLUMINENSE	--	--	--	--	120.9	--	113.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM PARADOXUM V PARVULUM	--	--	--	--	--	--	21.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	STAURASTRUM TETRACERUM	55.8	92.5	203.2	--	--	--	237.7	--	80.3	--	649.2	--	--	--	--	121.4	--	--	--	--	--	-
4	SURIRELLA ELEGANS	--	27.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
4	SYNEDRA ACUS	--	--	--	--	--	--	--	--	--	--	--	121.4	--	--	--	--	--	--	--	--	--	14
4	SYNEDRA RUMPENS V FAMILIARIS	61.5	41.0	--	--	--	--	--	--	--	--	--	24.2	--	167.5	--	--	--	--	29.0	--	--	-
3	TETRAEDRON MINIMUM	15.5	13.8	--	44.5	277.5	--	21.9	94.4	--	9.2	--	--	7.4	210.5	21.9	46.8	55.2	--	309.0	--	119.8	18
3	TETRAEDRON TRIGONUM	8.6	80.3	61.7	77.3	101.7	14.4	17.6	38.8	--	--	83.8	72.8	76.0	--	6.9	222.9	374.9	52.9	543.1	193.6	--	94
3	UNID CHLOROPHYCEAE FILAMENT BASAL CELLS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-
3	UNID FILAMENTOUS CHLOROPHYTA	--	33.3	--	--	--	--	1873.2	342.9	362.6	--	--	129.3	3895.1	329.9	6137.8	517.3	--	--	477.1	799.2	44.6	20

ns) 7 = Xanthophyceae (Yellow greens)
10 = Euglenophyta (Euglenoids)
ns) 11 = Cryptophyta (Cryptomoniads)
ryon) 12 = Pyrrhophyta (Dinoflagellates)

Organism	1			2			3			4			5			6			7	8
	PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20
NSIS V SUBAEQUALIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A	--	--	--	--	--	--	--	--	--	--	--	--	0.0015	--	--	--	--	--	0.0142	0.0152
UTISSIMUM	0.0100	0.0281	0.0227	0.0170	0.0053	0.0036	0.0061	0.0255	0.0175	0.0052	0.0091	0.0150	0.0646	0.0204	0.0981	0.0129	0.1296	0.0048	0.1215	0.1560
CULA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A	--	--	0.1212	--	--	0.0301	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A?	0.3528	1.0560	0.1729	0.5096	0.8196	1.5879	0.7010	0.2198	0.7661	0.4838	5.4313	1.3568	--	0.4573	0.0302	0.2738	0.6665	0.2847	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AFFINIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0465	--
UCIDA	--	--	--	--	--	--	--	0.0334	0.0416	--	--	--	--	--	--	--	--	--	0.0682	--
A?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2897	--
	--	--	0.0121	--	--	--	--	--	--	--	--	--	--	0.1692	--	--	--	--	0.0634	0.1827
RIOIDES	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5756	0.2189
ALCATUS	--	--	0.0072	--	0.0233	--	0.0035	0.0013	--	0.0008	0.1954	0.0064	0.0007	0.0056	0.0115	0.0016	0.0012	0.0013	0.0046	0.0243
ANNOSELENE	0.0008	0.0004	0.0004	0.0007	0.0005	0.0003	0.0003	0.0010	0.0007	--	0.0015	0.0030	0.0003	0.0007	0.0004	0.0003	0.0003	--	0.0004	0.0018
SPIRALIS	0.0005	0.0010	0.0010	0.0008	0.0008	0.0014	0.0003	0.0005	0.0006	0.0006	0.0013	0.0006	0.0030	0.0021	0.0004	0.0007	0.0006	0.0016	0.0014	0.0019
FERTA	0.0182	0.0071	--	--	--	--	0.0014	--	--	--	--	--	--	0.0219	--	--	0.3376	--	--	--
CATISSIMA	0.0008	0.0064	0.0013	0.0074	0.0134	0.0030	0.0051	0.0023	0.0104	0.0020	0.0036	0.0080	0.0232	0.0120	0.0096	0.0068	0.0139	0.0196	0.0243	0.0102
CHISTA	--	--	--	--	0.0151	--	0.0029	--	--	0.0140	--	--	--	--	--	--	--	--	--	--
VILLEI	--	--	--	--	--	--	--	0.5349	--	--	--	--	--	--	--	--	0.2440	--	--	--
RTA	0.0006	--	--	--	0.0093	0.0016	--	--	--	--	--	--	--	--	--	0.0020	--	--	0.0061	--
NCTONICA?	--	0.0077	--	--	0.0120	0.0336	0.0034	0.0014	--	0.0104	0.0078	0.0149	0.3324	0.0031	--	0.0113	0.0035	--	0.1300	0.0150
THRATA	0.0015	--	--	0.0135	0.0206	0.0043	0.0011	0.0049	--	0.0204	0.1635	0.0047	0.0672	0.0156	0.0060	0.0046	0.0428	0.0312	0.0123	0.0326
ROSCOPICA	--	--	--	--	--	--	0.0284	0.0098	--	--	--	--	--	--	--	--	--	--	--	--
LANS	--	--	0.0044	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COLA	--	--	--	--	0.0049	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
THII	0.0038	0.0077	0.0030	0.0196	0.0317	0.0381	0.0076	0.0146	0.0109	0.1146	0.1182	0.0316	0.0384	0.0612	0.1024	0.1362	0.1220	0.0155	0.0627	0.0807
GNINA	0.1535	0.0366	0.4483	0.2195	0.4502	0.4609	0.0829	0.0790	0.0379	0.2704	0.1980	0.4180	0.4561	0.4599	0.5997	0.6154	0.8653	0.8891	0.3535	0.5504
GNINA?	0.0385	0.0695	0.1135	0.0593	0.3679	0.0360	0.0336	0.0980	0.0189	0.0724	0.0541	0.0707	0.0210	0.0491	0.0748	0.0319	0.1342	0.0381	0.2430	0.1151
ABILIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0131	--
LOS-AQUAE	0.0134	0.0380	--	--	0.1152	--	--	0.0332	--	--	--	0.1512	--	0.0226	--	--	--	0.0069	0.0517	0.1557
NTIANA?	--	--	--	--	--	--	--	--	0.0030	--	--	0.0040	--	--	0.0075	--	--	--	--	--
ONTIANA?	--	--	--	--	0.1879	--	0.0247	--	--	--	--	--	--	--	--	--	--	--	--	--
ERI	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0278	--	--	--	--
IS?	--	--	--	--	--	--	--	--	0.0079	--	--	0.0084	--	--	--	--	--	--	--	--
CA V TENUISSIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0014	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.3829	--
OXA	--	--	--	--	--	--	--	0.0969	--	--	--	--	--	--	--	--	--	--	--	--
IDETICUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A	0.0516	0.0330	0.0270	0.0554	0.0260	--	--	0.0120	0.0057	--	0.0470	--	0.0044	--	0.0077	--	--	0.0118	--	0.0460
	--	0.1400	--	--	--	--	0.2371	--	--	--	--	--	--	--	--	--	--	--	--	--
RME	0.0022	--	--	--	--	0.0356	--	0.0129	--	--	--	--	0.0042	--	--	--	--	--	--	--
UMICOLA	0.0138	0.0094	--	--	0.0297	--	--	--	0.0055	0.0031	0.0304	--	0.0007	--	--	--	0.0014	--	--	--
PERSUS	0.0053	0.0242	0.0330	0.0281	0.0592	0.0485	0.0103	0.0218	0.0058	0.1167	0.2426	0.0218	0.0884	0.0673	0.1150	0.0287	0.0533	0.0453	0.1396	0.1212
PERSUS V MINOR	0.0045	0.0020	0.0052	--	0.0049	0.0101	--	0.0016	0.0018	0.0043	0.0082	0.0079	0.0022	0.0065	0.0007	0.0248	0.0075	0.0072	0.0408	0.0075
TANS	--	0.0983	--	--	--	--	--	--	--	--	0.0334	--	0.0064	--	--	--	--	--	--	--
NETICUS	0.0115	--	0.0139	--	--	0.0100	0.0048	0.0182	0.0064	--	--	--	0.0047	0.0722	0.0229	--	--	0.0442	0.0230	0.0131
UTUS	0.0056	0.0015	0.0027	0.0030	0.0165	0.0036	0.0040	0.0037	0.0010	0.0236	0.0135	0.0040	0.0169	0.0072	0.0433	0.0095	0.0125	0.0116	0.0573	0.0374
IMUS	0.0014	0.0081	0.0090	0.0150	0.0569	0.0070	0.0032	0.0053	0.0052	0.0059	0.0277	0.0091	0.0217	0.0130	0.0160	0.0209	0.0256	0.0213	0.0442	0.0594
NCTONICUS	--	--	--	--	--	--	--	0.0875	--	--	--	--	--	0.1615	--	0.1238	0.1997	--	--	--
ESCOTTII	--	--	--	--	0.0732	--	0.1471	--	--	--	--	--	0.0327	0.0380	0.0091	--	1.0940	0.0735	1.2849	0.4214
RGIDUS	0.0167	0.0380	0.0388	0.0624	0.0837	0.0610	0.0605	0.0429	0.0149	0.0139	0.0421	0.0490	0.0760	0.1828	--	0.0372	0.1030	0.0280	0.0682	0.1527
OSUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
E	--	--	--	--	--	--	0.0090	--	--	--	--	--	--	--	--	--	--	--	--	--
VUM	--	--	--	--	--	--	0.2015	--	--	--	--	--	--	--	--	--	--	--	--	--
A V MASSARTII	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ULUM	--	--	--	--	--	0.1785	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NTULA	--	--	--	--	--	--	--	--	0.0639	--	--	--	--	--	--	--	--	--	--	--
NTULA V EUGLYPTA	--	--	--	--	--	--	--	--	0.0120	--	--	--	--	--	--	--	--	--	--	--
NTULA V LINEATA	0.0097	0.0316	--	--	--	--	--	0.0305	0.5261	--	--	--	0.0232	0.0714	--	--	--	--	0.0341	--
KUETZINGIANUM	--	--	--	--	--	--	--	--	--	--	--	0.0116	--	--	--	--	--	--	--	--
OPORUM	--	--	0.0292	--	0.0148	--	0.0060	--	--	--	--	--	0.1404	--	--	--	0.1192	--	0.0022	--
ERICUM	0.0073	0.0328	--	--	0.0166	0.0056	--	--	--	0.0083	--	0.0151	0.0059	--	0.0023	--	0.0072	--	0.0799	0.3805
OSUM V CONCINNUM	--	0.0113	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0414	--	0.0227	--	0.0246
TUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
V HOFFII?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TIS	--	--	--	--	--	--	--	--	0.3717	--	--	0.5432	--	--	--	--	--	--	--	--
ACTUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RANII	--	--	--	--	--	--	--	--	--	80.7967	12.1787	--	--	--	--	--	--	--	--	--
TUM	--	--	--	0.6560	--	--	--	--	--	--	--	--	--	--	--	0.8271	--	--	--	2.8501
SSULUM	--	--	--	--	--	--	--	--	0.0962	--	--	--	--	--	--	--	--	--	--	0.7918
FORME	--	--	--	--	0.2566	--	--	--	--	--	--	--	--	--	--	--	0.1299	--	--	--
LUM V JAVANICUM	--	--	--	0.0443	0.1367	--	--	--	--	--	--	--	--	--	--	--	0.0864	--	--	--
ULATUM	--	0.2249	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OSTICHUM	--	--	--	--	--	--	--	--	--	--	--	0.0220	--	--	--	--	--	--	--	--
NYANUM	--	--	--	--	--	--	--	--	--	--	--	--	0.0773	--	--	--	--	--	--	--
ANUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5515	--

Organism	1			2			3			4			5			6			7	8
	PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20
ULATUM	--	--	--	0.1132	--	--	--	0.0250	0.0233	--	--	--	0.0246	0.0497	--	--	--	0.0250	--	--
JRCULATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ATUM V MINUTUM	--	--	--	--	--	--	--	--	0.1119	--	--	--	--	--	--	--	--	--	--	--
UM V EXCAVATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ATA	--	0.0110	0.0180	--	--	--	--	--	--	0.0028	--	--	--	--	--	--	--	--	--	--
ERA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ATA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PEDIA	--	0.0008	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SA	0.0080	--	--	0.0279	--	--	--	0.0530	--	--	0.0369	--	--	0.0140	0.0027	--	--	0.0348	--	--
TA	--	--	--	--	--	0.0233	--	--	0.0372	--	--	--	--	--	--	--	--	--	--	0.2953
HINIANA	0.0701	0.0277	0.0318	0.1309	0.0236	--	0.0208	--	0.3204	0.0099	--	0.0741	0.0164	0.0598	--	0.0386	--	--	--	--
OSTERIUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0010	--	--
MINUTUM?	--	--	--	--	--	0.0685	--	--	--	0.0408	--	--	--	--	--	--	--	--	--	--
MUSCICOLA?	--	--	--	--	--	--	--	--	--	0.0180	--	--	--	--	--	--	--	--	--	--
STAGNALE	--	--	--	--	--	--	0.1517	--	0.5756	--	--	--	--	--	--	--	--	0.3343	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EPHALA	0.0032	0.0121	0.0159	0.0106	0.0280	0.0119	0.0351	0.0114	0.0144	0.0047	0.0352	0.0183	0.0711	0.0104	0.0629	0.0162	0.0510	0.0483	0.0665	0.0619
V PSEUDOGRACILIS	0.2722	0.0950	0.0525	0.1358	0.1953	0.4047	0.0424	0.0940	0.0332	0.1488	0.3248	0.2570	0.6577	0.1951	0.0600	0.4772	0.1412	0.0485	0.2264	0.2113
GII	--	0.0740	--	--	--	--	--	--	0.3457	--	--	--	--	--	--	--	0.1770	--	--	0.6547
PULCHELLUM	--	--	0.0007	--	--	0.0340	--	--	--	--	--	--	--	--	--	0.0006	0.0181	--	--	--
RICUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0082	--	--	--	--
ARIA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1618	--	--	--	--
A	--	--	--	--	--	--	--	0.0717	0.0074	--	--	--	--	--	--	--	0.0141	--	--	--
ELLA	0.0098	0.0223	0.0557	--	0.2320	0.0050	0.0826	0.0327	0.0542	0.0408	--	0.0435	--	0.0125	--	0.0257	0.0269	0.0090	0.0239	--
	0.0204	0.0323	0.0198	0.0383	0.0488	0.0396	0.0603	0.0220	0.0357	0.0074	0.1420	0.0261	--	0.0650	--	0.0138	0.0714	0.0212	0.2458	--
	--	--	--	--	--	--	--	--	--	--	--	--	0.0196	--	--	--	--	--	--	--
	--	--	21.2597	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ATINOSA	--	--	--	--	0.0341	0.0217	--	--	--	--	--	--	--	--	0.0252	--	0.0070	--	--	0.0353
LADIANUM	0.0454	0.0709	0.0335	0.1321	0.7082	0.2514	0.0399	0.0464	0.0499	0.2335	0.9298	0.2031	0.3484	0.1532	0.5939	0.0945	0.3711	0.2690	0.3267	0.1764
DICA	--	--	--	--	--	--	--	0.0241	--	--	--	--	--	--	--	--	--	--	--	--
UM	0.0212	0.0216	0.1057	--	0.0330	0.0085	0.0161	0.0241	0.0309	0.0198	0.0147	0.0266	0.0036	0.0313	0.0045	0.0276	0.0564	0.0048	0.0058	0.0060
UM	--	0.0048	0.0004	--	0.0101	--	0.0025	--	0.0025	--	--	--	--	--	--	0.0064	--	--	0.0004	--
ERI	--	--	--	--	--	--	--	--	--	--	0.6094	--	--	--	--	--	--	--	--	--
ACUM	0.0216	0.0387	--	--	--	--	0.0166	0.0602	0.0106	--	--	--	--	--	0.4817	0.0091	--	0.0392	--	--
ACUM V ELEGANS	--	0.0400	0.2608	--	--	0.1465	--	0.0732	--	--	--	--	--	0.0732	2.2539	--	--	0.7355	0.7355	--
	--	0.2800	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2868	--	--	--	--
UM F MINOR	--	--	--	--	--	0.1381	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ATUM	--	--	--	0.5988	--	--	--	--	--	0.5911	--	--	--	--	--	0.6227	--	--	0.6573	--
BIENSE V MEDIANUM	0.1547	--	--	0.2091	--	--	--	0.2363	--	--	--	0.0805	0.9258	--	--	--	0.1457	0.1397	0.1391	0.7432
I V STRICTUM	--	--	--	--	--	--	--	0.1371	--	--	--	0.0291	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0263	--	--	--	0.0316	--	--
S	--	--	--	--	--	--	0.0600	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	0.4120	--	--	--	--	--	--	--	--	--	--	0.0273	--	--	--	--	--	--	--
V MINOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S V MINOR	--	--	--	--	--	--	0.0617	--	--	--	--	--	--	--	--	--	--	--	--	--
INA	--	--	--	0.0509	--	--	--	0.0290	--	0.0118	0.0539	--	0.0074	--	--	0.0121	0.0235	--	--	--
INA V GRACILIS	0.1308	0.0110	--	--	0.0162	0.1948	--	--	--	0.0217	0.0075	0.0402	--	0.0040	0.0316	0.0688	0.0318	--	--	--
NENSIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TISSIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0127	--	--	--	--	--
CA	0.0266	0.0537	0.0429	0.0211	0.1321	0.0963	0.0202	0.0341	0.0288	0.0417	0.3056	0.0450	0.0139	--	0.0112	0.0685	0.0580	0.0472	0.0339	0.0180
ULATA?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A?	0.2443	--	--	0.0458	0.2300	--	0.0429	0.0259	--	0.1537	--	0.5184	0.3746	--	0.2300	--	--	0.1063	0.1284	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0056	--	--	--	0.0126	0.0106
ROTESCA	0.2826	0.1796	0.1209	0.1121	0.2521	0.2092	0.1566	0.2468	0.1727	0.2224	1.1303	0.3936	0.3999	0.2242	1.2810	0.3627	0.3763	0.2453	0.4662	0.4182
A	--	--	--	--	--	--	--	0.0053	0.0024	--	--	--	--	0.0632	0.0006	--	--	0.0144	--	--
	--	--	--	--	0.6783	--	0.2784	0.2960	3.4269	--	--	0.3353	--	--	--	--	--	--	0.3411	0.7007
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	0.0226	--	0.0145	0.0300	0.0359	0.0037	0.0104	--	--	0.0513	0.0071	0.0730	--	0.0246	0.0106	0.1192	0.0460	0.1418	0.0526
	--	--	0.0021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	0.0856	--	--	--	--	--	--	--	--	0.1907	--	--
	--	--	--	--	0.0065	0.0005	0.0018	--	--	0.0024	--	--	--	--	--	0.0014	0.0017	0.0029	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	0.0261	--	--	--	--	--	--	--
	--	0.0061	--	--	--	--	0.0103	--	--	--	--	--	0.0007	--	--	--	--	--	--	--
SP	--	--	--	--	--	0.0059	0.0121	--	--	--	--	--	--	--	--	0.0143	--	--	--	--
P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0017	--	--	--	--	--
	0.0503	0.0753	--	--	--	--	0.1118	0.0581	0.0133	0.0508	--	0.0629	0.0308	0.2884	0.0041	--	10.1247	0.4284	0.1328	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0003	--	--	--	--	--	--
	--	--	--	0.0041	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.1419	0.0508	--	--	0.5670	--	--	0.1556	--	0.0444	0.0655	--	--	--	--	--	--	--	0.0726	0.0745
	--	--	--	--	0.0028	0.0014	--	--	--	--	--	--	--	0.0020	--	--	0.0005	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0027	--	--	0.0412	--	--	--
M SP	0.1130	0.3058	0.0909	0.1753	0.5614	0.4031	0.2671	0.1332	0.5387	0.5792	0.2372	0.3587	0.3765	0.3230	0.3660	0.1227	0.2753	0.2936	0.4358	1.0520
	--	--	--	--	0.0171	--	--	--	0.0334	--	--	--	--	--	--	0.1043	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	0.0066	--	--	--	--	--	0.0168	--	--	--	--	--	--	--

Organism	1			2			3			4			5			6			7	8
	PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0060	--	0.0268	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0144	--	--	--	--
P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0631	0.5177	--	--	--	--	--	0.2658	0.3316	--	--	--	--	--	--	--	--	0.4782	--	--
	0.0011	--	--	--	0.0006	--	0.0001	--	--	0.0007	0.0033	--	--	0.0438	--	--	0.0003	0.0124	0.0036	0.0007
M)	--	--	--	--	--	--	--	--	--	--	2.9743	--	--	--	--	--	--	0.5675	--	0.3378
	--	--	0.0044	0.0231	0.1485	0.0268	0.0278	0.0088	0.0008	0.4913	0.1043	0.0601	0.0889	0.0294	0.0227	0.1579	0.0228	0.0421	0.0231	0.1140
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	0.0026	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0129	--
	--	0.0041	--	--	--	--	--	--	0.0018	--	--	--	0.0007	--	--	--	--	--	--	--
)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.0063	--	--	--	0.0018	0.0032	--	0.0021	0.0030	0.0067	0.0130	0.0085	0.0020	0.0076	0.0006	0.0052	0.0008	0.0019	0.0123	0.0149
UM)	0.0887	0.0820	0.0458	--	--	--	0.0743	0.0886	--	0.0445	--	--	--	--	0.0433	0.0853	--	--	--	0.9514
L)	0.0038	0.0083	0.0007	--	--	0.0074	0.0116	0.0026	0.0531	0.0129	0.0258	0.0031	0.0022	0.0119	0.0032	0.0076	0.0023	0.0357	0.0123	--
	6.3055	0.2715	--	--	--	--	--	0.4014	0.0982	--	--	0.2140	--	--	--	--	--	--	1.2919	--
	--	0.0020	--	--	--	--	--	--	--	--	--	--	--	0.0035	--	--	--	--	--	--
	0.0046	--	--	--	0.0092	0.0250	--	0.0106	0.0009	--	0.0180	0.0638	--	--	0.0012	0.0615	--	0.0450	0.0653	0.0067
EDIUM)	0.2630	0.1538	0.0139	0.3004	0.6593	0.3849	0.1631	0.0127	0.0819	0.1032	0.1043	0.2000	0.8012	0.1249	--	0.2257	0.0786	0.1987	0.2074	0.3061
MALL)	0.0053	0.0074	0.0061	0.0227	0.0558	0.0505	0.0330	0.0122	0.0222	0.0846	0.1631	0.0108	0.0392	0.0198	0.0490	0.0179	0.0307	0.0246	0.0452	0.0640
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.4256	--	--	--
	0.0534	--	--	--	--	--	--	0.0979	0.0204	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3.6321	--	--	10.4178	3.4696	--	22.2949	10.1687	1.1254	76.8996	18.6589	12.8140	49.5881	0.0871	--	0.6730	--	--	--	6.9339
	--	--	--	--	--	--	--	9.0827	2.2940	--	--	--	--	--	--	--	--	--	6.1740	--
	--	--	--	--	--	--	0.0192	--	0.0233	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	0.0273	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0846
GINOSA	--	--	--	--	0.0006	--	--	--	--	--	0.0020	--	--	--	--	--	--	--	--	--
RIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0510
TATA	--	--	--	--	--	--	--	--	0.0014	--	--	--	--	--	--	--	--	--	--	--
STRIS	--	--	--	--	--	--	--	--	--	--	--	--	0.0762	--	--	--	--	--	--	--
A	--	--	--	--	0.0012	--	0.0026	--	--	--	--	--	0.0007	--	--	--	--	--	--	--
NE V INSIGNE	--	--	--	--	0.0760	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
APONINA	--	0.0724	0.0541	0.1616	--	0.0431	0.1975	0.1420	0.0950	--	--	0.0218	--	--	0.0075	0.0617	0.0361	--	--	--
OTOMUM	--	--	--	--	0.0141	--	--	--	--	--	--	--	--	--	--	--	0.0065	--	--	--
CILE	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0389	--	--	--	--	--	--
ICATUM V VIBRIO	0.0953	0.0635	0.0643	0.2653	--	--	0.0742	0.1410	0.1129	--	--	0.2964	--	0.0183	--	0.2653	0.1414	--	--	--
VULUM	--	--	--	--	0.2163	--	--	0.0759	0.2715	--	--	--	--	--	0.5494	0.0217	--	--	0.1061	--
ICA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RUM	--	0.5748	0.1435	--	--	--	0.1425	0.1245	0.1678	--	--	--	--	--	--	--	--	--	--	--
RUM?	0.6165	0.4666	1.1460	--	--	--	0.2091	--	0.5482	--	--	--	--	--	--	1.0493	--	--	--	--
ERI V CURVULA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	0.8778	--	--	--	--	--	1.2570	0.3161	--	--	--	--	--	--	--	--	--	--	--
A PELLUCIDA	0.0723	0.1259	0.3088	0.1146	0.0526	--	0.1305	0.1144	0.0521	0.1043	0.0895	0.0353	--	0.0991	0.3074	0.7841	0.1666	0.1274	0.2462	0.6928
IARIS	0.0003	--	--	--	--	0.0005	0.0009	--	0.0005	--	--	0.0090	0.0004	--	--	0.0008	0.0046	--	--	0.0046
ESA	--	--	--	--	0.0124	--	--	--	0.0011	--	--	--	--	--	--	--	--	--	--	0.0014
PALLIDA	--	0.0300	0.0692	--	0.1989	--	--	--	--	--	--	--	--	0.0175	--	0.0116	--	--	--	--
EO-CARULEA?	--	--	0.0586	0.2296	--	--	0.4446	0.2490	--	1.4936	0.5899	0.9059	3.5981	0.4060	5.5248	0.0667	--	--	2.5306	0.6137
I	0.3711	--	--	--	--	--	--	2.3936	0.8239	1.6651	0.8776	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.4316	--
CA	--	--	--	--	--	--	--	--	--	0.0186	0.1123	0.0292	--	0.4908	--	0.0773	--	--	0.0880	0.1427
MII	0.0131	0.0234	0.0267	0.0419	0.0885	0.1001	0.0498	0.0157	0.0214	0.0147	0.0655	0.0343	0.0584	0.0627	0.0801	0.0406	0.0664	0.0553	0.4928	0.4901
A	0.0097	--	0.0812	0.5164	2.3283	1.0986	0.1983	0.1866	0.2971	4.4395	5.3205	2.1261	3.2985	1.5743	2.1457	1.6740	4.2086	3.7895	1.9929	4.2906
A?	0.0215	--	0.0302	0.6335	0.4022	0.1160	0.0112	0.0121	--	0.4196	0.1415	0.0328	0.0232	0.1529	0.0852	0.0591	0.1126	0.1803	0.3798	0.4489
ANS?	--	--	--	--	--	0.0237	--	--	--	--	0.1184	0.0432	0.0927	0.0168	--	--	0.0435	0.2427	0.2420	--
	--	--	--	--	--	--	0.0001	--	--	--	--	--	--	0.0007	--	--	--	--	--	--
EOLATA	0.4642	0.9005	0.3993	1.1062	1.5703	1.7088	0.5620	0.5229	0.4387	1.5473	4.3007	1.1444	2.1665	1.4240	1.4610	0.9551	1.5593	0.9905	2.6253	0.9306
II	1.2741	0.8165	0.7386	2.2049	4.4133	3.7854	1.1968	0.9189	0.8458	4.9866	16.9419	3.4153	5.5304	2.6445	4.6523	1.5587	2.6388	2.7002	7.6081	2.4550
II V LACUSTRIS	0.1162	0.2310	0.3318	0.8511	2.7930	2.2688	0.1815	0.3010	0.3141	3.1264	3.9371	2.9847	3.5178	0.7153	1.7728	0.5792	1.1940	1.8980	1.9573	0.9914
PLEX	--	--	--	--	--	--	--	--	--	--	--	0.0157	--	--	--	0.0041	--	--	--	--
UCA	0.0021	0.0138	0.0138	0.0038	0.0179	0.0078	0.0040	0.0045	0.0040	0.0085	0.0071	0.0236	0.0096	0.0165	0.0034	0.1486	0.0103	0.0082	0.0228	0.0756
NCTATA	0.0007	0.0052	--	--	0.0276	--	0.0010	--	0.0004	0.0003	0.0019	--	--	0.0056	0.0007	0.0025	0.0026	0.0017	0.0032	--
UISSIMA	0.0004	0.0017	0.0018	0.0003	0.0003	0.0005	0.0002	0.0005	0.0004	0.0020	0.0008	0.0005	--	0.0022	0.0024	0.0007	0.0021	0.0009	0.0013	0.0017
GINOSA	0.0419	--	--	0.0372	0.0393	0.0761	0.0103	--	--	0.0708	0.0410	0.0562	0.9779	0.2828	0.0127	0.1265	0.0922	0.1083	0.1663	0.2503
A	0.0148	0.0200	0.0135	0.0125	0.0240	0.0251	0.0148	0.0204	0.0549	0.0454	0.0122	0.0107	0.0123	0.0227	0.0663	0.0124	0.0658	0.0273	0.0423	0.0477
-AQUAE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1608	--	--	--	--
RTA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0022	0.0031
NATIFIDA	--	1.2051	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HII	0.0045	--	--	--	--	--	0.0388	--	--	0.0258	--	--	--	--	--	--	--	--	0.0070	0.2031
CEPHALA	0.0170	0.0085	0.0126	0.0638	0.0633	0.0242	0.0265	--	0.0176	0.0307	0.0487	0.0196	0.1314	--	0.2753	0.0325	0.0686	0.0406	0.1245	0.1540
TENELLA	0.0507	0.0990	0.1847	0.0688	0.1705	0.1071	0.0341	0.0594	0.0568	0.0349	0.1296	0.0629	0.0283	0.0826	0.1314	0.0631	0.1076	0.2222	0.1922	0.0851
TA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SKII	0.2172	0.3646	0.1408	0.2678	--	0.2577	0.2227	0.1692	0.0562	--	--	0.1191	1.3448	0.1270	--	0.2678	0.1215	--	--	--
V CAPITATA	0.0681	0.0970	0.0444	0.0918	--	--	0.0365	0.0348	--	--	--	--	--	--	--	--	--	--	--	--
V RECTANGULARIS	0.0402	--	0.0535	--	--	--	0.0316	--	0.0552	--	--	--	--	--	--	--	--	--	--	--

	1			2			3			4			5			6			7	8
Organism	PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RIS	--	--	--	--	--	--	--	--	--	--	0.0075	--	--	--	--	--	--	--	0.0065	0.0037
A	0.0020	0.0068	--	--	--	0.0036	0.0036	--	0.2098	--	--	--	0.0040	--	--	--	--	--	--	--
ATA	--	--	--	--	--	--	0.0399	0.1059	0.0240	--	--	--	--	--	--	--	--	--	--	--
CTA	0.0362	0.0136	0.0355	--	0.0264	0.0178	0.0081	0.0137	0.0120	0.0126	0.0384	0.0134	0.0302	0.0334	0.0083	0.0308	0.0104	0.0153	--	0.0179
LA?	--	0.0262	0.1065	--	--	--	0.0092	0.0250	0.0118	--	--	--	--	--	0.0112	--	--	--	--	--
A	--	--	--	--	0.0018	--	0.0052	--	0.0009	--	--	0.0036	--	0.0167	0.0003	0.0077	--	0.0425	--	0.0045
LA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UM	0.0020	--	--	--	--	--	0.0890	--	--	0.0562	--	--	0.0013	--	--	--	--	--	0.0668	0.0112
S	--	--	--	--	--	--	0.0116	--	0.0112	--	--	--	0.0397	--	--	--	--	0.0655	--	--
FORMIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ICA?	0.0209	--	--	--	--	--	--	--	--	--	--	0.0388	--	--	--	--	0.1551	--	--	--
TA	--	--	--	--	--	--	0.0216	--	--	--	--	--	--	--	--	--	--	--	--	--
SIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EPHALA	0.0006	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	0.2294	0.0852	--	0.1622	--	0.0521	--	0.0396	--	--	--	0.0004	--	--	--	0.3554	--	0.3640	--
	--	--	--	--	--	--	--	--	0.2480	--	--	--	--	--	--	--	--	--	--	--
	0.0134	0.0219	0.0158	0.0370	0.0238	0.1172	0.0161	0.0290	0.0163	0.3561	0.0547	0.0366	0.1683	0.0769	0.0306	0.0155	0.0408	0.0361	0.0470	--
OEBIUS	--	--	--	--	--	--	--	0.0493	--	--	--	--	--	--	--	--	--	0.0166	--	--
EA	0.0010	0.0131	0.0035	0.0055	0.0228	0.0065	0.0037	0.0018	0.0010	0.0186	0.0897	0.0279	0.0275	0.0085	0.0293	0.0060	0.0132	0.0525	0.0565	0.0249
ORMIS	0.0672	0.3306	0.0752	0.1655	0.5872	0.2672	0.0497	0.0726	0.0567	0.3331	0.4846	0.1153	0.1357	0.4047	0.0803	0.3355	0.3270	0.4025	0.9970	0.6684
A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BUSTA	0.5512	0.4657	0.2052	0.0949	0.0640	0.1480	0.1227	0.1092	0.2057	0.0247	0.1601	0.0865	0.1137	0.0513	0.2176	0.1271	0.3621	0.0209	0.3945	0.2066
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TIRAPHE	0.2884	--	0.5368	0.6788	3.0175	2.4783	0.2088	0.8740	0.3909	0.6151	0.3406	0.3756	0.6405	1.5459	1.9296	0.2375	0.7277	0.4920	7.2805	2.2277
EA	--	--	--	--	--	--	--	18.3513	51.6084	--	--	--	--	--	--	--	--	--	--	--
LARIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GENA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CTATOSTRIATUM	23.4174	--	--	0.9752	--	--	--	3.5857	--	--	--	--	13.3485	--	--	--	--	4.8724	--	--
IS	--	--	--	--	--	--	--	--	--	--	--	--	0.0081	--	--	0.0109	--	--	--	--
	0.0012	--	0.0030	0.0022	--	0.0020	0.0015	0.0009	0.0024	0.0003	0.0012	0.0017	0.0005	0.0015	0.0086	--	0.0012	0.0165	0.0071	0.0117
IA	0.2105	0.0762	--	0.7911	--	--	0.0299	0.0631	--	--	0.3129	0.0181	0.0249	0.0488	0.0386	0.1190	0.0881	0.0724	--	0.4844
TATUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HIBIA	0.0190	0.5390	0.0234	0.0762	0.1548	0.0501	0.0923	0.2108	0.0144	0.4519	2.7486	0.0530	1.3711	0.6538	0.3193	0.0407	--	0.4380	0.2605	0.5748
HIGRANULATA	0.0044	--	--	--	0.0284	0.0007	--	--	--	--	0.0233	--	0.0583	--	0.0326	0.0044	--	--	0.0327	0.1162
USTISSIMA	0.0030	0.0129	0.0021	0.0269	0.0505	0.0350	0.0100	0.0158	0.0081	0.1031	0.1607	0.0182	0.0776	0.0253	0.0427	0.0228	0.0715	0.0629	0.0710	0.0750
MOSA	0.0770	0.0616	0.1857	0.5516	0.7397	0.3773	0.1527	0.2428	0.0724	2.1061	2.7674	0.6701	1.7054	1.1867	1.7967	0.2522	0.9931	0.8724	0.9796	1.1843
RNATA	--	--	--	--	--	--	--	--	--	--	0.0227	--	--	--	--	--	0.0124	--	--	--
NULATA	--	--	--	--	--	--	--	--	--	--	--	--	0.0305	--	--	0.1306	--	--	--	--
USTRIS?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MERMANNI	--	--	--	--	--	--	--	0.0068	--	--	--	--	--	0.0664	--	--	--	--	--	--
BETICA	0.0261	0.0118	0.0739	0.1199	0.4272	0.1956	0.0675	0.0666	0.0708	1.0768	2.3160	0.2226	0.4378	0.1559	0.7305	0.0516	0.2990	0.7303	0.2800	0.4822
NETICA?	0.0283	0.0287	0.0075	0.0659	0.1741	0.0475	0.0116	0.0127	0.0098	0.0461	0.0936	0.0240	0.0234	0.0982	0.0559	0.0089	0.0219	0.0408	0.2841	0.1896
OSA	--	0.7402	--	--	2.1935	--	--	--	--	--	1.6745	3.2435	1.1333	0.3734	--	--	--	--	7.8112	3.7641
NCEPS	--	--	--	25.6739	20.0562	13.2737	--	--	--	10.8162	47.1246	--	--	--	--	--	--	--	--	28.8703
IFICA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DRIPUNCTULATA	--	0.0027	--	--	--	0.0050	0.0029	--	0.0028	0.0029	--	--	--	0.0056	--	--	--	--	--	--
UIS	--	--	--	--	--	--	--	--	--	--	--	0.0197	--	--	--	--	--	--	--	--
LEI?	--	--	--	--	--	--	--	0.0815	0.0428	--	--	--	--	0.2270	--	--	--	0.5891	--	--
SUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0109	--
AS	--	--	--	--	--	--	--	--	--	--	0.0837	--	--	--	--	--	--	0.0671	--	--
AS V TETRAODON	--	--	0.0208	--	--	--	--	0.0088	--	--	--	0.0053	--	--	--	--	0.0209	--	--	0.0402
UFERA	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0175	--	--	--	--	--	--
UFERUM	--	--	--	--	--	--	--	--	--	--	--	--	0.0219	--	--	--	--	--	--	--
SPICUUM	0.0091	--	0.0818	--	--	0.0739	--	--	--	--	--	--	0.0120	--	--	0.0283	--	--	--	0.3017
UM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENSIS V SUBUNDULATA	--	--	0.1220	--	--	--	0.0609	--	0.0562	--	--	--	--	--	--	--	--	--	--	--
S	--	0.0405	--	--	--	--	0.0166	--	--	--	--	--	--	--	--	--	--	--	--	--
IERI	--	--	9.3871	--	--	--	--	--	12.6573	--	--	--	--	--	--	--	--	--	--	--
LIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TORAPHE	--	--	--	--	--	--	--	1.8107	--	--	--	--	--	--	--	--	--	--	--	--
S	--	--	--	--	--	--	--	--	2.1278	--	--	--	--	--	--	2.1330	--	--	--	--
LA V MINOR	--	--	--	--	--	--	--	1.4159	--	--	--	--	--	--	--	--	--	--	--	--
IDOPTERA	0.2959	--	1.6929	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ICATULUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INARUM V BOYERI	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OATI	--	0.0032	--	--	--	--	--	--	--	--	--	--	--	--	0.0097	--	--	--	--	--
USTRIS	--	--	--	--	--	--	--	--	0.0019	--	--	--	--	--	0.2334	--	--	--	--	--
ULARE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IBATUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NEARE?	0.0533	0.0167	--	0.5412	0.0549	0.0383	0.2791	1.1737	0.0234	0.0117	--	--	0.1752	0.0926	0.8130	0.0144	--	0.2311	--	--
ERULA V VANHEURCKII	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.4345
A V VENTRICOSA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.1638	0.6176
A	1.4147	1.4313	0.7496	0.6245	1.8307	1.5367	0.3131	0.9466	--	1.9970	1.9550	1.5903	0.8694	3.8201	6.0412	2.0359	2.6224	2.9131	9.7797	5.2934
UMINATUS	--	--	--	--	--	--	--	--	0.0016	--	--	--	--	0.0066	--	--	--	--	--	0.0056
MATUS	0.0058	--	--	--	--	0.0022	--	--	--	--	--	--	--	0.0282	--	--	--	--	0.0139	0.0068

Organism	1			2			3			4			5			6			7	8
	PP-9	PP-11	PP-18	PP-4	PP-7	PP-8	PP-12	PP-14	PP-17	PP-3	PP-5	PP-10	PP-2	PP-13	PP-16	PP-1	PP-6	PP-15	PP-19	PP-20
RPHUS	--	--	0.0030	0.0029	0.0006	--	--	--	--	--	0.0067	0.0020	--	--	0.0015	--	--	--	0.0070	--
QUUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ORICAUDA	0.0066	0.1983	0.0091	--	--	--	--	--	--	0.0117	--	0.0032	0.0074	0.0714	0.0179	0.0038	--	--	0.0262	0.0162
PULCHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
?	--	--	--	--	--	--	--	0.0076	--	--	--	0.0040	--	0.0044	--	--	--	--	--	--
SPICATUS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RIA?	0.0135	0.0029	--	0.1358	0.7849	0.0758	0.0985	0.0706	0.0835	--	2.0733	0.0068	0.2936	0.0379	2.2991	0.5380	0.4555	0.2870	0.2006	1.1892
OLA	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0013	--	--	--	--	--	--
ERA	0.0013	--	--	0.0090	0.0204	--	--	--	--	--	--	--	--	--	0.0094	--	--	--	--	0.0201
RI?	--	--	--	--	--	--	--	--	--	--	--	--	--	0.3683	--	--	--	--	--	--
IS	--	0.0539	0.0397	0.0239	0.1262	0.0286	0.0155	--	0.1890	0.1038	0.0254	0.0425	0.0128	0.1492	0.0886	0.0357	0.0018	0.0656	0.0524	0.1341
HROERTERI	0.0760	0.0167	0.0204	0.0546	0.5277	0.0832	0.3416	0.0367	0.0736	0.0795	0.2198	0.1121	0.2261	0.0641	0.2165	0.1723	1.0286	0.7606	0.3039	1.0593
	0.3390	--	--	0.0086	--	--	--	--	--	--	0.0401	0.3333	0.0196	0.0592	--	0.1358	0.0429	--	--	--
	--	--	--	--	--	0.0022	0.0044	--	--	0.0018	--	--	--	--	--	0.0081	--	0.0209	0.0081	--
A	0.0131	0.0356	0.0460	0.0166	0.0382	0.0607	0.0207	0.0177	0.0111	0.0354	0.2037	0.0502	0.0210	0.0197	0.1280	0.0272	0.0456	0.0322	0.0617	0.0125
SIMA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUM	--	--	--	0.0014	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CENTERON F GRACILIS	--	0.2097	--	--	--	--	--	--	0.1082	--	--	--	--	--	--	--	--	--	--	--
LACANTHUM V AMERICANUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CILE	0.0041	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACERUM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCLADUM V INSIGNE	--	--	--	--	--	--	--	--	--	--	--	0.1393	--	--	--	--	--	--	--	--
OCLADUM V SINUATUM	--	--	0.0603	0.1197	0.0568	--	0.1064	--	--	--	--	--	--	--	--	0.0369	0.2754	--	--	--
FELDTII V FLUMINENSE	--	--	--	--	0.6347	--	0.5958	--	--	--	--	--	--	--	--	--	--	--	--	--
ADOXUM V PARVULUM	--	--	--	--	--	--	0.0038	--	--	--	--	--	--	--	--	--	--	--	--	--
RACERUM	0.0035	0.0054	0.0117	--	--	--	0.0136	--	0.0046	--	0.0370	--	--	--	--	0.0070	--	--	--	--
S	--	4.0943	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--	--	--	0.2623	--	--	--	--	--	--	--	--
V FAMILIARIS	0.0138	0.0092	--	--	--	--	--	--	--	--	--	0.0054	--	0.0375	--	--	--	--	0.0065	--
UM	0.0006	0.0005	--	0.0022	0.0128	--	0.0011	0.0043	--	0.0003	--	--	0.0005	0.0098	0.0007	0.0021	0.0028	--	0.0143	--
NUM	0.0086	0.0783	0.0602	0.0752	0.0990	0.0136	0.0171	0.0378	--	--	0.0815	0.0709	0.0740	--	0.0069	0.2169	0.3649	0.0516	0.5284	0.1884
EAE FILAMENT BASAL CELLS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROPHYTA	--	0.0283	--	--	--	--	1.4793	0.2908	0.3077	--	--	0.1096	3.3030	0.2766	5.2049	0.4386	--	--	0.1195	0.2009

w greens)
noids)
noniads)
gellates)

EXHIBIT D.1-16

Porta-PSTA Wall Data Summary, November and December 1999

Date Sampled	PP #	Treat #	Sample Location	Sample Area (m^2)	TP (mg/kg dw)	Dry Weight (g/m^2)	Ash-Free Dry Weight (g/m^2)	Ash Weight (g/m^2)	TP (mg/m^2)	Cell Count ($\#/m^2$)	Biovolume (cm^3/m^2)	Corr. Chl a (mg/m^2)
11/18/1999	15	6	East	0.042	125.9	16.75	4.99	11.76	2.11	ND	ND	ND
11/18/1999	15	6	West	0.042	101.2	143.54	38.18	105.36	14.53	ND	ND	ND
11/18/1999	1	6	East	0.070	149.6	24.40	4.46	19.93	3.65	ND	ND	ND
11/18/1999	1	6	West	0.045	112.5	48.58	10.30	38.28	5.46	ND	ND	ND
12/14/1999	4	2	East	0.017	ND	204.70	47.73	156.97	ND	7.088E+10	149 45	52 18
12/14/1999	4	2	West	0.017	ND	257.73	55.15	202.58	ND	6.019E+10	124.64	61 30
12/14/1999	5	4	East	0.017	ND	224.85	50.91	173.94	ND	1.466E+11	182 43	67.88
12/14/1999	5	4	West	0.017	ND	257.73	55.15	202.58	ND	1.214E+11	233.46	86.33
12/14/1999	14	3	East	0.017	ND	25.14	8 48	16.65	ND	1.215E+09	1.32	1.07
12/14/1999	14	3	West	0.017	ND	26.41	7.32	19.09	ND	1.02E+09	1.42	1 05
12/14/1999	19	7	East	0.017	ND	200.45	45.61	154.85	ND	9.073E+10	57.26	57.48
12/14/1999	19	7	West	0.017	ND	260.91	58.33	202.58	ND	1.028E+11	141 38	60.88
12/14/1999	22	10	East	0.017	ND	282.12	54.09	228.03	ND	1.038E+11	172 62	79 44
12/14/1999	22	10	West	0.017	ND	273.64	57.27	216.36	ND	8.774E+10	183.96	93.23
Averages	--	--	--	--	**122.3**	**160.48**	**35.57**	**124.92**	**1.84**	**7.864E+10**	**124.79**	**56.08**

EXHIBIT D.1-17

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Treatments, April 1999- March 2000

Treatment	Date	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Respiration g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
Period of Record									
1	1999 - 2000	0.934	2.665	2.797	2.665	-0.132	0.117	34.8	1.467
2	1999 - 2000	0.511	1.135	2.360	1.135	0.329	0.098	34.1	0.636
3	1999 - 2000	0.357	1.529	1.962	1.529	-0.434	0.082	31.6	0.926
4	1999 - 2000	1.218	2.648	2.375	2.648	0.273	0.099	32.6	1.554
5	1999 - 2000	1.279	2.995	2.849	2.995	0.146	0.119	35.3	1.624
6	1999 - 2000	1.085	2.091	1.765	2.091	0.326	0.074	32.3	1.238
7	1999 - 2000	1.265	2.375	1.848	2.375	0.528	0.077	29.6	1.535
8	1999 - 2000	0.956	1.880	1.501	1.880	0.379	0.063	25.9	1.387
9	1999 - 2000	-0.046	0.368	1.233	0.368	-0.556	0.051	36.5	0.193
10	1999 - 2000	0.158	0.386	1.200	0.386	-0.026	0.050	36.4	0.203
11	1999 - 2000	1.049	2.294	2.161	2.294	0.133	0.090	27.5	1.597
12	1999 - 2000	0.210	1.612	2.368	1.612	-0.756	0.099	36.1	0.854
Quarterly									
1	Qtr-3	0.447	1.762	2.120	1.762	-0.358	0.088	41.4	0.815
	Qtr-4	1.355	3.796	3.905	3.796	-0.109	0.163	43.1	1.687
	Qtr-5	1.289	2.761	2.678	2.761	0.082	0.112	26.5	1.995
	Qtr-6	0.373	1.968	2.162	1.968	-0.194	0.090	25.5	1.476
	Qtr-7	--	--	--	--	--	--	--	--
2	Qtr-3	0.153	0.279	1.515	0.279	0.579	0.063	34.9	0.153
	Qtr-4	1.149	2.643	2.251	2.643	0.392	0.094	36.5	1.384
	Qtr-5	1.387	3.256	3.254	3.256	0.002	0.136	25.0	2.492
	Qtr-6	--	--	--	--	--	--	--	--
	Qtr-7	--	--	--	--	--	--	--	--
3	Qtr-3	0.614	2.011	2.270	2.011	-0.258	0.095	35.8	1.074
	Qtr-4	0.352	1.291	1.492	1.291	-0.201	0.062	40.7	0.606
	Qtr-5	0.403	1.673	2.159	1.673	-0.486	0.090	32.3	0.990
	Qtr-6	0.059	0.938	1.392	0.938	-0.454	0.058	21.5	0.835
	Qtr-7	0.526	1.990	2.562	1.990	-0.572	0.107	32.9	1.156
4	Qtr-3	1.471	2.903	2.315	2.903	0.588	0.096	41.5	1.339
	Qtr-4	1.054	2.442	2.130	2.442	0.312	0.089	36.5	1.279
	Qtr-5	1.224	2.504	2.237	2.504	0.266	0.093	33.8	1.416
	Qtr-6	0.743	1.238	0.802	1.238	0.436	0.033	25.4	0.933
	Qtr-7	1.488	3.474	3.404	3.474	0.070	0.142	29.5	2.256
5	Qtr-3	1.063	2.305	2.023	2.305	0.282	0.084	49.4	0.892
	Qtr-4	1.415	3.618	3.365	3.618	0.253	0.140	44.4	1.558
	Qtr-5	1.287	3.176	3.053	3.176	0.123	0.127	35.4	1.714
	Qtr-6	1.040	1.961	1.771	1.961	0.190	0.074	22.6	1.661
	Qtr-7	1.374	3.219	3.228	3.219	-0.009	0.135	30.2	2.038
6	Qtr-3	1.722	3.488	2.880	3.488	0.607	0.120	43.7	1.527
	Qtr-4	0.896	2.113	1.857	2.113	0.255	0.077	34.8	1.163
	Qtr-5	1.169	2.901	2.900	2.901	0.001	0.121	29.3	1.893
	Qtr-6	0.740	1.302	1.123	1.302	0.179	0.047	19.5	1.275
	Qtr-7	1.007	1.317	0.902	1.317	0.415	0.038	29.6	0.852
7	Qtr-3	--	--	--	--	--	--	--	--
	Qtr-4	1.655	3.451	2.754	3.451	0.697	0.115	35.7	1.851
	Qtr-5	1.100	1.820	1.329	1.820	0.491	0.055	30.5	1.143
	Qtr-6	0.748	1.246	0.971	1.246	0.275	0.040	19.2	1.240
	Qtr-7	1.468	2.623	1.986	2.623	0.637	0.083	34.4	1.459
8	Qtr-3	--	--	--	--	--	--	--	--
	Qtr-4	0.965	2.011	1.577	2.011	0.434	0.066	33.4	1.152
	Qtr-5	1.079	2.036	1.582	2.036	0.455	0.066	21.9	1.780
	Qtr-6	0.503	1.019	1.032	1.019	-0.013	0.043	15.6	1.246
	Qtr-7	--	--	--	--	--	--	--	--
9	Qtr-3	-0.044	0.119	1.188	0.119	-0.681	0.049	41.6	0.055
	Qtr-4	-0.104	0.658	1.159	0.658	-0.500	0.048	36.7	0.344
	Qtr-5	0.092	1.391	2.185	1.391	-0.794	0.091	22.7	1.173
	Qtr-6	0.159	0.795	1.122	0.795	-0.327	0.047	24.2	0.627
	Qtr-7	-0.679	0.121	0.937	0.121	-0.816	0.039	30.0	0.077
10	Qtr-3	0.094	0.215	1.430	0.215	0.047	0.060	38.5	0.107
	Qtr-4	0.228	1.382	1.777	1.382	-0.395	0.074	50.5	0.524
	Qtr-5	0.676	1.531	1.579	1.531	-0.048	0.066	31.0	0.945
	Qtr-6	0.312	0.662	0.635	0.662	0.027	0.026	22.2	0.571
	Qtr-7	0.456	1.274	1.400	1.274	-0.126	0.058	29.9	0.814
11	Qtr-3	--	--	--	--	--	--	--	--
	Qtr-4	1.191	2.276	1.707	2.276	0.569	0.071	40.0	1.089
	Qtr-5	1.099	2.132	1.907	2.132	0.225	0.079	24.8	1.644
	Qtr-6	0.606	1.235	1.188	1.235	0.048	0.049	23.5	1.007
	Qtr-7	1.528	3.772	3.845	3.772	-0.074	0.160	25.3	2.847

EXHIBIT D.1-17

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Treatments, April 1999- March 2000

Treatment	Date	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Respiration g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
12	Qtr-3	--	--	--	--	--	--	--	--
	Qtr-4	0.340	1.825	2.248	1.825	-0.423	0.094	47.2	0.740
	Qtr-5	0.084	0.909	1.581	0.909	-0.672	0.066	24.6	0.707
	Qtr-6	0.164	1.868	3.013	1.868	-1.145	0.126	32.7	1.094
	Qtr-7	--	--	--	--	--	--	--	--
Monthly									
1	Apr-1999	0.447	1.762	2.120	1.762	-0.358	0.088	41.4	0.815
	May-1999	1.355	3.796	3.905	3.796	-0.109	0.163	43.1	1.687
	Jun-1999	--	--	--	--	--	--	--	--
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	--	--	--	--	--	--	--	--
	Sep-1999	1.030	2.216	2.033	2.216	0.183	0.085	28.4	1.495
	Oct-1999	1.375	2.942	2.893	2.942	0.049	0.121	25.8	2.178
	Nov-1999	0.043	1.912	2.102	1.912	-0.190	0.088	29.8	1.226
	Dec-1999	0.869	2.053	2.253	2.053	-0.201	0.094	19.0	2.063
	Jan-2000	--	--	--	--	--	--	--	--
	Feb-2000	--	--	--	--	--	--	--	--
	Mar-2000	--	--	--	--	--	--	--	--
2	Apr-1999	1.147	2.093	1.515	2.093	0.579	0.063	53.9	0.744
	May-1999	--	--	--	--	--	--	--	--
	Jun-1999	0.902	2.051	1.739	2.051	0.312	0.072	32.0	1.225
	Jul-1999	1.520	3.533	3.020	3.533	0.513	0.126	43.3	1.561
	Aug-1999	1.051	3.164	3.623	3.164	-0.459	0.151	24.0	2.523
	Sep-1999	1.471	3.279	3.162	3.279	0.117	0.132	25.2	2.485
	Oct-1999	--	--	--	--	--	--	--	--
	Nov-1999	--	--	--	--	--	--	--	--
	Dec-1999	--	--	--	--	--	--	--	--
	Jan-2000	--	--	--	--	--	--	--	--
	Feb-2000	--	--	--	--	--	--	--	--
	Mar-2000	--	--	--	--	--	--	--	--
3	Apr-1999	0.614	2.011	2.270	2.011	-0.258	0.095	35.8	1.074
	May-1999	0.291	1.113	1.315	1.113	-0.202	0.055	43.2	0.492
	Jun-1999	0.556	1.884	2.080	1.884	-0.196	0.087	32.4	1.113
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	0.478	1.978	2.400	1.978	-0.422	0.100	37.0	1.024
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	0.329	1.368	1.918	1.368	-0.550	0.080	27.7	0.945
	Nov-1999	0.167	1.109	1.567	1.109	-0.458	0.065	29.4	0.720
	Dec-1999	0.143	0.945	1.504	0.945	-0.559	0.063	17.2	1.049
	Jan-2000	0.009	0.905	1.319	0.905	-0.414	0.055	21.6	0.801
	Feb-2000	0.320	1.212	1.681	1.212	-0.469	0.070	23.1	1.002
	Mar-2000	0.636	2.405	3.032	2.405	-0.627	0.126	38.2	1.206
4	Apr-1999	1.471	2.903	2.315	2.903	0.588	0.096	41.5	1.339
	May-1999	--	--	--	--	--	--	--	--
	Jun-1999	0.878	1.931	1.629	1.931	0.303	0.068	32.6	1.134
	Jul-1999	1.207	2.889	2.569	2.889	0.320	0.107	40.0	1.382
	Aug-1999	1.797	3.320	2.610	3.320	0.709	0.109	44.8	1.419
	Sep-1999	0.979	2.154	2.077	2.154	0.077	0.087	29.1	1.415
	Oct-1999	--	--	--	--	--	--	--	--
	Nov-1999	--	--	--	--	--	--	--	--
	Dec-1999	--	--	--	--	--	--	--	--
	Jan-2000	0.743	1.238	0.802	1.238	0.436	0.033	25.4	0.933
	Feb-2000	1.415	3.043	2.792	3.043	0.251	0.116	29.4	1.977
	Mar-2000	1.541	3.787	3.849	3.787	-0.063	0.160	29.5	2.459
5	Apr-1999	1.063	2.305	2.023	2.305	0.282	0.084	49.4	0.892
	May-1999	1.610	3.958	3.561	3.958	0.397	0.148	47.8	1.585
	Jun-1999	0.517	2.215	2.547	2.215	-0.332	0.106	30.1	1.408
	Jul-1999	1.494	3.646	3.388	3.646	0.258	0.141	45.0	1.551
	Aug-1999	1.270	3.158	3.021	3.158	0.138	0.126	35.6	1.696
	Sep-1999	1.386	3.279	3.246	3.279	0.034	0.135	34.4	1.826
	Oct-1999	--	--	--	--	--	--	--	--
	Nov-1999	1.191	2.344	2.129	2.344	0.215	0.089	25.5	1.759
	Dec-1999	--	--	--	--	--	--	--	--
	Jan-2000	0.964	1.770	1.592	1.770	0.178	0.066	21.1	1.603
	Feb-2000	1.069	2.306	2.260	2.306	0.045	0.094	25.7	1.713
	Mar-2000	1.642	4.019	4.076	4.019	-0.057	0.170	34.1	2.253

EXHIBIT D.1-17
Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Treatments, April 1999- March 2000

Treatment	Date	NPP(day) g/m^2/d	GPP(day) g/m^2/d	CR(24hr) g/m^2/d	CM(24hr) g/m^2/d	NPP(24hr) g/m^2/d	Avg Night Respiration g/m^2/hr	PAR(24hr) E/m^2/d	Efficiency %
6	Apr-1999	1.722	3.488	2.880	3.488	0.607	0.120	43.7	1.527
	May-1999	1.057	2.195	1.779	2.195	0.416	0.074	44.1	0.953
	Jun-1999	0.951	1.896	1.434	1.896	0.462	0.060	30.3	1.195
	Jul-1999	0.795	2.201	2.133	2.201	0.068	0.089	33.3	1.265
	Aug-1999	1.262	3.034	2.953	3.034	0.081	0.123	30.0	1.933
	Sep-1999	0.702	2.240	2.636	2.240	-0.397	0.110	25.8	1.661
	Oct-1999	--	--	--	--	--	--	--	--
	Nov-1999	--	--	--	--	--	--	--	--
	Dec-1999	--	--	--	--	--	--	--	--
	Jan-2000	0.740	1.302	1.123	1.302	0.179	0.047	19.5	1.275
	Feb-2000	0.707	1.115	0.737	1.115	0.379	0.031	26.9	0.792
	Mar-2000	1.393	1.577	1.115	1.577	0.462	0.046	33.0	0.914
7	Apr-1999	--	--	--	--	--	--	--	--
	May-1999	0.862	1.831	1.511	1.831	0.319	0.063	42.8	0.819
	Jun-1999	2.250	4.666	3.686	4.666	0.980	0.154	30.3	2.942
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	--	--	--	--	--	--	--	--
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	1.100	1.820	1.329	1.820	0.491	0.055	30.5	1.143
	Nov-1999	0.664	1.100	0.806	1.100	0.294	0.034	21.3	0.988
	Dec-1999	0.581	1.101	1.004	1.101	0.097	0.042	19.3	1.092
	Jan-2000	0.944	1.440	0.992	1.440	0.447	0.041	18.5	1.492
	Feb-2000	0.914	1.348	0.758	1.348	0.590	0.032	28.6	0.903
	Mar-2000	2.023	3.898	3.214	3.898	0.683	0.134	40.2	1.855
8	Apr-1999	--	--	--	--	--	--	--	--
	May-1999	--	--	--	--	--	--	--	--
	Jun-1999	0.985	2.011	1.577	2.011	0.434	0.066	33.4	1.152
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	1.312	3.040	2.764	3.040	0.276	0.115	24.5	2.369
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	0.845	1.033	0.399	1.033	0.634	0.017	19.2	1.028
	Nov-1999	--	--	--	--	--	--	--	--
	Dec-1999	0.503	1.019	1.032	1.019	-0.013	0.043	15.6	1.246
	Jan-2000	--	--	--	--	--	--	--	--
	Feb-2000	--	--	--	--	--	--	--	--
	Mar-2000	--	--	--	--	--	--	--	--
9	Apr-1999	-0.186	0.506	1.188	0.506	-0.681	0.049	44.6	0.217
	May-1999	-0.187	0.605	1.224	0.605	-0.619	0.051	50.5	0.229
	Jun-1999	-0.076	0.676	1.137	0.676	-0.461	0.047	32.0	0.404
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	0.045	1.340	2.073	1.340	-0.732	0.086	19.8	1.294
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	0.188	1.493	2.409	1.493	-0.916	0.100	28.5	1.004
	Nov-1999	-0.055	0.616	1.209	0.616	-0.594	0.050	21.0	0.561
	Dec-1999	0.425	1.023	1.196	1.023	-0.173	0.050	25.1	0.780
	Jan-2000	0.107	0.745	0.960	0.745	-0.215	0.040	26.6	0.535
	Feb-2000	-0.679	0.121	0.937	0.121	-0.816	0.039	30.0	0.077
	Mar-2000	--	--	--	--	--	--	--	--
10	Apr-1999	0.643	1.477	1.430	1.477	0.047	0.060	44.6	0.633
	May-1999	0.228	1.382	1.777	1.382	-0.395	0.074	50.5	0.524
	Jun-1999	--	--	--	--	--	--	--	--
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	--	--	--	--	--	--	--	--
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	0.676	1.531	1.579	1.531	-0.048	0.066	31.0	0.945
	Nov-1999	0.200	0.640	0.748	0.640	-0.109	0.031	22.6	0.541
	Dec-1999	0.123	0.338	0.430	0.338	-0.092	0.018	17.5	0.369
	Jan-2000	0.723	1.030	0.613	1.030	0.417	0.026	25.9	0.761
	Feb-2000	0.458	1.274	1.400	1.274	-0.126	0.058	29.9	0.814
	Mar-2000	--	--	--	--	--	--	--	--

EXHIBIT D.1-17

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Treatments, April 1999- March 2000

Treatment	Date	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Respiration g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
11	Apr-1999	--	--	--	--	--	--	--	--
	May-1999	1.253	2.335	1.691	2.335	0.644	0.070	44.1	1.013
	Jun-1999	1.003	2.101	1.757	2.101	0.344	0.073	27.7	1.450
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	--	--	--	--	--	--	--	--
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	1.099	2.132	1.907	2.132	0.225	0.079	24.8	1.644
	Nov-1999	1.052	2.048	1.594	2.048	0.454	0.066	24.4	1.606
	Dec-1999	0.777	1.323	1.034	1.323	0.289	0.043	26.3	0.963
	Jan-2000	0.448	1.038	1.168	1.038	-0.130	0.049	22.2	0.895
	Feb-2000	1.696	3.788	3.587	3.788	0.201	0.149	28.6	2.536
	Mar-2000	1.361	3.755	4.104	3.755	-0.349	0.171	22.1	3.249
12	Apr-1999	--	--	--	--	--	--	--	--
	May-1999	0.340	1.825	2.248	1.825	-0.423	0.094	47.2	0.740
	Jun-1999	--	--	--	--	--	--	--	--
	Jul-1999	--	--	--	--	--	--	--	--
	Aug-1999	--	--	--	--	--	--	--	--
	Sep-1999	--	--	--	--	--	--	--	--
	Oct-1999	--	--	--	--	--	--	--	--
	Nov-1999	0.158	1.057	1.660	1.057	-0.603	0.069	27.1	0.747
	Dec-1999	--	--	--	--	--	--	--	--
	Jan-2000	0.009	0.760	1.502	0.760	-0.742	0.063	22.1	0.659
	Feb-2000	0.188	1.697	2.772	1.697	-1.074	0.115	23.7	1.370
	Mar-2000	0.140	2.039	3.255	2.039	-1.216	0.136	41.6	0.937

EXHIBIT D.1-18

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	Z (m)	Ext Coeff (m^{-1})
Period of Record						
1	1999 - 2000	0.64	1138.6	484.1	0.51	2.22
2	1999 - 2000	0.63	1167.8	609.0	0.51	1.72
3	1999 - 2000	0.29	708.9	451.5	0.17	3.04
4	1999 - 2000	0.36	920.5	535.4	0.24	2.80
5	1999 - 2000	0.55	1066.6	456.9	0.42	2.55
6	1999 - 2000	0.40	1111.0	616.5	0.34	1.60
7	1999 - 2000	0.39	1178.9	556.0	0.27	3.31
8	1999 - 2000	0.69	1115.6	561.9	0.57	1.45
9	1999 - 2000	0.63	887.8	111.5	0.51	4.70
10	1999 - 2000	0.65	944.1	102.7	0.52	4.63
11	1999 - 2000	0.34	1197.2	761.2	0.21	2.46
12	1999 - 2000	0.34	890.8	576.2	0.22	2.33
Quarterly						
1	Qtr-3	0.61	155.9	57.3	0.49	2.03
	Qtr-4	0.63	2016.1	994.4	0.51	1.39
	Qtr-5	0.65	862.5	312.9	0.53	2.51
	Qtr-6	0.64	563.9	117.8	0.51	3.07
	Qtr-7	--	--	--	--	--
2	Qtr-3	0.61	136.9	69.1	0.49	1.43
	Qtr-4	0.60	2160.7	1368.5	0.48	1.00
	Qtr-5	0.65	940.9	314.9	0.53	2.34
	Qtr-6	0.64	528.0	217.4	0.52	1.85
	Qtr-7	--	--	--	--	--
3	Qtr-3	0.28	220.4	137.0	0.16	2.79
	Qtr-4	0.27	1486.3	1101.7	0.15	1.89
	Qtr-5	0.30	498.4	293.8	0.18	2.76
	Qtr-6	0.29	624.2	266.8	0.17	4.99
	Qtr-7	0.29	227.1	147.3	0.17	2.39
4	Qtr-3	0.35	200.6	148.9	0.22	1.39
	Qtr-4	0.37	2101.1	1467.6	0.22	1.64
	Qtr-5	0.37	655.2	334.2	0.25	2.46
	Qtr-6	0.36	358.9	170.5	0.27	3.49
	Qtr-7	0.36	946.6	334.4	0.23	4.55
5	Qtr-3	0.62	312.6	119.2	0.50	1.87
	Qtr-4	0.61	1799.5	805.8	0.46	1.86
	Qtr-5	0.64	906.1	367.9	0.52	2.05
	Qtr-6	0.53	967.0	431.8	0.41	2.50
	Qtr-7	0.32	707.7	258.5	0.20	4.65
6	Qtr-3	0.33	208.8	160.4	0.20	1.37
	Qtr-4	0.51	1766.5	1051.4	0.39	1.23
	Qtr-5	0.64	995.9	379.4	0.52	2.11
	Qtr-6	0.26	751.5	548.0	0.14	1.53
	Qtr-7	0.13	--	--	--	--
7	Qtr-3	0.67	276.7	131.7	0.55	1.35
	Qtr-4	0.34	2251.0	1297.5	0.22	3.08
	Qtr-5	0.37	691.8	158.0	0.25	4.25
	Qtr-6	0.36	1348.0	403.1	0.24	4.95
	Qtr-7	0.36	1119.6	776.4	0.24	1.47
8	Qtr-3	0.66	300.2	132.7	0.53	1.53
	Qtr-4	0.66	2001.7	1063.8	0.54	1.19
	Qtr-5	0.72	515.1	151.3	0.60	2.05
	Qtr-6	0.71	1095.1	639.4	0.59	0.91
	Qtr-7	--	--	--	--	--
9	Qtr-3	0.64	275.6	45.2	0.52	3.49
	Qtr-4	0.61	1517.9	270.5	0.48	3.65
	Qtr-5	0.64	188.0	14.3	0.52	5.13
	Qtr-6	0.63	995.9	120.0	0.51	4.53
	Qtr-7	0.64	1136.2	39.2	0.52	6.52
10	Qtr-3	0.64	289.7	48.0	0.52	3.47
	Qtr-4	0.63	1273.9	233.7	0.50	3.36
	Qtr-5	0.65	176.9	13.0	0.53	5.04
	Qtr-6	0.65	1109.2	95.2	0.53	4.99
	Qtr-7	0.66	1597.3	82.8	0.54	5.76
11	Qtr-3	0.34	283.5	224.2	0.21	1.10
	Qtr-4	0.31	2106.7	1585.7	0.19	1.94
	Qtr-5	0.35	164.2	85.8	0.23	2.79
	Qtr-6	0.34	1431.2	782.2	0.21	3.22
	Qtr-7	0.34	1488.3	894.5	0.22	2.31
12	Qtr-3	0.37	244.2	165.4	0.24	1.60
	Qtr-4	0.34	1681.2	1154.2	0.21	1.90
	Qtr-5	0.34	93.6	42.8	0.22	3.73
	Qtr-6	0.35	752.3	418.8	0.23	2.27
	Qtr-7	0.34	1033.3	684.0	0.22	2.01

EXHIBIT D.1-16

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Water Depth (m)	PAR (μmol/m²/s) Surface	PAR (μmol/m²/s) Bottom	Z (m)	Ext Coeff (m⁻¹)
Monthly						
1	Apr-99	0.61	155.9	57.3	0.49	2.03
	May-99	0.65	1698.3	840.1	0.53	1.34
	Jun-99	0.59	2174.2	1157.0	0.47	1.33
	Jul-99	0.65	2176.0	986.2	0.52	1.52
	Aug-99	0.64	1790.7	771.1	0.52	1.64
	Sep-99	0.64	413.2	114.2	0.52	2.48
	Oct-99	0.67	383.6	53.5	0.55	3.42
	Nov-99	0.63	648.0	143.4	0.51	2.97
	Dec-99	0.64	479.8	92.2	0.52	3.16
	Jan-00	--	--	--	--	--
	Feb-00	--	--	--	--	--
	Mar-00	--	--	--	--	--
2	Apr-99	0.61	136.9	69.1	0.49	1.43
	May-99	0.61	1496.7	841.0	0.49	1.16
	Jun-99	0.57	2546.7	1492.6	0.45	1.18
	Jul-99	0.63	2217.3	1596.0	0.51	0.72
	Aug-99	0.65	1654.2	567.1	0.52	2.67
	Sep-99	0.64	615.3	227.1	0.54	1.86
	Oct-99	0.65	553.3	150.5	0.52	2.50
	Nov-99	0.63	888.8	376.5	0.51	1.70
	Dec-99	0.64	167.2	58.4	0.52	1.99
	Jan-00	--	--	--	--	--
	Feb-00	--	--	--	--	--
	Mar-00	--	--	--	--	--
3	Apr-99	0.28	220.4	137.0	0.16	2.79
	May-99	0.28	1490.3	1248.6	0.17	1.01
	Jun-99	0.22	1228.1	882.1	0.10	2.41
	Jul-99	0.30	1746.5	1174.2	0.18	2.24
	Aug-99	0.29	1137.6	647.3	0.17	3.23
	Sep-99	0.31	200.9	118.5	0.19	2.82
	Oct-99	0.29	156.6	115.7	0.17	2.24
	Nov-99	0.29	627.9	290.6	0.17	5.21
	Dec-99	0.29	420.1	224.3	0.17	3.60
	Jan-00	0.29	824.5	285.6	0.17	6.16
	Feb-00	0.29	170.6	115.8	0.17	2.30
	Mar-00	0.30	283.6	178.7	0.17	2.47
4	Apr-99	0.35	200.6	148.9	0.22	1.39
	May-99	0.35	1471.8	1209.5	0.23	0.85
	Jun-99	0.40	2352.0	1643.6	0.22	1.78
	Jul-99	0.35	2269.7	1464.3	0.22	2.02
	Aug-99	0.36	1160.2	567.1	0.23	3.14
	Sep-99	0.35	566.0	268.2	0.23	3.29
	Oct-99	0.42	239.5	167.2	0.29	0.95
	Nov-99	0.35	716.4	318.8	0.23	3.85
	Dec-99	0.36	114.5	45.8	0.34	3.82
	Jan-00	0.35	245.9	147.4	0.23	2.79
	Feb-00	0.35	1522.1	481.7	0.23	6.15
	Mar-00	0.36	371.0	187.0	0.24	2.96
5	Apr-99	0.62	312.6	119.2	0.50	1.87
	May-99	0.62	1325.9	860.8	0.40	1.10
	Jun-99	0.58	1940.4	762.0	0.48	2.17
	Jul-99	0.62	2132.1	794.6	0.50	2.29
	Aug-99	0.63	1571.2	731.8	0.51	1.52
	Sep-99	0.65	573.9	184.3	0.52	2.18
	Oct-99	0.64	406.9	97.5	0.54	2.65
	Nov-99	0.63	874.2	254.4	0.50	2.48
	Dec-99	0.63	486.5	133.8	0.51	2.41
	Jan-00	0.33	1540.2	907.1	0.21	2.61
	Feb-00	0.32	276.7	144.0	0.20	3.43
	Mar-00	0.33	1138.8	372.9	0.21	5.87
6	Apr-99	0.33	208.8	160.4	0.20	1.37
	May-99	0.33	1505.0	1330.0	0.20	0.52
	Jun-99	0.59	1562.0	773.3	0.46	1.53
	Jul-99	0.63	2232.7	1050.8	0.50	1.63
	Aug-99	0.65	1336.4	612.7	0.53	1.53
	Sep-99	0.63	939.5	368.9	0.51	1.97
	Oct-99	0.65	711.6	156.7	0.53	2.84
	Nov-99	0.33	913.5	720.1	0.21	1.17
	Dec-99	0.33	589.6	375.8	0.21	1.89
	Jan-00	0.13	--	--	0.01	--
	Feb-00	0.12	--	--	--	--
	Mar-00	0.13	--	--	--	--

EXHIBIT D.1-18

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	z (m)	Ext Coeff (m^{-1})
7	Apr-99	0.67	276.7	131.7	0.55	1.35
	Jun-99	0.31	2468.0	2005.0	0.19	1.08
	Jul-99	0.37	2034.0	590.0	0.24	5.08
	Aug-99	0.37	1657.7	253.9	0.25	7.51
	Sep-99	0.38	179.6	85.8	0.26	2.89
	Oct-99	0.37	238.0	134.3	0.24	2.35
	Nov-99	0.37	1479.3	398.8	0.25	5.24
	Dec-99	0.36	1216.7	407.4	0.23	4.66
	Jan-00	--	--	--	--	--
	Feb-00	0.36	1827.9	1260.5	0.24	1.54
	Mar-00	0.37	411.2	292.2	0.24	1.40
8	Apr-99	0.66	300.2	132.7	0.53	1.53
	May-99	0.67	1605.6	857.2	0.55	1.14
	Jun-99	0.61	2476.0	1395.6	0.49	1.17
	Jul-99	0.69	1923.5	938.6	0.57	1.25
	Aug-99	0.76	1031.5	305.6	0.64	1.90
	Sep-99	0.70	205.7	71.7	0.58	1.81
	Oct-99	0.69	308.1	76.6	0.57	2.44
	Nov-99	0.73	891.1	698.0	0.60	0.40
	Dec-99	0.69	1299.1	580.8	0.57	1.42
	Jan-00	--	--	--	--	--
	Feb-00	--	--	--	--	--
	Mar-00	--	--	--	--	--
9	Apr-99	0.64	275.6	45.2	0.52	3.49
	May-99	0.61	1263.8	240.4	0.49	3.40
	Jun-99	0.56	1628.0	399.6	0.44	3.18
	Jul-99	0.64	1661.8	171.5	0.52	4.36
	Aug-99	0.64	277.1	25.1	0.52	4.64
	Sep-99	0.65	133.9	9.6	0.52	5.02
	Oct-99	0.63	153.1	8.1	0.51	5.74
	Nov-99	0.64	404.3	29.3	0.52	5.09
	Dec-99	0.63	1381.0	225.8	0.51	3.56
	Jan-00	0.62	1202.5	104.8	0.49	4.94
	Feb-00	0.62	1071.1	49.0	0.49	6.25
	Mar-00	0.67	1201.3	29.5	0.55	6.79
10	Apr-99	0.64	289.7	48.0	0.52	3.47
	May-99	0.64	1194.8	241.0	0.52	3.09
	Jun-99	0.59	1131.2	283.1	0.47	2.95
	Jul-99	0.65	1495.8	177.1	0.53	4.05
	Aug-99	0.65	247.4	21.9	0.53	4.58
	Sep-99	0.65	132.9	9.2	0.53	5.04
	Oct-99	0.66	150.3	7.9	0.54	5.50
	Nov-99	0.65	886.0	95.0	0.52	4.26
	Dec-99	0.65	1353.1	179.8	0.53	3.81
	Jan-00	0.66	1098.8	53.0	0.53	5.94
	Feb-00	0.65	1968.5	126.0	0.53	5.18
	Mar-00	0.66	1226.0	39.5	0.54	6.33
11	Apr-99	0.34	263.5	224.2	0.21	1.10
	May-99	0.34	1630.7	1382.5	0.21	0.77
	Jun-99	0.28	2783.0	2652.0	0.16	0.30
	Jul-99	0.33	1906.5	722.7	0.20	4.75
	Aug-99	0.38	190.5	63.3	0.26	4.20
	Sep-99	0.33	120.9	75.4	0.21	2.24
	Oct-99	0.34	181.3	116.6	0.22	1.93
	Nov-99	0.33	1461.5	396.1	0.21	6.30
	Dec-99	0.34	1269.8	999.0	0.21	1.12
	Jan-00	0.34	1562.2	951.6	0.22	2.23
	Feb-00	0.34	1377.8	963.9	0.22	1.61
	Mar-00	0.34	1598.7	825.0	0.22	3.01
12	Apr-99	0.37	244.2	165.4	0.24	1.60
	May-99	0.37	1398.3	1001.7	0.24	1.37
	Jun-99	0.30	2274.0	1692.5	0.18	1.61
	Jul-99	0.34	1371.4	768.5	0.21	2.71
	Aug-99	--	--	--	--	--
	Sep-99	0.34	54.5	22.2	0.22	4.09
	Oct-99	0.34	132.7	63.4	0.22	3.37
	Nov-99	0.33	974.3	555.0	0.21	2.72
	Dec-99	0.36	377.5	353.6	0.24	0.27
	Jan-00	0.37	905.2	347.8	0.25	3.83
	Feb-00	0.34	835.1	487.5	0.22	2.45
	Mar-00	0.34	1231.5	880.5	0.21	1.57

Note:

Extinction coefficient = $(\ln PAR_{surf} - \ln PAR_{bot})/z$ and z = water depth - 0.122 m

EXHIBIT D.1-19
Average Soil (upper 10 cm) Phosphorus Fractions (mg/kg) in the Porta-PSTA Treatments, April 1999 - March 2000

					Organic Phosphorus Fractions (mg/kg)		
Treatment	Soil Type	TP	TIP	TOP	Labile	Moderately Labile	Residual
1	Peat	208	117	91	10	7	43
2	Shellrock	1044	950	94	2	-18	41
3	Peat	203	114	89	13	3	58
4	Shellrock	1015	955	60	1	-19	42
5	Shellrock	985	932	53	2	-24	36
6	Shellrock	975	966	9	2	-16	50
7	Sand	29	14	15	0	1	15
8	Sand	24	13	11	2	2	5
9	Peat	206	116	90	8	6	53
10	Shellrock	941	932	9	1	-16	43
11	Shellrock	964	940	24	1	-16	35
12	Peat	195	116	79	10	0	54

Note: TP, TIP, and TOP are averages of monthly periphyton core samples. Organic fractions are from quarterly periphyton grab composites including floating and submerged mats.

EXHIBIT D.1-20

Porta-PSTA Sediment Trap Data, July - October 1999 and November 1999 - February 2000

Treatment	Wet Accretion (ml/m2/y)	Dry Accretion (g/m2/y)	TP Accretion (g/m2/y)	Wet Bulk Density (g/cm3)	Dry Bulk Density (g/cm3)	Wet Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
All	14944	919	0.568	0.902	0.050	55.23	4.11	94.23	644.26	62.09
Peat	7775	242	0.136	0.930	0.029	31.01	0.89	96.79	653.03	37.70
Sand	8164	962	0.044	0.953	0.069	36.75	4.46	92.69	236.43	80.64
Shellrock	20497	1358	0.953	0.878	0.060	73.03	6.10	92.81	693.37	72.63
1	9553	390	0.193	0.998	0.039	36.84	1.38	96.01	483.52	42.66
2	14582	493	0.220	0.886	0.039	49.67	1.92	95.56	595.50	64.27
3	6629	155	0.099	0.912	0.024	31.74	0.70	97.03	620.79	33.06
4	40472	4230	3.132	0.898	0.100	157.52	18.38	89.32	786.25	84.42
5	14477	512	0.321	0.901	0.041	54.80	2.27	95.56	687.59	64.43
6	9396	552	0.357	0.864	0.070	31.18	2.38	91.87	724.55	71.55
7	14788	1858	0.060	1.033	0.096	67.58	8.64	90.38	18.87	83.51
8	1540	67	0.027	0.873	0.043	5.92	0.29	95.00	453.99	77.76
9	4852	217	0.167	0.998	0.049	21.39	0.96	95.13	769.84	46.76
10	14927	219	0.199	0.614	0.015	39.69	0.97	97.48	908.38	70.06
11	30829	1829	1.372	0.955	0.067	88.13	7.86	88.87	555.22	82.66
12	7686	111	0.070	0.826	0.014	25.78	0.48	98.37	897.26	27.66

Values are averages of all replicates within a treatment.

EXHIBIT D.1-21

Average Periphyton Mat Phosphorus Fractions (mg/kg) in the Porta-PSTA Treatments, April 1999 - March 2000

Treatment	Soil Type	TP	TIP	TOP	Organic Phosphorus Fractions (mg/kg)		
					Labile	Moderately Labile	Residual
1	Peat	271	79	192	96	51	51
2	Shellrock	423	175	247	63	-3	44
3	Peat	382	94	287	161	26	47
4	Shellrock	1277	240	1037	16	-5	39
5	Shellrock	652	176	476	92	11	47
6	Shellrock	589	231	358	39	-4	29
7	Sand	305	25	280	34	14	17
8	Sand	204	21	182	78	38	25
9	Peat	338	101	237	98	5	34
10	Shellrock	554	340	214	78	8	25
11	Shellrock	1745	697	1049	48	-12	62
12	Peat	292	93	199	289	-3	92

Note: TP, TIP, and TOP are averages of monthly soil core samples. Organic fractions are from quarterly soil core composites.

Phase 2 Data Summaries

EXHIBIT D.1-22
Water Balances for the Phase 2 Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Month	Depth (m)	HLR (cm/d)	Inflow (m^3/d)	Inflow (m^3)	Outflow (m^3/d)	Outflow (m^3)	Rainfall (in)	Rainfall (m^3)	ET (mm)	ET (m^3)	ΔSTORAGE (m^3)	Residual (m^3)	Residual (% of Inflow)
3	Apr-2000	0.300	5.31	0.324	10.06	0.315	9.77	4.90	0.75	142.60	0.86	0.000	0.33	3.13
	May-2000	0.300	6.99	0.408	12.63	0.381	11.81	0.76	0.12	165.76	0.99	-0.012	-0.04	-0.44
	Jun-2000	0.302	8.99	0.537	16.66	0.530	16.42	1.37	0.21	139.80	0.84	0.018	-0.41	-2.43
	Jul-2000	0.298	8.40	0.506	15.69	0.493	15.29	7.42	1.13	131.78	0.79	-0.037	0.77	5.50
	Aug-2000	0.301	8.17	0.483	14.98	0.465	14.41	2.30	0.35	129.00	0.77	0.018	0.12	1.09
	Sep-2000	0.303	7.68	0.443	13.73	0.393	12.20	7.08	1.08	112.51	0.68	0.000	1.93	12.93
	Oct-2000	0.302	6.22	0.373	11.57	0.364	11.27	10.82	1.65	--	--	0.012	--	--
4	Apr-2000	0.367	4.34	0.271	8.40	0.263	8.16	4.90	0.75	142.60	0.86	0.037	0.09	0.96
	May-2000	0.368	7.37	0.431	13.35	0.463	14.36	0.76	0.12	165.76	0.99	0.006	-1.90	-13.84
	Jun-2000	0.369	8.94	0.536	16.61	0.552	17.11	1.37	0.21	139.80	0.84	0.012	-1.14	-6.28
	Jul-2000	0.372	7.93	0.456	14.13	0.468	14.52	7.42	1.13	131.78	0.79	0.043	-0.10	-0.47
	Aug-2000	0.369	8.90	0.536	16.61	0.550	17.05	2.30	0.35	129.00	0.77	0.018	-0.88	-5.05
	Sep-2000	0.369	8.60	0.518	16.07	0.485	15.05	7.08	1.08	112.51	0.68	-0.006	1.43	8.52
	Oct-2000	0.369	8.95	0.537	16.65	0.529	16.41	10.82	1.65	--	--	-0.006	--	--
7	Apr-2000	0.406	5.19	0.321	9.95	0.300	9.29	4.90	0.75	142.60	0.86	0.786	-0.23	-2.11
	May-2000	0.364	7.68	0.467	14.47	0.498	15.44	0.76	0.12	165.76	0.99	0.018	-1.87	-12.83
	Jun-2000	0.366	8.35	0.490	15.18	0.505	15.65	1.37	0.21	139.80	0.84	0.037	-1.14	-7.38
	Jul-2000	0.365	8.87	0.521	16.17	0.500	15.50	7.42	1.13	131.78	0.79	-0.018	1.03	5.94
	Aug-2000	0.366	8.37	0.492	15.24	0.491	15.21	2.30	0.35	129.00	0.77	0.000	-0.39	-2.51
	Sep-2000	0.366	7.48	0.465	14.41	0.400	12.40	7.08	1.08	112.51	0.68	-0.018	2.43	15.69
	Oct-2000	0.379	8.10	0.486	15.07	0.428	13.28	10.82	1.65	--	--	0.165	--	--
11	Apr-2000	0.340	5.37	0.978	30.33	0.970	30.06	4.90	2.24	142.60	2.57	-0.055	0.00	0.00
	May-2000	0.335	6.78	1.137	35.25	1.116	34.60	0.76	0.35	165.76	2.98	0.000	-1.99	-5.58
	Jun-2000	0.336	9.15	1.667	51.67	1.686	52.25	1.37	0.63	139.80	2.52	0.110	-2.58	-4.93
	Jul-2000	0.338	8.56	1.555	48.21	1.569	48.63	7.42	3.39	131.78	2.37	0.110	0.50	0.96
	Aug-2000	0.347	9.53	1.710	53.01	1.696	52.58	2.30	1.05	129.00	2.32	0.000	-0.84	-1.55
	Sep-2000	0.340	9.18	1.575	48.82	1.515	46.97	7.08	3.24	112.51	2.03	-0.110	3.17	6.09
	Oct-2000	0.341	13.10	2.358	73.10	2.437	75.55	10.82	4.95	--	--	0.110	--	--
12	Apr-2000	0.331	5.73	1.037	32.14	1.009	31.27	4.90	2.24	142.60	2.57	0.110	0.43	1.26
	May-2000	0.332	6.70	1.138	35.27	1.134	35.14	0.76	0.35	165.76	2.98	0.055	-2.57	-7.21
	Jun-2000	0.333	9.67	1.732	53.70	1.797	55.71	1.37	0.63	139.80	2.52	0.055	-3.95	-7.28
	Jul-2000	0.333	9.08	1.660	51.46	1.726	53.50	7.42	3.39	131.78	2.37	-0.055	-0.97	-1.76
	Aug-2000	0.334	8.17	1.446	44.83	1.403	43.49	2.30	1.05	129.00	2.32	0.110	-0.04	-0.09
	Sep-2000	0.334	8.57	1.569	48.63	1.506	46.68	7.08	3.24	112.51	2.03	-0.055	3.21	6.19
	Oct-2000	0.335	8.94	1.609	49.89	1.580	48.99	10.82	4.95	--	--	0.110	--	--
13	Apr-2000	0.277	5.67	0.346	10.73	0.368	11.41	4.90	0.75	142.60	0.86	0.957	-1.74	-15.07
	May-2000	0.337	7.35	0.437	13.54	0.437	13.54	0.76	0.12	165.76	0.99	-0.043	-0.84	-6.10
	Jun-2000	0.340	8.47	0.522	16.19	0.525	16.26	1.37	0.21	139.80	0.84	0.006	-0.71	-3.79
	Jul-2000	0.336	8.64	0.535	16.57	0.555	17.22	7.42	1.13	131.78	0.79	0.018	-0.33	-1.71
	Aug-2000	0.357	8.62	0.521	16.14	0.484	15.01	2.30	0.35	129.00	0.77	0.530	0.18	0.50
	Sep-2000	0.339	8.75	0.512	15.86	0.481	14.90	7.08	1.08	112.51	0.68	0.000	1.36	8.01
	Oct-2000	0.339	9.10	0.546	16.93	0.514	15.94	10.82	1.65	--	--	0.000	--	--
14	Apr-2000	0.296	5.49	0.333	10.33	0.338	10.48	4.90	0.75	142.60	0.86	0.311	-0.56	-5.71
	May-2000	0.312	7.54	0.444	13.77	0.477	14.80	0.76	0.12	165.76	0.99	0.043	-1.95	-14.14
	Jun-2000	0.314	8.67	0.514	15.92	0.722	22.38	1.37	0.21	139.80	0.84	0.012	-7.10	-44.67
	Jul-2000	0.309	8.10	0.450	13.94	0.461	14.28	7.42	1.13	131.78	0.79	-0.006	0.01	-0.41
	Aug-2000	0.314	8.71	0.526	16.29	0.563	17.45	2.30	0.35	129.00	0.77	0.018	-1.60	-9.63
	Sep-2000	0.315	9.21	0.559	17.34	0.553	17.13	7.08	1.08	112.51	0.68	0.000	0.61	3.26

EXHIBIT D.1-22

Water Balances for the Phase 2 Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Month	Depth (m)	HLR (cm/d)	Inflow (m^3/d)	Inflow (m^3)	Outflow (m^3/d)	Outflow (m^3)	Rainfall (in)	Rainfall (m^3)	ET (mm)	ET (m^3)	ΔSTORAGE (m^3)	Residual (m^3)	Residual (% of inflow)
	Oct-2000	0.314	9.14	0.548	17.00	0.547	16.96	10.82	1.65	--	--	0.000	--	--
15	Apr-2000	0.343	4.92	0.295	9.16	0.261	8.08	4.90	0.75	142.60	0.86	0.140	0.82	8.33
	May-2000	0.344	6.70	0.392	12.14	0.360	11.15	0.76	0.12	165.76	0.99	-0.006	0.11	0.76
	Jun-2000	0.347	8.64	0.516	16.01	0.507	15.70	1.37	0.21	139.80	0.84	0.043	-0.36	-2.20
	Jul-2000	0.346	8.29	0.505	15.67	0.459	14.24	7.42	1.13	131.78	0.79	0.000	1.77	11.80
	Aug-2000	0.346	7.40	0.444	13.76	0.428	13.25	2.30	0.35	129.00	0.77	0.012	0.07	1.40
	Sep-2000	0.346	7.31	0.436	13.52	0.399	12.36	7.08	1.08	112.51	0.68	-0.024	1.59	11.78
	Oct-2000	0.347	8.62	0.517	16.03	0.474	14.69	10.82	1.65	--	--	-0.006	--	--
16	Apr-2000	0.063	--	0.205	6.36	0.029	0.89	4.90	0.75	142.60	0.86	-1.006	6.37	91.35
	May-2000	0.190	7.61	0.396	12.26	0.285	8.84	0.76	0.12	165.76	0.99	2.079	0.46	5.17
	Jun-2000	0.358	16.18	0.952	29.51	0.991	30.72	1.37	0.21	139.80	0.84	-0.037	-1.80	-6.06
	Jul-2000	0.358	19.16	1.147	35.56	1.214	37.64	7.42	1.13	131.78	0.79	-0.024	-1.71	-4.63
	Aug-2000	0.376	17.68	1.086	33.67	1.165	36.12	2.30	0.35	129.00	0.77	0.530	-3.40	-10.05
	Sep-2000	0.359	17.46	1.027	31.82	1.042	32.31	7.08	1.08	112.51	0.68	-0.006	-0.07	-0.04
	Oct-2000	0.360	17.32	1.039	32.22	1.056	32.74	10.82	1.65	--	--	-0.006	--	--
17	Apr-2000	0.232	5.62	0.337	10.45	0.299	9.26	4.90	0.75	142.60	0.86	2.432	-1.35	-12.06
	May-2000	0.331	7.80	0.494	15.32	0.518	16.05	0.76	0.12	165.76	0.99	0.037	-1.65	-10.66
	Jun-2000	0.332	8.37	0.469	14.55	0.491	15.22	1.37	0.21	139.80	0.84	0.055	-1.35	-9.18
	Jul-2000	0.330	7.88	0.472	14.64	0.610	18.91	7.42	1.13	131.78	0.79	-0.037	-3.90	-24.71
	Aug-2000	0.328	6.63	0.399	12.37	0.398	12.34	2.30	0.35	129.00	0.77	0.037	-0.43	-3.37
	Sep-2000	0.331	7.88	0.488	15.11	0.466	14.44	7.08	1.08	112.51	0.68	-0.055	1.13	6.97
	Oct-2000	0.329	8.10	0.486	15.07	0.468	14.51	10.82	1.65	--	--	0.000	--	--
18	Apr-2000	0.468	5.59	0.347	10.76	0.311	9.63	4.90	0.75	142.60	0.86	0.384	0.64	5.52
	May-2000	0.328	9.48	0.602	18.65	0.505	15.66	0.76	0.12	165.76	0.99	0.110	1.99	10.63
	Jun-2000	0.329	8.34	0.515	15.96	0.517	16.03	1.37	0.21	139.80	0.84	0.000	-0.70	-4.31
	Jul-2000	0.331	6.94	0.432	13.39	0.658	20.41	7.42	1.13	131.78	0.79	-0.018	-6.66	-45.83
	Aug-2000	0.326	7.70	0.487	15.08	0.561	17.38	2.30	0.35	129.00	0.77	0.018	-2.74	-17.74
	Sep-2000	0.327	8.52	0.490	15.18	0.554	17.19	7.08	1.08	112.51	0.68	0.000	-1.60	-9.87
	Oct-2000	0.322	8.88	0.533	16.52	0.605	18.75	10.82	1.65	--	--	-0.018	--	--
19	Apr-2000	0.437	6.59	0.360	11.16	0.443	13.74	4.90	0.75	142.60	0.86	-1.408	-1.28	-10.75
	May-2000	0.331	6.71	0.406	12.60	0.488	15.14	0.76	0.12	165.76	0.99	0.018	-3.43	-27.00
	Jun-2000	0.333	9.05	0.528	16.36	0.544	16.87	1.37	0.21	139.80	0.84	0.000	-1.14	-6.90
	Jul-2000	0.333	8.93	0.513	15.91	0.545	16.90	7.42	1.13	131.78	0.79	-0.018	-0.63	-3.70
	Aug-2000	0.335	7.92	0.458	14.21	0.470	14.57	2.30	0.35	129.00	0.77	-0.018	-0.77	-5.30
	Sep-2000	0.336	7.96	0.458	14.19	0.468	14.51	7.08	1.08	112.51	0.68	-0.037	0.12	0.80
	Oct-2000	0.340	9.48	0.569	17.63	0.679	21.04	10.82	1.65	--	--	-0.018	--	--

EXHIBIT D.1-23

Monthly Average Values of Selected Field Parameters Collected at the Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, Phase 2, April 2000 - October 2000

Parameter	Month	Head Tank Outflow	Treatment 3 (Peat) Outflow	4 (Shellrock) Outflow	7 (Sand) Outflow	11 (Shellrock) Outflow	12 (Peat) Outflow	13 (Peat-Ca amended) Outflow	14 (Limerock) Outflow	15 (Shellrock-Increased Velocity) Outflow	16 (Shellrock-Variable Stage) Outflow	17 (Sand- Acid Rinsed) Outflow	18 (None) Outflow	19 (None-Aquamat) Outflow
Water Temp (°C)	Apr-00	24.94	23.48	23.69	23.46	24.19	23.27	23.63	24.30	26.58	26.55	23.94	24.02	23.50
	May-00	29.19	27.37	26.87	27.07	26.74	25.80	26.96	28.38	29.63	27.73	27.26	27.53	28.53
	Jun-00	29.96	28.42	28.25	27.93	29.01	28.39	28.11	28.54	31.60	29.24	28.31	28.00	28.38
	Jul-00	30.04	28.96	28.68	28.89	28.04	28.20	28.36	29.57	31.40	29.01	28.92	28.22	28.79
	Aug-00	30.90	28.69	28.99	29.10	29.08	29.14	28.40	28.99	31.99	29.05	28.62	28.30	28.45
	Sep-00	29.91	28.21	29.46	27.13	27.87	28.50	29.61	28.13	30.34	29.36	27.79	28.23	27.25
	Oct-00	27.45	27.24	26.92	26.76	27.51	25.70	25.41	25.97	28.61	26.89	27.47	27.34	27.59
pH (units)	Apr-00	7.16	7.11	7.89	8.06	7.69	7.14	8.62	7.53	7.49	7.71	7.88	7.91	7.94
	May-00	7.22	7.06	7.71	7.69	7.61	7.18	7.96	7.81	7.62	7.84	8.23	8.14	8.15
	Jun-00	7.36	6.98	7.53	7.75	7.57	6.90	7.80	7.85	7.40	7.71	8.20	8.16	8.18
	Jul-00	7.19	6.95	7.55	7.59	7.41	7.01	7.90	7.65	7.36	7.57	7.85	8.09	7.80
	Aug-00	7.32	7.11	7.47	7.47	7.43	7.22	7.77	7.48	7.40	7.45	7.61	7.82	7.69
	Sep-00	7.25	6.93	7.40	7.48	7.58	7.22	7.58	7.63	7.63	7.50	7.58	7.79	7.92
	Oct-00		--	--	--	7.62	7.30	--	7.68	7.37	--	--	--	--
Conductivity (μmhos/cm)	Apr-00	925	883	787	728	879	960	722	897	881	1009	902	906	942
	May-00	1011	1008	961	916	1000	1135	1025	905	1095	930	905	1004	895
	Jun-00	958	940	929	877	1044	962	929	940	1006	980	899	948	978
	Jul-00	910	952	964	962	913	994	957	869	1014	931	875	856	848
	Aug-00	1246	1127	1166	1065	1236	1229	1069	1151	1153	1209	1191	1178	1155
	Sep-00	1181	1098	1170	1149	1182	1074	1425	1008	1208	1156	983	977	1040
	Oct-00		--	--	--	1189	963	--	959	1017	--	--	--	--
Salinity (ppt)	Apr-00	--	0.46	0.41	0.37	0.46	0.51	--	0.47	0.46	0.53	0.47	0.47	0.49
	May-00	--	0.53	0.50	0.47	0.52	0.60	0.54	0.47	0.58	0.49	0.47	0.53	0.46
	Jun-00	--	0.49	0.48	0.45	0.55	0.50	0.48	0.49	0.53	0.51	0.47	0.50	0.52
	Jul-00	--	0.50	0.51	0.51	0.47	0.52	0.50	0.45	0.53	0.49	0.45	0.44	0.44
	Aug-00	--	0.59	0.61	0.57	0.65	0.65	0.56	0.60	0.60	0.64	0.63	0.62	0.61
	Sep-00	--	0.58	0.62	0.61	0.62	--	0.78	0.53	0.65	0.61	0.51	0.51	0.54
	Oct-00	--	--	--	--	0.63	0.50	--	0.50	0.53	--	--	--	--
Total Dissolved Solids (g/L)	Apr-00	0.592	0.565	0.503	0.466	0.562	0.615	0.467	0.574	0.564	0.646	0.577	0.580	0.603
	May-00	0.646	0.645	0.615	0.586	0.640	0.726	0.656	0.581	0.701	0.595	0.579	0.643	0.573
	Jun-00	0.613	0.602	0.595	0.561	0.668	0.616	0.596	0.602	0.644	0.628	0.576	0.607	0.626
	Jul-00	0.556	0.610	0.617	0.616	0.584	0.636	0.612	0.556	0.649	0.596	0.560	0.548	0.543
	Aug-00	0.797	0.721	0.746	0.695	0.791	0.787	0.684	0.737	0.738	0.773	0.762	0.753	0.739
	Sep-00	0.718	0.703	0.749	0.736	0.756	0.720	0.912	0.645	0.773	0.740	0.629	0.626	0.665
	Oct-00	0.803	0.759	0.764	0.745	0.762	0.622	0.768	0.625	0.659	0.791	0.759	0.741	0.759
Dissolved Oxygen Saturation (%)	Apr-00	48.0	71.9	114.0	128.2	118.6	68.7	57.0	84.5	63.3	88.2	111.5	101.9	111.3
	May-00	45.2	69.5	99.9	95.7	101.3	65.9	67.4	108.3	84.6	104.6	141.0	127.2	123.1
	Jun-00	52.0	55.4	88.2	103.2	87.2	46.9	94.6	115.2	85.3	100.1	159.7	121.8	128.0
	Jul-00	45.6	40.9	91.4	82.5	87.6	51.5	97.8	91.1	76.5	98.2	129.9	117.4	113.0
	Aug-00	42.7	43.8	93.2	105.7	94.0	65.6	113.5	103.6	89.1	89.8	114.8	110.1	124.3
	Sep-00	27.0	38.6	87.5	49.9	86.4	42.8	57.2	98.9	96.4	86.7	95.2	112.7	122.3
	Oct-00	43.5	46.0	78.2	103.6	86.6	53.2	69.9	98.6	65.4	72.0	89.6	100.9	106.1
Dissolved Oxygen (mg/L)	Apr-00	3.96	6.04	9.56	10.64	9.96	5.83	4.83	7.02	5.07	7.05	9.34	8.38	9.37
	May-00	3.46	5.41	7.89	7.48	8.02	5.31	5.24	8.37	6.38	8.03	11.09	9.97	9.48
	Jun-00	3.93	4.28	6.83	7.95	6.69	3.54	7.34	8.87	6.22	7.61	12.27	9.46	9.99
	Jul-00	3.56	3.10	6.97	6.30	6.80	3.98	7.49	6.86	5.61	7.52	9.93	9.11	8.67
	Aug-00	3.16	3.35	7.08	8.05	7.14	4.93	8.73	7.86	6.46	6.82	8.81	8.58	9.60
	Sep-00	2.05	2.97	6.60	3.88	6.75	3.26	4.30	7.64	7.22	6.56	7.44	8.69	9.50
	Oct-00	3.42	3.65	6.21	8.16	6.94	4.32	5.56	7.97	5.04	5.74	7.09	7.95	8.38

EXHIBIT D.1-24

Monthly Average Values of Water Quality Data Collected at the Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April 2000 - October 2000

		Treatment																							
		3 (Peat)		4 (Shellrock)		7 (Sand)		11 (Shellrock)		12 (Peat)		13 (Peat- Ca amended)		14 (Limerock)		15 (Shellrock- Increased		16 (Shellrock- Variable Stage)		17 (Sand- Acid Rinsed)		18 (None)		19 (None- Aquamat)	
Parameter	Month	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow	Inflow[a]	Outflow
Total Phosphorus as P (mg/L)	Apr-00	0.038	0.020	0.039	0.017	0.036	0.018	0.037	0.023	0.036	0.027	0.042	0.023	0.037	0.024	0.036	0.028	--	--	0.041	0.030	0.038	0.026	0.035	0.022
	May-00	0.053	0.019	0.054	0.017	0.055	0.020	0.055	0.023	0.054	0.020	0.054	0.026	0.053	0.018	0.054	0.022	0.046	0.020	0.053	0.019	0.053	0.023	0.054	0.018
	Jun-00	0.028	0.022	0.028	0.017	0.028	0.015	0.028	0.022	0.028	0.026	0.028	0.021	0.028	0.019	0.028	0.018	0.028	0.021	0.028	0.013	0.028	0.017	0.028	0.023
	Jul-00	0.021	0.018	0.020	0.014	0.020	0.012	0.020	0.020	0.020	0.018	0.020	0.018	0.021	0.014	0.020	0.016	0.021	0.018	0.020	0.010	0.020	0.015	0.020	0.014
	Aug-00	0.019	0.017	0.019	0.012	0.019	0.011	0.019	0.013	0.019	0.017	0.020	0.012	0.019	0.013	0.019	0.012	0.019	0.013	0.019	0.009	0.019	0.012	0.019	0.010
	Sep-00	0.028	0.020	0.028	0.013	0.028	0.021	0.028	0.018	0.028	0.018	0.028	0.014	0.028	0.013	0.028	0.013	0.028	0.018	0.028	0.016	0.028	0.013	0.028	0.010
	Oct-00	0.017	0.016	0.016	0.010	0.016	0.010	0.014	0.011	0.014	0.012	0.016	0.009	0.015	0.012	0.016	0.009	0.015	0.011	0.015	0.010	0.020	0.008	0.015	0.007
Total Particulate Phosphorus (mg/L)	Apr-00	0.020	0.008	0.022	0.006	0.018	0.008	0.019	0.011	0.019	0.015	0.025	0.010	0.019	0.010	0.019	0.013	--	--	0.022	0.014	0.020	0.015	0.017	0.009
	May-00	0.035	0.008	0.035	0.007	0.036	0.009	0.036	0.009	0.034	0.008	0.035	0.013	0.035	0.007	0.035	0.010	0.025	0.008	0.034	0.008	0.034	0.010	0.035	0.005
	Jun-00	0.010	0.010	0.010	0.006	0.010	0.004	0.010	0.010	0.010	0.013	0.010	0.008	0.010	0.009	0.010	0.007	0.010	0.008	0.010	0.003	0.010	0.004	0.010	0.010
	Jul-00	0.005	0.010	0.005	0.007	0.005	0.004	0.005	0.012	0.005	0.008	0.005	0.009	0.005	0.007	0.005	0.008	0.005	0.010	0.004	0.004	0.005	0.008	0.005	0.006
	Aug-00	0.005	0.009	0.005	0.006	0.005	0.006	0.005	0.006	0.005	0.010	0.006	0.006	0.005	0.007	0.006	0.006	0.005	0.005	0.005	0.003	0.005	0.004	0.006	0.004
	Sep-00	0.016	0.011	0.016	0.005	0.016	0.015	0.016	0.010	0.016	0.009	0.016	0.007	0.016	0.006	0.016	0.006	0.016	0.009	0.016	0.007	0.016	0.006	0.016	0.002
	Oct-00	0.004	0.009	0.005	0.005	0.005	0.004	0.002	0.004	0.003	0.005	0.004	0.003	0.005	0.007	0.004	0.004	0.005	0.005	0.004	0.003	0.009	0.001	0.004	0.001
Total Dissolved Phosphorus (mg/L)	Apr-00	0.018	0.012	0.018	0.011	0.018	0.010	0.018	0.012	0.018	0.012	0.018	0.015	0.018	0.013	0.017	0.015	--	--	0.018	0.013	0.018	0.011	0.018	0.013
	May-00	0.019	0.012	0.019	0.010	0.019	0.011	0.019	0.014	0.019	0.013	0.019	0.015	0.019	0.011	0.019	0.012	0.021	0.013	0.019	0.011	0.019	0.015	0.019	0.014
	Jun-00	0.018	0.013	0.018	0.011	0.018	0.010	0.018	0.012	0.018	0.013	0.018	0.013	0.018	0.011	0.018	0.011	0.018	0.013	0.018	0.011	0.018	0.014	0.018	0.013
	Jul-00	0.015	0.008	0.015	0.007	0.015	0.008	0.015	0.008	0.015	0.010	0.015	0.010	0.015	0.007	0.015	0.008	0.015	0.008	0.015	0.006	0.015	0.008	0.015	0.008
	Aug-00	0.014	0.008	0.014	0.007	0.014	0.006	0.014	0.007	0.013	0.007	0.014	0.006	0.014	0.005	0.014	0.006	0.014	0.008	0.014	0.006	0.014	0.008	0.013	0.006
	Sep-00	0.013	0.009	0.013	0.008	0.013	0.006	0.013	0.008	0.013	0.009	0.013	0.007	0.013	0.007	0.013	0.008	0.013	0.009	0.013	0.009	0.013	0.007	0.013	0.008
	Oct-00	0.012	0.006	0.011	0.005	0.011	0.006	0.012	0.007	0.011	0.007	0.012	0.006	0.010	0.005	0.011	0.005	0.010	0.007	0.011	0.007	0.011	0.007	0.011	0.006
Dissolved Reactive Phosphorus (mg/L)	Apr-00	0.004	--	0.004	--	0.004	--	0.004	--	0.004	--	0.004	--	0.004	--	0.004	--	--	--	0.004	--	0.004	--	0.004	--
	May-00	0.005	--	0.005	--	0.005	--	0.005	--	0.005	--	0.005	--	0.005	--	0.005	--	0.005	0.005	0.005	--	0.005	--	0.005	--
	Jun-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-00	0.008	0.003	0.007	0.002	0.007	0.001	0.008	0.001	0.008	0.001	0.007	0.001	0.007	0.001	0.007	0.002	0.007	0.001	0.007	0.001	0.008	0.001	0.007	0.002
	Sep-00	0.011	0.003	0.011	0.001	0.011	--	0.011	--	0.011	--	0.011	0.003	0.011	0.001	0.011	0.003	0.011	0.002	0.011	--	0.011	--	0.011	--
	Oct-00	0.006	0.001	0.004	0.002	0.004	0.002	0.005	0.003	0.004	0.005	0.005	0.002	0.004	0.002	0.006	0.002	0.007	0.003	0.004	0.002	0.004	0.002	0.004	0.001
Dissolved Organic Phosphorus (mg/L)	Apr-00	0.014	--	0.014	--	0.014	--	0.014	--	0.014	--	0.014	--	0.014	--	0.013	--	--	--	0.014	--	0.014	--	0.014	--
	May-00	0.013	--	0.014	--	0.014	--	0.014	--	0.014	--	0.013	--	0.014	--	0.014	--	0.015	0.011	0.014	--	0.014	--	0.014	--
	Jun-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-00	0.006	0.004	0.007	0.003	0.006	0.003	0.006	0.003	0.006	0.004	0.006	0.003	0.007	0.003	0.006	0.003	0.006	0.006	0.006	0.003	0.006	0.004	0.006	0.003
	Sep-00	0.003	0.005	0.003	0.008	0.003	--	0.003	--	0.003	--	0.003	0.005	0.003	0.008	0.003	0.004	0.003	0.008	0.003	--	0.003	--	0.003	--
	Oct-00	0.005	0.005	0.007	0.003	0.007	0.004	0.007	0.004	0.007	0.002	0.007	0.004	0.006	0.003	0.005	0.003	0.004	0.004	0.007	0.005	0.007	0.005	0.007	0.005
Total Nitrogen, as N (mg/L)	Apr-00	1.78	0.44	1.78	1.58	1.78	1.70	1.78	0.51	1.78	0.66	1.78	1.02	1.78	0.43	1.78	0.73	--	--	1.78	0.64	1.78	0.55	1.78	1.38
	May-00	1.82	2.00	1.82	2.15	1.82	2.09	1.82	2.28	1.82	1.91	1.82	2.60	1.82	1.76	1.82	2.30	--	--	1.82	1.66	1.82	1.91	1.82	2.13
	Jun-00	2.47	2.29	2.37	2.53	2.15	3.89	2.45	2.46	2.46	2.41	2.33	2.29	2.38	2.08	2.39	2.56	2.42	2.35	2.36	2.35	5.65	2.48	2.39	2.44
	Jul-00	2.36	2.68	2.36	2.62	2.36	2.65	2.36	2.92	2.36	2.40	2.36	2.59	2.36	2.43	2.36	2.70	2.36	2.56	2.36	2.60	2.36	2.56	2.36	3.43
	Aug-00	2.04	2.61	2.04	2.11	2.04	2.75	2.04	2.47	2.04	2.41	2.04	2.28	2.04	1.97	2.04	2.29	2.04	2.18	2.04	2.64	2.04	2.26	2.04	2.42
	Oct-00	1.64	2.42	2.08	2.03	0.62	2.32	2.45	2.37	1.32	2.26	1.73	2.19	2.39	1.43	1.45	2.07	1.97	2.24	2.36	2.28	2.17	2.28	2.38	2.25

EXHIBIT D.1-24

Monthly Average Values of Water Quality Data Collected at the Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April 2000 - October 2000

		Treatment																							
		3 (Peat)		4 (Shellrock)		7 (Sand)		11 (Shellrock)		12 (Peat)		13 (Peat- Ca amended)		14 (Limerock)		15 (Shellrock- Increased		16 (Shellrock- Variable Stage)		17 (Sand- Acid Rinsed)		18 (None)		19 (None- Aquamat)	
Parameter	Month	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow	Inflow*	Outflow
Total Kjeldahl Nitrogen, as N (mg/L)	Apr-00	1.78	0.44	1.78	1.58	1.78	1.70	1.78	0.51	1.78	0.66	1.78	0.98	1.78	0.43	1.78	0.71	--	--	1.78	0.46	1.78	0.55	1.78	1.38
	May-00	1.82	2.00	1.82	2.15	1.82	2.09	1.82	2.28	1.82	1.91	1.82	2.60	1.82	2.00	1.82	2.30	--	--	1.82	1.86	1.82	1.91	1.82	2.13
	Jun-00	2.40	2.29	2.30	2.53	2.08	2.64	2.39	2.46	2.39	2.41	2.26	2.29	2.31	2.07	2.32	2.56	2.35	2.34	2.30	2.35	5.59	2.48	2.32	2.44
	Jul-00	2.34	2.68	2.34	2.61	2.34	2.65	2.34	2.92	2.34	2.40	2.34	2.59	2.34	2.41	2.34	2.67	2.34	2.56	2.34	2.60	2.34	2.56	2.34	3.42
	Aug-00	2.01	2.58	2.01	2.09	2.01	2.74	2.01	2.47	2.01	2.40	2.01	2.27	2.01	1.96	2.01	2.28	2.01	2.17	2.01	2.64	2.01	2.26	2.01	2.42
	Oct-00	1.63	2.42	2.07	2.03	0.61	2.32	2.44	2.37	1.31	2.26	1.72	2.19	2.37	1.42	1.78	2.07	1.96	2.24	2.35	2.28	2.16	2.28	2.37	2.25
Nitrate/Nitrite, as N (mg/L)	Apr-00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.02	1.96	2.24	0.00	0.00	0.00	0.00	0.00	0.00
	May-00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00	0.00
	Jun-00	0.07	0.00	0.07	0.00	0.07	1.25	0.06	0.00	0.07	0.00	0.07	0.00	0.07	0.01	0.07	0.00	0.07	0.00	0.06	0.00	0.06	0.00	0.07	0.00
	Jul-00	0.02	0.00	0.02	0.01	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.01	0.02	0.02	0.02	0.03	0.02	0.01	0.02	0.00	0.02	0.00	0.02	0.01
	Aug-00	0.03	0.03	0.03	0.02	0.03	0.01	0.03	0.00	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.02	0.03	0.00	0.03	0.00	0.03	0.00
	Oct-00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
Ammonia, as NH_3 (mg/L)	Apr-00	0.03	--	0.03	0.03	0.03	0.04	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	--	--	0.03	--	0.03	--	0.03	0.02
	May-00	0.02	0.00	0.02	0.02	0.02	0.03	0.02	0.04	0.02	0.00	0.02	0.20	0.02	0.00	0.02	0.02	--	--	0.02	0.00	0.02	0.02	0.02	0.01
	Jun-00	0.04	0.04	0.04	0.04	0.04	0.05	0.07	0.05	0.07	0.11	0.04	0.04	0.04	0.03	0.04	0.03	0.07	0.02	0.05	0.02	0.05	0.05	0.05	0.04
	Jul-00	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--	0.03	--
	Aug-00	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--	0.06	--
	Oct-00	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--	0.00	--
Organic Nitrogen (mg/L)	Apr-00	1.75	--	1.75	1.55	1.75	1.66	1.75	--	1.75	--	1.75	--	1.75	--	1.75	--	--	--	1.75	--	1.75	--	1.75	1.36
	May-00	1.80	1.99	1.80	2.13	1.80	2.06	1.80	2.24	1.80	1.90	1.80	2.39	1.80	1.99	1.80	2.28		--	1.80	1.86	1.80	1.89	1.80	2.12
	Jun-00	2.36	2.25	2.26	2.49	2.04	2.59	2.32	2.41	2.32	2.30	2.22	2.25	2.27	2.04	2.28	2.53	2.28	2.32	2.25	2.33	5.54	2.43	2.27	2.40
	Jul-00	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--	2.31	--
	Aug-00	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--	1.95	--
	Oct-00	1.63	--	2.07	--	0.61	--	2.44	--	1.31	--	1.72	--	2.37	--	1.78	--	1.96	--	2.35	--	2.16	--	2.37	--
TOC (mg/L)	Apr-00	33.00	28.17	33.00	26.67	33.00	28.00	33.00	29.00	33.00	31.00	33.00	31.00	33.00	25.33	33.00	30.67	--	--	33.00	31.00	33.00	29.00	33.00	26.50
	May-00	32.00	37.67	32.00	36.67	32.00	36.00	32.00	37.00	32.00	40.00	32.00	42.33	32.00	38.67	32.00	44.00			32.00	36.00	32.00	37.00	32.00	44.00
	Jun-00	46.67	48.33	38.33	38.33	47.00	48.00	45.00	49.00	48.00	44.00	48.33	41.33	37.33	35.83	40.00	43.33	42.67	45.00	49.00	44.00	53.00	44.00	47.00	47.00
	Jul-00	31.00	35.33	31.00	34.00	31.00	37.00	31.00	28.00	31.00	36.00	31.00	34.67	31.00	31.33	31.00	34.67	31.00	33.33	31.00	37.00	31.00	37.00	31.00	36.00
	Aug-00	42.00	43.00	42.00	42.00	42.00	42.00	42.00	43.00	42.00	43.00	42.00	42.67	42.00	39.00	42.00	42.67	42.00	43.17	42.00	43.00	42.00	42.00	42.00	42.00
	Oct-00	98.67	41.67	97.00	41.00	100.00	42.00	76.00	58.00	78.00	58.00	93.00	40.33	98.00	36.67	85.67	50.67	87.00	48.17	100.00	52.00	100.00	52.00	100.00	56.00
TSS (mg/L)	Apr-00	--	2.27	--	1.80	--	2.00	--	2.60	--	3.80	--	14.33	--	2.27	--	3.33	--	--	--	1.80	--	2.60	--	1.80
	May-00	12.00	4.67	12.00	3.00	12.00	6.00	12.00	7.00	12.00	4.00	12.00	3.67	12.00	3.00	12.00	4.33			12.00	4.00	12.00	3.00	12.00	15.50
	Jun-00	1.33	1.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	2.00	1.00	1.33	1.00	1.00	1.00	1.33	1.00	1.00	2.00	1.00	2.00	1.00	1.00	1.00
	Jul-00	1.00	2.33	1.00	1.33	1.00	1.00	1.00	1.00	1.00	3.50	1.00	1.33	1.00	2.00	1.00	3.00	1.00	1.33	1.00	1.00	1.00	1.00	1.00	1.00
	Aug-00	4.00	2.00	4.00	2.67	4.00	1.00	4.00	1.00	4.00	2.00	4.00	3.00	4.00	3.67	4.00	4.00	4.00	3.50	4.00	1.00	4.00	2.00	4.00	1.00
	Oct-00	3.33	7.00	5.33	3.33	1.00	1.00	1.00	17.00	1.00	12.00	6.50	2.67	9.33	3.67	5.33	4.00	4.67	4.17	1.00	10.00	1.00	6.00	1.00	5.00
Calcium (mg/L)	Apr-00	--	53.00	--	32.00	--	35.00	--	48.00	--	52.00	--	45.67	--	46.33	--	53.67	--	--	--	53.00	--	47.00	--	41.50
	May-00	57.90	66.83	57.90	49.77	57.90	50.00	57.90	63.60	57.90	69.80	57.90	57.60	57.90	50.37	57.90	65.35		--	57.90	52.50	57.90	50.00	57.90	41.80
	Jun-00	46.10	54.43	46.27	46.07	45.20	43.20	46.30	50.20	43.60	50.40	45.97	46.17	46.83	41.08	45.37	55.47	46.37	45.30	43.80	36.60	46.20	37.20	45.10	33.60
	Jul-00	55.60	54.43	55.60	47.87	55.60	43.60	55.60	52.50	55.60	49.45	55.60	46.47	55.60	38.87	55.60	56.17	55.60	52.27	55.60	33.30	55.60	41.00	55.60	38.00
	Aug-00	78.40	80.77	78.40	71.03	78.40	67.90	78.40	80.70	78.40	80.00	78.40	66.80	78.40	61.57	78.40	77.07	78.40	77.42	78.40	63.70	78.40	59.80	78.40	63.30
	Oct-00	97.90	83.40	95.37	77.33	97.60	74.40	98.60	84.60	95.90	88.00	95.53	78.97	95.50	69.40	98.03	79.93	96.90	89.28	96.90	81.90	98.30	69.90	95.90	71.20
Alkalinity (mg/L)	Apr-00	--	171.67	--	115.00	--	120.00	--	160.00	--	150.00	--	78.00	--	123.33	--	176.67	--	--	--	170.00	--	150.00	--	140.00
	May-00	180.00	210.00	180.00	174.67	180.00	180.00	180.00	200.00	180.00	221.00	180.00	176.00	180.00	157.33	180.00	214.67		--	180.00	172.00	180.00	168.00	180.00	148.00
	Jun-00	173.33	191.33	176.00	172.00	172.00	160.00	168.00	184.00	168.00	188.00	173.33	172.00	176.00	151.33	174.67	198.67	174.67	173.33	172.00	144.00	168.00	148.00	168.00	136.00
	Jul-00	184.00	202.67	184.00	185.33	184.00	176.00	184.00	196.00	184.00	186.00	184.00	179.33	184.00	154.00	184.00	205.33	184.00	190.67	184.00	144.00	184.00	160.00	184.00	148.00
	Aug-00	260.00	265.33	260.00	240.67	260.00	236.00	260.00	264.00	260.00	268.00	260.00	232.67	260.00	224.00	260.00	257.33	260.00	260.67	260.00	220.00	260.00	216.00	260.00	220.00
	Oct-00	296.00	232.00	296.00	256.00	300.00	248.00	304.00	272.00	300.00	276.00	294.00	244.00	297.33	234.67	294.67	263.33	292.00	270.67	296.00	258.00	300.00	234.00	296.00	236.00

Notes.

*Inflow averages include data from constant head tank outlet and samples collected from individual tank inlets

EXHIBIT D.1-25

Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Date	TP (mg/L) Inflow	TP (mg/L) Outflow	q_in (cm/d)	MB_TP ($g/m^2/y$) Inflow	MB_TP ($g/m^2/y$) Outflow	Removal ($g/m^2/y$)	Removal (%)	Calc_k (m/y)
Monthly									
3	Apr-00	0.038	0.020	5.31	0.743	0.373	0.370	49.75	12.93
	May-00	0.053	0.019	6.99	1.242	0.435	0.806	64.93	27.00
	Jun-00	0.028	0.022	8.99	0.898	0.696	0.202	22.49	8.15
	Jul-00	0.021	0.018	8.40	0.629	0.488	0.141	22.43	4.99
	Aug-00	0.019	0.017	8.17	0.559	0.458	0.101	18.08	3.02
	Sep-00	0.028	0.020	7.68	0.796	0.508	0.288	36.14	9.63
	Oct-00	0.017	0.016	6.22	0.374	0.341	0.033	8.94	1.40
4	Apr-00	0.039	0.017	4.34	0.635	0.260	0.375	59.13	13.03
	May-00	0.054	0.017	7.37	1.292	0.513	0.779	60.29	31.58
	Jun-00	0.028	0.017	8.94	0.903	0.543	0.359	39.80	15.73
	Jul-00	0.020	0.014	7.93	0.612	0.434	0.178	29.04	10.38
	Aug-00	0.019	0.012	8.90	0.623	0.405	0.218	34.96	14.29
	Sep-00	0.028	0.013	8.60	0.891	0.397	0.493	55.39	23.68
	Oct-00	0.016	0.010	8.95	0.539	0.316	0.223	41.36	17.13
7	Apr-00	0.036	0.018	5.19	0.674	0.305	0.369	54.79	13.35
	May-00	0.055	0.020	7.68	1.518	0.588	0.930	61.27	27.77
	Jun-00	0.028	0.015	8.35	0.823	0.451	0.372	45.24	19.69
	Jul-00	0.020	0.012	8.87	0.657	0.366	0.292	44.36	17.21
	Aug-00	0.019	0.011	8.37	0.585	0.328	0.256	43.83	16.49
	Sep-00	0.028	0.021	7.48	0.760	0.477	0.283	37.17	8.18
	Oct-00	0.016	0.010	8.10	0.473	0.261	0.212	44.91	13.90
11	Apr-00	0.037	0.023	5.37	0.724	0.444	0.280	38.70	9.49
	May-00	0.055	0.023	6.78	1.237	0.569	0.668	54.02	21.43
	Jun-00	0.028	0.022	9.15	0.932	0.761	0.171	18.34	7.66
	Jul-00	0.020	0.020	8.56	0.605	0.564	0.042	6.90	0.91
	Aug-00	0.019	0.013	9.53	0.663	0.457	0.206	31.02	12.47
	Sep-00	0.028	0.018	9.18	0.959	0.580	0.379	39.50	15.09
	Oct-00	0.014	0.011	13.10	0.669	0.544	0.126	18.79	11.53
12	Apr-00	0.036	0.027	5.73	0.760	0.549	0.211	27.79	6.45
	May-00	0.054	0.020	6.70	1.195	0.474	0.721	60.36	24.03
	Jun-00	0.028	0.026	9.67	0.975	0.983	-0.008	-0.81	1.86
	Jul-00	0.020	0.018	9.08	0.653	0.554	0.099	15.12	4.97
	Aug-00	0.019	0.017	8.17	0.559	0.479	0.081	14.43	3.05
	Sep-00	0.028	0.018	8.57	0.894	0.534	0.360	40.32	14.38
	Oct-00	0.014	0.012	8.94	0.457	0.385	0.072	15.82	5.03
13	Apr-00	0.042	0.023	5.67	0.872	0.528	0.343	39.40	12.16
	May-00	0.054	0.028	7.35	1.550	0.731	0.819	52.84	17.61
	Jun-00	0.028	0.021	8.47	0.835	0.654	0.181	21.66	8.53
	Jul-00	0.020	0.018	8.64	0.609	0.579	0.030	4.94	2.91
	Aug-00	0.020	0.012	8.62	0.608	0.343	0.264	43.51	15.18
	Sep-00	0.028	0.014	8.75	0.904	0.421	0.484	53.47	22.51
	Oct-00	0.016	0.009	9.10	0.525	0.276	0.249	47.45	20.02
14	Apr-00	0.037	0.024	5.49	0.747	0.477	0.270	36.17	9.27
	May-00	0.053	0.018	7.54	1.271	0.526	0.745	58.62	29.59
	Jun-00	0.028	0.019	8.67	0.867	0.810	0.057	6.57	11.27
	Jul-00	0.021	0.014	8.10	0.613	0.428	0.185	30.16	12.08
	Aug-00	0.019	0.013	8.71	0.602	0.439	0.163	27.02	12.88
	Sep-00	0.028	0.013	9.21	0.925	0.437	0.488	52.78	26.20
	Oct-00	0.015	0.012	9.14	0.512	0.399	0.112	21.95	9.12
15	Apr-00	0.036	0.028	4.92	0.649	0.433	0.216	33.23	4.72
	May-00	0.054	0.022	6.70	1.179	0.487	0.691	58.65	22.11
	Jun-00	0.028	0.018	8.64	0.855	0.541	0.314	36.76	13.92
	Jul-00	0.020	0.016	8.29	0.612	0.415	0.197	32.15	7.63
	Aug-00	0.019	0.012	7.40	0.524	0.312	0.211	40.35	12.03
	Sep-00	0.028	0.013	7.31	0.743	0.314	0.429	57.78	20.47
	Oct-00	0.016	0.009	8.62	0.492	0.261	0.231	46.97	16.30
16	Apr-00	--	--	--	--	--	--	--	--
	May-00	0.046	0.020	7.61	1.034	0.504	0.530	51.24	22.84
	Jun-00	0.028	0.021	16.18	1.595	1.228	0.367	23.01	16.99
	Jul-00	0.021	0.018	19.16	1.424	1.331	0.093	6.51	8.97
	Aug-00	0.019	0.013	17.68	1.251	0.904	0.347	27.75	25.88
	Sep-00	0.028	0.018	17.46	1.827	1.178	0.649	35.52	29.00
	Oct-00	0.015	0.011	17.32	0.965	0.730	0.235	24.32	19.11
17	Apr-00	0.041	0.030	5.62	0.850	0.583	0.267	31.36	6.16
	May-00	0.053	0.019	7.80	1.626	0.579	1.048	64.42	29.13
	Jun-00	0.028	0.013	8.37	0.862	0.426	0.436	50.58	22.48
	Jul-00	0.020	0.010	7.88	0.573	0.370	0.202	35.32	20.29
	Aug-00	0.019	0.009	6.63	0.455	0.207	0.248	54.51	18.87
	Sep-00	0.028	0.016	7.88	0.805	0.422	0.383	47.56	16.21
	Oct-00	0.015	0.010	8.10	0.443	0.270	0.173	39.01	13.50
18	Apr-00	0.038	0.026	5.59	0.768	0.447	0.321	41.79	7.67
	May-00	0.053	0.023	9.48	1.520	0.689	0.831	54.66	29.67
	Jun-00	0.028	0.017	8.34	0.820	0.525	0.295	35.95	14.38
	Jul-00	0.020	0.015	6.94	0.452	0.754	-0.302	-66.76	6.74
	Aug-00	0.019	0.012	7.70	0.548	0.348	0.200	36.54	14.23
	Sep-00	0.028	0.013	8.52	0.847	0.436	0.410	48.47	24.38
	Oct-00	0.020	0.008	8.86	0.648	0.294	0.354	54.59	29.70
19	Apr-00	0.035	0.022	6.59	0.841	0.623	0.218	25.91	11.17
	May-00	0.054	0.018	6.71	1.323	0.528	0.795	60.08	26.57
	Jun-00	0.028	0.023	9.05	0.911	0.756	0.154	16.95	6.46
	Jul-00	0.020	0.014	8.93	0.593	0.456	0.137	23.05	12.16
	Aug-00	0.019	0.010	7.92	0.532	0.297	0.235	44.25	19.79
	Sep-00	0.028	0.010	7.96	0.844	0.292	0.552	65.41	31.52
	Oct-00	0.015	0.007	9.48	0.519	0.289	0.230	44.32	26.37

EXHIBIT D.1-26

Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Treatments, April 2000 - October 2000

		TN (mg/L)		q_in	MB_TN (g/m²/y)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(cm/d)	Inflow	Outflow	(g/m²/y)	(%)	(m/y)
Monthly									
3	Apr-00	1.78	0.44	5.31	34.50	8.20	26.29	76.23	26.81
	May-00	1.82	2.00	6.99	46.46	47.93	-1.48	-3.18	-2.29
	Jun-00	2.47	2.29	8.99	81.05	74.40	6.65	8.20	2.42
	Jul-00	2.36	2.68	8.40	72.36	78.59	-6.23	-8.61	-3.85
	Aug-00	2.04	2.61	8.17	60.80	74.97	-14.18	-23.32	-7.24
	Oct-00	1.64	2.42	6.22	37.23	53.45	-16.22	-43.57	-8.69
4	Apr-00	1.78	1.58	4.34	28.22	24.20	4.03	14.27	1.82
	May-00	1.82	2.15	7.37	48.94	64.73	-15.79	-32.26	-4.79
	Jun-00	2.37	2.53	8.94	77.34	82.39	-5.05	-6.53	-2.13
	Jul-00	2.36	2.62	7.93	68.33	78.74	-10.41	-15.24	-3.05
	Aug-00	2.04	2.11	8.90	66.27	69.05	-2.78	-4.20	-1.05
	Oct-00	2.08	2.03	8.95	67.95	65.46	2.49	3.66	0.74
7	Apr-00	1.78	1.70	5.19	33.73	29.86	3.87	11.47	0.84
	May-00	1.82	2.09	7.68	51.02	62.16	-11.14	-21.83	-4.00
	Jun-00	2.15	3.89	8.35	65.53	121.40	-55.87	-85.26	-18.29
	Jul-00	2.36	2.65	8.87	76.39	81.95	-5.56	-7.27	-3.67
	Aug-00	2.04	2.75	8.37	62.32	80.10	-17.78	-28.52	-8.91
	Oct-00	0.62	2.32	8.10	18.33	60.46	-42.13	-229.84	-36.70
11	Apr-00	1.78	0.51	5.37	34.90	9.92	24.97	71.56	24.42
	May-00	1.82	2.28	6.78	45.06	54.89	-9.83	-21.83	-5.50
	Jun-00	2.45	2.46	9.15	81.84	84.66	-2.82	-3.44	-0.14
	Jul-00	2.36	2.92	8.56	73.70	91.87	-18.17	-24.65	-6.67
	Aug-00	2.04	2.47	9.53	70.94	84.75	-13.80	-19.46	-6.61
	Oct-00	2.45	2.37	13.10	117.15	117.13	0.02	0.02	1.61
12	Apr-00	1.78	0.66	5.73	37.21	13.54	23.66	63.60	20.55
	May-00	1.82	1.91	6.70	44.53	45.69	-1.16	-2.61	-1.11
	Jun-00	2.46	2.41	9.67	86.84	90.66	-3.82	-4.40	0.75
	Jul-00	2.36	2.40	9.08	78.22	80.49	-2.28	-2.91	-0.49
	Aug-00	2.04	2.41	8.17	60.80	70.94	-10.15	-16.69	-4.94
	Oct-00	1.32	2.26	8.94	43.07	72.43	-29.35	-68.15	-17.39
13	Apr-00	1.78	1.02	5.67	36.84	23.29	13.55	36.77	12.21
	May-00	1.82	2.60	7.35	48.80	71.20	-22.39	-45.88	-9.64
	Jun-00	2.33	2.29	8.47	71.94	69.61	2.34	3.25	0.53
	Jul-00	2.36	2.59	8.64	74.42	84.36	-9.93	-13.35	-3.02
	Aug-00	2.04	2.28	8.62	64.15	66.08	-1.93	-3.01	-3.36
	Oct-00	1.73	2.19	9.10	57.57	68.61	-11.04	-19.17	-7.59
14	Apr-00	1.78	0.43	5.49	35.64	8.63	27.02	75.80	28.74
	May-00	1.82	1.78	7.54	50.09	53.83	-3.73	-7.45	0.64
	Jun-00	2.38	2.08	8.67	75.27	87.74	-12.47	-16.56	4.91
	Jul-00	2.36	2.43	8.10	69.74	74.40	-4.66	-6.68	-0.88
	Aug-00	2.04	1.97	8.71	64.82	65.97	-1.16	-1.78	1.14
	Oct-00	2.39	1.43	9.14	79.62	47.49	32.13	40.35	17.15
15	Apr-00	1.78	0.73	4.92	31.98	11.18	20.80	65.04	14.94
	May-00	1.82	2.30	6.70	44.49	51.72	-7.23	-16.25	-5.46
	Jun-00	2.39	2.56	8.64	75.43	79.23	-3.80	-5.04	-2.14
	Jul-00	2.36	2.70	8.29	71.42	72.38	-0.96	-1.34	-3.84
	Aug-00	2.04	2.29	7.40	55.12	58.89	-3.77	-6.83	-3.05
	Oct-00	1.45	2.07	8.62	45.73	59.78	-14.06	-30.74	-10.71
16	Apr-00	--	--	--	--	--	--	--	--
	May-00	--	--	--	--	--	--	--	--
	Jun-00	2.42	2.35	16.18	143.09	142.70	0.39	0.27	1.93
	Jul-00	2.36	2.56	19.16	165.04	189.22	-24.17	-14.65	-5.94
	Aug-00	2.04	2.18	17.68	131.61	152.29	-20.68	-15.72	-4.56
	Oct-00	1.97	2.24	17.32	124.54	143.68	-19.14	-15.37	-8.09
17	Apr-00	1.78	0.64	5.62	36.51	10.93	25.58	70.06	19.23
	May-00	1.82	1.86	7.80	51.82	56.13	-4.32	-8.33	-0.64
	Jun-00	2.36	2.35	8.37	72.06	75.35	-3.30	-4.58	0.13
	Jul-00	2.36	2.60	7.88	67.91	96.91	-29.00	-42.70	-3.20
	Aug-00	2.04	2.64	6.63	49.37	61.57	-12.21	-24.73	-6.13
	Oct-00	2.36	2.28	8.10	69.77	64.77	5.00	7.17	1.06
18	Apr-00	1.78	0.55	5.59	36.32	9.94	26.38	72.64	22.59
	May-00	1.82	1.91	9.48	62.98	60.68	2.30	3.65	-1.60
	Jun-00	5.65	2.48	8.34	171.99	75.90	96.09	55.87	25.13
	Jul-00	2.36	2.56	6.94	59.75	114.03	-54.29	-90.86	-2.84
	Aug-00	2.04	2.26	7.70	57.30	68.67	-11.38	-19.85	-2.99
	Oct-00	2.17	2.28	8.88	70.33	83.89	-13.55	-19.27	-1.71
19	Apr-00	1.78	1.38	6.59	42.82	39.69	3.12	7.30	6.72
	May-00	1.82	2.13	6.71	44.56	62.91	-18.35	-41.18	-4.25
	Jun-00	2.39	2.44	9.05	78.95	83.32	-4.37	-5.53	-0.70
	Jul-00	2.36	3.43	8.93	76.91	119.44	-42.53	-55.30	-12.60
	Aug-00	2.04	2.42	7.92	58.97	71.28	-12.31	-20.87	-4.98
	Oct-00	2.38	2.25	9.48	82.35	92.88	-10.53	-12.79	2.13

EXHIBIT D.1-27

Monthly Summaries of Sediment Data for the Porta-PSTA Treatments, April 2000 - October 200X

Treatment	Date	Density (g/cm^3)	Solids (%)	Bulk Den (g/cm^3)	Vol Solids (%)	TP (mg/kg)	TIP (mg/kg)	TKN (mg/kg)	TOC (mg/kg)
Monthly									
3	Apr-00	1.30	17.83	0.22	--	103.0	89.1	--	--
	May-00	0.73	27.77	0.20	--	159.5	132.3	--	--
	Jun-00	0.38	24.50	0.09	--	81.3	95.8	9483.3	--
	Jul-00	0.43	26.63	0.11	--	72.2	80.5	--	--
	Aug-00	0.49	24.23	0.12	--	160.0	101.7	--	--
	Oct-00	0.38	31.45	0.12	--	222.5	98.4	255.3	--
4	Apr-00	2.07	71.17	1.47	--	977.7	1043.7	--	--
	May-00	1.61	79.53	1.28	--	812.3	783.0	--	--
	Jun-00	1.60	79.28	1.27	--	985.5	1134.0	52.2	--
	Jul-00	1.44	80.77	1.16	--	1096.0	1099.0	--	--
	Aug-00	1.51	81.32	1.22	--	620.5	610.8	--	--
	Oct-00	1.73	82.23	1.42	--	1046.1	1021.6	69.7	--
7	Apr-00	2.10	73.00	1.53	--	59.6	10.7	--	--
	May-00	1.56	79.10	1.23	--	16.0	8.7	--	--
	Jun-00	1.51	79.00	1.19	--	12.6	1.8	25.0	--
	Jul-00	1.40	77.00	1.08	--	21.2	5.7	--	--
	Aug-00	1.43	80.40	1.15	--	10.0	9.0	--	--
	Oct-00	1.58	81.00	1.28	--	43.4	10.5	20.3	--
11	Apr-00	2.00	72.00	1.44	--	942.1	1023.7	--	--
	May-00	1.25	20.80	0.26	--	865.5	876.2	--	--
	Jun-00	1.65	56.00	0.92	--	894.0	946.0	25.0	--
	Jul-00	1.58	82.30	1.30	--	820.0	880.0	--	--
	Aug-00	1.70	74.30	1.26	--	490.0	454.0	--	--
	Oct-00	1.71	84.10	1.44	--	1078.6	1018.3	119.0	--
12	Apr-00	1.10	21.00	0.23	--	--	--	--	--
	May-00	1.07	48.97	0.52	--	549.8	547.5	--	--
	Jun-00	0.33	35.00	0.12	--	--	157.0	6840.0	--
	Jul-00	0.37	38.80	0.14	--	103.0	136.0	--	--
	Aug-00	0.62	36.60	0.23	--	130.0	103.0	--	--
	Oct-00	0.46	35.90	0.17	--	195.3	103.5	1280.0	--
13	Apr-00	1.43	27.33	0.42	--	162.0	102.0	--	--
	May-00	0.88	38.27	0.33	--	83.8	90.2	--	--
	Jun-00	0.49	43.03	0.21	--	70.5	86.3	3150.0	--
	Jul-00	0.55	39.18	0.21	--	76.5	89.8	--	--
	Aug-00	0.51	28.07	0.15	--	130.3	73.7	--	--
	Oct-00	0.60	45.57	0.27	--	141.2	98.5	4258.7	--
14	Apr-00	--	--	--	--	--	--	--	--
	May-00	0.97	31.70	0.31	--	--	--	--	--
	Jun-00	--	--	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--	--	--
	Aug-00	--	--	--	--	--	--	--	--
	Oct-00	--	--	--	--	--	--	--	--
15	Apr-00	1.93	66.67	1.29	--	946.1	980.7	--	--
	May-00	1.29	19.53	0.25	--	888.0	954.6	--	--
	Jun-00	1.58	81.60	1.29	--	966.0	1125.0	42.8	--
	Jul-00	1.70	81.43	1.39	--	921.5	1006.5	--	--
	Aug-00	1.68	76.90	1.29	--	747.0	773.0	--	--
	Oct-00	1.74	82.83	1.44	--	1061.1	1057.5	102.3	--
16	Apr-00	2.03	70.00	1.42	--	921.1	1008.2	--	--
	May-00	1.74	77.60	1.35	--	930.7	945.2	--	--
	Jun-00	1.69	78.50	1.33	--	827.3	986.7	38.0	--
	Jul-00	1.70	80.43	1.37	--	1016.7	1032.3	--	--
	Aug-00	1.44	83.12	1.20	--	599.7	697.3	--	--
	Oct-00	1.64	82.72	1.36	--	987.0	966.1	45.7	--
17	Apr-00	1.90	61.00	1.16	--	25.0	10.7	--	--
	May-00	1.23	17.50	0.22	--	18.2	17.0	--	--
	Jun-00	1.45	76.80	1.11	--	12.6	6.5	25.0	--
	Jul-00	1.36	79.70	1.08	--	15.0	5.1	--	--
	Aug-00	1.42	80.90	1.15	--	8.0	6.0	--	--
	Oct-00	1.60	82.10	1.31	--	44.0	11.4	7.9	--
18	Apr-00	--	--	--	--	--	--	--	--
	May-00	--	--	--	--	--	--	--	--
	Jun-00	--	--	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--	--	--
	Aug-00	--	--	--	--	--	--	--	--
	Oct-00	--	--	--	--	--	--	--	--
19	Apr-00	--	--	--	--	--	--	--	--
	May-00	--	--	--	--	--	--	--	--
	Jun-00	--	--	--	--	--	--	--	--
	Jul-00	--	--	--	--	--	--	--	--
	Aug-00	--	--	--	--	--	--	--	--
	Oct-00	--	--	--	--	--	--	--	--

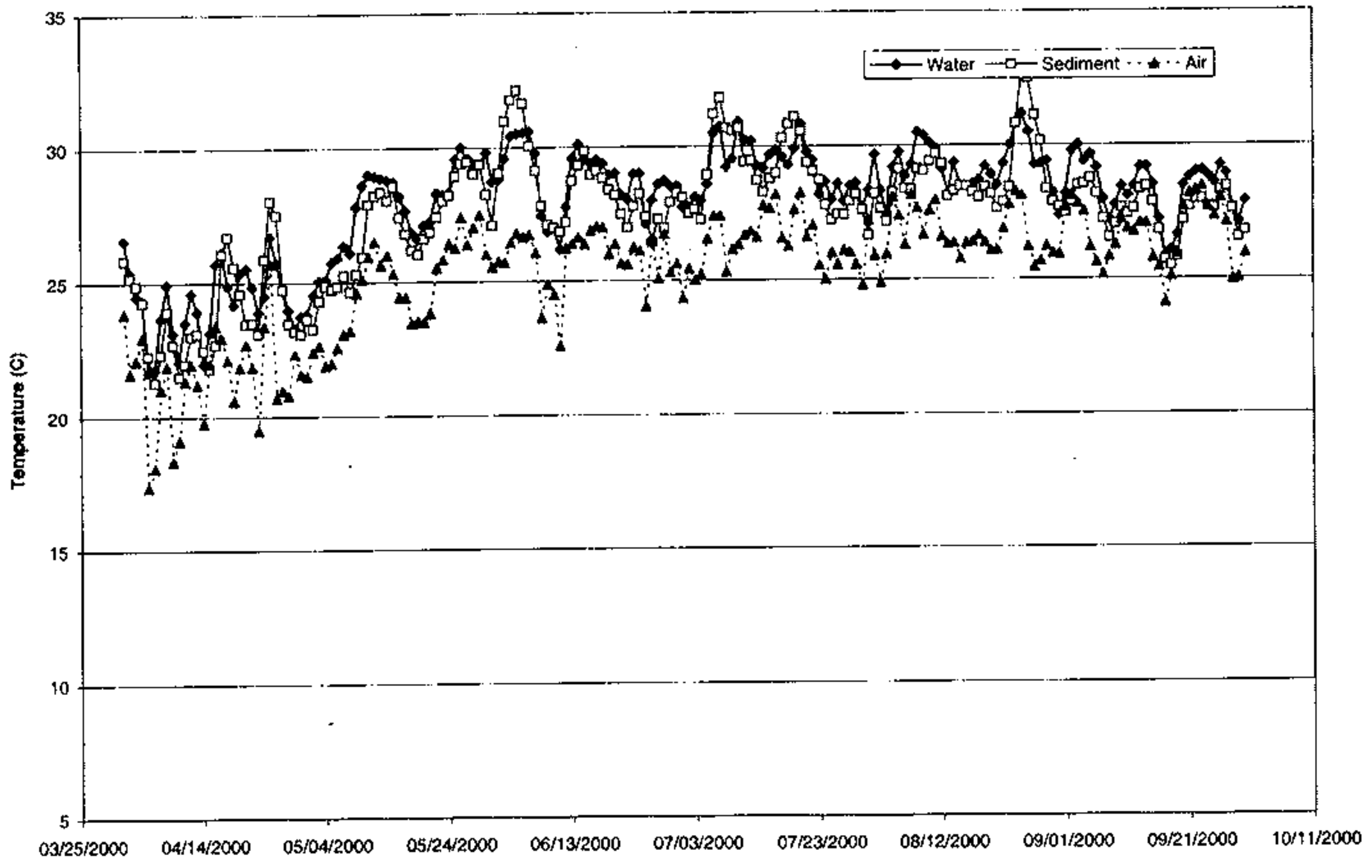


EXHIBIT D.1-28
Daily Average Temperatures in the Air, Water and Sediments of the Porta-PSTA Treatments, April 2000 - October 2000

EXHIBIT D.1-29

Non-Reactive Phosphorus Data Summary for Porta-PSTA Sediments, April 2000 - October 2000

Treatmemt	Soil	Date	Moisture %	TP mg/kg	NaHCO3 PI mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPI mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg
3	PE	06/20/2000	62.77	273.9	4.06	8.72	4.65	96.7	8.2	24.9
		10/04/2000	68.07	137.9	2.61	9.63	7.02	74.8	9.2	35.8
4	SR	06/20/2000	19.55	1012.4	3.08	2.94	-0.14	929.4	-26.1	40.1
		10/03/2000	22.11	979.2	1.71	1.90	0.19	921.7	-30.5	47.5
7	SA	06/20/2000	20.11	38.7	0.49	1.24	0.75	11.1	0.6	6.5
		10/04/2000	23.64	28.2	0.67	0.86	0.20	2.5	1.1	8.1
11	SR	06/21/2000	18.89	888.3	2.75	2.50	-0.25	828.6	-42.6	48.5
		10/03/2000	21.81	1106.5	2.27	1.64	-0.64	952.3	-37.0	46.2
12	PE	06/21/2000	67.96	135.7	2.65	10.23	7.58	129.4	18.1	32.6
		10/04/2000	70.23	179.3	3.30	10.46	7.16	116.0	17.0	37.1
13	PE_limed	06/20/2000	51.45	86.9	1.59	4.30	2.71	58.5	-0.2	23.5
		10/04/2000	73.83	151.9	2.17	12.71	10.54	81.9	19.7	38.9
15	SR	06/21/2000	19.96	992.8	2.93	2.68	-0.25	978.9	-26.7	38.8
		10/04/2000	17.34	957.6	3.21	2.22	-0.99	968.6	-33.2	44.1
16	SR	06/21/2000	17.57	960.7	3.28	2.77	-0.51	1004.6	-33.0	40.4
		10/03/2000	20.19	1036.3	2.56	1.44	-1.11	979.6	-28.0	41.3
17	SA_HCl	06/21/2000	21.25	28.9	2.64	2.07	-0.57	28.2	0.9	7.7
		10/04/2000	18.55	31.4	1.85	1.09	-0.77	3.8	3.1	9.0

EXHIBIT D.1-30

Summary of Sediment Trap Data from the Porta-PSTA Mesocosms During Phase 2 Research Period (April - October 2000). Values are Averages of All Replicates Within a Treatment.

Treatment	Soil	Wet Accretion (ml/m²/y)	Dry Accretion (g/m²/y)	TP Accretion (g/m²/y)	Wet Bulk Density (g/cm³)	Dry Bulk Density (g/cm³)	Wet Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
PP-3	PE	21614	799	0.393	1.694	0.028	91.44	2.33	98.16	566.7	31.30
PP-4	SR	45622	2722	1.218	1.009	0.077	91.01	7.65	92.15	449.1	74.34
PP-7	SA	69528	1879	0.264	1.329	0.034	134.02	5.42	96.34	90.0	73.45
PP-11	SR	37410	948	0.368	2.161	0.043	64.25	2.78	96.39	428.0	65.20
PP-12	PE	14559	270	0.190	1.443	0.017	55.96	0.74	98.77	697.1	31.88
PP-13	PE (limed)	114612	1485	0.556	0.474	0.020	135.51	4.45	96.31	393.8	61.09
PP-14	LR	13130	262	0.069	1.160	0.023	23.87	0.79	97.08	299.9	64.51
PP-15	SR	59019	1635	0.980	1.120	0.038	127.62	4.67	96.31	638.1	64.46
PP-16	SR	70548	1728	0.841	0.713	0.044	98.34	5.18	94.22	490.4	72.51
PP-17	SA (HCl)	78448	2684	0.427	0.451	0.034	106.08	8.04	92.42	159.0	77.34
PP-18	none	123514	1529	0.378	0.339	0.012	125.58	4.58	96.35	247.3	63.68
PP-19	none	93470	2467	0.465	0.567	0.026	158.70	7.39	95.34	188.4	66.52

Notes:

Sample Area = 154 cm² (14.0 cm diameter)

ND = not determined

Assume BD = 0.05 g/cm³ when not determined

Assume TP = 0.05% when not determined

EXHIBIT D.1-31

Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover	No. Stems/ m^2
Monthly										
3	Apr-00	2%	2%	69%	0%	2%	4%	71%	74%	537
	May-00	9%	0%	63%	0%	4%	9%	67%	75%	435
	Jun-00	13%	0%	64%	0%	0%	13%	65%	77%	560
	Jul-00	10%	0%	54%	0%	0%	10%	54%	64%	446
	Aug-00	5%	0%	51%	0%	1%	5%	52%	57%	359
	Oct-00	2%	0%	69%	0%	3%	2%	72%	74%	315
4	Apr-00	28%	0%	5%	0%	1%	28%	6%	33%	67
	May-00	36%	0%	6%	0%	2%	36%	8%	44%	88
	Jun-00	39%	0%	5%	0%	3%	39%	8%	47%	126
	Jul-00	16%	0%	12%	0%	2%	16%	13%	29%	137
	Aug-00	7%	0%	11%	0%	6%	7%	18%	24%	161
	Oct-00	7%	0%	14%	0%	6%	7%	20%	27%	117
3	Apr-00	46%	0%	3%	0%	0%	46%	3%	49%	25
	May-00	63%	0%	3%	0%	0%	63%	3%	66%	24
	Jun-00	68%	0%	3%	0%	0%	68%	3%	71%	61
	Jul-00	63%	0%	3%	0%	0%	63%	3%	66%	72
	Aug-00	38%	0%	5%	0%	0%	38%	5%	42%	105
	Oct-00	21%	0%	8%	0%	0%	21%	8%	28%	105
11	Apr-00	5%	0%	5%	0%	0%	5%	5%	9%	215
	May-00	8%	0%	8%	0%	0%	8%	8%	15%	117
	Jun-00	6%	0%	14%	0%	0%	6%	14%	20%	272
	Jul-00	5%	0%	31%	0%	0%	5%	31%	35%	757
	Aug-00	6%	0%	54%	0%	0%	6%	54%	60%	319
	Oct-00	3%	0%	63%	0%	3%	3%	65%	68%	304
12	Apr-00	1%	0%	73%	0%	0%	1%	73%	73%	471
	May-00	1%	0%	44%	0%	0%	1%	44%	45%	299
	Jun-00	0%	0%	63%	0%	0%	0%	63%	63%	331
	Jul-00	0%	0%	83%	0%	0%	0%	83%	83%	1072
	Aug-00	1%	0%	83%	0%	0%	1%	83%	83%	385
	Oct-00	0%	0%	89%	0%	0%	0%	89%	89%	384
13	Apr-00	0%	0%	1%	0%	0%	0%	1%	1%	2
	May-00	0%	0%	1%	0%	0%	0%	1%	1%	3
	Jun-00	1%	0%	1%	0%	4%	1%	5%	6%	15
	Jul-00	11%	0%	3%	0%	10%	11%	13%	24%	31
	Aug-00	26%	0%	6%	0%	26%	26%	32%	58%	99
	Oct-00	0%	34%	14%	0%	38%	34%	52%	86%	138
14	Apr-00	0%	0%	2%	0%	0%	0%	2%	2%	5
	May-00	0%	0%	3%	0%	0%	0%	3%	3%	10
	Jun-00	20%	0%	2%	0%	0%	20%	2%	23%	20
	Jul-00	13%	0%	3%	0%	0%	13%	3%	16%	21
	Aug-00	5%	0%	3%	0%	0%	5%	3%	8%	40
	Oct-00	8%	0%	3%	0%	0%	8%	3%	11%	17
15	Apr-00	0%	1%	9%	0%	0%	1%	9%	10%	96
	May-00	6%	2%	10%	0%	0%	8%	10%	18%	241
	Jun-00	21%	0%	25%	0%	1%	21%	27%	47%	331
	Jul-00	1%	0%	42%	0%	3%	1%	45%	46%	287
	Aug-00	7%	0%	42%	0%	14%	7%	56%	63%	239
	Oct-00	28%	0%	51%	0%	16%	29%	67%	96%	263
16	Apr-00	89%	0%	5%	0%	0%	89%	5%	94%	196
	May-00	0%	0%	5%	0%	0%	0%	5%	5%	153
	Jun-00	1%	0%	6%	0%	0%	1%	6%	7%	136
	Jul-00	3%	0%	8%	0%	0%	3%	9%	12%	167
	Aug-00	16%	0%	14%	0%	1%	16%	15%	31%	81
	Oct-00	13%	0%	9%	0%	1%	13%	10%	24%	121
17	Apr-00	1%	0%	3%	0%	0%	1%	3%	4%	8
	May-00	2%	3%	3%	0%	0%	5%	3%	8%	16
	Jun-00	76%	0%	2%	0%	0%	76%	2%	78%	32
	Jul-00	74%	0%	3%	0%	0%	74%	3%	77%	47
	Aug-00	54%	0%	3%	0%	0%	54%	3%	57%	62
	Oct-00	31%	0%	3%	0%	1%	31%	4%	35%	58
18	Apr-00	5%	0%	0%	0%	0%	5%	0%	5%	0
	May-00	14%	0%	0%	0%	0%	14%	0%	14%	0
	Jun-00	51%	0%	0%	0%	0%	51%	0%	51%	0
	Jul-00	28%	0%	0%	0%	0%	28%	0%	28%	0
	Aug-00	63%	0%	0%	0%	0%	63%	0%	63%	0
	Oct-00	46%	0%	0%	0%	0%	46%	0%	46%	0
19	Apr-00	3%	0%	0%	0%	0%	3%	0%	3%	0
	May-00	3%	6%	0%	0%	0%	9%	0%	9%	0
	Jun-00	--	--	--	--	--	--	--	--	--
	Jul-00	16%	0%	0%	0%	0%	16%	0%	16%	0
	Aug-00	46%	0%	0%	0%	0%	46%	0%	46%	0
	Oct-00	46%	0%	0%	0%	0%	46%	0%	46%	0

Final Porta-PSTA sampling postponed until October due to electrical failure at ENR site.

Dry Wt	Ash Wt	AFDW	(g/m²)	(mg/m²)	(mg/m²)	(g/m²)	(g/m²)	(g/m²)	(# cells/m²)*10³	(# taxa)	(# cells/m²)*10³	(# taxa)	(# cells/m²)*10³	(# taxa)	(# cells/m²)*10³	(# taxa)	(# cells/m²)*10³	(# taxa)
505.7	1466.0	960.3	124.8	105.8	10.8	1.048	0.201	--	119296.5	14.0	3860.5	9.0	2944.9	6.7	40.5	0.3	126142.4	30.0
200.7	368.2	167.4	39.1	95.1	7.7	0.155	0.063	--	68874.2	15.7	2473.9	11.3	1702.3	8.0	15.7	0.7	73066.1	35.7
290.2	656.8	366.7	76.5	218.5	41.5	0.160	0.103	6.94	230310.3	10.7	2491.4	6.7	1438.4	4.3	0.0	0.0	234240.0	23.7
352.9	699.6	346.7	47.8	118.5	29.3	0.436	--	--	--	--	--	--	--	--	--	--	--	--
302.0	631.8	329.9	36.1	224.1	122.6	0.161	0.256	--	--	--	--	--	--	--	--	--	--	--
226.5	580.4	353.9	39.5	233.5	97.8	0.370	0.050	15.21	104046.0	8.0	2386.1	8.7	1783.5	4.3	0.0	0.0	108215.5	21.0
532.8	428.0	116.0	224.5	186.1	28.6	0.495	0.098	--	283272.5	16.3	9342.0	8.3	854.1	1.7	0.0	0.0	293468.5	26.3
543.8	695.9	152.1	120.4	214.7	0.1	0.440	0.238	--	486757.3	10.3	13806.3	7.3	2236.2	2.0	0.0	0.0	502799.7	19.7
395.1	495.6	100.5	133.9	105.4	0.1	0.122	0.131	1.68	184577.4	17.0	4690.1	9.3	1622.1	5.3	0.0	0.0	141273.0	31.7
981.0	1176.0	194.3	268.9	186.7	5.4	0.255	0.237	--	--	--	--	--	--	--	--	--	--	--
284.1	352.8	68.7	46.9	66.0	11.4	0.107	0.124	--	--	--	--	--	--	--	--	--	--	--
271.9	357.8	85.9	83.6	160.0	21.7	0.201	0.125	2.81	126930.7	15.3	1558.0	6.0	1991.5	3.0	78.9	0.3	130559.1	24.7
333.0	430.4	97.4	110.0	7.4	7.0	0.151	0.016	--	485219.5	12.0	14569.5	10.0	--	--	0.0	0.0	499789.0	22.0
85.2	122.2	37.2	34.4	70.8	0.0	0.046	0.018	--	155377.8	18.0	3487.2	12.0	1937.3	3.0	129.1	1.0	160931.4	34.0
955.4	1173.7	218.4	175.6	310.3	0.0	0.141	0.059	0.63	1210727.9	15.0	13207.9	6.0	2935.1	1.0	0.0	0.0	1226870.9	22.0
891.3	1074.6	183.2	117.9	149.3	5.0	0.084	0.065	--	--	--	--	--	--	--	--	--	--	--
1145.0	1422.9	277.9	137.8	249.6	1.9	0.013	0.002	--	--	--	--	--	--	--	--	--	--	--
600.7	743.9	143.2	137.0	157.8	29.5	0.174	0.013	2.98	505714.1	15.0	3924.8	5.0	2803.3	2.0	0.0	0.0	512442.2	22.0
1383.1	1602.7	219.5	248.8	164.7	0.0	1.804	0.173	--	521117.6	13.0	16524.8	7.0	9442.8	8.0	0.0	0.0	547085.2	28.0
1629.1	2009.5	380.4	280.3	333.3	0.0	1.109	0.594	--	968322.7	23.0	16005.7	10.0	12671.0	6.0	0.0	0.0	996999.4	39.0
207.1	295.9	88.9	73.8	119.1	0.0	0.099	0.039	1.43	217832.9	19.0	2060.5	3.0	883.1	3.0	0.0	0.0	220776.4	25.0
602.2	818.0	215.8	172.5	218.7	5.9	0.320	0.220	--	--	--	--	--	--	--	--	--	--	--
127.2	198.4	71.2	25.7	174.7	1.3	0.181	0.244	--	--	--	--	--	--	--	--	--	--	--
433.7	532.1	98.4	134.4	205.8	12.2	0.123	0.027	6.28	107450.0	18.0	1391.1	7.0	945.8	7.0	0.0	0.0	109787.0	32.0
478.1	1115.7	636.1	99.1	45.3	17.3	0.506	0.090	--	46483.9	8.0	2828.4	13.0	2618.3	8.0	0.0	0.0	51930.6	29.0
68.9	115.7	46.8	10.3	23.4	0.1	0.035	0.011	--	13500.5	14.0	490.8	10.0	454.1	9.0	0.0	0.0	14445.4	33.0
493.5	247.8	245.8	42.1	122.4	55.9	0.096	0.053	4.34	21737.2	8.0	2246.6	8.0	660.7	4.0	0.0	0.0	24644.5	20.0
512.2	1241.9	729.7	79.6	243.8	35.1	0.523	0.240	--	--	--	--	--	--	--	--	--	--	--
300.4	500.1	199.7	39.0	63.6	34.7	0.698	0.310	--	--	--	--	--	--	--	--	--	--	--
217.7	441.4	223.8	30.7	117.8	87.7	0.415	0.046	1.03	20149.1	14.0	855.5	13.0	293.2	5.0	0.0	0.0	21297.7	32.0
2180.9	5487.7	3306.8	711.6	81.3	26.4	2.856	1.363	--	44470.1	5.0	3822.1	6.7	1802.9	5.0	208.0	0.7	50303.0	17.3
644.9	1237.6	592.7	269.5	124.4	43.1	0.432	0.246	--	26399.3	8.7	1912.5	10.3	3867.7	11.7	8.4	0.3	32188.0	31.0
417.3	1030.6	390.8	132.0	77.3	3.3	0.125	0.298	6.80	30210.6	12.3	1599.8	9.0	916.5	2.7	58.9	1.0	32746.6	24.3
1274.1	2573.7	1298.2	278.0	97.1	27.0	0.690	0.485	--	28420.5	11.7	2589.0	10.0	499.6	3.7	0.0	0.0	31509.1	25.3
752.8	1237.3	484.4	93.1	80.0	76.9	0.099	0.109	--	50643.6	10.0	4915.7	10.7	2194.8	4.3	0.0	0.0	57754.1	25.0
202.1	372.9	170.8	69.4	58.0	11.1	0.133	0.034	3.28	52068.9	10.3	1780.0	9.0	2153.5	4.3	0.0	0.0	56002.3	23.7
259.6	335.7	76.1	49.9	10.0	0.2	0.033	0.013	--	36447.9	9.3	480.5	9.3	233.5	5.7	12.1	2.0	37174.1	25.3
723.2	1000.9	277.0	272.7	322.3	0.2	0.263	0.073	--	680711.4	21.3	18887.9	6.0	7415.8	3.7	0.0	0.0	707015.1	31.0
54.7	89.5	34.7	19.1	42.9	0.0	0.030	0.002	0.76	65208.0	15.3	3587.3	8.0	1958.4	5.3	0.0	0.0	70753.6	28.7
220.6	303.2	82.6	54.6	79.0	5.5	0.060	0.032	--	90063.0	17.3	2193.2	5.7	838.5	6.0	44.9	1.0	93109.5	29.3
201.3	279.2	77.9	57.4	71.9	11.6	0.007	0.037	--	289853.4	14.0	4423.7	3.0	1870.2	1.3	0.0	0.0	296147.3	18.3
346.8	489.2	142.5	133.0	195.4	17.9	0.086	0.015	3.64	671111.1	16.0	10377.4	6.0	7354.1	5.3	0.0	0.0	688842.6	27.3
598.4	731.3	132.9	136.8	115.0	0.0	0.492	0.019	--	261925.3	13.0	9344.0	6.5	3442.3	2.7	0.0	0.0	274711.5	21.7
366.9	498.4	131.7	127.7	103.6	7.1	0.292	0.147	--	214521.7	15.3	8193.5	9.0	3500.2	6.0	89.6	0.3	226305.1	30.7
273.6	363.8	843.5	97.5	104.3	0.1	0.189	0.052	2.08	237182.0	13.7	3385.8	7.3	6033.3	7.3	0.0	0.0	246601.1	28.3
279.1	365.5	86.3	74.3	86.1	5.6	0.229	0.140	--	290405.6	15.7	2799.1	5.3	3573.0	3.7	0.0	0.0	296777.7	24.7
274.1	343.3	69.1	49.7	71.5	2.0	0.169	0.192	--	142573.3	15.0	3152.3	7.3	1772.9	6.7	0.0	0.0	147498.5	29.0
136.6	188.6	52.0	45.4	74.1	12.2	0.108	0.047	1.35	69442.3	13.7	1123.0	6.7	580.2	3.3	0.0	0.0	71145.5	23.7
461.0	561.0	100.1	158.3	41.9	34.0	0.547	0.024	--	419496.7	16.0	10655.7	7.5	1718.4	3.5	0.0	0.0	431298.0	26.0
164.7	218.1	53.3	102.5	59.5	0.1	0.165	0.095	--	81652.5	14.3	2232.2	7.3	110.0	1.3	0.0	0.0	83994.7	23.0
914.9	1139.7	224.8	211.5	320.9	5.4	0.429	0.139	2.56	653290.6	13.7	9740.1	5.3	6115.1	2.3	0.0	0.0	669145.8	21.3
1504.2	1734.5	232.1	273.2	177.8	5.8	1.207	0.744	--	207913.9	19.3	3469.3	3.3	13005.4	4.7	0.0	0.0	224388.6	27.3
804.9	1016.9	212.0	384.8	249.4	13.4	0.335	0.314	--	729106.7	18.0	4472.9	5.0	2440.7	1.7	0.0	0.0	736020.3	24.7
859.9	1014.5	154.6	219.3	188.8	47.5	1.156	0.776	5.22	310528.9	18.3	3332.2	4.3	2496.9	2.0	190.2	0.3	290103.2	25.0
430.4	603.3	172.9	88.2	82.2	0.2	0.268	0.044	--	487999.8	19.0	5100.8	9.0	566.6	2.0	0.0	0.0	493667.2	30.0
500.1	694.8	194.7	165.3	262.7	0.0	0.208	0.054	--	596194.8	14.0	6090.6	4.0	6090.6	2.0	0.0	0.0	609052.7	21.0
353.1	496.3	143.2	78.6	232.6	0.0	0.090	0.052	2.74	730591.6	14.0	3678.8	4.0	9564.7	3.0	0.0	0.0	743835.1	21.0
462.4	579.7	117.4	49.7	64.6	5.9	0.081	0.039	--	115600.9	18.0	1047.3	7.0	6570.4	5.0	0.0	0.0	123218.5	30.0
821.2	1090.1	268.9	276.8	323.4	6.1	0.031	0.053	--	680155.9	16.0	5783.8	4.0	7518.8	4.0	0.0	0.0	693458.5	24.0
1539.5	1794.9	254.0	267.2	303.7	34.3	0.240	0.031	7.68	589571.0	17.0	3340.5	4.0	7237.4	3.0	0.0	0.0	600149.0	24.0
122.9	172.7	49.8	43.2	21.2	0.0	0.057	0.002	--	155413.6	19.0	3409.1	7.0	587.8	2.0	117.5	1.0	159528.1	29.0
1975.1	2872.2	897.2	670.4	657.3	0.2	0.624	0.244	--	2891406.1	15.0	53005.9	9.0	55655.3	5.0	0.0	0.0	3000067.3	29.0
365.1	561.0	195.9	112.2	274.1	0.0	0.128	0.024	4.03	365630.2	9.0	6674.9	3.0	10383.0	2.0	0.0	0.0	382688.1	14.0
814.9	1172.1	357.2	202.3	280.5	7.0	0.159	0.273	--	518178.5	12.0	5626.5	6.0	6188.9	3.0	0.0	0.0	529993.9	21.0
330.0	467.5	137.5	86.2	129.3	1.5	0.088	0.058	--	371809.2	12.0	3332.6	5.0	6188.9	4.0	0.0	0.0	381330.6	21.0
213.0	299.8	86.8	74.6	114.7	14.6	0.066	0.013	2.00	586460.8	10.0	3470.2	4.0	578.4	1.0	0.0	0.0	590509.5	15.0
55.4	73.0	17.6	16.8	1.2	0.6	0.048	0.017	--	76658.5	11.0	1471.8	8.0	797.2	4.0	0.0	0.0	78927.5	23.0
223.2	303.1	79.8	77.9	105.1	0.0	0.169	0.034	--	154441.8	15.0	4188.1	8.0	3272.0	5.0	0.0	0.0	161901.9	28.0
284.9	399.5	114.5	91.6	144.8	0.0	0.143	0.078	1.56	826817.3	10.0	2216.8	3.0	2216.7	1.0	0.0	0.0	831250.8	14.0
1523.8	2065.6	541.9	275.9	329.7	7.1	0.609	0.494	--	604724.5	14.0	2282.0	3.0	--	--	0.0	0.0	607006.6	17.0
448.9	597.4	148.4	111.2	201.0	1.5	0.227	0.137	--	635937.2	18.0	6896.4	7.0	2463.1	3.0	0.0	0.0	645296.7	28.0
392.9	539.0	146.1	133.8	156.2	16.6	0.100	0.064	1.48	564081.9	13.0	3482.1	5.0	0.0	0.0	0.0	0.0	567564.1	18.0

EXHIBIT D.1-33

Non-Reactive Phosphorus Data Summary for Porta-PSTA Periphyton, April 2000 - October 2000

Treatmemt	Soil	Date	Moisture %	TP mg/kg	NaHCO3 Pi mg/kg	NaHCO3TP mg/kg	Labile Po mg/kg	HClPi mg/kg	Alkali Hydrolyz Po (NaOH TP) mg/kg	Residual Po mg/kg
3	PE	06/20/2000	96.69	315.0	2.58	149.67	147.09	227.5	-1.2	43.2
		10/04/2000	95.91	331.6	2.77	182.68	179.91	57.2	28.4	45.3
4	SR	06/20/2000	90.56	467.6	1.71	54.46	52.75	275.2	0.7	29.2
		10/03/2000	94.02	298.5	2.73	124.62	121.89	125.0	20.4	51.9
7	SA	06/20/2000	94.90	208.2	1.63	90.73	89.10	167.3	3.8	30.6
		10/04/2000	92.65	147.9	2.07	54.32	52.25	20.2	20.3	27.2
11	SR	06/21/2000	93.44	300.5	2.24	105.72	103.48	142.2	6.5	39.7
		10/03/2000	93.51	675.8	2.58	179.78	177.21	623.5	3.3	85.1
13	PE_limed	06/20/2000	89.34	212.3	1.39	57.46	56.07	174.3	14.1	26.6
		10/04/2000	94.03	342.0	2.32	135.23	132.92	92.4	26.1	60.6
14	LR	06/20/2000	95.20	187.8	1.69	79.72	78.03	135.6	-0.5	27.1
		10/03/2000	93.54	522.3	2.23	165.81	163.58	307.3	14.8	65.7
15	SR	06/21/2000	94.94	471.3	2.35	194.03	191.68	209.1	20.4	51.7
		10/04/2000	93.76	567.2	2.45	212.66	210.21	262.4	30.2	84.6
16	SR	06/21/2000	85.07	535.8	1.63	48.21	46.58	421.2	4.5	40.7
		10/03/2000	94.60	169.3	2.60	67.74	65.14	34.2	39.6	29.4
17	SA_HCl	06/21/2000	84.35	18.0	1.52	36.90	35.38	67.2	5.8	19.5
		10/04/2000	91.93	161.6	3.80	70.21	66.41	27.8	16.6	39.4
18	none	06/21/2000	94.12	71.5	2.18	71.55	69.37	105.0	6.6	26.8
		10/03/2000	95.34	169.5	2.54	77.53	74.99	86.0	8.7	39.5
19	none	06/21/2000	94.48	168.5	2.19	66.26	64.07	181.6	-2.6	29.1
		10/03/2000	95.07	300.3	1.83	107.34	105.51	207.3	11.9	50.4

EXHIBIT D.1-34

Summary of Macrophyte Biomass Data for the Porta-PSTA Treatments, April 2000 - October 2000

	Treatment (Porta-PSTA Mesocosm)																				
	3			4			7	11	12	13			14		15			16			17
Month	**12**	**14**	**17**	**3**	**5**	**10**	**19**	**23**	**24**	**9**	**11**	**18**	**4**	**8**	**2**	**13**	**16**	**1**	**6**	**15**	**20**
Apr-00	438	501	154	---	160	---	---	102	857	---	---	---	---	---	54	21	118	128	17	96	---
May-00	355	649	352	---	65	46	5	60	114	---	---	---	17	30	50	100	176	34	---	---	33
Jun-00	451	486	253	---	89	21	114	44	314	---	---	---	19	---	83	76	365	83	---	39	8
Jul-00	627	468	247	24	80	161	---	70	420	---	14	---	---	---	250	---	362	---	---	39	---
Aug-00	111	593	542	---	160	123	66	395	471	118	---	32	---	5	95	103	329	222	38	20	---
Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Oct-00	188	674	361	234	131	86	336	266	504	163	124	318	100	49	268	375	854	137	130	83	50
Cell Average	**362**	**562**	**318**	**129**	**114**	**87**	**130**	**156**	**447**	**140**	**69**	**175**	**45**	**28**	**137**	**135**	**367**	**121**	**62**	**55**	**30**
Treatment Average		**414**			**106**		**130**	**156**	**447**		**128**		**37**			**218**			**82**		**30**

Notes:

All values are in units of g dry/m^2

EXHIBIT D.1-35

Porta-PSTA Average Algal Cell Counts (# cells/m² x 10⁵), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
ANAB CIR	1	ANABAENOPSIS CIRCULARIS	--	--	--	--	--	--	4001.3529	--	1675.5865	5567.2323	--	--
APH DEL	1	APHANOCAPSA DELICATISSIMA	4,893	5,261	12,570	16,516	6,382	5,972	3,568	14,123	15,699	20,251	29,382	3,507
APH GRE	1	APHANOCAPSA GREVILLEI	--	21,435	--	--	273	294	--	--	--	--	--	--
APH INC	1	APHANOCAPSA INCERTA	--	--	--	--	--	2,731	5,690	25,226	16,889	--	--	--
APH NUB	1	APHANOCAPSA NUBILUM	--	--	--	--	--	--	--	2,423	94,527	--	--	--
APH PLA	1	APHANOCAPSA PLANCTONICA?	3,637	2,031	40,289	--	--	1,177	18,804	7,596	13,905	17,922	20,947	31,526
APHA CLA	1	APHANOTHECE CLATHRATA	2,928	5,476	14,675	10,670	--	--	3,001	2,345	5,630	3,124	23,200	6,964
APHA SMI	1	APHANOTHECE SMITHII	7,415	8,337	19,975	18,997	293	1,678	24,609	6,330	28,124	15,009	1,881	4,724
APHA STA	1	APHANOTHECE STAGNINA	5,237	13,491	118,595	9,617	1,957	3,772	6,652	10,993	33,646	20,628	13,530	31,737
APHA VAR	1	APHANOTHECE VARIABILIS?	--	--	--	--	--	--	--	1,743	--	--	--	--
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	--	--	--	--	2,910	14,105	--	--	--	--	62,067
ART TEN	1	ARTHROSPIRA TENUIS?	--	39,282	--	--	--	--	--	--	88,147	--	--	--
CAL EPI	1	CALOTHRIX EPIPHYTICA	--	--	--	--	--	--	--	--	710	--	--	--
CHR DIS	1	CHROOCOCCUS DISPERSUS	1,576	6,547	6,464	10,930	1,961	1,048	2,180	3,087	1,164	3,562	23,083	524
CHR MIN	1	CHROOCOCCUS MINUTUS	406	2,103	3,364	1,746	549	420	1,484	1,076	2,854	2,958	2,257	2,580
CHR MINI	1	CHROOCOCCUS MINIMUS	2,847	5,534	13,727	7,135	1,473	3,327	2,271	7,210	13,339	22,606	32,706	6,965
CHR PLA	1	CHROOCOCCUS PLANCTONICUS	--	587	--	--	--	--	--	--	--	--	--	--
CHR TUR	1	CHROOCOCCUS TURGIDUS	316	299	--	111	147	77	1,152	358	868	--	--	2,282
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	4,716	--	--	--	--	--	--	--	--	--	--	--
CYL STA	1	CYLINDROSPERMUM STAGNALE	--	--	--	--	--	--	--	--	--	--	--	--
EUC MIN	1	EUCAPSIS MINOR	--	--	--	--	196	--	--	--	--	--	--	--
G ANA	1	ANABAENA SP	6,947	4,260	--	736	--	781	3,415	4,063	4,085	6,681	--	1,832
G CYL	1	CYLINDROSPERMUM SP	11,536	12,040	12,970	3,395	--	6,915	10,885	19,516	7,573	6,549	14,865	33,729
G GLO	1	GLOEOCAPSA SP	--	1,824	14,200	258	419	600	6,689	5,020	6,019	14,383	2,299	5,911
G LYN SM	1	LYNGBYA SP (SMALL)	--	17,219	20,665	10,783	--	1,285	16,373	9,573	26,864	9,254	97,341	7,973
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	--	--	--	--	--	283	--	--	35,390	--	--	--
G OSC SM	1	OSCILLATORIA SP (SMALL)	15,371	7,546	--	5,335	--	870	6,308	13,708	2,714	44,209	13,247	2,225
G SCY	1	SCYTONEMA SP?	11,263	--	14,577	1,770	--	684	5,905	2,763	12,583	--	87,458	22,053
G SYNE	1	SYNECHOCOCCUS SP	52,298	26,761	2,416	30,259	49	13,917	44,157	39,231	18,951	36,470	7,068	8,725
GLO MEM	1	GLOEOTHECE MEMBRANACEAE	--	--	--	--	--	--	--	--	--	11,018	--	--
GOM APO	1	GOMPHOSPHAERIA APONINA	3,867	3,787	--	--	4,301	--	--	15,417	2,681	--	--	--
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	1,876	16,400	--	4,001	4,652	--	927	5,276	6,264	1,143	588	3,712
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	20,173	15,360	27,585	41,025	--	2,937	8,125	5,612	27,836	10,768	57,128	20,828
LYN AES	1	LYNGBYA AESTUARII	29,149	5,845	--	--	--	--	--	--	--	--	--	--
LYN CON	1	LYNGBYA CONTORTA	--	--	--	17,339	--	--	--	--	--	--	--	--
LYN EPI	1	LYNGBYA EPIPHYTICA	12,661	11,991	10,135	33,956	10,888	3,175	16,236	8,383	26,833	29,603	20,700	--
LYN LAG	1	LYNGBYA LAGERHEIMII	3,804	5,873	59,455	14,242	1,345	10,243	22,037	18,681	27,246	98,603	188,080	35,194
LYN LIM	1	LYNGBYA LIMNETICA	8,068	52,930	64,165	117,938	491	3,084	64,575	26,680	110,621	97,817	148,721	124,223
LYN PER	1	LYNGBYA PERELEGANS?	--	1,467	1,550	14,211	--	--	6,609	10,049	--	--	--	30,048
LYN TAY	1	LYNGBYA TAYLORII?	--	--	--	73,358	--	--	--	--	--	--	--	--
MER DUP	1	MERISMOPEDIA DUPLEX	--	--	--	--	--	889	--	--	--	--	--	--
MER GLA	1	MERISMOPEDIA GLAUCA	1,977	407	--	2,355	98	740	5,087	2,898	710	--	--	--
MER PUN	1	MERISMOPEDIA PUNCTATA	--	10,576	--	--	--	3,711	--	--	5,908	--	--	--
MER TEN	1	MERISMOPEDIA TENUISSIMA	1,288	1,367	517	5,335	959	3,359	3,671	14,186	2,195	1,134	--	--
MIC AER	1	MICROCYSTIS AERUGINOSA	9,716	--	--	--	1,873	5,084	--	--	--	1,524	--	--
MIC FIR	1	MICROCYSTIS FIRMA	16,936	6,551	81,856	--	1,780	--	18,124	24,984	17,129	97,448	4,702	9,162
MIC FLO	1	MICROCYSTIS FLOS-AQUAE	--	--	--	--	6,015	--	--	--	--	--	--	--
MIC SMI	1	MICROCYSTIS SMITHII	--	--	16,532	--	466	--	--	--	--	106,923	--	--
OSC AMP	1	OSCILLATORIA AMPHIBIA	--	19,042	--	--	--	1,401	9,623	1,303	14,177	--	--	8,622
OSC AMPH	1	OSCILLATORIA AMPHIGRANULATA	--	--	--	--	--	--	1,181	--	--	--	--	--
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	25,705	43,067	51,467	25,208	2,775	7,178	17,343	22,336	30,560	50,477	112,566	75,771
OSC FOR	1	OSCILLATORIA FORMOSA	5,680	14,186	20,068	35,345	856	2,310	46,936	8,567	35,327	32,584	32,219	39,861
OSC LIM	1	OSCILLATORIA LIMNETICA	15,994	66,465	150,869	70,826	2,162	5,097	68,706	26,538	47,663	72,153	257,202	97,327
OSC LIMO	1	OSCILLATORIA LIMOSA	--	--	38,007	--	--	--	--	3,853	19,437	--	--	--
OSC TEN	1	OSCILLATORIA TENUIS	--	13,284	--	--	--	--	--	--	--	--	5,626	--
OSC WIL	1	OSCILLATORIA WILLEI?	--	--	--	2,671	--	--	126,374	5,604	27,872	28,342	--	--
PHO LUC	1	PHORMIDIUM LUCIDUM?	--	--	--	--	--	--	--	2,732	--	--	--	--
PHO TEN	1	PHORMIDIUM TENUE	--	2,202	--	1,766	--	--	--	6,449	26,514	--	--	--
RHA LIN	1	RHABDODERMA LINEARE?	21,226	4,019	--	11,184	--	--	7,750	25,040	3,972	4,060	1,913	1,440
SCH ARE	1	SCHIZOTHRIX ARENARIA?	10,461	50,605	--	73,417	--	--	23,906	19,527	38,184	19,584	52,660	--

EXHIBIT D.1-35

Porta-PSTA Average Algal Cell Counts (# cells/m² x 10⁶), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
SCY HOF	1	SCYTONEMA HOFMANII?	--	--	--	--	--	--	--	--	28,525	--	--	--
SNO LAC	1	SNOWELLA LACUSTRIS	--	2,187	--	--	--	1,802	2,791	5,410	3,197	--	--	--
SPI LAX	1	SPIRULINA LAXA	--	--	--	--	--	--	--	--	--	480	--	--
SPI MAJ	1	SPIRULINA MAJOR	--	--	--	--	--	--	470	--	--	--	--	--
SPI SUB	1	SPIRULINA SUBSALSA	933	849	927	601	--	210	1,103	1,187	685	906	2,935	1,026
ANK FAL	3	ANKISTRODESMUS FALCATUS	285	--	--	667	71	319	276	123	506	--	--	131
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	197	74	561	737	117	312	112	297	66	--	--	61
ANK SPI	3	ANKISTRODESMUS SPIRALIS	159	512	2,935	365	111	209	573	464	689	--	1,614	123
CHA ENS	3	CHARACIUM ENSIFORME	--	--	--	--	--	--	6	--	--	--	--	--
CLO PAR	3	CLOSTERIUM PARVULUM	--	114	--	--	--	53	5	18	--	--	--	--
COE MIC	3	COELASTRUM MICROPORUM	--	--	--	--	--	204	4,595	--	4,611	--	--	--
COE SPH	3	COELASTRUM SPHAERICUM	1,451	1,174	--	5,335	--	665	684	2,341	--	--	--	491
COS BOT	3	COSMARIUM BOTRYTIS	--	--	--	--	--	--	--	--	412	--	--	--
COS GRAN	3	COSMARIUM GRANATUM	--	--	--	--	--	--	--	--	115	--	--	--
COS PUN	3	COSMARIUM PUNCTULATUM	--	--	--	--	--	--	15	--	590	--	--	--
COS SUBR	3	COSMARIUM SUBRENIFORME	66	114	--	590	39	86	342	491	482	95	--	131
COS TUB	3	COSMOCLADIUM TUBURCULATUM	--	--	--	--	--	--	--	--	--	--	--	--
CRU API	3	CRUCIGENIA APICULATA	--	947	--	--	--	204	897	--	--	--	--	--
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	--	--	--	--	--	--	--	--	--	4,454	--	--
ELA GEL	3	ELAKATOTHRIX GELATINOSA	122	--	--	--	--	--	--	--	--	--	--	--
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	23	473	129	111	--	35	88	241	103	337	2,888	493
EUA VER	3	EUASTRUM VERRUCOSUM	--	--	--	--	--	53	--	--	--	--	--	--
G CHLA	3	CHLAMYDOMONAS SP	53	266	--	--	--	25	90	--	--	--	--	--
G COS	3	COSMARIUM SP	--	--	--	--	--	59	--	--	--	--	--	--
G GONA	3	GONATOZYGON SP	--	266	--	--	--	--	--	--	--	--	--	--
G MOU	3	MOUGEOTIA SP	--	--	--	--	--	282	--	--	--	--	--	--
G OED	3	OEDOGONIUM SP	729	1,284	1,292	--	--	164	2,388	1,056	--	--	--	--
G SPI	3	SPIROGYRA SP	--	--	--	--	--	--	--	919	1,011	--	--	--
G STAU	3	STAURASTRUM SP	--	--	--	--	12	--	--	--	--	--	--	--
GOL RAD	3	GOLENKINIA RADIATA	243	--	--	--	--	--	--	--	--	--	--	--
KIR CON	3	KIRCHNERIELLA CONTORTA	--	--	--	--	--	--	3,774	--	--	--	--	--
KIR LUN	3	KIRCHNERIELLA LUNARIS	272	73	--	--	--	70	15	195	--	--	--	--
KIR OBE	3	KIRCHNERIELLA OBESA	243	--	--	1,180	--	57	25	--	335	--	--	--
LAG SUB	3	LAGERHEIMIA SUBSALSA	--	--	--	--	--	51	--	--	--	--	--	--
MIC PIN	3	MICRASTERIAS PINNATIFIDA	118	--	--	--	--	--	--	--	--	--	--	--
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	118	--	--	--	--	1,698	886	895	--	3,240	9,963	2,217
OOC PAR	3	OOCYSTIS PARVA	99	977	--	56	419	170	461	362	335	420	--	--
OOC SOL	3	OOCYSTIS SOLITARIA	547	373	--	1,219	--	232	336	227	1,448	576	2,650	493
PED BIR	3	PEDIASTRUM BIRADIATUM	--	147	--	--	--	--	--	--	5,908	--	--	--
PED OBT	3	PEDIASTRUM OBTUSUM	--	--	--	--	--	--	--	--	710	--	--	--
PED TET	3	PEDIASTRUM TETRAS	--	367	--	--	--	--	438	--	--	--	--	--
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	105	455	--	--	--	187	336	1,077	--	--	--	--
SCE ACU	3	SCENEDESMUS ACUMINATUS	--	--	--	--	49	97	4,595	--	--	--	--	--
SCE ARM	3	SCENEDESMUS ARMATUS	243	--	--	2,668	--	415	--	--	--	--	--	--
SCE BIJ	3	SCENEDESMUS BIJUGA	661	579	517	1,320	468	583	870	984	1,611	1,380	711	192
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	--	589	--	--	98	385	345	588	--	--	4,501	--
SCE DEN	3	SCENEDESMUS DENTICULATUS	598	--	--	2,361	--	204	--	1,180	--	--	--	--
SCE DIM	3	SCENEDESMUS DIMORPHUS	544	--	--	--	49	446	--	--	--	--	--	--
SCE QUA	3	SCENEDESMUS QUADRICAUDA	231	--	--	--	191	416	--	224	594	--	--	--
SCE SUB	3	SCENEDESMUS SUBSPICATUS	926	--	--	--	--	--	--	--	--	--	--	--
SCH SET	3	SCHROEDERIA SETIGERA	--	--	--	--	--	--	--	269	--	--	--	--
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	408	1,291	--	445	--	901	1,522	2,982	12,505	5,886	--	--
SPO PLA	3	SPONDYLOSIUM PLANUM	--	--	--	--	--	--	--	--	--	--	--	--
STAU HEX	3	STAURASTRUM HEXACERUM	--	--	--	--	--	56	--	--	--	--	--	--
STAU MAN	3	STAURASTRUM MANFELDTII	38	--	--	--	--	--	--	269	--	--	--	--
STAU PAR P	3	STAURASTRUM PARADOXUM V PARVULUM	243	--	--	--	--	94	--	--	--	--	--	--
STAU TET	3	STAURASTRUM TETRACERUM	298	285	--	--	89	163	90	183	--	--	--	--
TET MIN	3	TETRAEDRON MINIMUM	53	114	--	56	24	25	41	482	105	--	118	524
TET TRI	3	TETRAEDRON TRIGONUM	256	74	--	351	85	76	246	316	563	283	563	--
UN CHL FI	3	UNID CHLOROPHYCEAE FILAMENT BASAL CELLS	--	--	--	--	--	--	--	460	--	--	--	--

EXHIBIT D.1-35

Porta-PSTA Average Algal Cell Counts (# cells/m^2 x 10^6), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	525	442	2,243	442	264	204	295	307	--	3,130	7,858	1,851
ACH EXI	4	ACHNANTHES EXIGUA	--	--	--	--	105	--	--	--	--	283	--	--
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	276	500	633	629	85	88	283	773	675	736	2,650	61
AMP LIN	4	AMPHORA LINEOLATA?	--	747	129	--	--	69	--	--	--	--	--	--
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	--	--	--	--	--	--	--	--	--	--	--	--
AMP PEL	4	AMPHIPLEURA PELLUCIDA	--	--	--	--	--	25	--	--	--	--	--	--
AMP VEN	4	AMPHORA VENETA	--	--	129	--	--	--	--	--	--	--	--	--
BRA VIT	4	BRACHYSIRA VITREA	57	--	1,468	--	--	118	--	126	--	283	118	--
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	--	--	--	--	--	--	--	--	--	--	--	--
COS GRA	4	COSCINODISCUS GRANII	--	--	--	--	12	--	--	--	--	--	--	--
CYC MEN	4	CYCLOTELLA MENEGHINIANA	161	--	--	147	--	74	6	--	130	--	--	--
CYM MIC	4	CYMBELLA MICROCEPHALA	180	229	--	438	12	246	146	252	349	371	1,100	1,016
DIP ELL	4	DIPLONEIS ELLIPTICA	--	--	--	--	--	98	--	--	--	--	--	--
DIP FIN	4	DIPLONEIS FINNICA	275	--	--	--	66	--	--	--	--	--	--	--
DIP OBL	4	DIPLONEIS OBLONGELLA	366	421	--	407	90	302	--	--	263	--	--	--
DIP OVA	4	DIPLONEIS OVALIS	242	102	--	--	45	79	112	112	702	--	--	--
ENC EVE	4	ENCYONEMA EVERGLADIANUM	706	2,694	2,240	5,484	77	550	1,765	1,486	2,355	1,930	2,391	550
ENC MIN	4	ENCYONEMA MINUTUM	--	--	--	--	--	--	--	--	576	--	--	--
ENC SIL	4	ENCYONEMA SILESIACUM	--	--	--	--	105	--	--	--	--	--	--	--
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	199	686	441	--	105	75	15	558	335	95	1,110	356
EPI ADN	4	EPITHEMIA ADNATA	243	--	--	--	--	--	--	590	--	--	--	--
EUN PEC MI	4	EUNOTIA PECTINALIS V MINOR	463	--	--	--	--	--	--	56	--	--	--	--
FRA FAS	4	FRAGILARIA FASCICULATA?	--	--	--	--	--	--	--	--	--	--	--	--
FRA NAN	4	FRAGILARIA NANANA?	159	491	446	667	--	31	34	32	565	337	578	96
FRA SYN	4	FRAGILARIA SYNEGROTESCA	362	533	1,014	1,180	205	151	726	570	941	283	5,300	351
FRA ULN	4	FRAGILARIA ULNA	122	--	--	--	--	25	--	311	--	--	--	--
G AMP	4	AMPHORA SP	--	--	--	--	--	--	--	--	--	--	--	--
G NAV SM	4	NAVICULA SP (SMALL)	--	--	--	--	--	--	--	--	--	--	--	--
G NIT	4	NITZSCHIA SP	--	--	--	--	--	--	--	--	--	--	--	--
G NIT ME	4	NITZSCHIA SP (MEDIUM)	37	--	--	--	--	--	--	--	133	--	--	--
G NIT SM	4	NITZSCHIA SP (SMALL)	282	473	1,267	--	65	155	559	331	739	--	--	--
G STE	4	STEPHANODISCUS SP	--	--	--	--	--	--	5	--	--	--	--	--
GOM AFF IN	4	GOMPHONEMA AFFINE V INSIGNE	71	--	--	--	--	--	--	269	--	--	--	--
GOM GRA	4	GOMPHONEMA GRACILE	--	--	--	--	24	--	--	--	--	--	--	--
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	289	--	--	--	65	50	6	280	571	--	--	--
GOM PAR	4	GOMPHONEMA PARVULUM	--	--	--	--	210	85	--	239	--	--	--	--
GYR OBS	4	GYROSIGMA OBSCURUM?	90	--	--	--	--	--	--	--	--	--	--	--
MAS LANC	4	MASTOGLOIA LANCEOLATA	--	707	--	--	66	123	655	311	--	450	1,230	617
MAS SMI	4	MASTOGLOIA SMITHII	273	1,325	1,286	868	207	211	1,106	918	1,088	615	4,115	679
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	572	1,000	1,635	1,028	150	200	2,931	724	1,800	876	3,033	1,162
NAV CRY	4	NAVICULA CRYPTOCEPHALA	--	--	633	--	25	267	15	549	--	557	--	--
NAV CRYP	4	NAVICULA CRYPTOTENELLA	232	394	129	361	89	219	213	349	429	283	--	--
NAV POD	4	NAVICULA PODZORSKII	202	368	--	56	--	167	--	100	847	283	--	--
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	--	--	--	--	--	46	--	--	--	--	--	--
NAV RAD	4	NAVICULA RADIOSA	--	--	--	--	--	--	--	--	--	--	--	--
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	563	--	590	12	578	112	--	--	--	--	--
NAV SUBR	4	NAVICULA SUBRHYNCHOCEPHALA	--	--	--	--	--	73	--	--	--	--	--	--
NIT ACI	4	NITZSCHIA ACICULARIS	--	--	--	--	--	--	6	--	--	--	--	--
NIT AMP	4	NITZSCHIA AMPHIBIA	122	147	--	--	--	78	5	430	1,407	--	--	--
NIT ANG	4	NITZSCHIA ANGUSTATA	--	--	--	--	--	73	--	--	--	--	--	--
NIT CON	4	NITZSCHIA CONSTRICTA	--	114	--	--	--	82	6	--	--	--	--	--
NIT FRU	4	NITZSCHIA FRUSTULUM	--	--	--	--	--	--	--	--	--	--	--	--
NIT NAN	4	NITZSCHIA NANA	--	--	--	--	--	94	--	--	--	--	--	--
NIT PAL	4	NITZSCHIA PALEA	--	606	863	--	--	111	272	206	228	--	2,650	--
NIT PALE	4	NITZSCHIA PALEACEA	--	1,175	1,842	667	37	144	96	202	498	--	845	312
NIT PALF	4	NITZSCHIA PALEAFORMIS	--	--	--	--	--	--	708	--	576	--	--	580
NIT SCA	4	NITZSCHIA SCALARIS	--	--	--	--	--	--	--	--	--	--	--	--
NIT SEM	4	NITZSCHIA SEMIROBUSTA	315	437	446	473	656	1,229	411	1,077	998	677	--	727
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	74	--	561	--	--	85	--	590	172	--	--	--
PIN VIR	4	PINNULARIA VIRIDIS	--	--	--	--	24	--	--	--	--	--	--	--

EXHIBIT D.1-35

Porta-PSTA Average Algal Cell Counts (# cells/m^2 x 10^6), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
PIN VIR MI	4	PINNULARIA VIRIDIS V MINOR	122	--	--	--	--	37	--	--	--	--	--	--
RHO GIBA	4	RHOPALODIA GIBBA	151	--	129	--	18	104	15	191	--	--	--	131
SYN ACU	4	SYNEDRA ACUS	--	--	--	--	--	25	--	--	--	--	--	--
OPH DES MI	7	OPHIOCYTIUM DESERTUM V MINOR	73	--	--	--	--	--	--	--	--	--	--	--
G EUG	10	EUGLENA SP	--	237	--	--	--	59	5	269	--	--	--	--
G CHI	11	CHILOMONAS SP	23	--	--	--	--	--	--	--	--	--	--	--
G CHRM	11	CHROOMONAS SP	--	--	--	--	--	578	--	--	--	--	--	--
G CRY	11	CRYPTOMONAS SP	--	--	--	--	--	--	--	--	571	677	--	--
G GYM SM	12	GYMNODINIUM SP (SMALL)	--	--	--	--	--	46	16	--	--	--	--	--
PER INC	12	PERIDINIUM INCONSPICUUM	--	--	129	--	--	25	45	--	--	--	--	--
PER PUS	12	PERIDINIUM PUSILLUM	--	--	--	--	--	--	--	--	--	--	118	--

Codes:

1 = Cyanobacteria (Bluegreens) 7 = Xanthophyceae (Yellow greens)
3 = Chlorophytea (Greens) 10 = Euglenophyta (Euglenoids)
4 = Bacillariophyceae (Diatoms) 11 = Cryptophyta (Cryptomoniads)
5 = Chrysomonodales (Dinobryo 12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT D.1-36

Porta-PSTA Average Algal Cell Biovolume Data (cm^3/m^2), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
G ANA	1	ANABAENA SP	0.132	0.081	--	0.014	--	0.015	0.065	0.077	0.078	0.127	--	0.035
ANAB CIR	1	ANABAENOPSIS CIRCULARIS	--	--	--	--	--	--	0.236	--	0.099	0.328	--	--
APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	--	--	--	--	0.064	0.310	--	--	--	--	1.365
APH DEL	1	APHANOCAPSA DELICATISSIMA	0.005	0.005	0.013	0.017	0.006	0.006	0.004	0.014	0.016	0.020	0.029	0.004
APH GRE	1	APHANOCAPSA GREVILLEI	--	1.393	--	--	0.018	0.019	--	--	--	--	--	--
APH INC	1	APHANOCAPSA INCERTA	--	--	--	--	--	0.003	0.006	0.025	0.017	--	--	--
APH NUB	1	APHANOCAPSA NUBILUM	--	--	--	--	--	--	--	0.010	0.378	--	--	--
APH PLA	1	APHANOCAPSA PLANCTONICA?	0.029	0.016	0.322	--	--	0.009	0.150	0.061	0.111	0.143	0.168	0.252
APHA CLA	1	APHANOTHECE CLATHRATA	0.009	0.016	0.044	0.032	--	--	0.009	0.007	0.017	0.009	0.070	0.021
APHA SMI	1	APHANOTHECE SMITHII	0.045	0.050	0.120	0.114	0.002	0.010	0.149	0.038	0.169	0.090	0.011	0.028
APHA STA	1	APHANOTHECE STAGNINA	0.126	0.324	2.846	0.231	0.047	0.091	0.160	0.264	0.808	0.495	0.325	0.762
APHA VAR	1	APHANOTHECE VARIABILIS?	--	--	--	--	--	--	--	0.010	--	--	--	--
ART TEN	1	ARTHROSPIRA TENUIS?	--	0.354	--	--	--	--	--	--	0.793	--	--	--
CAL EPI	1	CALOTHRIX EPIPHYTICA	--	--	--	--	--	--	--	--	0.026	--	--	--
CHR DIS	1	CHROOCOCCUS DISPERSUS	0.022	0.092	0.090	0.153	0.027	0.015	0.031	0.043	0.016	0.050	0.323	0.007
CHR MINI	1	CHROOCOCCUS MINIMUS	0.011	0.022	0.055	0.029	0.006	0.013	0.009	0.029	0.053	0.090	0.131	0.028
CHR MIN	1	CHROOCOCCUS MINUTUS	0.004	0.023	0.037	0.019	0.006	0.005	0.016	0.012	0.031	0.033	0.025	0.028
CHR PLA	1	CHROOCOCCUS PLANCTONICUS	--	0.106	--	--	--	--	--	--	--	--	--	--
CHR TUR	1	CHROOCOCCUS TURGIDUS	0.065	0.080	--	0.030	0.039	0.021	0.309	0.096	0.233	--	--	0.612
COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	0.043	--	--	--	--	--	--	--	--	--	--	--
G CYL	1	CYLINDROSPERMUM SP	0.404	0.421	0.454	0.119	--	0.242	0.381	0.683	0.265	0.229	0.520	1.181
CYL STA	1	CYLINDROSPERMUM STAGNALE	--	--	--	--	--	--	--	--	--	--	--	--
EUC MIN	1	EUCAPSIS MINOR	--	--	--	--	0.003	--	--	--	--	--	--	--
G GLO	1	GLOEOCAPSA SP	--	0.007	0.057	0.001	0.002	0.002	0.027	0.020	0.024	0.058	0.009	0.024
GLO MEM	1	GLOEOTHECE MEMBRANACEAE	--	--	--	--	--	--	--	--	--	1.157	--	--
GOM APO	1	GOMPHOSPHAERIA APONINA	0.108	0.106	--	--	0.120	--	--	0.432	0.075	--	--	--
JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	0.105	0.918	--	0.224	0.261	--	0.052	0.296	0.352	0.064	0.033	0.208
LYN AER	1	LYNGBYA AERUGINEO-CARULEA?	2.380	1.812	3.255	4.841	--	0.347	0.959	0.662	3.285	1.271	6.741	2.458
LYN AES	1	LYNGBYA AESTUARII	7.724	1.549	--	--	--	--	--	--	--	--	--	--
LYN CON	1	LYNGBYA CONTORTA	--	--	--	0.277	--	--	--	--	--	--	--	--
LYN EPI	1	LYNGBYA EPIPHYTICA	0.076	0.072	0.061	0.204	0.065	0.019	0.097	0.050	0.161	0.178	0.124	--
LYN LAG	1	LYNGBYA LAGERHEIMII	0.023	0.035	0.357	0.065	0.008	0.061	0.132	0.112	0.163	0.592	1.128	0.211
LYN LIM	1	LYNGBYA LIMNETICA	0.202	1.323	1.604	2.948	0.012	0.077	1.614	0.667	2.766	2.445	3.718	3.106
LYN PER	1	LYNGBYA PERELEGANS?	--	0.028	0.029	0.270	--	--	0.126	0.191	--	--	--	0.571
G LYN SM	1	LYNGBYA SP (SMALL)	--	0.086	0.103	0.054	--	0.007	0.082	0.048	0.134	0.046	0.487	0.040
LYN TAY	1	LYNGBYA TAYLORII?	--	--	--	7.189	--	--	--	--	--	--	--	--
MER DUP	1	MERISMOPEDIA DUPLEX	--	--	--	--	--	0.013	--	--	--	--	--	--
MER GLA	1	MERISMOPEDIA GLAUCA	0.028	0.006	--	0.033	0.001	0.010	0.071	0.041	0.010	--	--	--
MER PUN	1	MERISMOPEDIA PUNCTATA	--	0.032	--	--	--	0.011	--	--	0.018	--	--	--
MER TEN	1	MERISMOPEDIA TENUISSIMA	0.001	0.001	0.000	0.005	0.001	0.003	0.004	0.014	0.002	0.001	--	--
MIC AER	1	MICROCYSTIS AERUGINOSA	0.330	--	--	--	0.064	0.173	--	--	--	0.052	--	--
MIC FIR	1	MICROCYSTIS FIRMA	0.135	0.052	0.655	--	0.014	--	0.145	0.200	0.137	0.780	0.038	0.073
MIC FLO	1	MICROCYSTIS FLOS-AQUAE	--	--	--	--	0.866	--	--	--	--	--	--	--
MIC SMI	1	MICROCYSTIS SMITHII	--	--	0.562	--	0.016	--	--	--	--	3.635	--	--
OSC AMP	1	OSCILLATORIA AMPHIBIA	--	1.219	--	--	--	0.090	0.616	0.083	0.907	--	--	0.552
OSC AMPH	1	OSCILLATORIA AMPHIGRANULATA	--	--	--	--	--	--	0.019	--	--	--	--	--
OSC ANG	1	OSCILLATORIA ANGUSTISSIMA	0.051	0.086	0.103	0.050	0.006	0.014	0.035	0.045	0.061	0.101	0.225	0.152
OSC FOR	1	OSCILLATORIA FORMOSA	0.449	1.121	1.585	2.792	0.068	0.182	3.708	0.677	2.791	2.574	2.545	3.149
OSC LIM	1	OSCILLATORIA LIMNETICA	0.112	0.465	1.056	0.496	0.015	0.036	0.481	0.186	0.334	0.505	1.800	0.681
OSC LIMO	1	OSCILLATORIA LIMOSA	--	--	15.127	--	--	--	--	1.533	7.736	--	--	--
G OSC ME	1	OSCILLATORIA SP (MEDIUM)	--	--	--	--	--	0.024	--	--	3.008	--	--	--
G OSC SM	1	OSCILLATORIA SP (SMALL)	0.077	0.038	--	0.027	--	0.004	0.031	0.069	0.014	0.221	0.066	0.011
OSC TEN	1	OSCILLATORIA TENUIS	--	0.784	--	--	--	--	--	--	--	--	0.332	--
OSC WIL	1	OSCILLATORIA WILLEI?	--	--	--	0.056	--	--	2.654	0.118	0.585	0.595	--	--
PHO LUC	1	PHORMIDIUM LUCIDUM?	--	--	--	--	--	--	--	0.314	--	--	--	--
PHO TEN	1	PHORMIDIUM TENUE	--	0.055	--	0.044	--	--	--	0.161	0.663	--	--	--

EXHIBIT D.1-36

Porta-PSTA Average Algal Cell Biovolume Data (cm^3/m^2), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
RHA LIN	1	RHABDODERMA LINEARE?	0.955	0.181	--	0.503	--	--	0.349	1.127	0.179	0.183	0.086	0.065
SCH ARE	1	SCHIZOTHRIX ARENARIA?	0.136	0.658	--	0.954	--	--	0.311	0.254	0.496	0.255	0.685	--
SCY HOF	1	SCYTONEMA HOFMANII?	--	--	--	--	--	--	--	--	2.139	--	--	--
G SCY	1	SCYTONEMA SP?	15.599	--	20.189	2.451	--	0.947	8.179	3.826	17.428	--	121.129	30.543
SNO LAC	1	SNOWELLA LACUSTRIS	--	0.055	--	--	--	0.045	0.070	0.135	0.080	--	--	--
SPI LAX	1	SPIRULINA LAXA	--	--	--	--	--	--	--	--	--	0.060	--	--
SPI MAJ	1	SPIRULINA MAJOR	--	--	--	--	--	--	0.030	--	--	--	--	--
SPI SUB	1	SPIRULINA SUBSALSA	0.059	0.054	0.058	0.038	--	0.013	0.069	0.075	0.043	0.057	0.185	0.065
G SYNE	1	SYNECHOCCOCCUS SP	3.347	1.713	0.155	1.937	0.003	0.891	2.826	2.511	1.213	2.334	0.452	0.558
ANK FAL	3	ANKISTRODESMUS FALCATUS	0.015	--	--	0.035	0.004	0.017	0.014	0.006	0.026	--	--	0.007
ANK NAN	3	ANKISTRODESMUS NANNOSELENE	0.001	0.000	0.002	0.003	0.001	0.001	0.001	0.001	0.000	--	--	0.000
ANK SPI	3	ANKISTRODESMUS SPIRALIS	0.002	0.006	0.035	0.004	0.001	0.003	0.007	0.006	0.008	--	0.019	0.001
CHA ENS	3	CHARACIUM ENSIFORME	--	--	--	--	--	--	0.000	--	--	--	--	--
G CHLA	3	CHLAMYDOMONAS SP	0.014	0.071	--	--	--	0.007	0.024	--	--	--	--	--
CLO PAR	3	CLOSTERIUM PARVULUM	--	0.167	--	--	--	0.078	0.007	0.026	--	--	--	--
COE MIC	3	COELASTRUM MICROPORUM	--	--	--	--	--	0.013	0.299	--	0.300	--	--	--
COE SPH	3	COELASTRUM SPHAERICUM	0.113	0.092	--	0.416	--	0.052	0.053	0.183	--	--	--	0.038
COS BOT	3	COSMARIUM BOTRYTIS	--	--	--	--	--	--	--	--	10.919	--	--	--
COS GRAN	3	COSMARIUM GRANATUM	--	--	--	--	--	--	--	--	1.385	--	--	--
COS PUN	3	COSMARIUM PUNCTULATUM	--	--	--	--	--	--	0.150	--	5.978	--	--	--
G COS	3	COSMARIUM SP	--	--	--	--	--	0.147	--	--	--	--	--	--
COS SUBR	3	COSMARIUM SUBRENIFORME	0.017	0.030	--	0.155	0.010	0.023	0.090	0.129	0.126	0.025	--	0.034
COS TUB	3	COSMOCLADIUM TUBURCULATUM	--	--	--	--	--	--	--	--	--	--	--	--
CRU API	3	CRUCIGENIA APICULATA	--	0.025	--	--	--	0.005	0.023	--	--	--	--	--
DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	--	--	--	--	--	--	--	--	--	0.062	--	--
ELA GEL	3	ELAKATOTHRIX GELATINOSA	0.018	--	--	--	--	--	--	--	--	--	--	--
EUA COR ME	3	EUASTRUM CORNUBIENSE V MEDIANUM	0.062	1.249	0.341	0.294	--	0.092	0.233	0.635	0.272	0.889	7.622	1.300
EUA VER	3	EUASTRUM VERRUCOSUM	--	--	--	--	--	4.136	--	--	--	--	--	--
GOL RAD	3	GOLENKINIA RADIATA	0.028	--	--	--	--	--	--	--	--	--	--	--
G GONA	3	GONATOZYGON SP	--	0.516	--	--	--	--	--	--	--	--	--	--
KIR CON	3	KIRCHNERIELLA CONTORTA	--	--	--	--	--	--	0.026	--	--	--	--	--
KIR LUN	3	KIRCHNERIELLA LUNARIS	0.003	0.001	--	--	--	0.001	0.000	0.003	--	--	--	--
KIR OBE	3	KIRCHNERIELLA OBESA	0.002	--	--	0.011	--	0.000	0.000	--	0.003	--	--	--
LAG SUB	3	LAGERHEIMIA SUBSALSA	--	--	--	--	--	0.005	--	--	--	--	--	--
MIC PIN	3	MICRASTERIAS PINNATIFIDA	2.700	--	--	--	--	--	--	--	--	--	--	--
G MOU	3	MOUGEOTIA SP	--	--	--	--	--	0.106	--	--	--	--	--	--
OED PUN	3	OEDOGONIUM PUNCTATOSTRIATUM	0.944	--	--	--	--	13.634	7.133	7.183	--	26.014	80.005	17.600
G OED	3	OEDOGONIUM SP	1.466	2.581	2.597	--	--	0.330	4.801	2.124	--	--	--	--
OOC PAR	3	OOCYSTIS PARVA	0.002	0.024	--	0.001	0.010	0.004	0.011	0.009	0.008	0.011	--	--
OOC SOL	3	OOCYSTIS SOLITARIA	0.742	0.507	--	1.654	--	0.315	0.456	0.309	1.965	0.785	3.597	0.668
PED BIR	3	PEDIASTRUM BIRADIATUM	--	0.020	--	--	--	--	--	--	0.798	--	--	--
PED OBT	3	PEDIASTRUM OBTUSUM	--	--	--	--	--	--	--	--	0.034	--	--	--
PED TET	3	PEDIASTRUM TETRAS	--	0.027	--	--	--	--	0.032	--	--	--	--	--
PED TET TE	3	PEDIASTRUM TETRAS V TETRAODON	0.009	0.038	--	--	--	0.016	0.028	0.090	--	--	--	--
SCE ACU	3	SCENEDESMUS ACUMINATUS	--	--	--	--	0.001	0.003	0.124	--	--	--	--	--
SCE ARM	3	SCENEDESMUS ARMATUS	0.016	--	--	0.179	--	0.028	--	--	--	--	--	--
SCE BIJ	3	SCENEDESMUS BIJUGA	0.007	0.006	0.005	0.013	0.005	0.006	0.009	0.010	0.016	0.014	0.007	0.002
SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	--	0.019	--	--	0.003	0.012	0.011	0.019	--	--	0.144	--
SCE DEN	3	SCENEDESMUS DENTICULATUS	0.124	--	--	0.489	--	0.042	--	0.244	--	--	--	--
SCE DIM	3	SCENEDESMUS DIMORPHUS	0.013	--	--	--	0.001	0.011	--	--	--	--	--	--
SCE QUA	3	SCENEDESMUS QUADRICAUDA	0.024	--	--	--	0.019	0.042	--	0.023	0.061	--	--	--
SCE SUB	3	SCENEDESMUS SUBSPICATUS	0.035	--	--	--	--	--	--	--	--	--	--	--
SCH SET	3	SCHROEDERIA SETIGERA	--	--	--	--	--	--	--	0.046	--	--	--	--
SPH SCH	3	SPHAEROCYSTIS SCHROERTERI	0.046	0.146	--	0.050	--	0.102	0.172	0.337	1.413	0.665	--	--
G SPI	3	SPIROGYRA SP	--	--	--	--	--	--	--	82.762	91.058	--	--	--
SPO PLA	3	SPONDYLOSIUM PLANUM	--	--	--	--	--	--	--	--	--	--	--	--

EXHIBIT D.1-36

Porta-PSTA Average Algal Cell Biovolume Data (cm^3/m^2), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
STAU HEX	3	STAURASTRUM HEXACERUM	--	--	--	--	--	0.294	--	--	--	--	--	--
STAU MAN	3	STAURASTRUM MANFELDTII	0.241	--	--	--	--	--	--	1.697	--	--	--	--
STAU PAR P	3	STAURASTRUM PARADOXUM V PARVULUM	0.042	--	--	--	--	0.016	--	--	--	--	--	--
G STAU	3	STAURASTRUM SP	--	--	--	--	0.016	--	--	--	--	--	--	--
STAU TET	3	STAURASTRUM TETRACERUM	0.017	0.016	--	--	0.005	0.009	0.005	0.010	--	--	--	--
TET MIN	3	TETRAEDRON MINIMUM	0.002	0.005	--	0.003	0.001	0.001	0.002	0.022	0.005	--	0.005	0.024
TET TRI	3	TETRAEDRON TRIGONUM	0.249	0.072	--	0.341	0.083	0.074	0.239	0.307	0.547	0.276	0.547	--
UN CHL FI	3	UNID CHLOROPHYCEAE FILAMENT BASAL CELLS	--	--	--	--	--	--	--	0.036	--	--	--	--
UN FIL CH	3	UNID FILAMENTOUS CHLOROPHYTA	0.445	0.374	1.902	0.374	0.224	0.173	0.250	0.260	--	2.655	6.664	1.570
ACH EXI	4	ACHNANTHES EXIGUA	--	--	--	--	0.014	--	--	--	--	0.037	--	--
ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	0.039	0.070	0.089	0.088	0.012	0.012	0.040	0.108	0.123	0.103	0.371	0.009
AMP PEL	4	AMPHIPLEURA PELLUCIDA	--	--	--	--	--	0.060	--	--	--	--	--	--
AMP LIN	4	AMPHORA LINEOLATA?	--	4.061	0.702	--	--	0.378	--	--	--	--	--	--
AMP OVA AF	4	AMPHORA OVALIS V AFFINIS	--	--	--	--	--	--	--	--	--	--	--	--
G AMP	4	AMPHORA SP	--	--	--	--	--	--	--	--	--	--	--	--
AMP VEN	4	AMPHORA VENETA	--	--	0.052	--	--	--	--	--	--	--	--	--
BRA VIT	4	BRACHYSIRA VITREA	0.026	--	0.672	--	--	0.054	--	0.057	--	0.130	0.054	--
COC PLA LI	4	COCCONEIS PLACENTULA V LINEATA	--	--	--	--	--	--	--	--	--	--	--	--
COS GRA	4	COSCINODISCUS GRANII	--	--	--	--	4.065	--	--	--	--	--	--	--
CYC MEN	4	CYCLOTELLA MENEGHINIANA	0.174	--	--	0.159	--	0.080	0.006	--	0.140	--	--	--
CYM MIC	4	CYMBELLA MICROCEPHALA	0.031	0.039	--	0.074	0.002	0.042	0.025	0.043	0.059	0.063	0.187	0.173
DIP ELL	4	DIPLONEIS ELLIPTICA	--	--	--	--	--	0.123	--	--	--	--	--	--
DIP FIN	4	DIPLONEIS FINNICA	14.580	--	--	--	3.504	--	--	--	--	--	--	--
DIP OBL	4	DIPLONEIS OBLONGELLA	0.123	0.142	--	0.137	0.030	0.102	--	--	0.088	--	--	--
DIP OVA	4	DIPLONEIS OVALIS	0.098	0.041	--	--	0.018	0.032	0.045	0.045	0.263	--	--	--
ENC EVE	4	ENCYONEMA EVERGLADIANUM	0.133	0.506	0.421	1.031	0.014	0.103	0.332	0.279	0.443	0.363	0.449	0.103
ENC MIN	4	ENCYONEMA MINUTUM	--	--	--	--	--	--	--	--	0.101	--	--	--
ENC SIL	4	ENCYONEMA SILESIACUM	--	--	--	--	0.078	--	--	--	--	--	--	--
ENC SIL EL	4	ENCYONEMA SILESIACUM V ELEGANS	0.240	0.827	0.532	--	0.126	0.090	0.018	0.672	0.404	0.115	1.339	0.429
EPI ADN	4	EPITHEMIA ADNATA	2.041	--	--	--	--	--	--	4.960	--	--	--	--
EUN PEC MI	4	EUNOTIA PECTINALIS V MINOR	0.422	--	--	--	--	--	--	0.051	--	--	--	--
FRA FAS	4	FRAGILARIA FASCICULATA?	--	--	--	--	--	--	--	--	--	--	--	--
FRA NAN	4	FRAGILARIA NANANA?	0.060	0.185	0.168	0.251	--	0.012	0.013	0.012	0.213	0.127	0.218	0.036
FRA SYN	4	FRAGILARIA SYNEGROTESCA	0.388	0.571	1.087	1.265	0.220	0.162	0.778	0.612	1.009	0.304	5.682	0.376
FRA ULN	4	FRAGILARIA ULNA	1.437	--	--	--	--	0.298	--	3.657	--	--	--	--
GOM AFF IN	4	GOMPHONEMA AFFINE V INSIGNE	0.096	--	--	--	--	--	--	0.365	--	--	--	--
GOM GRA	4	GOMPHONEMA GRACILE	--	--	--	--	0.009	--	--	--	--	--	--	--
GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	0.631	--	--	--	0.141	0.109	0.012	0.612	1.246	--	--	--
GOM PAR	4	GOMPHONEMA PARVULUM	--	--	--	--	0.374	0.152	--	0.427	--	--	--	--
GYR OBS	4	GYROSIGMA OBSCURUM?	0.778	--	--	--	--	--	--	--	--	--	--	--
MAS LANC	4	MASTOGLOIA LANCEOLATA	--	4.745	--	--	0.444	0.824	4.397	2.088	--	3.023	8.257	4.146
MAS SMI	4	MASTOGLOIA SMITHII	0.950	4.610	4.472	3.019	0.719	0.732	3.847	3.194	3.785	2.140	14.313	2.360
MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	0.919	1.608	2.629	1.653	0.241	0.322	4.712	1.165	2.894	1.408	4.878	1.901
NAV CRY	4	NAVICULA CRYPTOCEPHALA	--	--	0.269	--	0.010	0.113	0.006	0.233	--	0.236	--	--
NAV CRYP	4	NAVICULA CRYPTOTENELLA	0.172	0.292	0.096	0.268	0.066	0.163	0.158	0.259	0.319	0.210	--	--
NAV POD	4	NAVICULA PODZORSKII	0.446	0.811	--	0.123	--	0.369	--	0.220	1.868	0.625	--	--
NAV PUP RE	4	NAVICULA PUPULA V RECTANGULARIS	--	--	--	--	--	0.041	--	--	--	--	--	--
NAV RAD	4	NAVICULA RADIOSA	--	--	--	--	--	--	--	--	--	--	--	--
NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	0.532	--	0.558	0.012	0.546	0.106	--	--	--	--	--
G NAV SM	4	NAVICULA SP (SMALL)	--	--	--	--	--	--	--	--	--	--	--	--
NAV SUBR	4	NAVICULA SUBRHYNCHOCEPHALA	--	--	--	--	--	0.059	--	--	--	--	--	--
NIT ACI	4	NITZSCHIA ACICULARIS	--	--	--	--	--	--	0.001	--	--	--	--	--
NIT AMP	4	NITZSCHIA AMPHIBIA	0.029	0.035	--	--	--	0.019	0.001	0.103	0.338	--	--	--
NIT ANG	4	NITZSCHIA ANGUSTATA	--	--	--	--	--	0.124	--	--	--	--	--	--
NIT CON	4	NITZSCHIA CONSTRICTA	--	0.069	--	--	--	0.050	0.004	--	--	--	--	--
NIT FRU	4	NITZSCHIA FRUSTULUM	--	--	--	--	--	--	--	--	--	--	--	--

EXHIBIT D.1-36

Porta-PSTA Average Algal Cell Biovolume Data (cm^3/m^2), April 2000 - October 2000

Organism Code	Division Code	Organism	Treatment 3	4	7	11	12	13	14	15	16	17	18	19
NIT NAN	4	NITZSCHIA NANA	--	--	--	--	--	0.265	--	--	--	--	--	--
NIT PAL	4	NITZSCHIA PALEA	--	0.318	0.453	--	--	0.058	0.143	0.108	0.120	--	1.391	--
NIT PALE	4	NITZSCHIA PALEACEA	--	0.074	0.116	0.042	0.002	0.009	0.006	0.013	0.031	--	0.053	0.020
NIT PALF	4	NITZSCHIA PALEAFORMIS	--	--	--	--	--	--	0.604	--	0.492	--	--	0.496
NIT SCA	4	NITZSCHIA SCALARIS	--	--	--	--	--	--	--	--	--	--	--	--
NIT SEM	4	NITZSCHIA SEMIROBUSTA	0.185	0.257	0.262	0.278	0.385	0.722	0.241	0.633	0.587	0.398	--	0.427
NIT SERP	4	NITZSCHIA SERPENTIRAPHE	0.690	--	5.212	--	--	0.788	--	5.487	1.597	--	--	--
G NIT	4	NITZSCHIA SP	--	--	--	--	--	--	--	--	--	--	--	--
G NIT ME	4	NITZSCHIA SP (MEDIUM)	0.057	--	--	--	--	--	--	--	0.207	--	--	--
G NIT SM	4	NITZSCHIA SP (SMALL)	0.030	0.050	0.134	--	0.007	0.016	0.059	0.035	0.078	--	--	--
PIN VIR	4	PINNULARIA VIRIDIS	--	--	--	--	2.034	--	--	--	--	--	--	--
PIN VIR MI	4	PINNULARIA VIRIDIS V MINOR	3.480	--	--	--	--	1.052	--	--	--	--	--	--
RHO GIBA	4	RHOPALODIA GIBBA	3.821	--	3.272	--	0.464	2.646	0.375	4.832	--	--	--	3.316
G STE	4	STEPHANODISCUS SP	--	--	--	--	--	--	0.006	--	--	--	--	--
SYN ACU	4	SYNEDRA ACUS	--	--	--	--	--	0.055	--	--	--	--	--	--
OPH DES MI	7	OPHIOCYTIUM DESERTUM V MINOR	0.071	--	--	--	--	--	--	--	--	--	--	--
G EUG	10	EUGLENA SP	--	3.048	--	--	--	0.759	0.062	3.462	--	--	--	--
G CHI	11	CHILOMONAS SP	0.066	--	--	--	--	--	--	--	--	--	--	--
G CHRM	11	CHROOMONAS SP	--	--	--	--	--	0.007	--	--	--	--	--	--
G CRY	11	CRYPTOMONAS SP	--	--	--	--	--	--	--	--	0.029	0.034	--	--
G GYM SM	12	GYMNODINIUM SP (SMALL)	--	--	--	--	--	0.027	0.009	--	--	--	--	--
PER INC	12	PERIDINIUM INCONSPICUUM	--	--	0.171	--	--	0.034	0.060	--	--	--	--	--
PER PUS	12	PERIDINIUM PUSILLUM	--	--	--	--	--	--	--	--	--	--	0.189	--

Codes:

1 = Cyanobacteria (Bluegreens)
3 = Chlorophytea (Greens)
4 = Bacillariophyceae (Diatoms)
5 = Chrysomonodales (Dinobryon)
7 = Xanthophyceae (Yellow greens)
10 = Euglenophyta (Euglenoids)
11 = Cryptophyta (Cryptomoniads)
12 = Pyrrhophyta (Dinoflagellates)

EXHIBIT D.1-37

Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Date	NPP(day) $g/m^2/d$	GPP(day) $g/m^2/d$	CR(24hr) $g/m^2/d$	CM(24hr) $g/m^2/d$	NPP(24hr) $g/m^2/d$	Avg Night Respiration $g/m^2/hr$	PAR(24hr) $E/m^2/d$	Efficiency %
Monthly									
3	Apr-00	0.846	2.132	2.122	2.132	0.010	0.088	37.2	1.096
	May-00	1.136	3.141	3.171	3.141	-0.030	0.132	49.7	1.208
	Jun-00	0.874	2.664	2.686	2.664	-0.021	0.112	38.4	1.327
	Jul-00	0.585	1.877	1.948	1.877	-0.071	0.081	35.6	1.009
	Aug-00	0.556	1.522	1.633	1.522	-0.112	0.068	28.4	1.026
	Sep-00	0.722	1.745	1.774	1.745	-0.030	0.074	28.2	1.182
4	Apr-00	1.805	4.386	4.289	4.386	0.098	0.179	39.8	2.108
	May-00	1.577	4.397	4.483	4.397	-0.086	0.187	47.4	1.773
	Jun-00	1.301	3.861	3.859	3.861	0.002	0.161	39.2	1.887
	Jul-00	1.343	3.980	4.017	3.980	-0.037	0.167	32.8	2.322
	Aug-00	1.641	4.001	4.036	4.001	-0.035	0.168	30.2	2.534
	Sep-00	1.530	3.822	3.929	3.822	-0.107	0.164	30.0	2.436
7	Apr-00	2.192	5.257	4.905	5.257	0.352	0.204	48.3	2.082
	May-00	2.083	5.017	4.694	5.017	0.323	0.196	44.4	2.160
	Jun-00	1.447	4.568	4.682	4.568	-0.114	0.195	38.0	2.300
	Jul-00	1.270	3.932	3.993	3.932	-0.062	0.166	31.9	2.355
	Aug-00	1.455	4.342	4.619	4.342	-0.278	0.192	34.6	2.401
	Sep-00	1.148	2.296	1.967	2.296	0.328	0.082	19.1	2.295
11	Apr-00	1.772	4.436	4.465	4.436	-0.029	0.186	43.8	1.939
	May-00	1.328	3.740	3.782	3.740	-0.042	0.158	40.0	1.790
	Jun-00	1.065	3.348	3.424	3.348	-0.076	0.143	22.1	2.895
	Jul-00	1.110	3.073	3.059	3.073	0.014	0.127	21.1	2.790
	Aug-00	1.731	3.859	3.648	3.859	0.211	0.152	30.8	2.400
	Sep-00	1.525	3.046	2.697	3.046	0.349	0.112	25.5	2.289
12	Apr-00	0.638	1.910	2.181	1.910	-0.271	0.091	31.7	1.151
	May-00	0.946	2.708	2.820	2.708	-0.111	0.117	44.9	1.154
	Jun-00	0.820	2.563	2.649	2.563	-0.086	0.110	41.9	1.169
	Jul-00	0.645	2.086	2.217	2.086	-0.131	0.092	25.5	1.562
	Aug-00	1.272	3.061	3.136	3.061	-0.075	0.131	33.0	1.772
	Sep-00	0.201	0.668	0.754	0.668	-0.086	0.031	7.7	1.670
13	Apr-00	--	--	--	--	--	--	--	--
	May-00	0.371	1.091	1.137	1.091	-0.046	0.047	44.3	0.471
	Jun-00	0.613	1.777	1.746	1.777	0.031	0.073	36.4	0.934
	Jul-00	0.706	2.122	2.162	2.122	-0.040	0.090	29.5	1.378
	Aug-00	1.214	3.317	3.542	3.317	-0.225	0.148	27.8	2.286
	Sep-00	0.928	2.305	2.360	2.305	-0.055	0.098	31.2	1.415
14	Apr-00	0.516	1.355	1.341	1.355	0.013	0.056	44.4	0.584
	May-00	1.293	3.471	3.347	3.471	0.123	0.139	43.2	1.536
	Jun-00	1.260	3.718	3.795	3.718	-0.077	0.158	29.9	2.375
	Jul-00	1.149	3.371	3.376	3.371	-0.005	0.141	27.8	2.317
	Aug-00	1.592	4.062	4.236	4.062	-0.173	0.176	30.6	2.540
	Sep-00	1.961	4.448	4.319	4.448	0.130	0.180	27.0	3.150
15	Apr-00	0.728	1.897	1.945	1.897	-0.049	0.081	38.9	0.934
	May-00	0.289	0.904	0.980	0.904	-0.076	0.041	45.8	0.378
	Jun-00	0.396	1.309	1.368	1.309	-0.060	0.057	34.0	0.737
	Jul-00	0.369	1.240	1.316	1.240	-0.076	0.055	25.0	0.950
	Aug-00	0.515	1.565	1.712	1.565	-0.147	0.071	30.2	0.991
	Sep-00	0.381	0.771	0.662	0.771	0.109	0.028	23.4	0.631
16	Apr-00	0.008	0.065	0.098	0.065	-0.033	0.004	31.7	0.039
	May-00	0.500	1.359	1.374	1.359	-0.015	0.057	43.4	0.599
	Jun-00	0.770	2.410	2.475	2.410	-0.065	0.103	36.4	1.266
	Jul-00	0.749	2.175	2.206	2.175	-0.031	0.092	29.1	1.429
	Aug-00	1.245	2.725	2.556	2.725	0.169	0.107	34.8	1.497
	Sep-00	1.326	3.360	3.528	3.360	-0.168	0.147	29.0	2.216
17	Apr-00	0.478	1.261	1.252	1.261	0.009	0.052	45.6	0.529
	May-00	1.271	3.401	3.334	3.401	0.066	0.139	51.6	1.260
	Jun-00	1.348	3.951	3.904	3.951	0.047	0.163	39.3	1.925
	Jul-00	1.514	3.983	3.704	3.983	0.279	0.154	40.2	1.895
	Aug-00	1.340	2.904	2.682	2.904	0.222	0.112	31.9	1.744
	Sep-00	1.390	3.161	3.065	3.161	0.096	0.128	23.3	2.595
18	Apr-00	0.639	1.664	1.668	1.664	-0.005	0.070	41.3	0.771
	May-00	0.703	1.849	1.832	1.849	0.016	0.076	43.4	0.815
	Jun-00	0.692	2.203	2.265	2.203	-0.063	0.094	30.9	1.365
	Jul-00	0.567	1.753	1.834	1.753	-0.082	0.076	33.6	0.999
	Aug-00	1.216	2.697	2.538	2.697	0.159	0.106	36.2	1.427
	Sep-00	0.784	2.042	2.157	2.042	-0.115	0.090	28.9	1.353
19	Apr-00	0.835	1.965	1.829	1.965	0.135	0.076	44.2	0.851
	May-00	0.732	1.934	1.835	1.934	0.099	0.076	44.4	0.833
	Jun-00	0.647	1.879	1.928	1.879	-0.050	0.080	27.3	1.318
	Jul-00	0.671	1.793	1.714	1.793	0.078	0.071	26.5	1.296
	Aug-00	0.606	1.608	1.718	1.608	-0.110	0.072	30.6	1.006
	Sep-00	0.857	1.998	2.021	1.998	-0.022	0.084	29.2	1.311

Final Porta-PSTA sampling postponed until October due to electrical failure at ENR site

EXHIBIT D.1-38

Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Treatments, April 2000 - October 2000

Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	z (m)	Ext Coeff (m^{-1})
Monthly						
3	Apr-00	0.30	684.0	393.0	0.18	4.34
	May-00	0.29	685.7	244.8	0.17	5.83
	Jun-00	0.29	342.4	223.4	0.17	3.65
	Jul-00	0.29	784.2	470.1	0.16	3.29
	Aug-00	0.29	500.6	263.3	0.17	4.19
	Sep-00	0.28	121.1	78.5	0.16	2.53
4	Apr-00	0.35	1810.1	1225.9	0.23	1.67
	May-00	0.35	417.3	261.1	0.23	1.99
	Jun-00	0.36	1582.3	533.3	0.24	5.55
	Jul-00	0.35	965.6	250.0	0.23	5.54
	Aug-00	0.35	640.6	388.7	0.23	2.77
	Sep-00	0.35	229.7	120.3	0.23	3.21
7	Apr-00	0.37	1836.5	1020.7	0.25	2.38
	May-00	0.37	1222.9	290.8	0.24	5.89
	Jun-00	0.40	405.5	107.9	0.28	4.72
	Jul-00	0.36	1638.0	546.2	0.24	4.56
	Aug-00	0.37	417.2	122.3	0.24	5.03
	Sep-00	0.38	386.6	215.1	0.26	2.26
11	Apr-00	0.35	558.2	387.2	0.23	1.62
	May-00	0.35	1653.7	1150.0	0.23	1.61
	Jun-00	0.34	1478.5	1013.5	0.22	1.74
	Jul-00	0.33	1759.9	1132.6	0.21	2.10
	Aug-00	0.34	1827.3	970.0	0.21	2.97
	Sep-00	0.34	661.6	440.7	0.22	1.88
12	Apr-00	0.33	458.3	297.4	0.20	2.12
	May-00	0.35	1260.9	820.0	0.23	1.86
	Jun-00	0.36	756.0	417.5	0.24	2.47
	Jul-00	0.36	1425.4	862.7	0.24	2.11
	Aug-00	0.33	735.4	238.7	0.21	5.35
	Sep-00	0.30	229.7	111.8	0.18	3.94
13	Apr-00	0.34	1693.8	896.7	0.22	10.41
	May-00	0.35	729.7	301.5	0.22	3.14
	Jun-00	0.35	843.8	545.0	0.23	2.33
	Jul-00	0.34	1336.7	400.7	0.22	5.86
	Aug-00	0.35	1181.5	534.7	0.23	4.09
	Sep-00	0.34	293.1	110.3	0.21	4.63
14	Apr-00	0.32	2000.9	1692.8	0.19	0.86
	May-00	0.32	499.3	400.3	0.22	1.02
	Jun-00	0.32	416.3	337.3	0.19	1.04
	Jul-00	0.32	900.0	343.6	0.20	4.91
	Aug-00	0.33	283.1	175.2	0.19	2.35
	Sep-00	0.32	302.0	231.4	0.20	1.33
15	Apr-00	0.33	1786.5	1048.1	0.20	3.47
	May-00	0.33	407.3	273.0	0.21	1.95
	Jun-00	0.33	1216.2	505.5	0.20	4.84
	Jul-00	0.33	764.3	233.1	0.21	5.18
	Aug-00	0.32	742.0	408.0	0.20	3.45
	Sep-00	0.31	119.6	67.3	0.19	3.60
16	Apr-00	--	--	--	--	--
	May-00	0.11	--	--	--	--
	Jun-00	0.37	1501.1	983.5	0.24	1.75
	Jul-00	0.36	838.9	330.4	0.24	3.31
	Aug-00	0.34	570.2	282.9	0.22	3.18
	Sep-00	0.33	258.9	138.6	0.21	3.16
17	Apr-00	0.33	2069.0	1539.6	0.21	1.43
	May-00	0.32	1280.6	372.0	0.20	6.15
	Jun-00	0.33	388.3	125.0	0.21	5.39
	Jul-00	0.34	1648.5	1007.1	0.22	2.25
	Aug-00	0.34	644.6	206.6	0.22	5.11
	Sep-00	0.34	467.9	306.0	0.21	1.99
18	Apr-00	0.32	1943.4	1537.7	0.20	1.18
	May-00	0.33	574.4	410.4	0.20	1.65
	Jun-00	0.33	346.2	98.4	0.21	6.07
	Jul-00	0.36	484.2	297.3	0.23	1.90
	Aug-00	0.32	322.7	116.4	0.20	5.15
	Sep-00	0.31	360.0	143.3	0.19	4.80
19	Apr-00	0.33	1788.0	414.8	0.21	7.05
	May-00	0.33	581.7	396.4	0.20	1.88
	Jun-00	--	--	--	--	--
	Jul-00	0.34	1125.3	337.6	0.22	5.49
	Aug-00	0.33	1742.5	1003.9	0.20	2.70
	Sep-00	0.34	302.3	121.9	0.21	4.26

Note:

Extinction coefficient = $(\ln PAR_{surf} - \ln PAR_{bot})/z$ and z = water depth - 0.122 m

EXHIBIT D.1-39

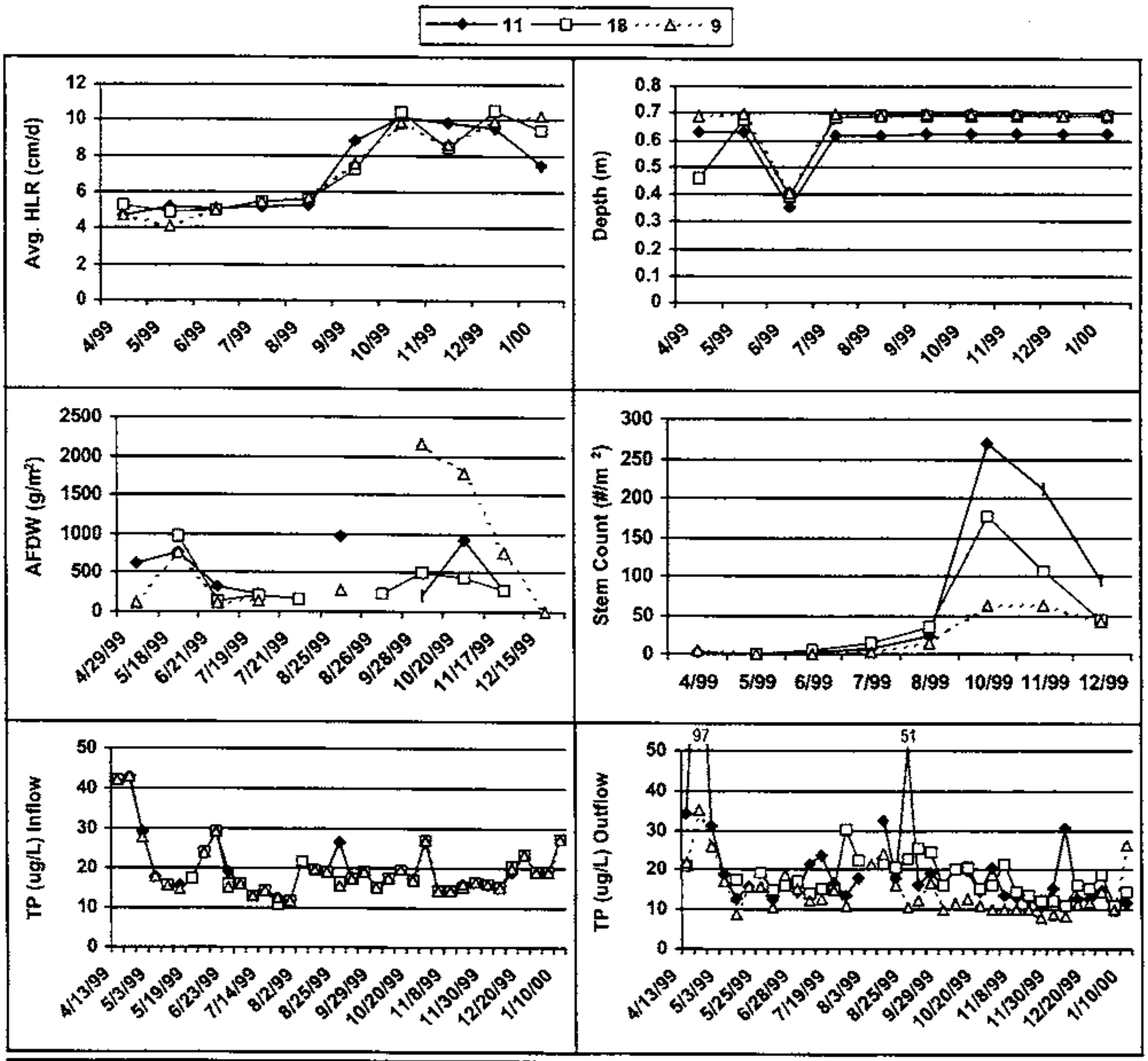
Porta-PSTA Sediment Trap Data, April 2000 - September 2000

Site	Tank	Soil	Treatment	Date Installed	Date Collected	PSTA #	Sediment Volume (ml)	# Days	Wet Accretion (ml/m²/y)	Dry Accretion (g/m²/y)	TP Accretion (g/m²/y)	Wet Bulk Density (g/cm³)	Dry Bulk Density (g/cm³)	Wet Weight (g)	Dry Weight (g)	Moisture Content (%)	TP (mg/kg)	Ash (%)
PORTA	1	shell	16	7/31/00	10/10/00	220	70	71	23367	1245	0.606	0.975	0.053	68.25	3.73	94.5	486.5	73.1
PORTA	2	shell	15	2/21/00	4/20/00	6660	35	59	14060	675	0.418	1.737	0.048	60.80	1.68	97.2	619.0	63.2
PORTA	2	shell	15	7/31/00	10/10/00	221	370	71	123514	2648	1.271	0.539	0.021	199.27	7.93	96.0	480.0	70.6
PORTA	3	shell	4	2/21/00	4/20/00	6661	40	59	16069	1695	0.817	1.725	0.106	68.98	4.22	93.9	481.8	81.3
PORTA	3	shell	4	7/31/00	10/10/00	222	400	71	133528	6942	2.164	0.547	0.052	218.87	20.60	90.5	311.7	74.8
PORTA	4	limerock	14	7/31/00	10/10/00	223	92	71	30712	561	0.130	0.334	0.018	30.70	1.68	94.5	230.9	63.1
PORTA	5	shell	4	2/21/00	4/20/00	6662	48	59	19282	3965	2.953	1.230	0.206	59.05	9.87	83.3	744.8	90.2
PORTA	5	shell	4	7/31/00	10/10/00	224	160	71	53411	2090	0.803	0.562	0.039	89.99	6.26	93.0	384.0	68.8
PORTA	6	shell	16	7/31/00	10/10/00	225	84	71	28041	1851	1.094	0.840	0.066	70.52	5.54	92.1	591.1	78.5
PORTA	7	limerock	14	7/31/00	10/10/00	226	13	71	4340	100	0.031	1.485	0.023	19.30	0.30	98.4	305.3	63.5
PORTA	8	limerock	14	7/31/00	10/10/00	227	13	71	4340	125	0.045	1.662	0.029	21.60	0.37	98.3	363.6	66.9
PORTA	9	peat_limed	13	7/31/00	10/10/00	228	210	71	70102	1331	0.520	0.519	0.019	109.07	3.99	96.3	390.4	62.5
PORTA	10	shell	4	2/21/00	4/20/00	6663	30	59	12052	289	0.128	1.426	0.024	42.78	0.72	98.3	442.4	61.2
PORTA	10	shell	4	7/31/00	10/10/00	229	118	71	39391	1353	0.446	0.563	0.034	66.38	4.05	93.9	330.0	69.6
PORTA	11	peat_limed	13	7/31/00	10/10/00	230	630	71	210307	642	0.285	0.286	0.003	160.17	1.92	98.9	443.6	54.1
PORTA	12	peat	3	2/21/00	4/20/00	6664	55	59	22094	554	0.311	1.927	0.025	106.00	1.38	98.7	561.1	26.9
PORTA	12	peat	3	7/31/00	10/10/00	231	100	71	33382	792	0.472	1.334	0.024	133.42	2.37	98.2	595.7	21.7
PORTA	13	shell	15	2/21/00	4/20/00	6665	25	59	10043	759	0.583	1.983	0.076	49.57	1.89	96.2	767.6	64.8
PORTA	13	shell	15	7/31/00	10/10/00	232	280	71	93470	2983	1.683	0.591	0.032	165.37	8.94	94.6	564.3	70.0
PORTA	14	peat	3	2/21/00	4/20/00	6666	14	59	5624	133	0.091	2.284	0.024	31.98	0.33	99.0	684.3	28.2
PORTA	14	peat	3	7/31/00	10/10/00	233	50	71	16691	282	0.251	1.326	0.017	66.31	0.64	98.7	892.4	44.7
PORTA	15	shell	16	7/31/00	10/10/00	234	480	71	160234	2089	0.822	0.326	0.013	156.25	6.26	96.0	393.5	65.9
PORTA	16	shell	15	2/21/00	4/20/00	6667	175	59	70300	1227	0.811	1.095	0.017	191.57	3.05	98.4	660.7	54.5
PORTA	16	shell	15	7/31/00	10/10/00	235	128	71	42729	1515	1.117	0.774	0.035	99.13	4.54	95.4	737.2	63.6
PORTA	17	peat	3	2/21/00	4/20/00	6668	17	59	6829	96	0.025	1.980	0.014	33.66	0.24	99.3	255.8	NS
PORTA	17	peat	3	7/31/00	10/10/00	236	135	71	45066	2936	1.206	1.313	0.065	177.27	8.80	95.0	410.9	35.0
PORTA	18	peat_limed	13	7/31/00	10/10/00	237	190	71	63426	2483	0.862	0.617	0.039	117.30	7.44	93.7	347.4	66.7
PORTA	19	sand	7	2/21/00	4/20/00	6669	47	59	18881	611	0.001	2.201	0.043	103.46	2.02	98.0	1.6	76.3
PORTA	19	sand	7	7/31/00	10/10/00	238	360	71	120176	2946	0.526	0.457	0.025	164.57	8.83	94.6	178.5	70.6
PORTA	20	sand_HCl	17	7/31/00	10/10/00	239	235	71	78448	2684	0.427	0.451	0.034	106.08	8.04	92.4	159.0	77.3
PORTA	21	none	18	7/31/00	10/10/00	240	370	71	123514	1529	0.378	0.339	0.012	125.58	4.58	96.4	247.3	63.7
PORTA	22	none	19	7/31/00	10/10/00	241	280	71	93470	2467	0.465	0.567	0.026	158.70	7.39	95.3	188.4	66.5
PORTA	23E	shell	11	2/21/00	4/20/00	6670	9	59	3615	253	0.118	4.366	0.070	39.29	0.63	98.4	467.8	67.5
PORTA	23E	shell	11	7/31/00	10/10/00	242	136	71	45400	1450	0.684	0.488	0.032	66.39	4.34	93.5	472.0	68.0
PORTA	23W	shell	11	2/21/00	4/20/00	6671	9.5	59	3816	197	0.092	3.380	0.052	32.11	0.49	98.5	467.8	59.5
PORTA	23W	shell	11	7/31/00	10/10/00	243	290	71	96808	1891	0.575	0.411	0.020	119.21	5.66	95.2	304.3	65.8
PORTA	24E	peat	12	2/21/00	4/20/00	6672	48	59	19282	358	0.269	1.561	0.019	74.94	0.89	98.8	751.2	28.0
PORTA	24E	peat	12	7/31/00	10/10/00	244	24	71	8012	95	0.065	1.415	0.012	33.96	0.28	99.2	689.6	28.6
PORTA	24W	peat	12	2/21/00	4/20/00	6673	28	59	11248	157	0.103	1.614	0.014	45.18	0.39	99.1	657.5	25.8
PORTA	24W	peat	12	7/31/00	10/10/00	245	59	71	19695	471	0.325	1.182	0.024	69.76	1.41	98.0	690.0	45.1

Sample Area = 154 cm² (14.0 cm diameter)
Assume BD = 0.05 g/cm³ when not determined
Assume TP = 0.05% when not determined

PSTA Research and Demonstration Project

Treatment:	PP-1	**Period:**	4/1/1999 -	2/28/2001
Tank(s)/Cell(s):	9, 11, 18	**Plants:**	yes	**Other:**
Research Scale:	Porta-PSTA	**Recirculation:**	no	
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	peat	

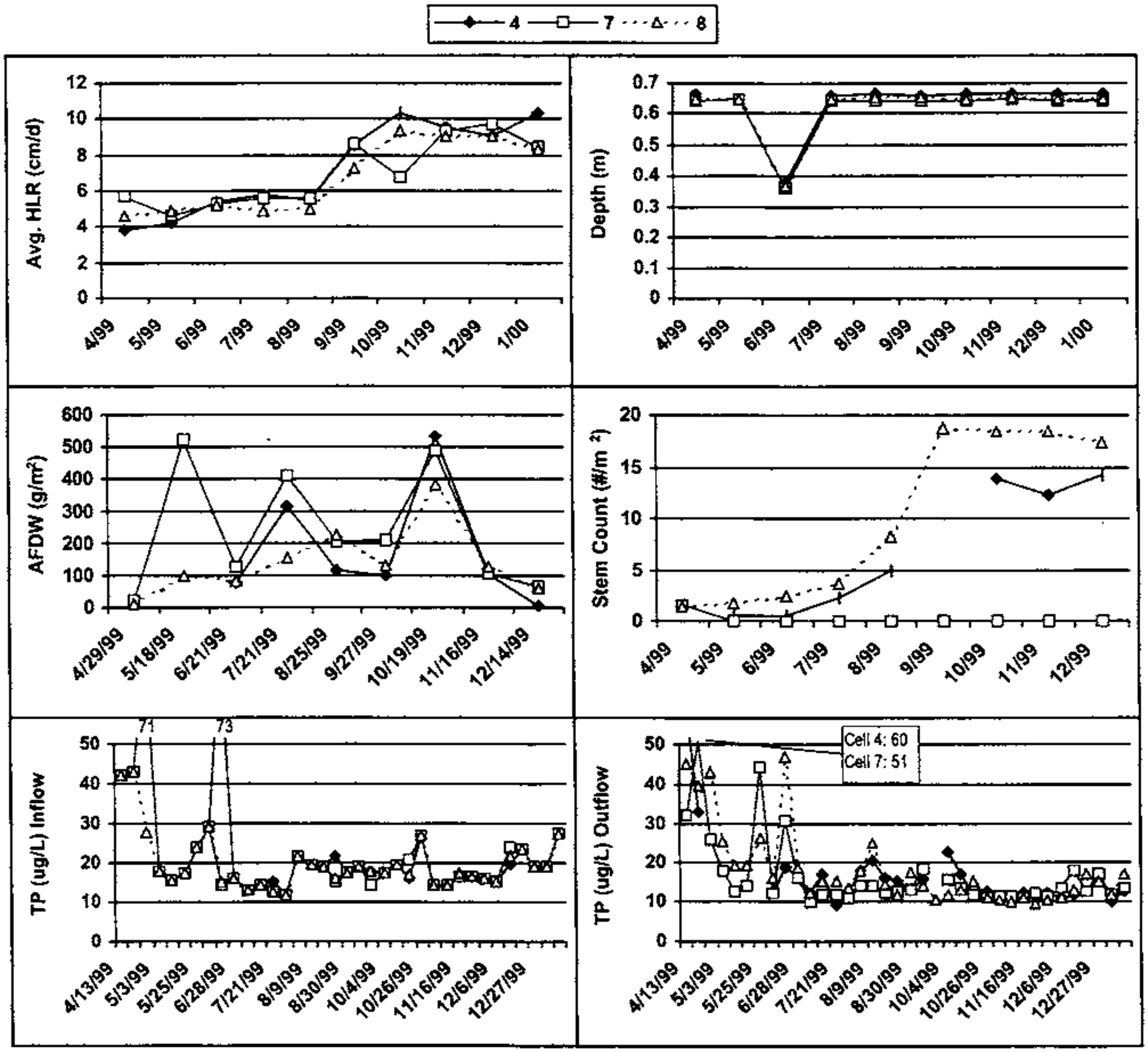


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
11	7.05	0.61	20	21	-1.2
18	7.10	0.66	19	18	1.6
9	6.74	0.68	20	14	7.5
Mean	6.96	0.65	19	18	2.6

PSTA Research and Demonstration Project

Treatment:	PP-2	**Period:**	4/1/1999 -	2/28/2001
Tank(s)/Cell(s):	4, 7, 8	**Plants:**	yes	**Other:**
Research Scale:	Porta-PSTA	**Recirculation:**	no	
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock	

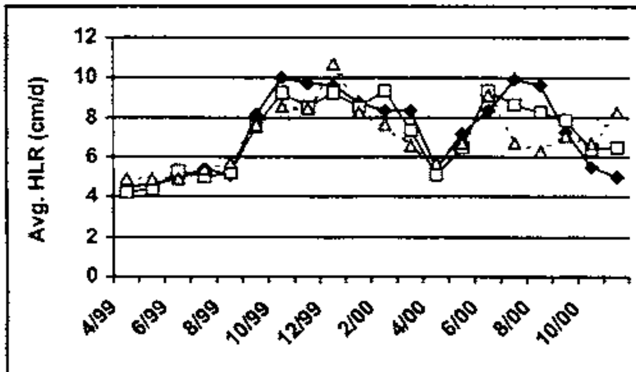


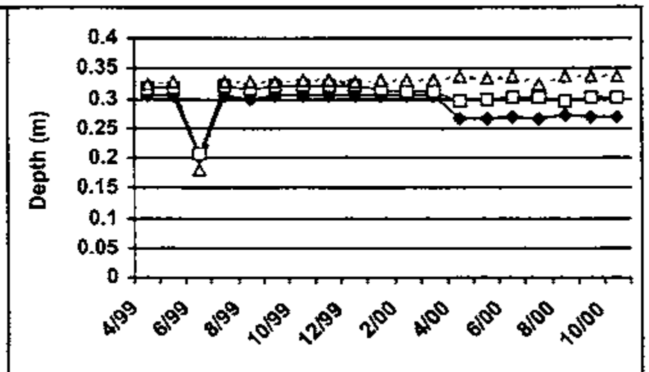
Summary For Period

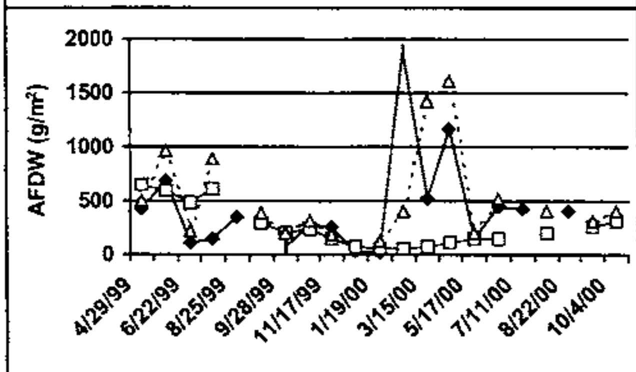
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
4	7.03	0.65	22	16	7.5
7	6.74	0.63	21	17	5.8
8	6.54	0.64	20	18	2.1
Mean	6.77	0.64	21	17	5.1

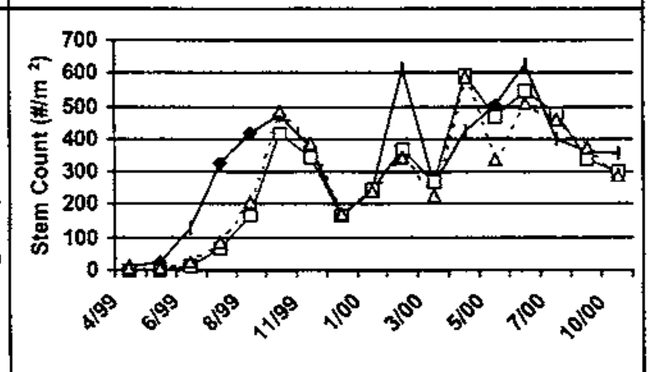
PSTA Research and Demonstration Project

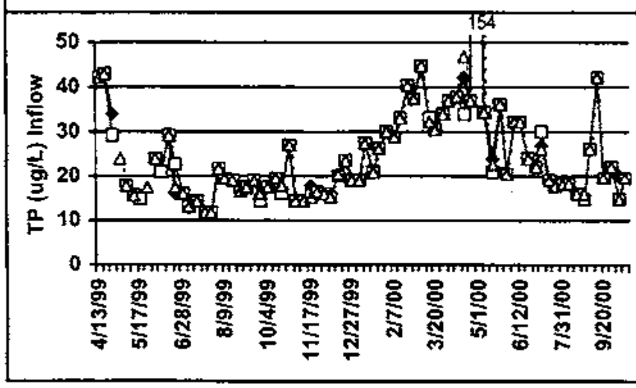
Treatment:	PP-3	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	12, 14, 17	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	peat		

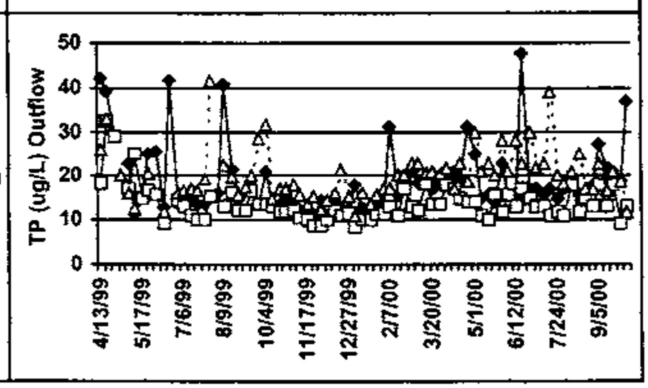










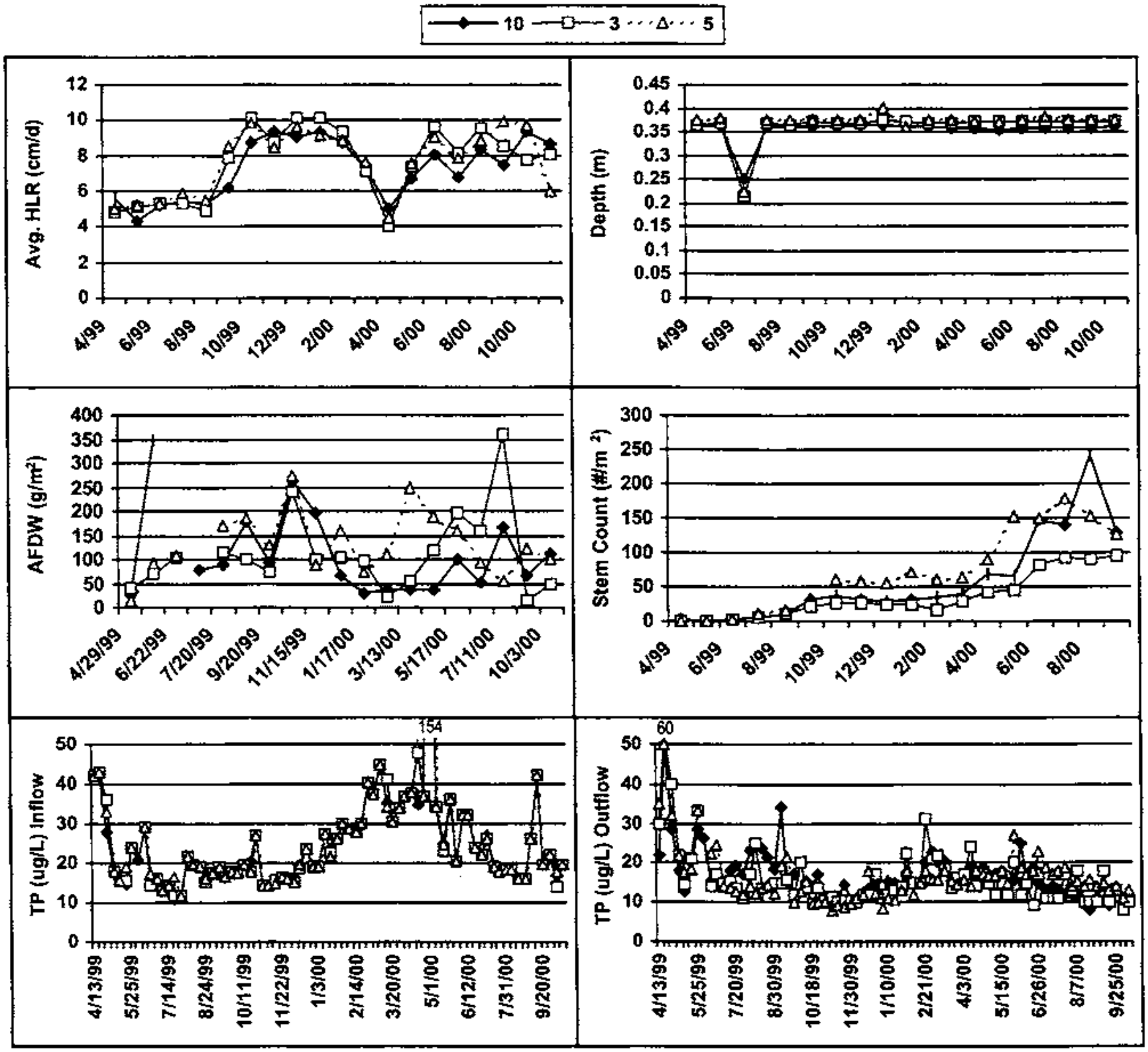


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
12	7.39	0.29	26	19	8.1
14	7.12	0.31	26	14	16.1
17	6.98	0.33	26	20	6.2
Mean	7.16	0.31	26	18	10.1

PSTA Research and Demonstration Project

Treatment:	PP-4	**Period:**	4/1/1999 -	2/28/2001
Tank(s)/Cell(s):	3, 5, 10	**Plants:**	yes	**Other:**
Research Scale:	Porta-PSTA	**Recirculation:**	no	
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock	

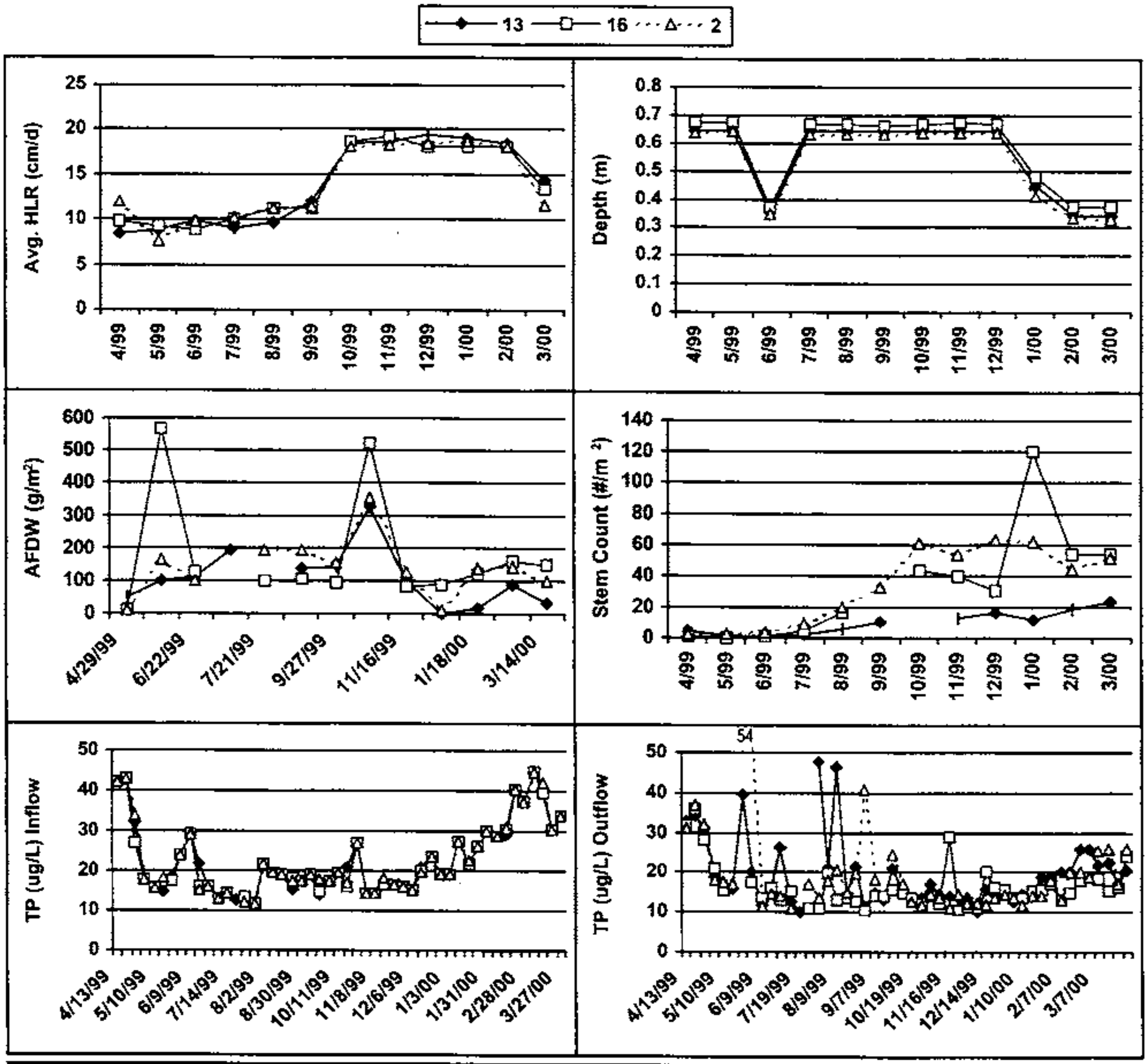


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
10	7.08	0.36	26	17	10.8
3	7.53	0.37	26	16	13.4
5	7.54	0.37	26	16	13.0
Mean	7.38	0.37	26	16	12.4

PSTA Research and Demonstration Project

Treatment:	PP-5	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	2, 13, 16	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock		

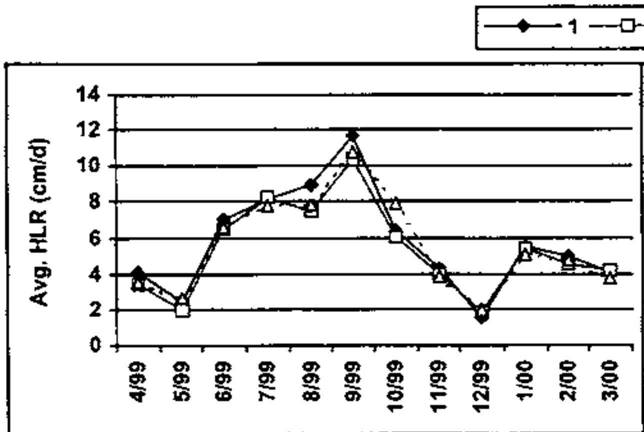


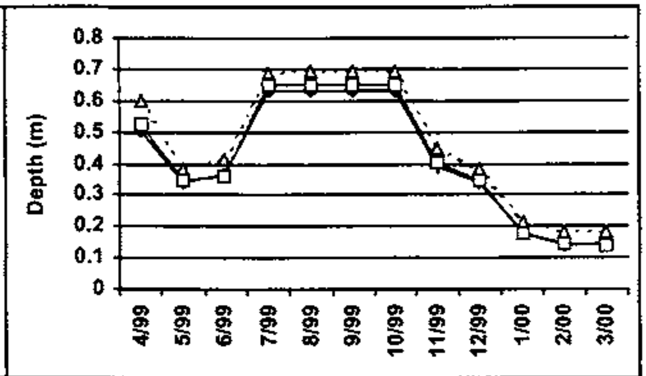
Summary For Period

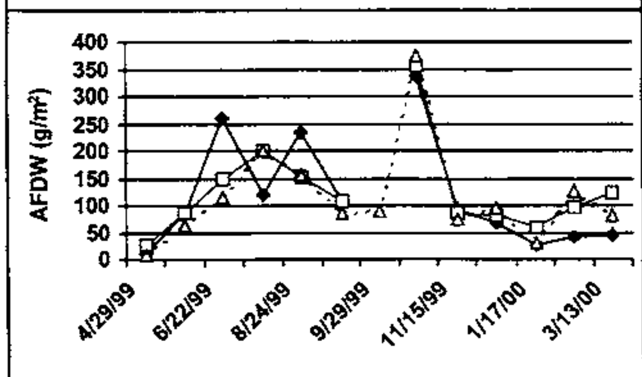
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
13	14.07	0.53	23	20	8.4
16	13.85	0.57	23	16	16.8
2	13.79	0.52	23	19	10.9
Mean	13.91	0.54	23	18	12.0

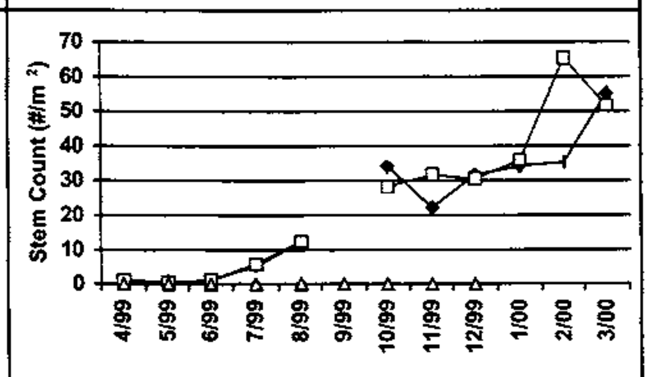
PSTA Research and Demonstration Project

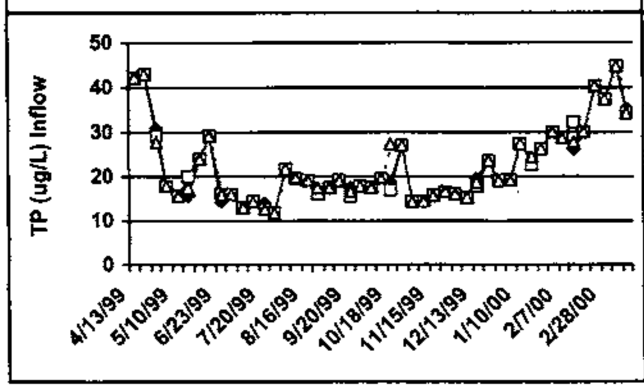
Treatment:	PP-6	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	1, 6, 15	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock		

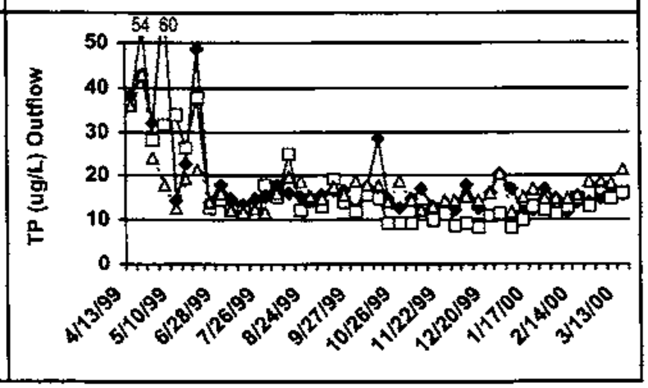










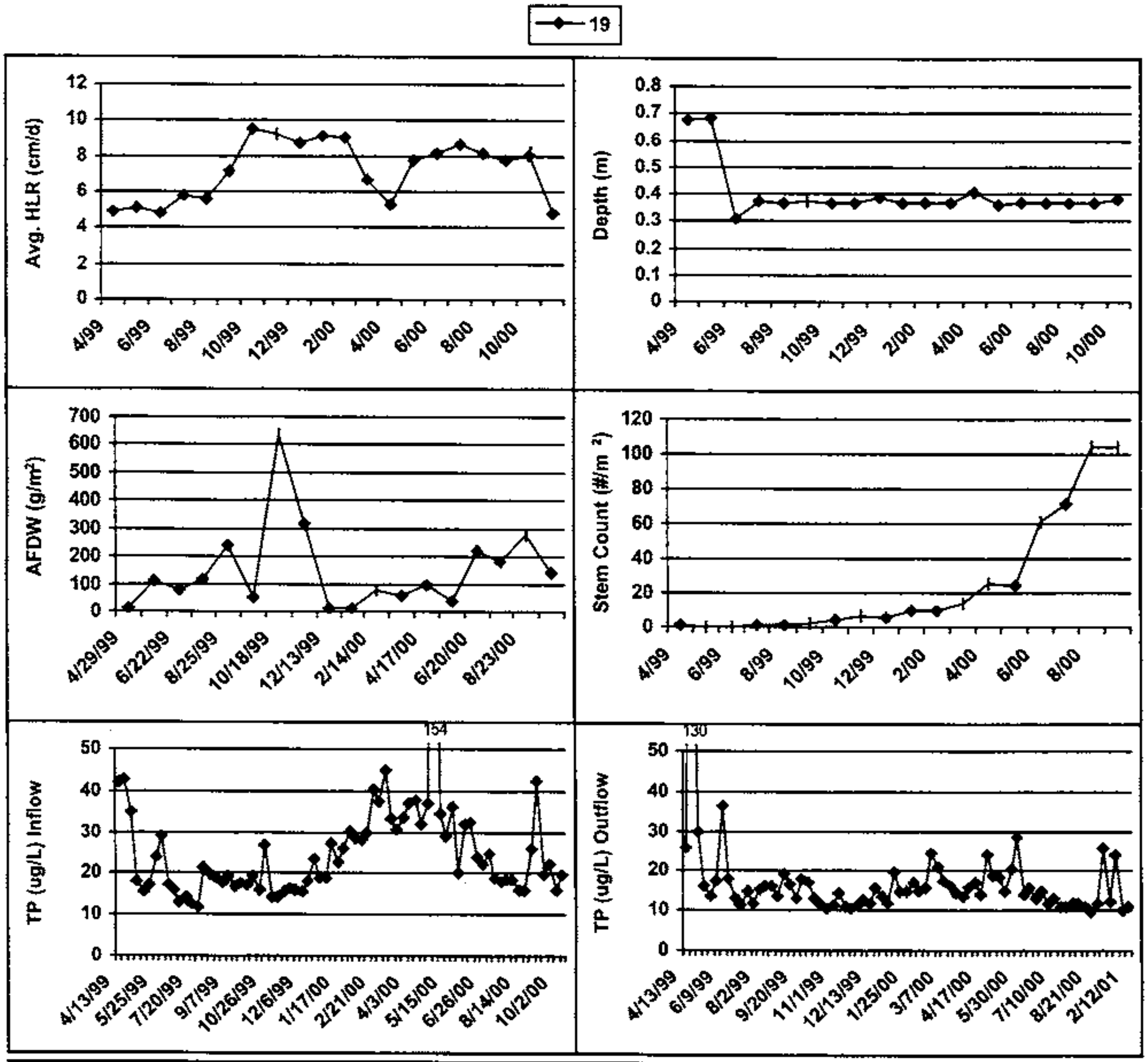


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
1	5.44	0.38	22	19	3.5
15	5.08	0.40	23	16	5.8
6	5.23	0.44	23	17	5.2
Mean	5.25	0.41	23	18	4.8

PSTA Research and Demonstration Project

Treatment:	PP-7	**Period:**	4/1/1999 -	2/28/2001	
Tank(s)/Cell(s):	19	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	sand		

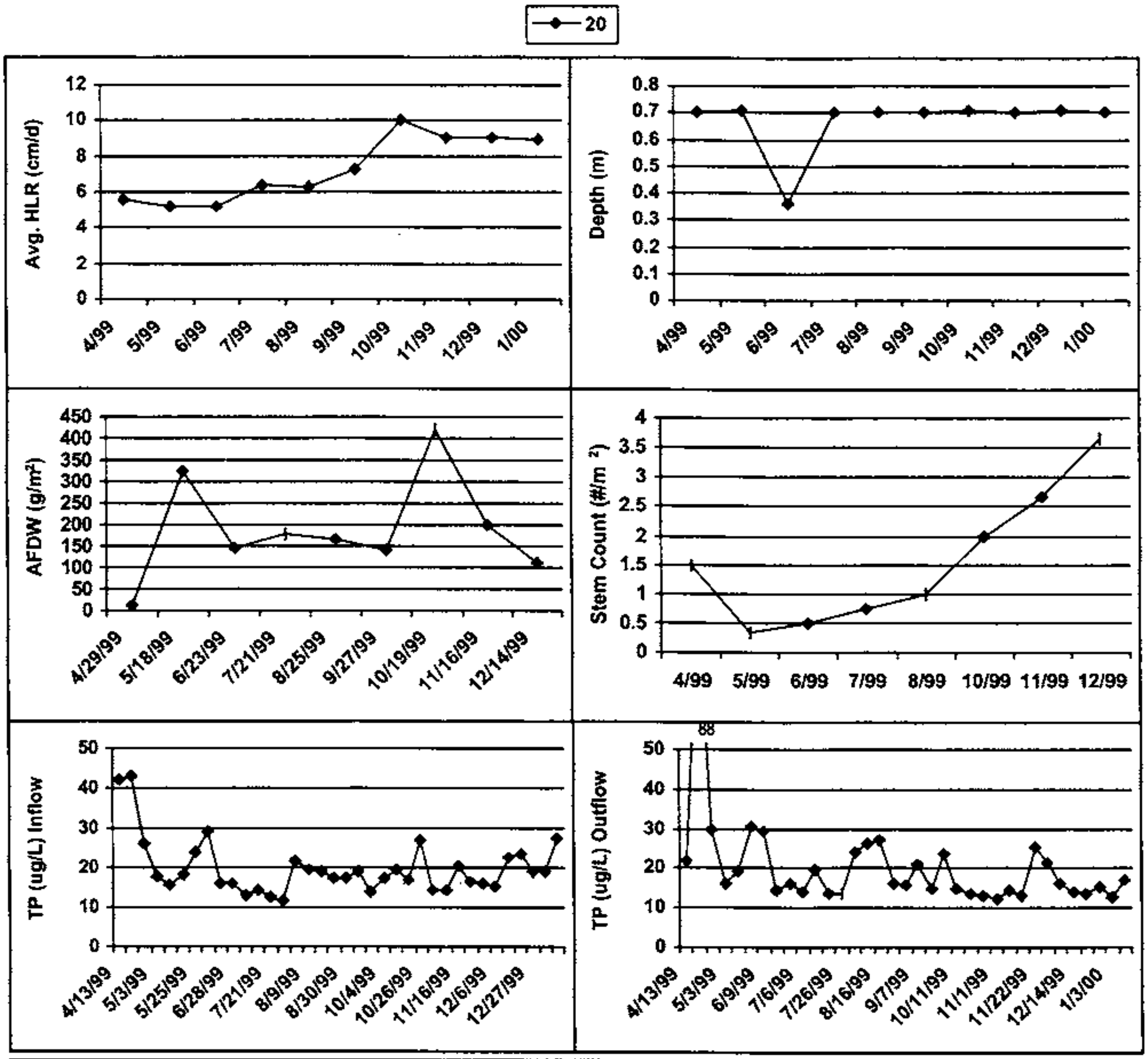


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
19	7.28	0.39	26	17	10.6
Mean	7.28	0.39	26	17	10.6

PSTA Research and Demonstration Project

Treatment:	PP-8	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	20	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	sand		

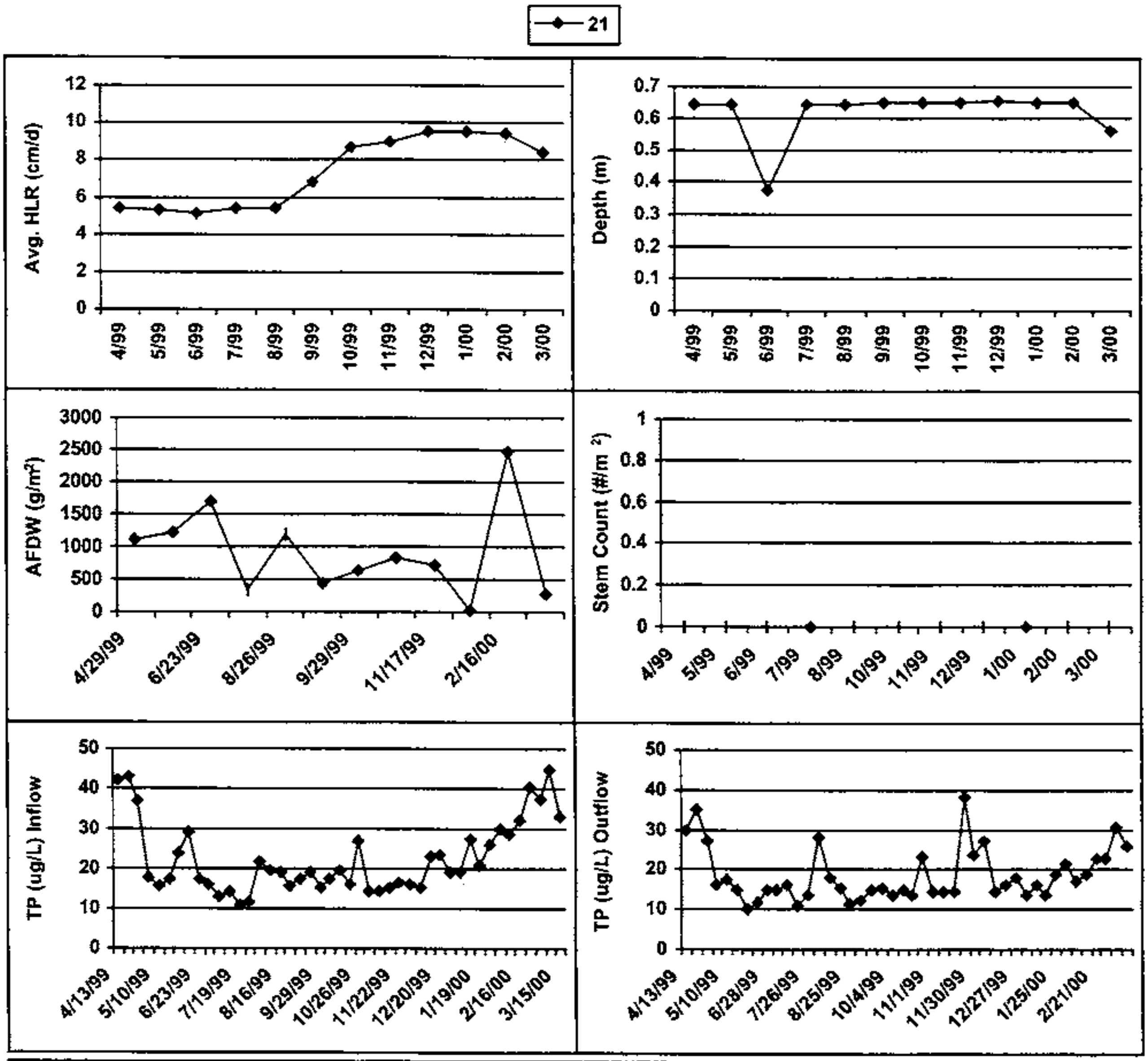


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
20	7.08	0.69	20	20	-0.6
Mean	7.08	0.69	20	20	-0.6

PSTA Research and Demonstration Project

Treatment:	PP-9	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	21	**Plants:**	no	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	peat		

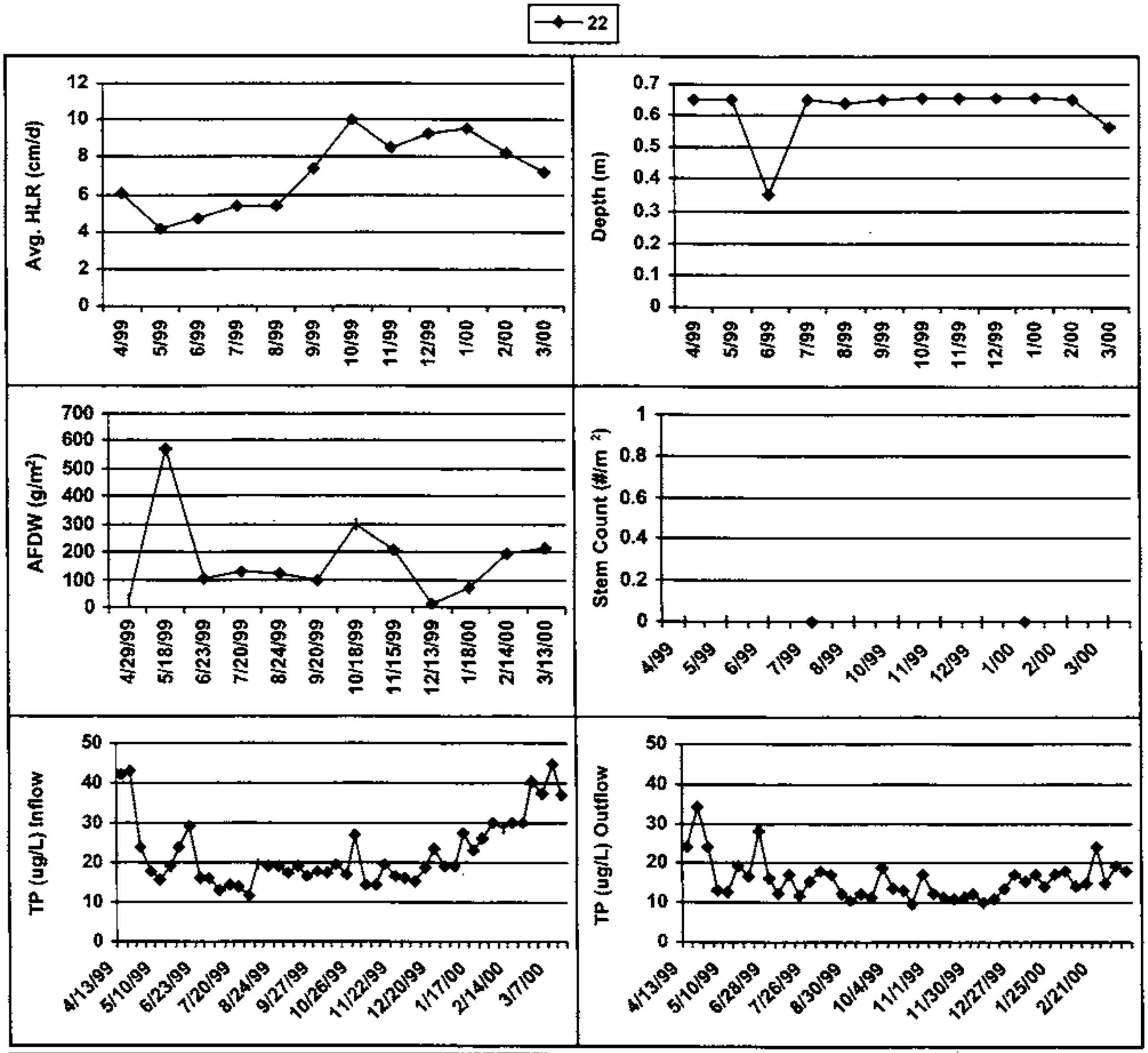


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
21	7.40	0.63	23	19	5.3
Mean	7.40	0.63	23	19	5.3

PSTA Research and Demonstration Project

Treatment:	PP-10	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	22	**Plants:**	no	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock		

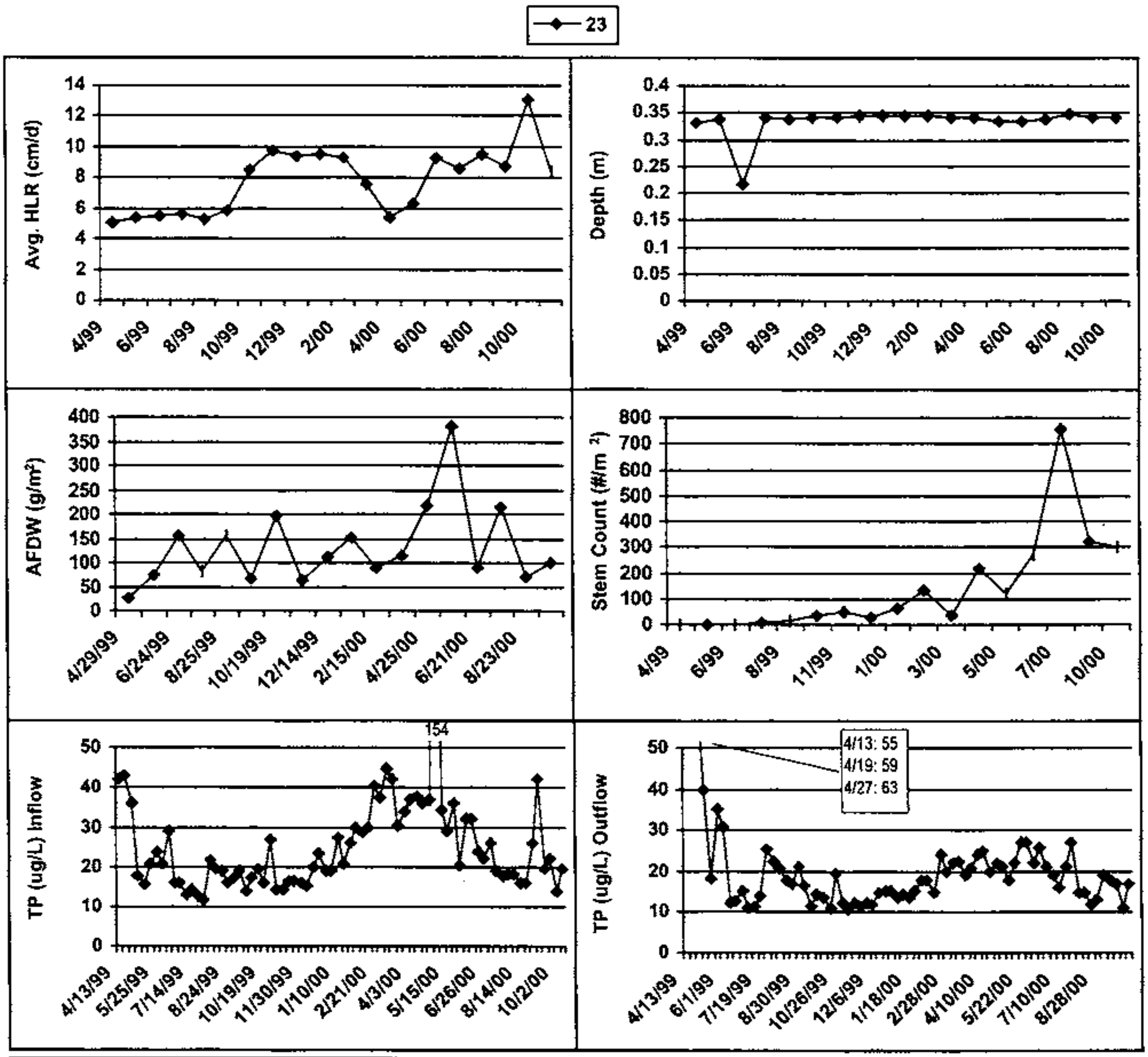


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
22	7.09	0.63	23	16	9.3
Mean	7.09	0.63	23	16	9.3

PSTA Research and Demonstration Project

Treatment:	PP-11	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	23	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	3 x 6 m (18m2)	**Soil:**	shellrock		



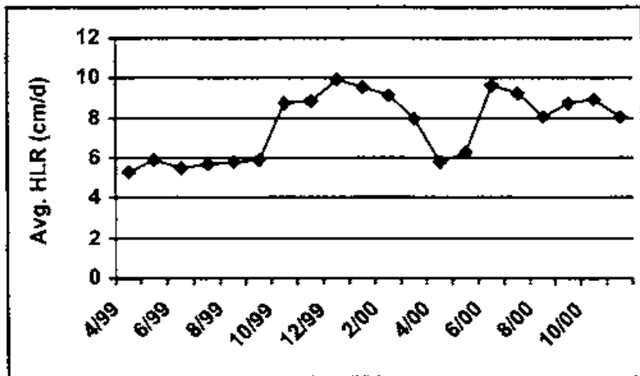
Summary For Period

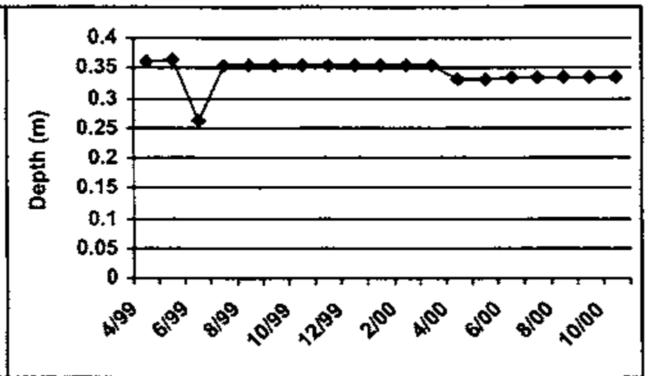
Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
23	7.54	0.34	26	20	7.2
Mean	7.54	0.34	26	20	7.2

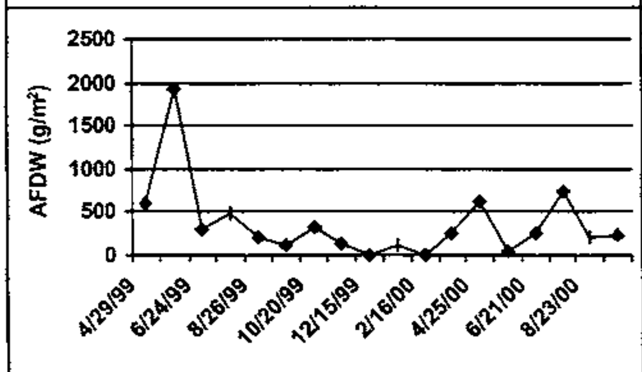
PSTA Research and Demonstration Project

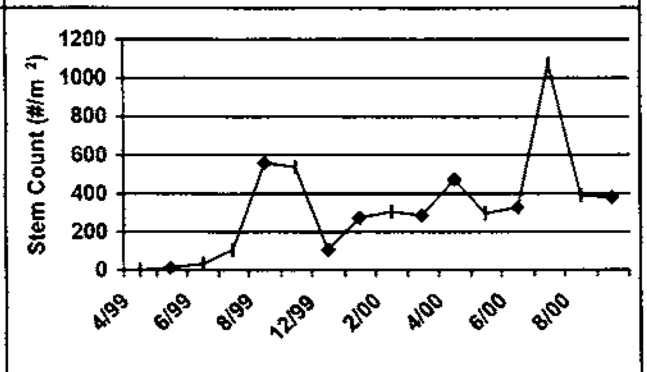
Treatment:	PP-12	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	24	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	3 x 6 m (18m2)	**Soil:**	peat		

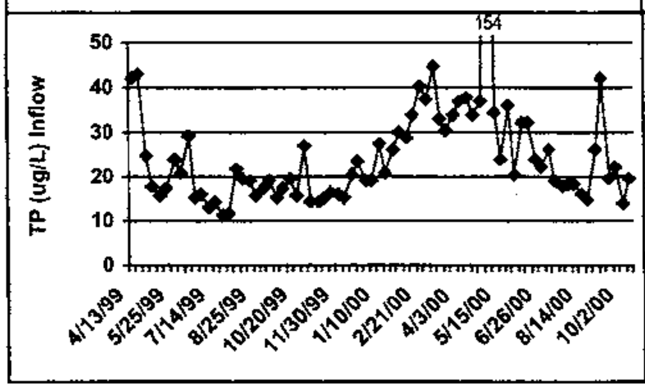
24

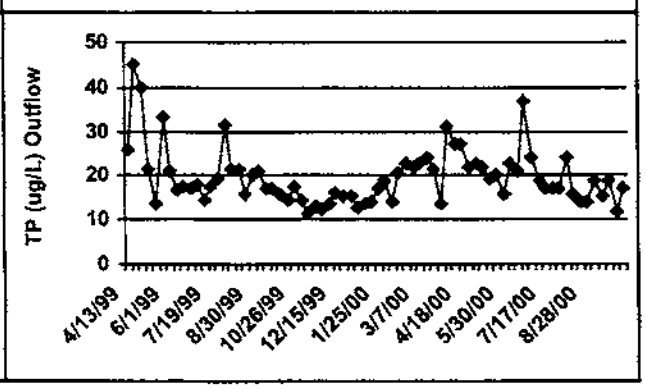










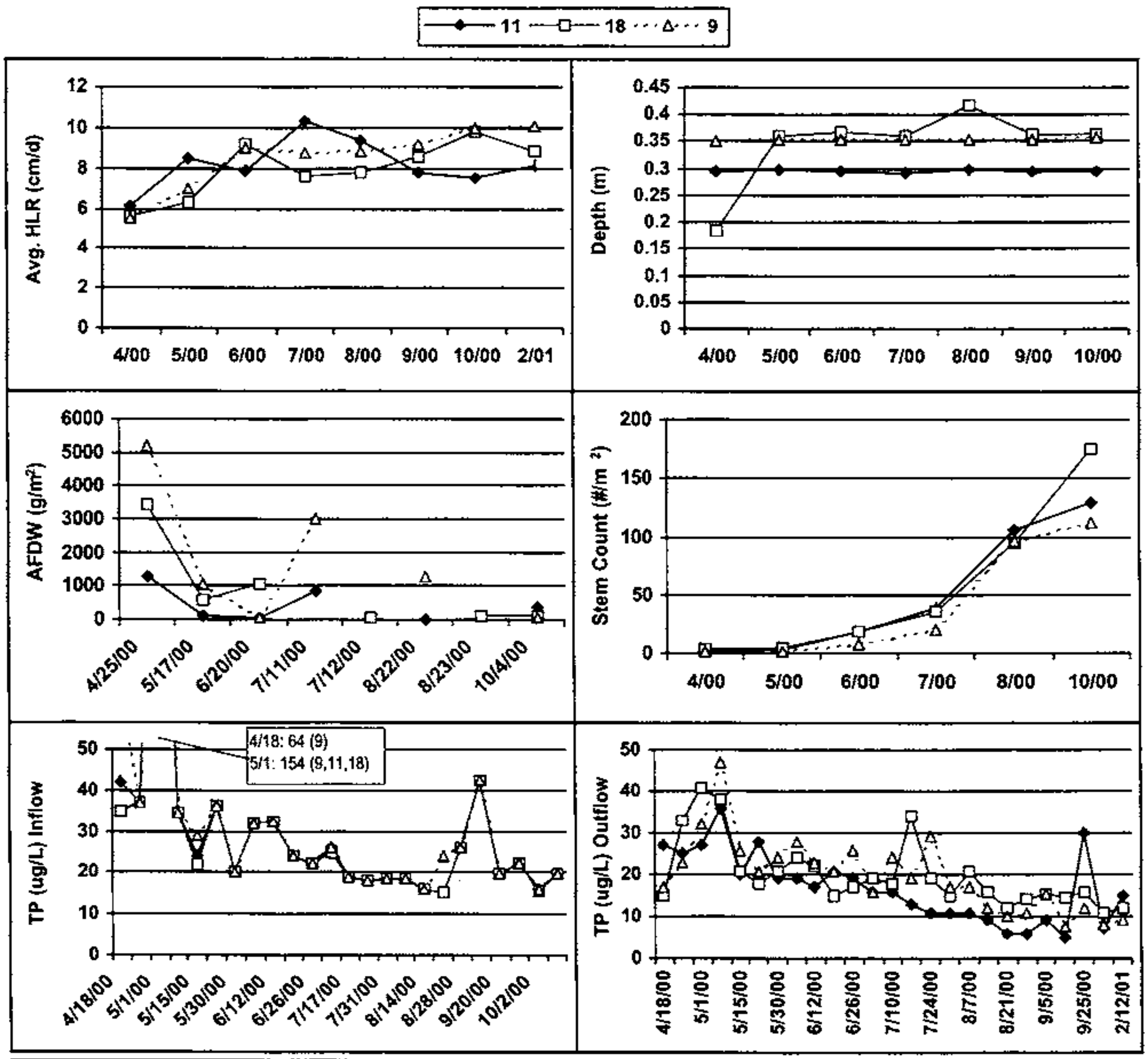


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
24	7.62	0.34	25	20	7.2
Mean	7.62	0.34	25	20	7.2

PSTA Research and Demonstration Project

Treatment:	PP-13	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	9, 11, 18	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	peat amended with CaOH		

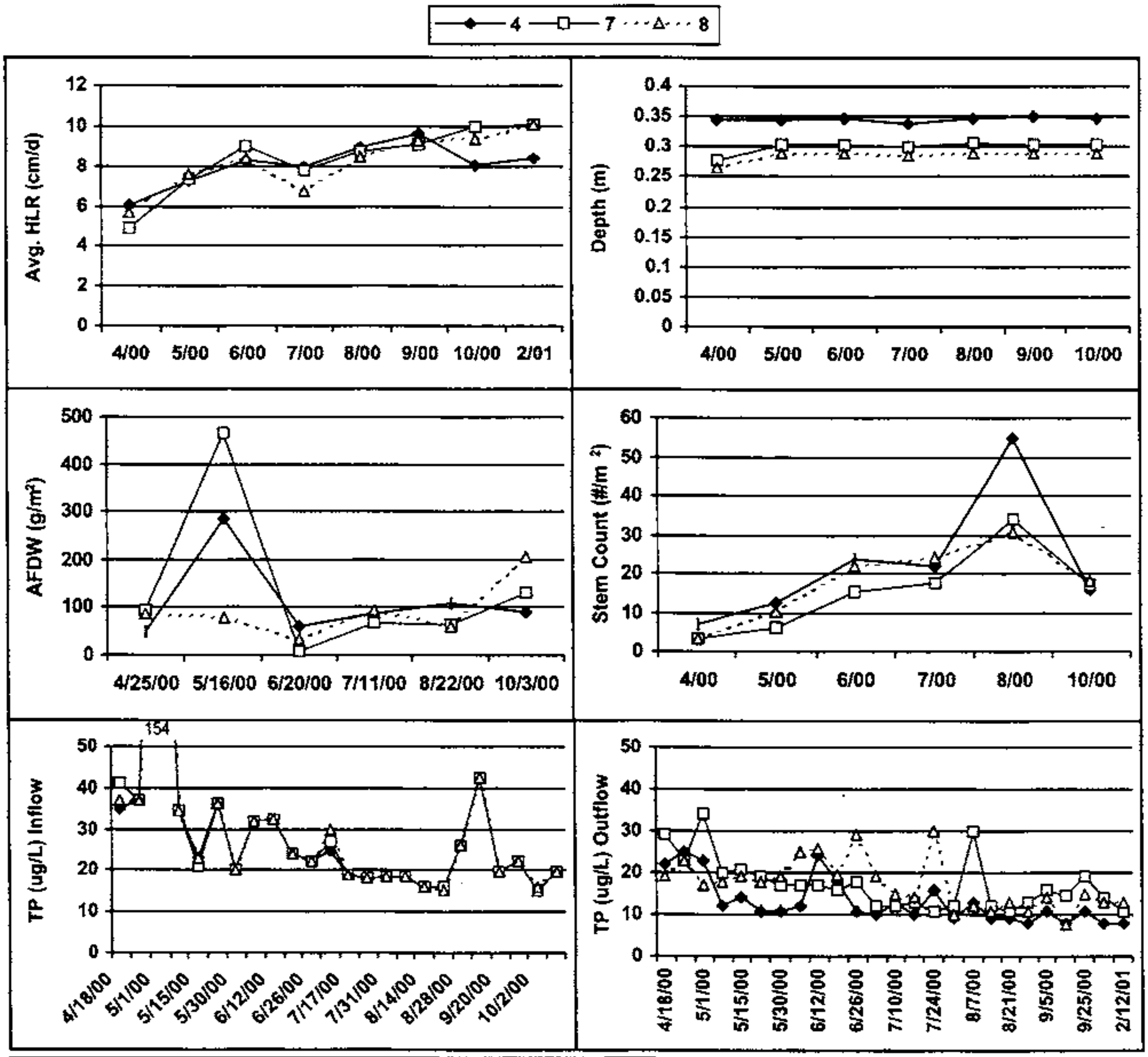


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
11	8.33	0.30	31	17	18.0
18	7.69	0.34	30	20	11.4
9	8.26	0.35	32	20	14.6
Mean	8.09	0.33	31	19	14.7

PSTA Research and Demonstration Project

Treatment:	PP-14	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	4, 7, 8	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	lime-rock		

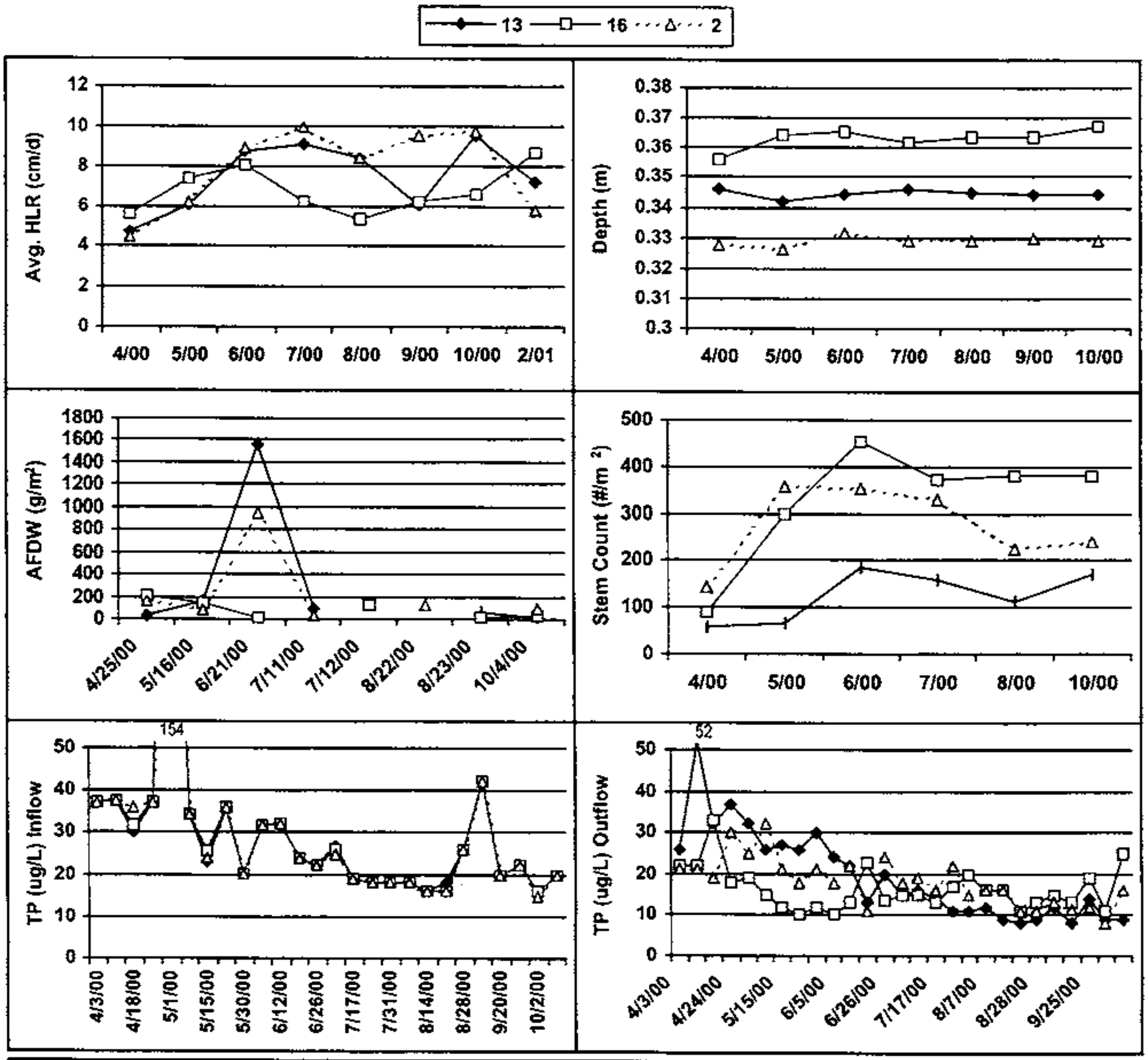


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
4	8.06	0.35	30	13	24.8
7	8.09	0.30	30	17	16.8
8	7.90	0.29	31	17	16.5
Mean	8.02	0.31	30	16	19.4

PSTA Research and Demonstration Project

Treatment:	PP-15	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	2, 13, 16	**Plants:**	yes	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	yes		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock		

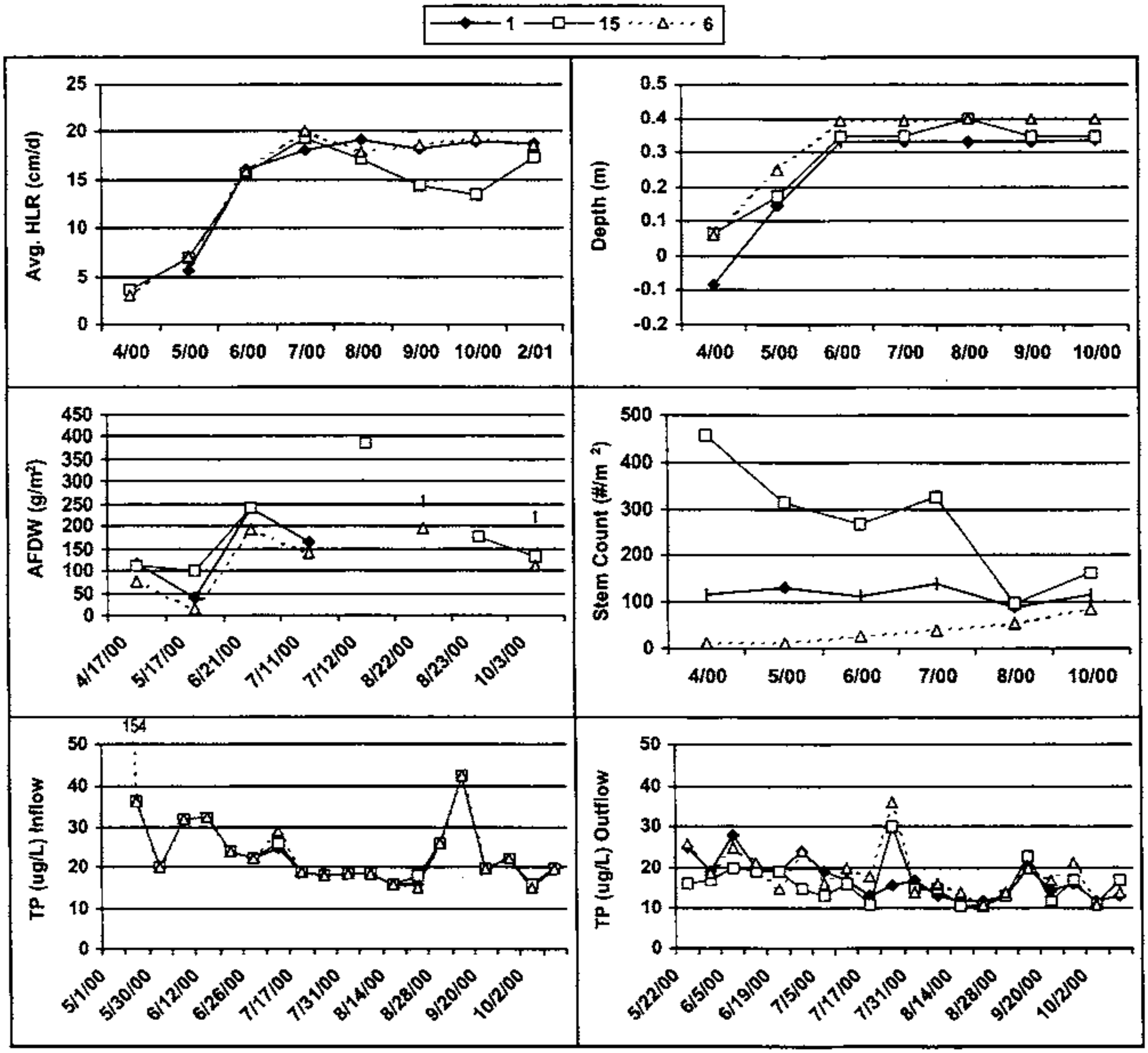


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
13	7.17	0.34	31	19	12.1
16	6.63	0.36	31	16	15.4
2	7.77	0.33	31	18	15.2
Mean	7.19	0.35	31	18	14.2

PSTA Research and Demonstration Project

Treatment:	PP-16	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	1, 6, 15	**Plants:**	yes	**Other:**	dry-out
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	shellrock		

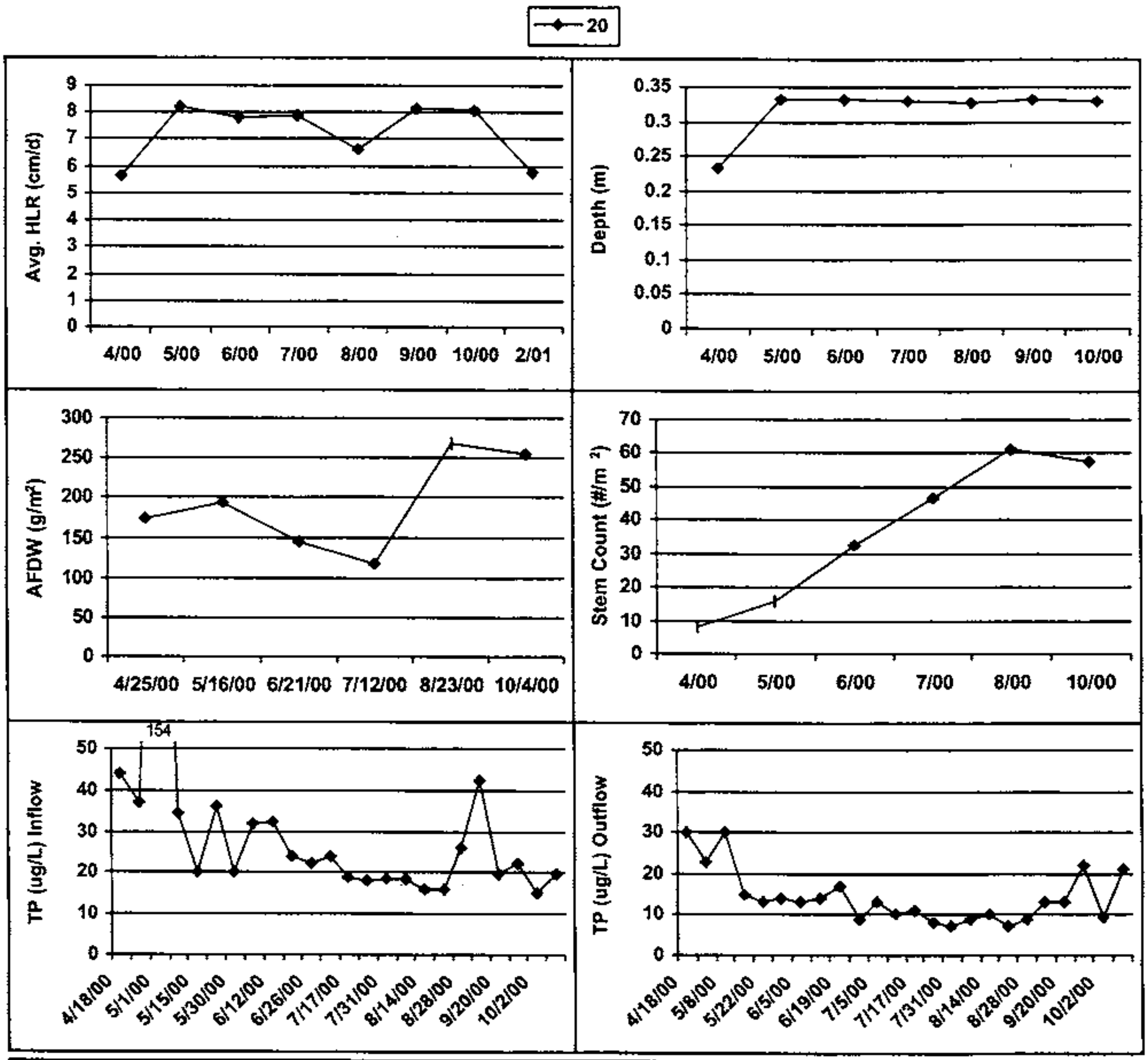


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
1	15.54	0.28	23	17	17.5
15	14.34	0.28	24	16	20.1
6	15.61	0.34	30	19	27.3
Mean	15.16	0.30	26	17	21.6

PSTA Research and Demonstration Project

Treatment:	PP-17	**Period:**	4/1/1999 - 2/28/2001	
Tank(s)/Cell(s):	20	**Plants:**	yes	**Other:**
Research Scale:	Porta-PSTA	**Recirculation:**	no	
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	acid washed sand	

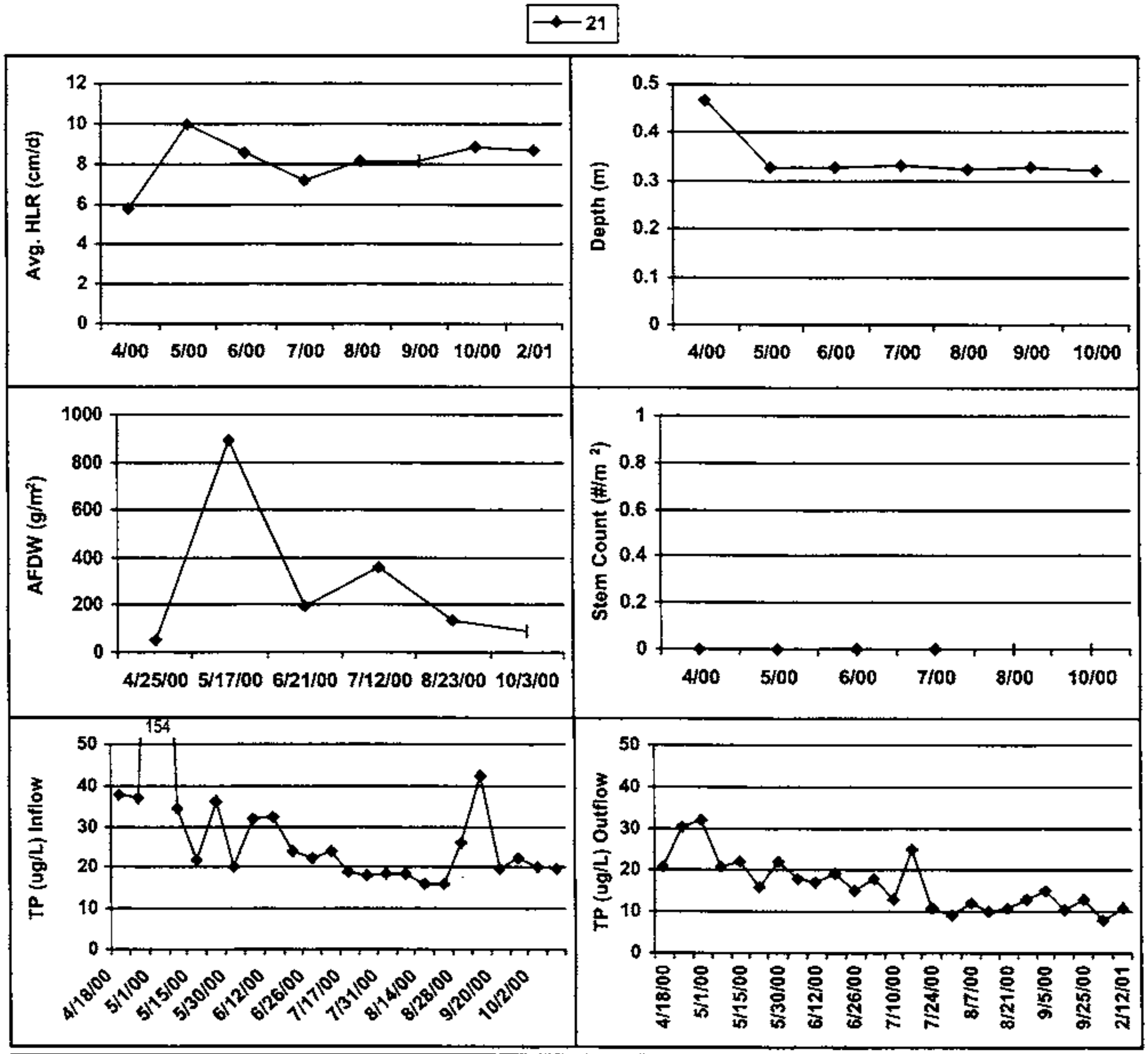


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
20	7.51	0.31	30	14	20.9
Mean	7.51	0.31	30	14	20.9

PSTA Research and Demonstration Project

Treatment:	PP-18	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	21	**Plants:**	no	**Other:**	
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	none		

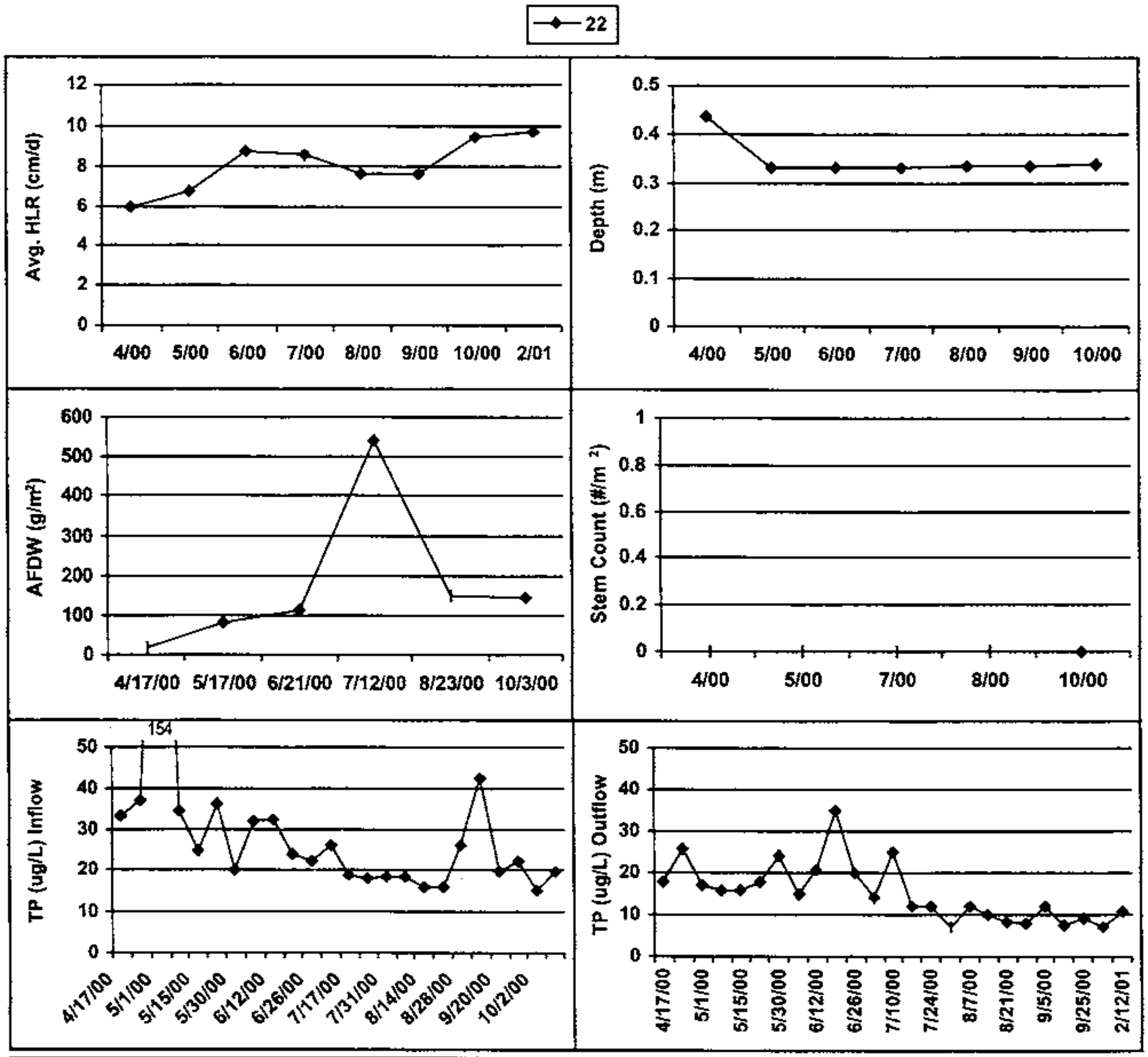


Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
21	8.13	0.35	30	17	18.2
Mean	8.13	0.35	30	17	18.2

PSTA Research and Demonstration Project

Treatment:	PP-19	**Period:**	4/1/1999	-	2/28/2001
Tank(s)/Cell(s):	22	**Plants:**	no	**Other:**	aquamat
Research Scale:	Porta-PSTA	**Recirculation:**	no		
Mesocosm Size:	1 x 6 m (6m2)	**Soil:**	none		



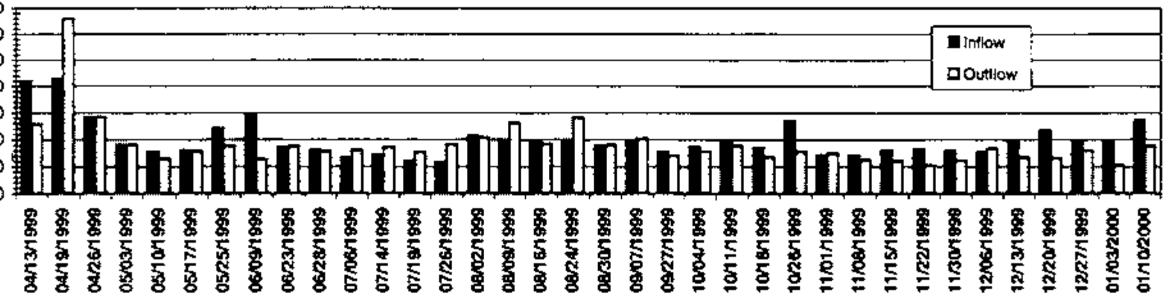
Summary For Period

Tank/Cell	HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k1 (m/y)
22	7.63	0.35	30	15	19.1
Mean	7.63	0.35	30	15	19.1

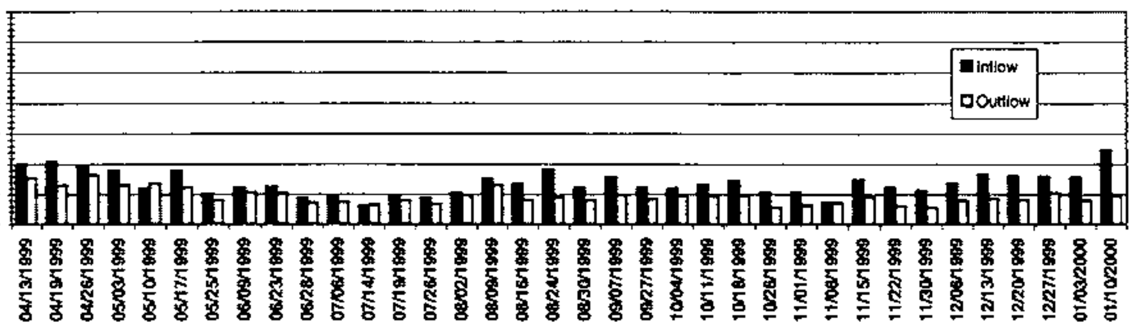
APPENDIX D.2

Trend Charts

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

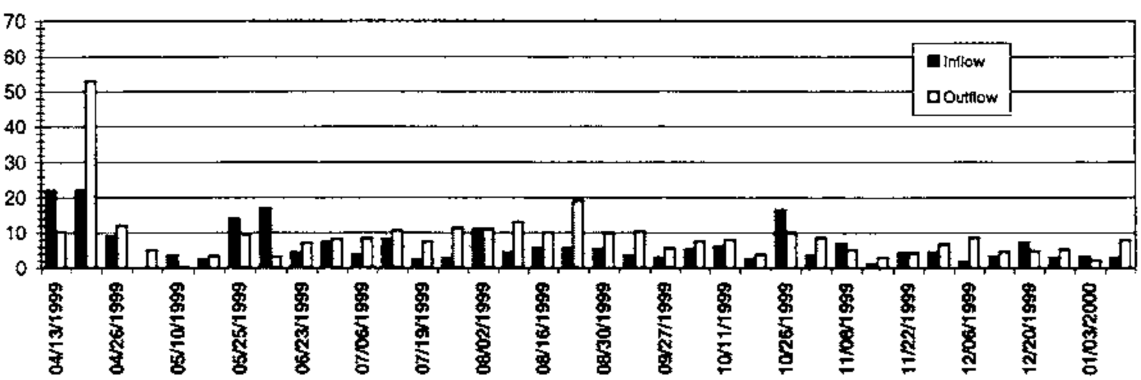
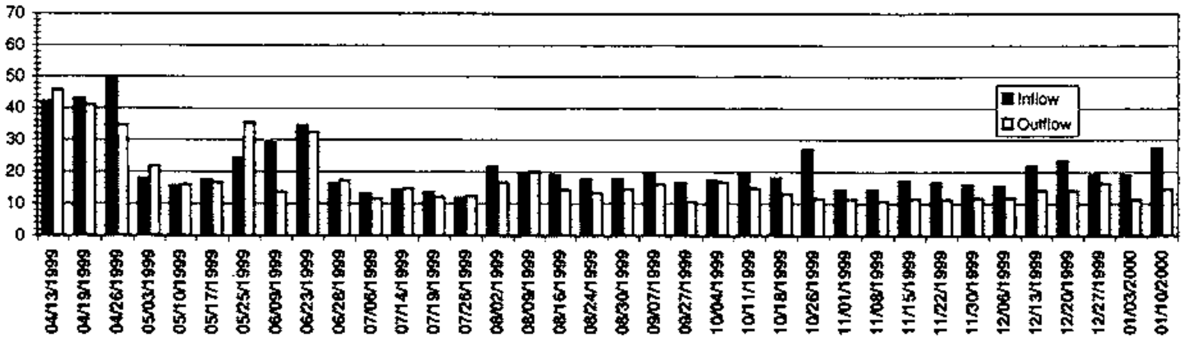


Exhibit D.2-1

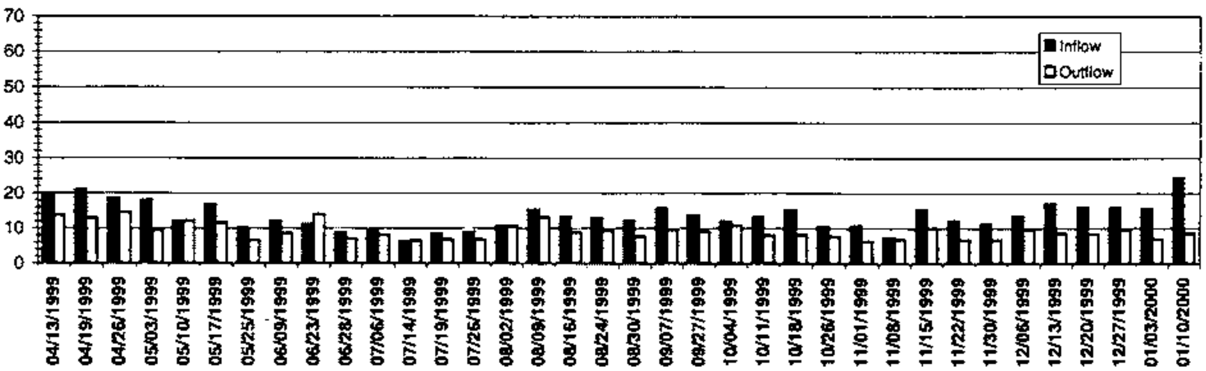
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 1, April 1999 - January 2000.

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

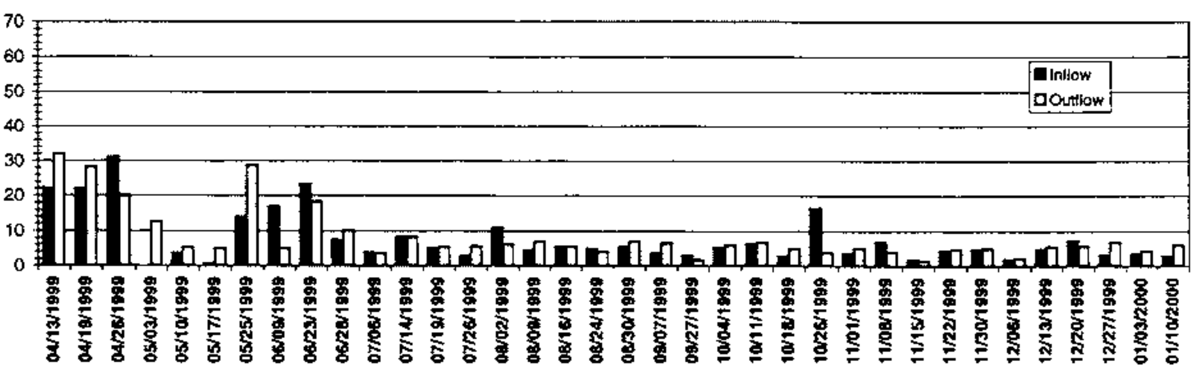
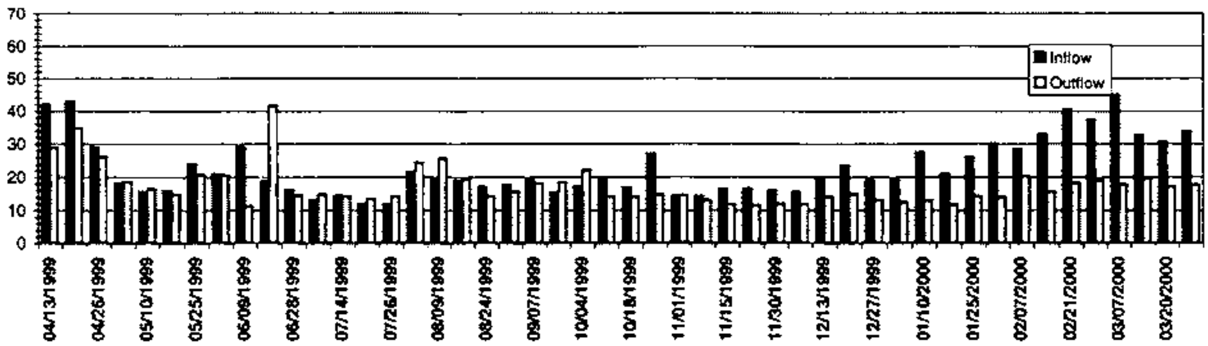


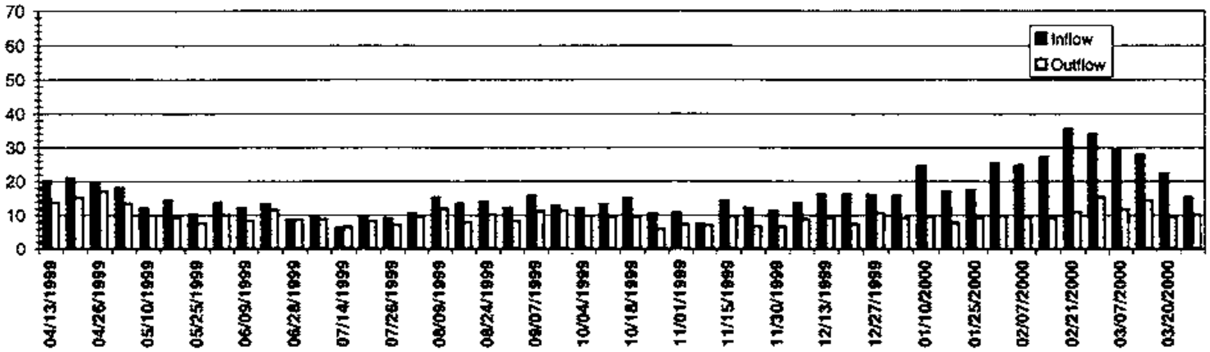
Exhibit D.2-2
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 2, April 1999 - January 2000.

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

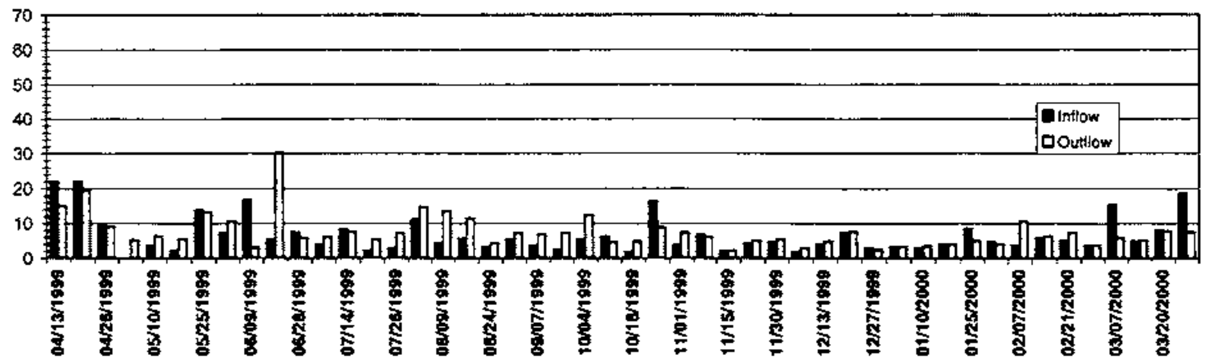
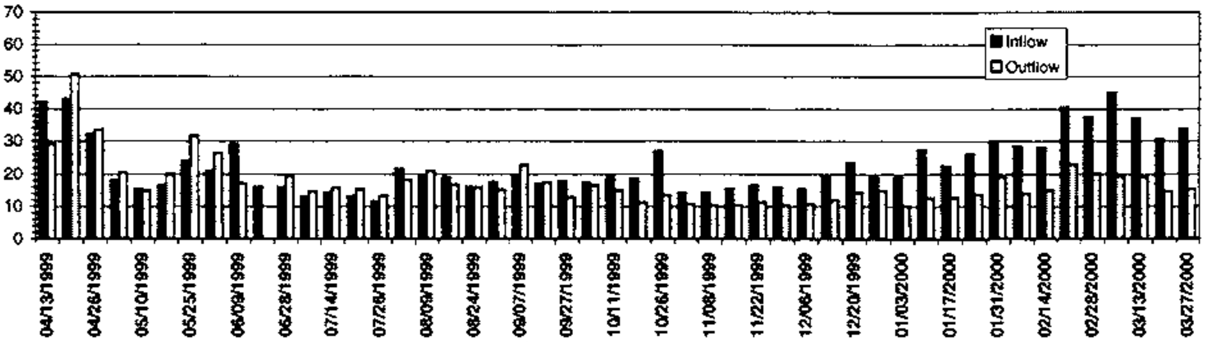


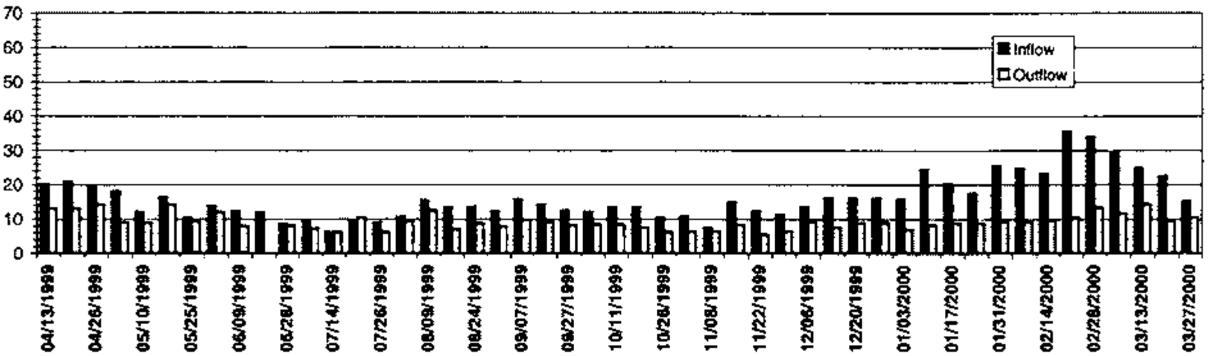
Exhibit D.2-3
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 3, April 1999 - March 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

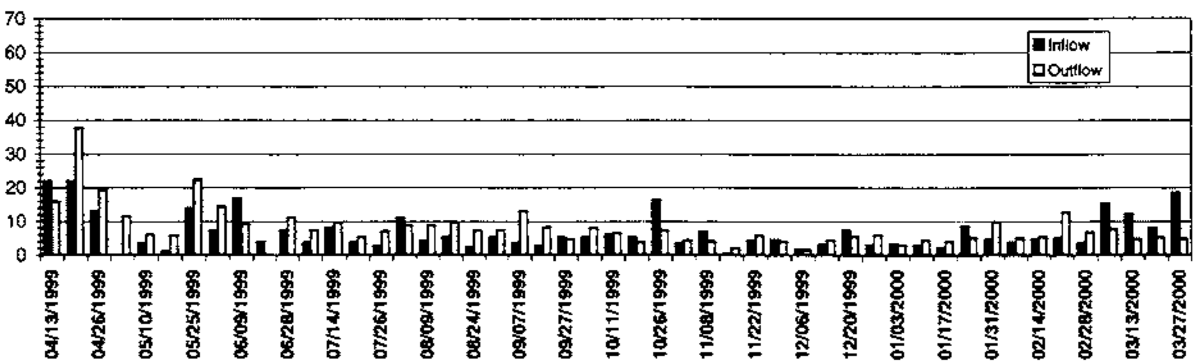
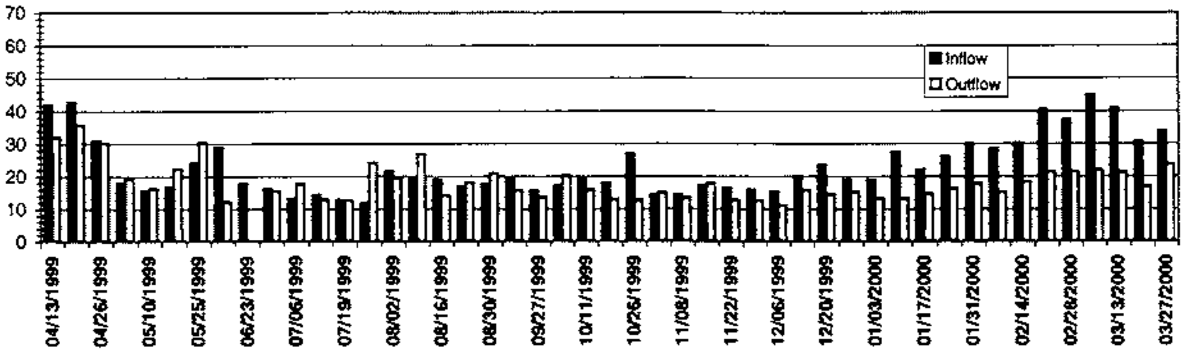


Exhibit D.2-4

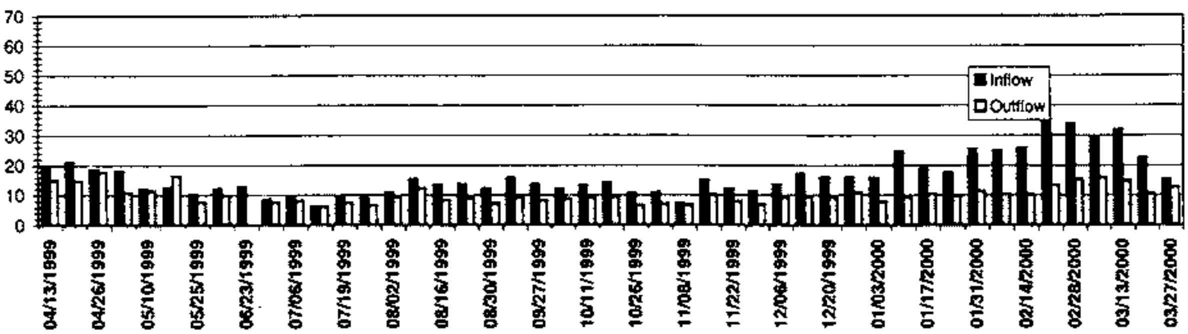
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 4, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

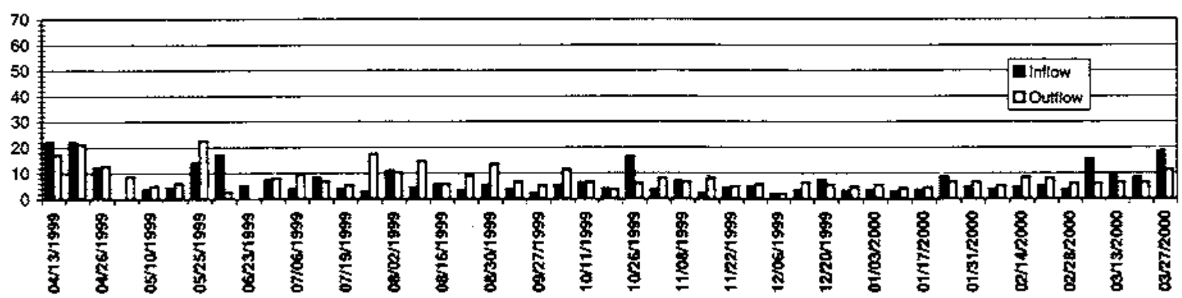
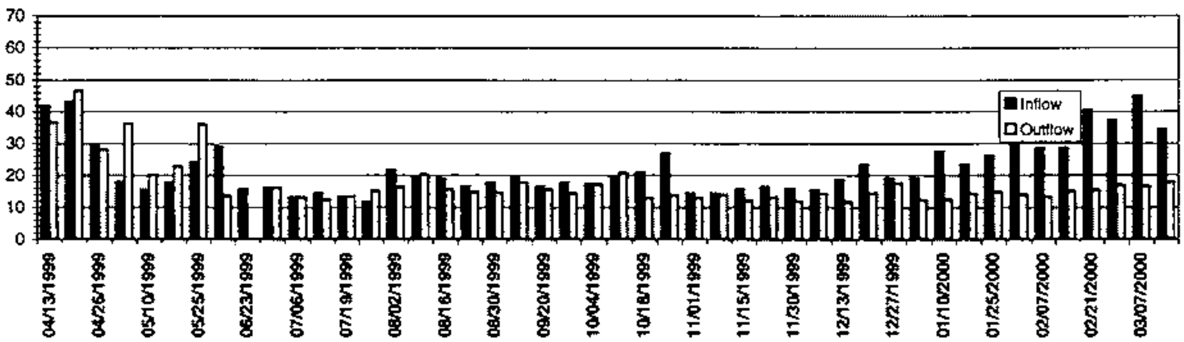


Exhibit D.2-5

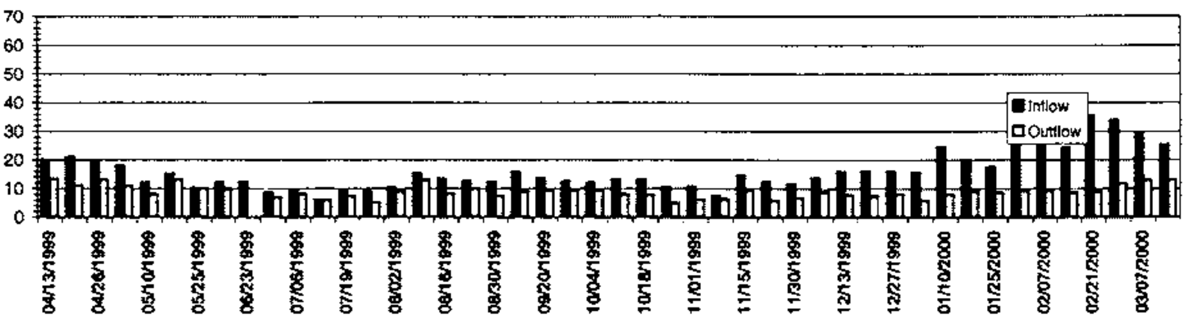
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 5, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 12 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

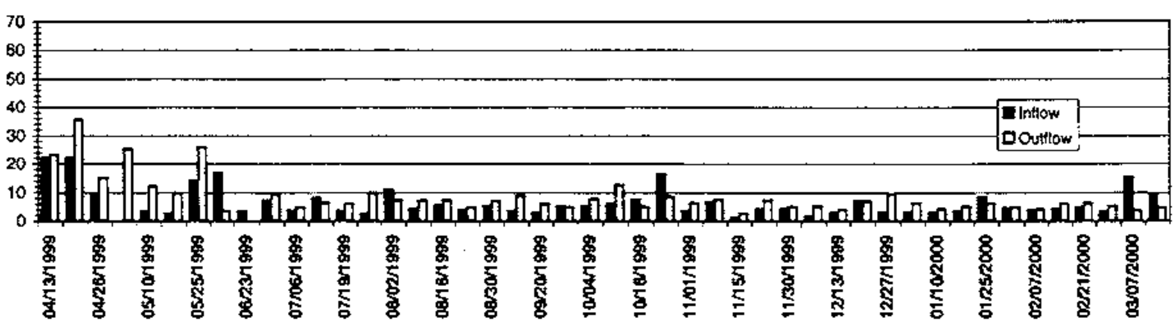
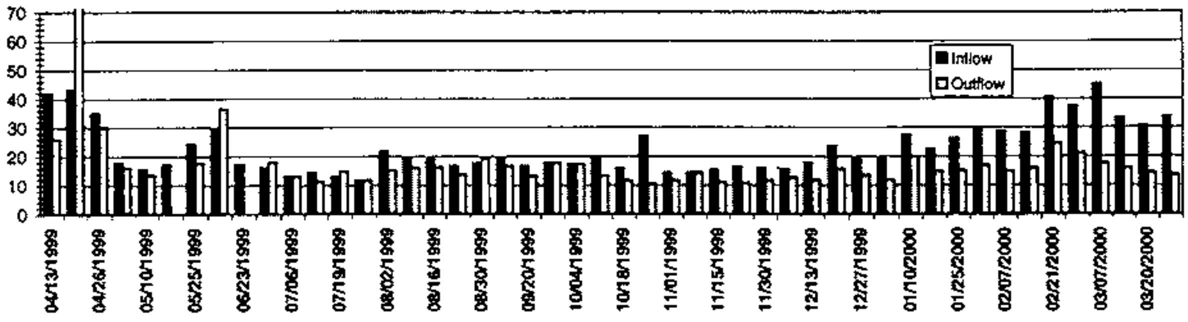


Exhibit D.2-6

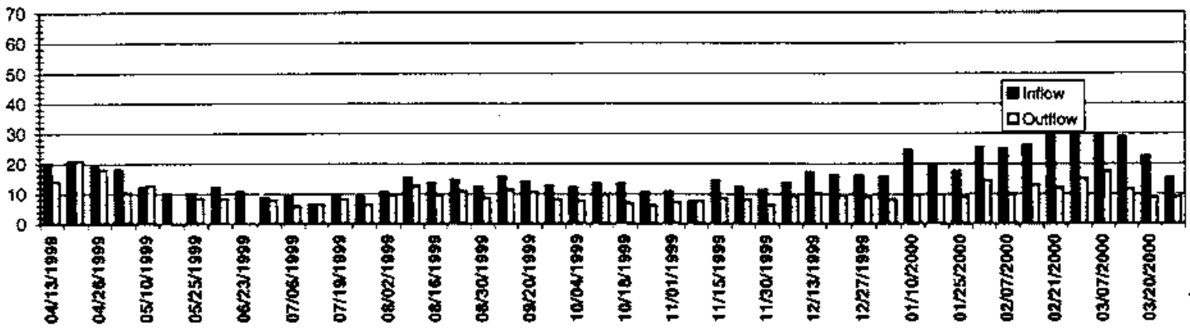
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 6, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 60 cm
HLR: 0 - 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

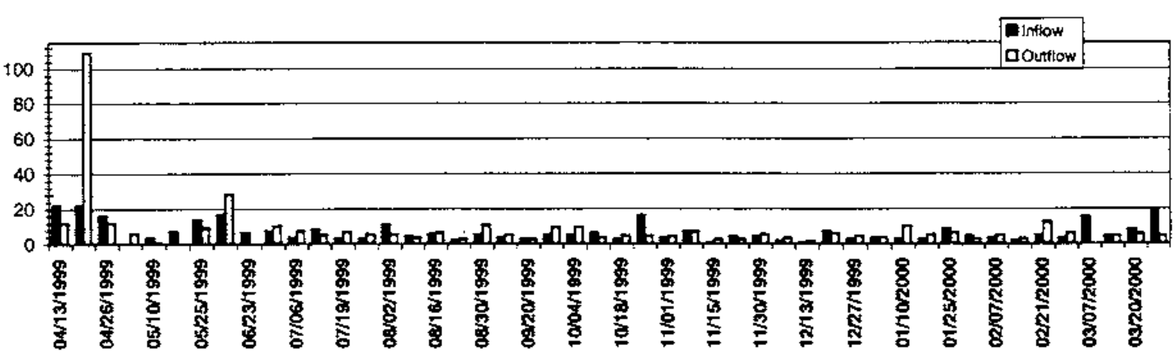
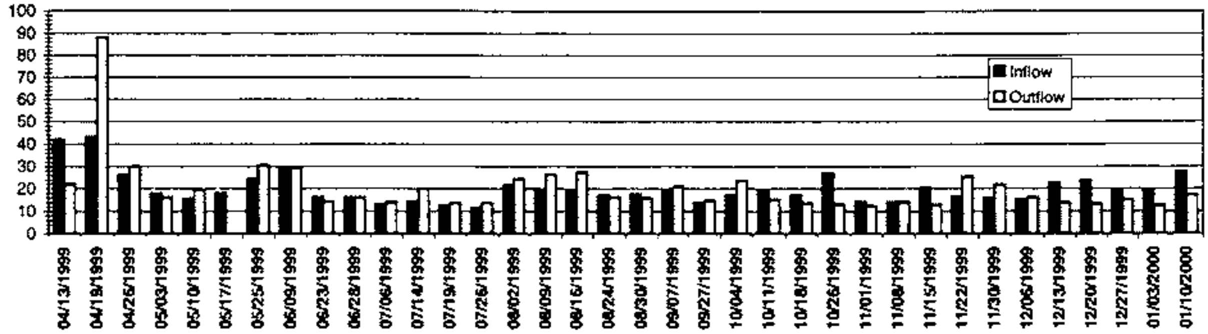


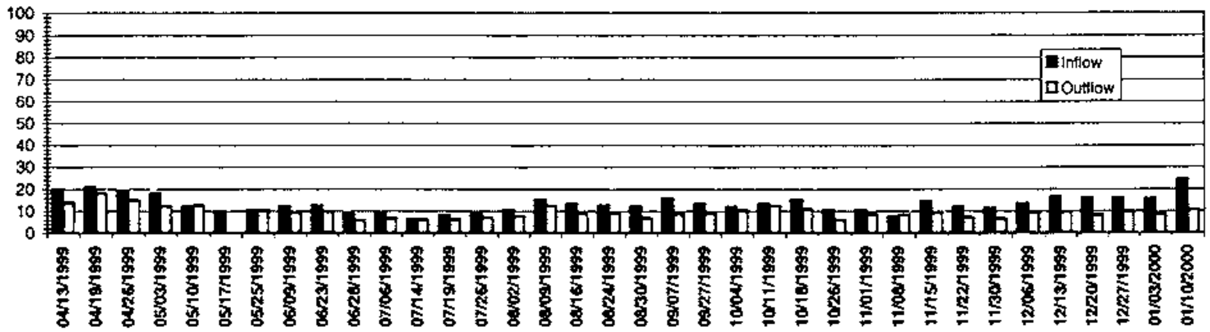
EXHIBIT D.2-7
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 7, April 1999 - March 2000.

Key Conditions:
Substrate: Sand
Depth: 30 cm
HLR: 6 cm/day

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

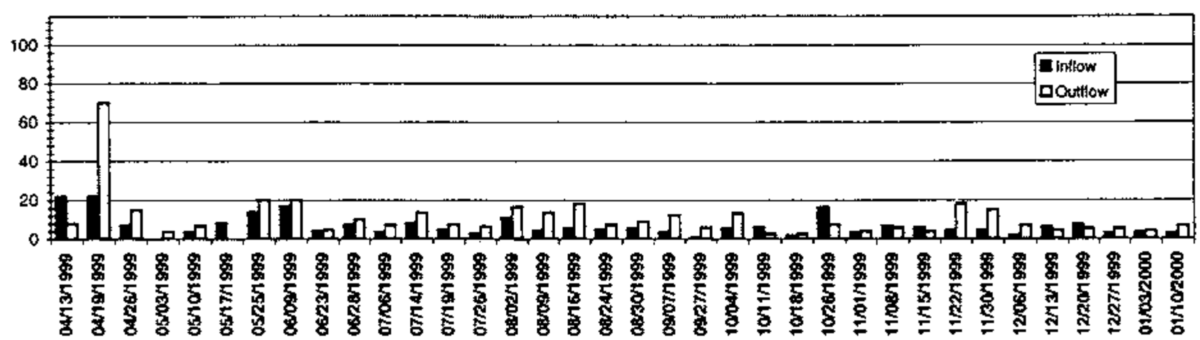
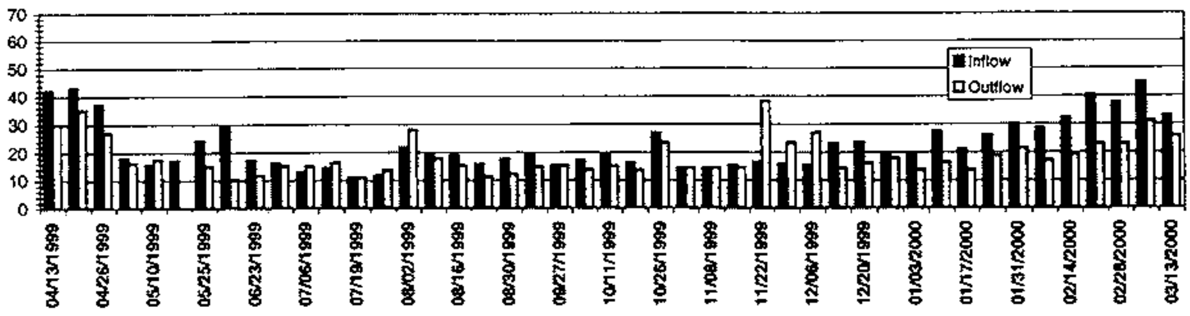


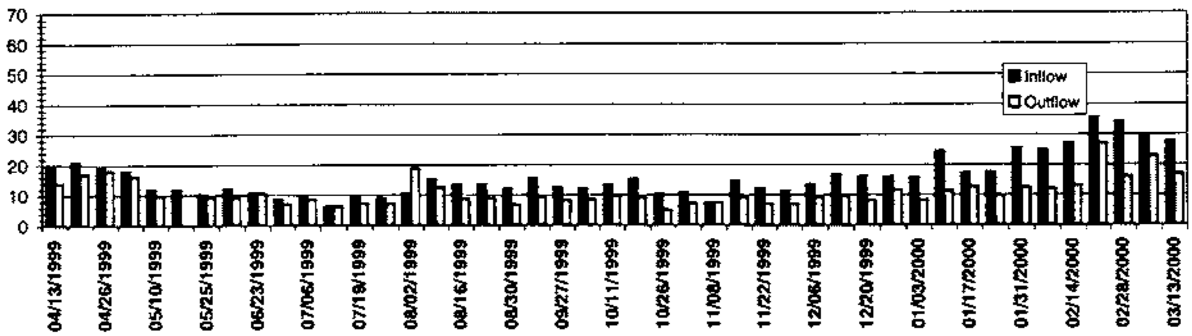
Exhibit D.2-8
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 8, April 1999 - January 2000.

Key Conditions:
Substrate: Sand
Depth: 60 cm
HLR: 6 cm/day

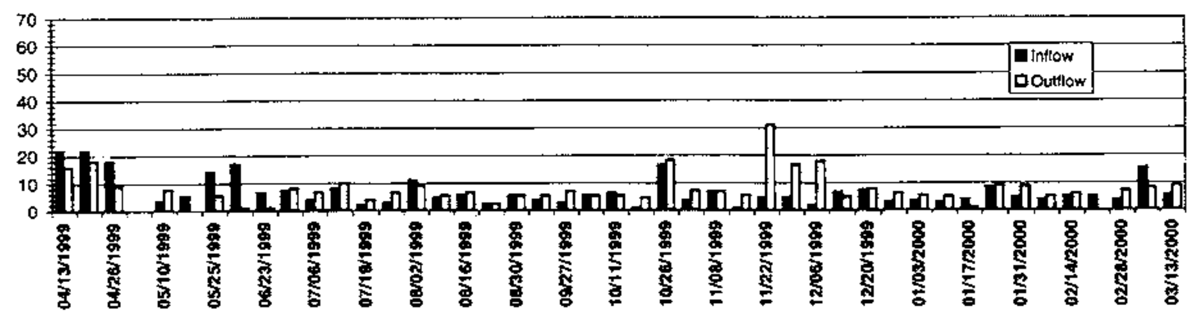
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



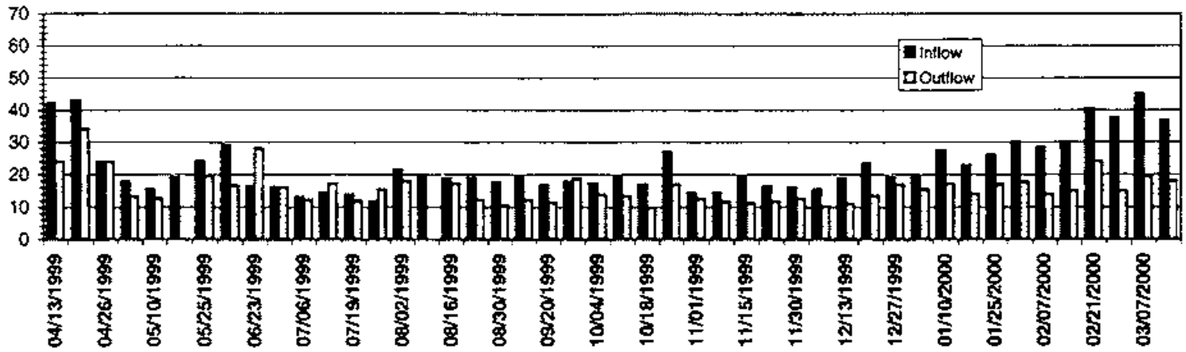
TOTAL PARTICULATE PHOSPHORUS



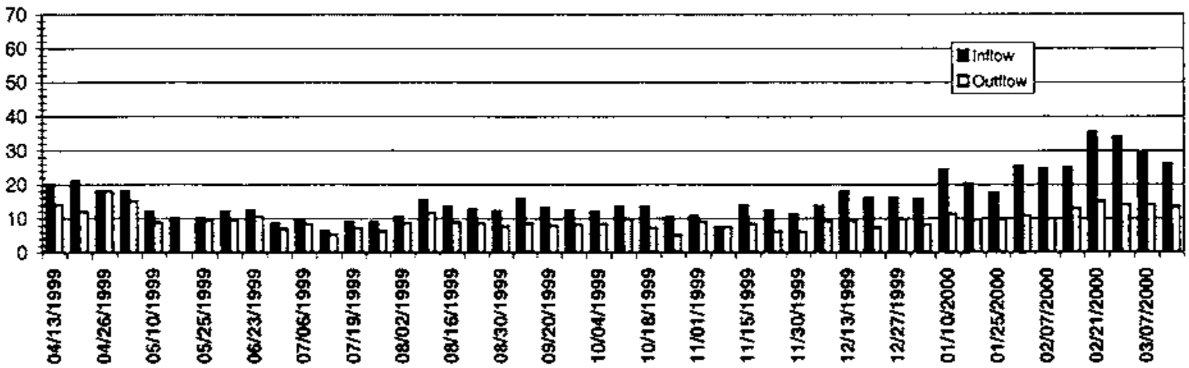
Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

Exhibit D.2-9
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 9, April 1999 - March 2000.

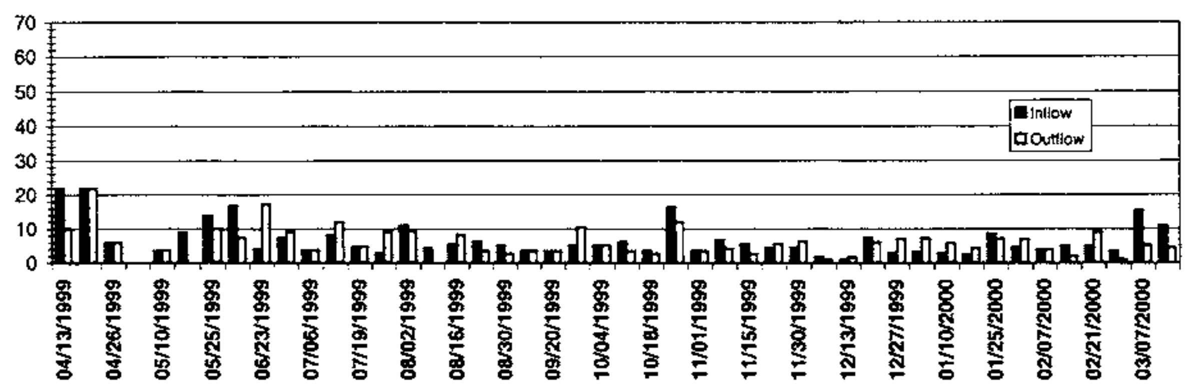
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



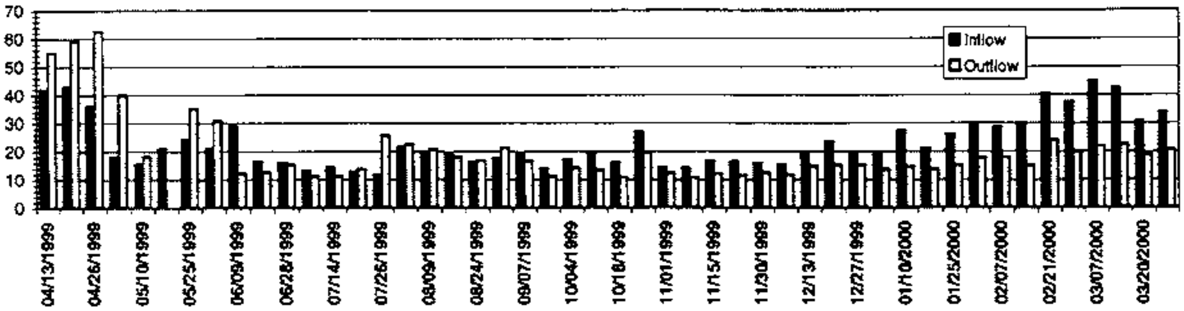
TOTAL PARTICULATE PHOSPHORUS



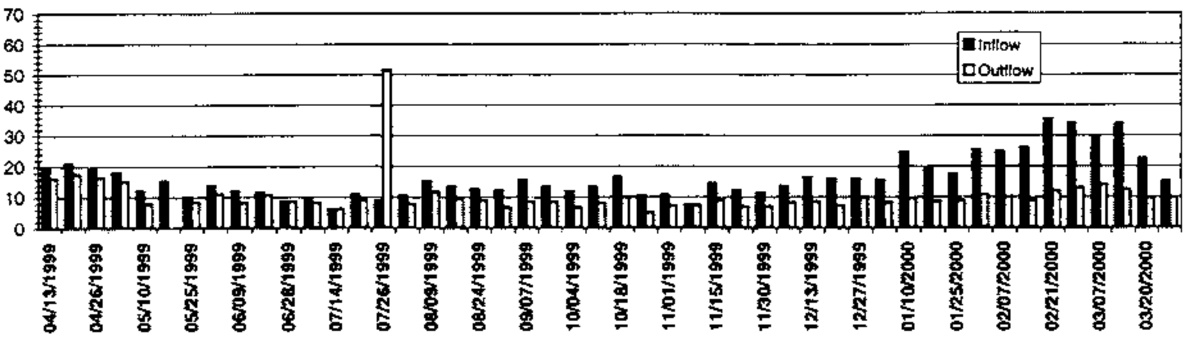
Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

Exhibit D.2-10
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 10, April 1999 - March 2000.

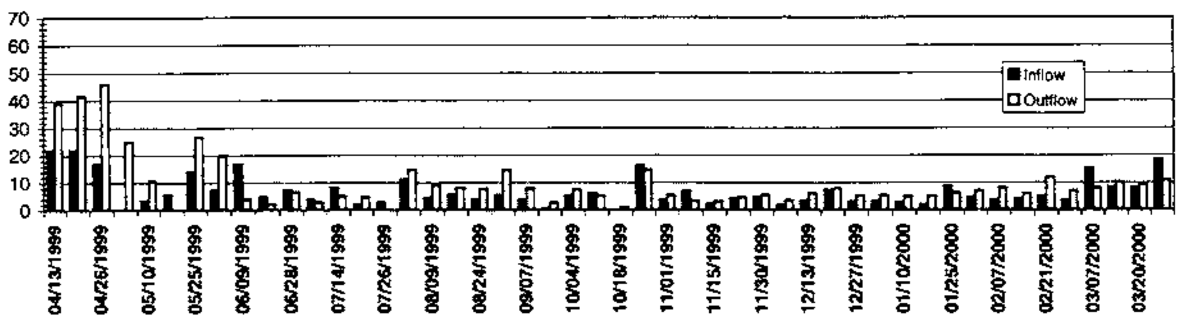
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



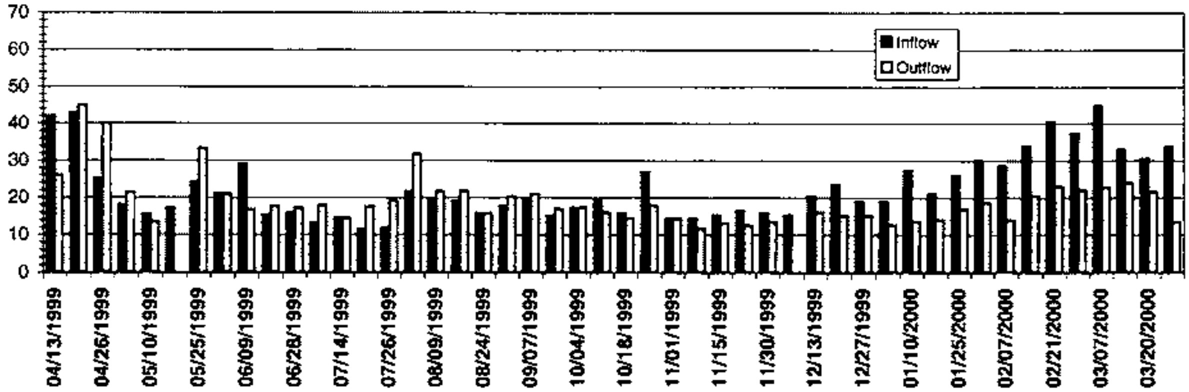
TOTAL PARTICULATE PHOSPHORUS



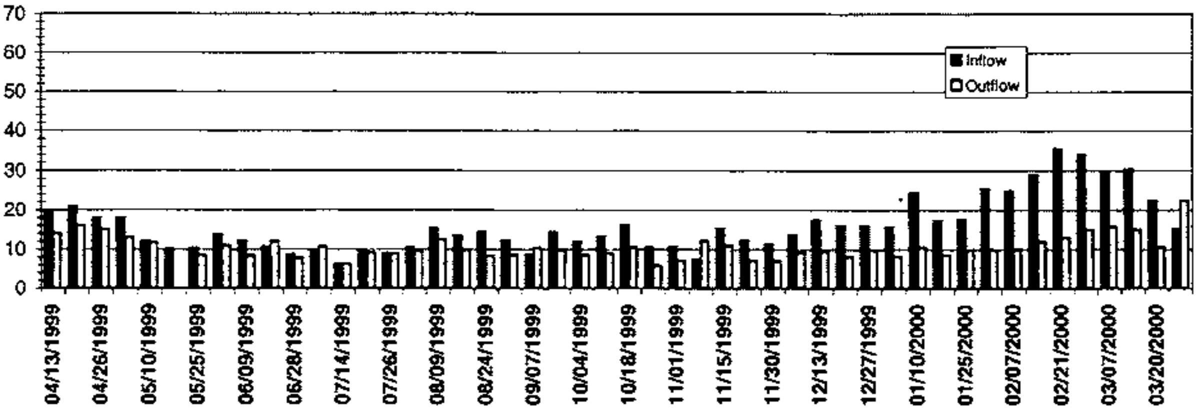
Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width

Exhibit D.2-11
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 11, April 1999 - March 2000.

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

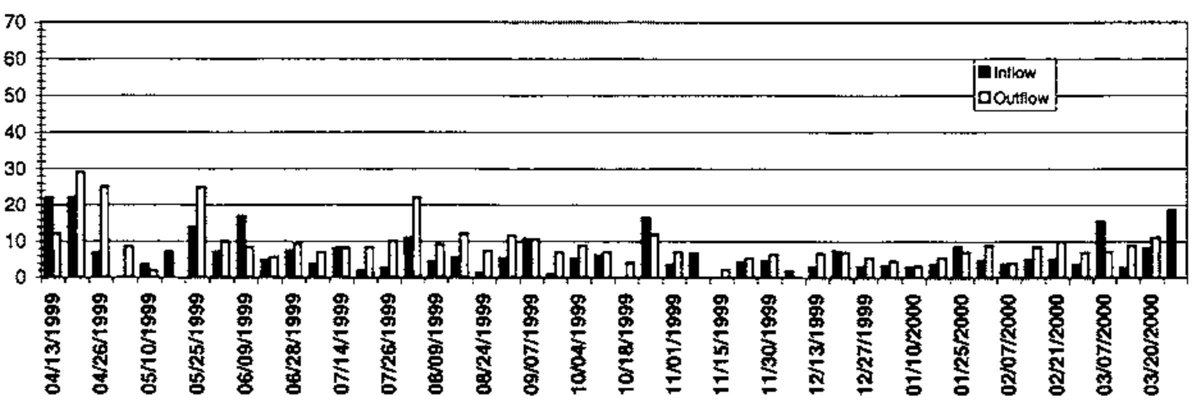
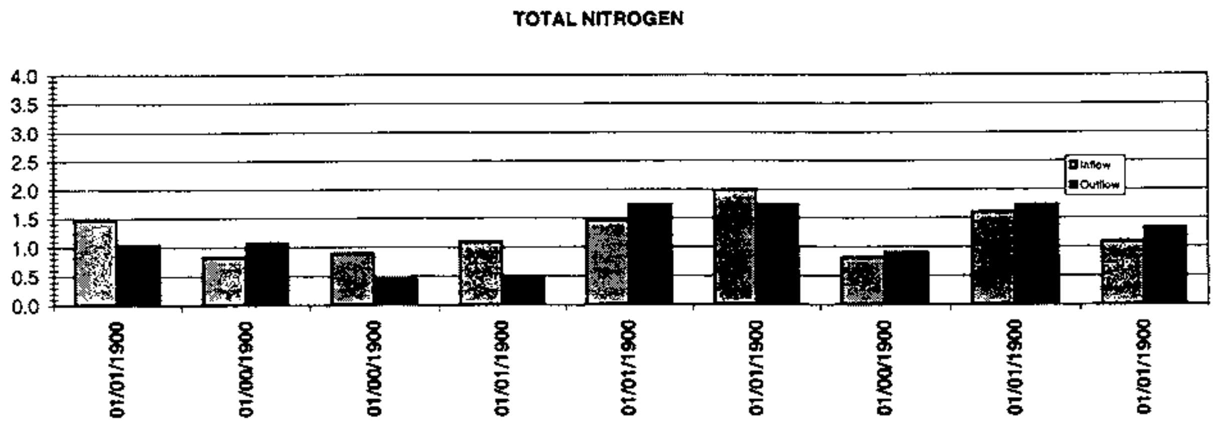
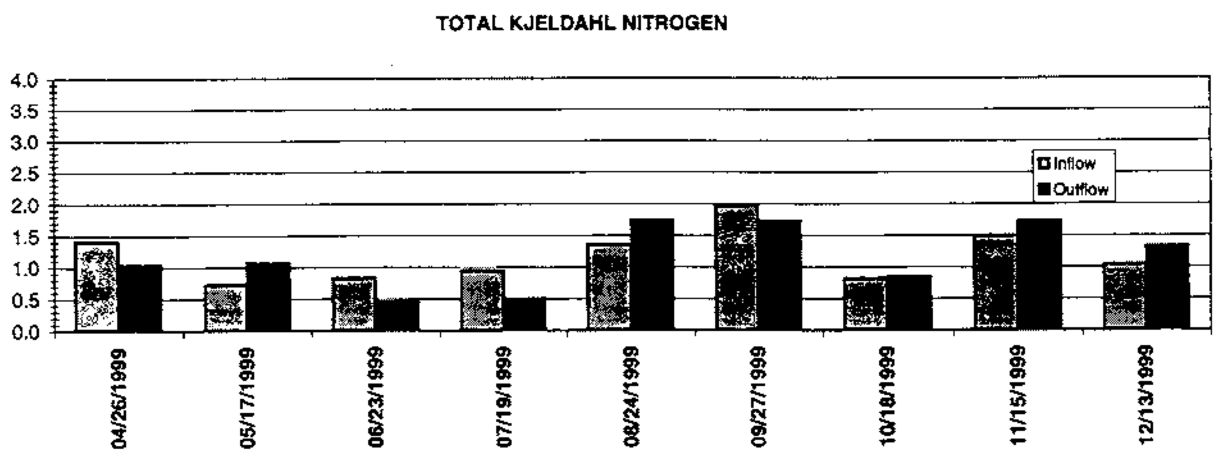


Exhibit D.2-12
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus and Total Particulate Phosphorus for Porta-PSTA Treatment No. 12, April 1999 - March 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width





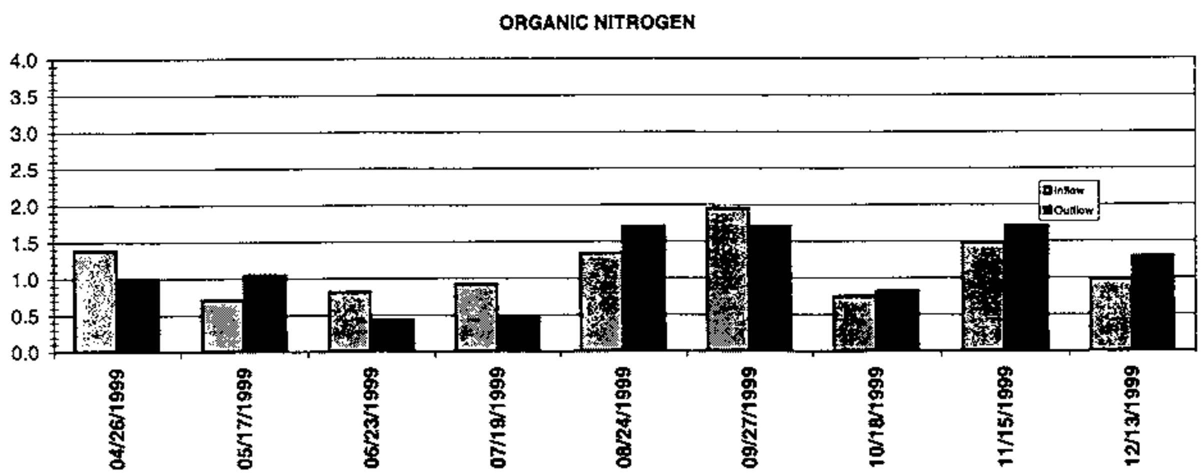
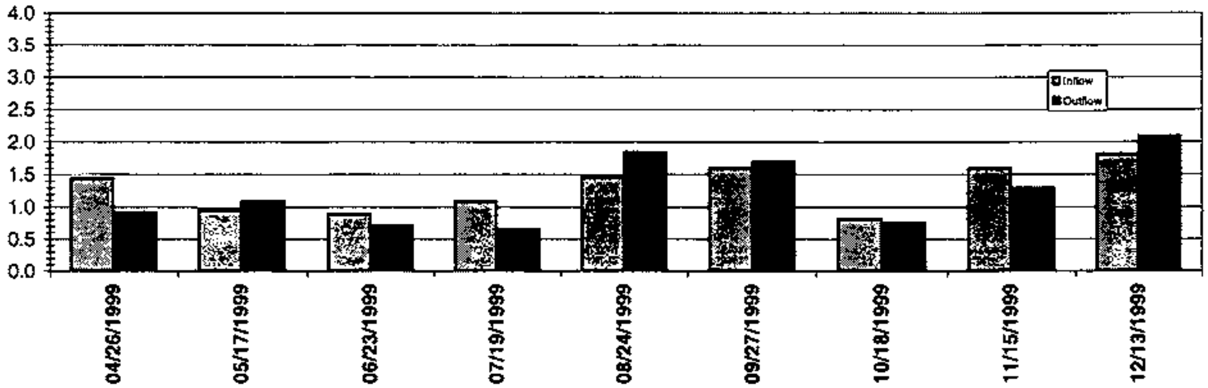


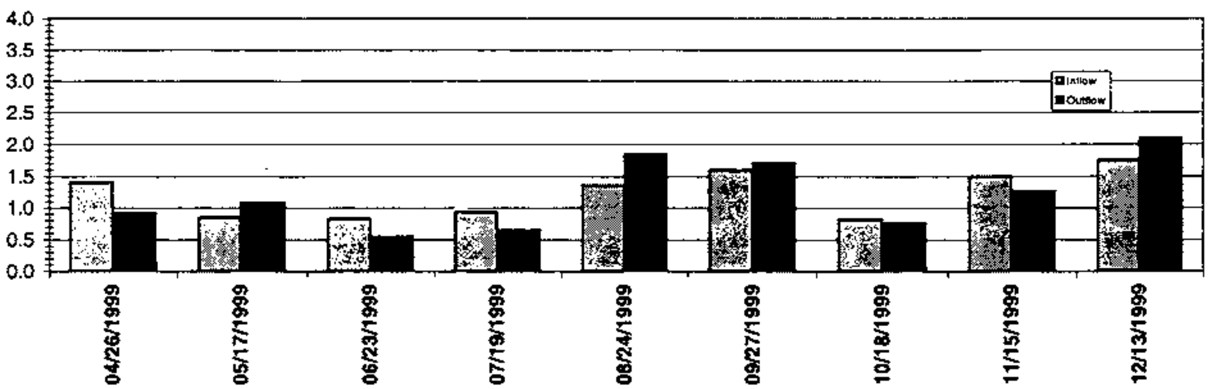
Exhibit D.2-13
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 1, April 1999 - December 1999.

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

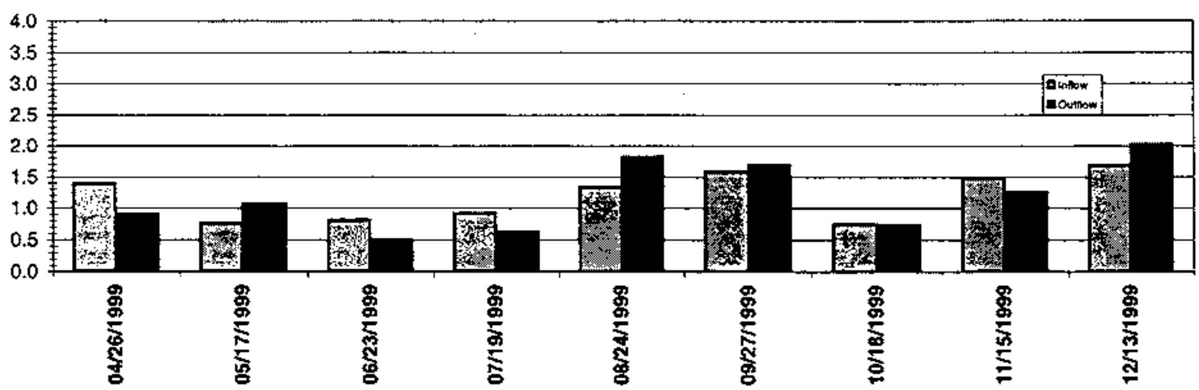
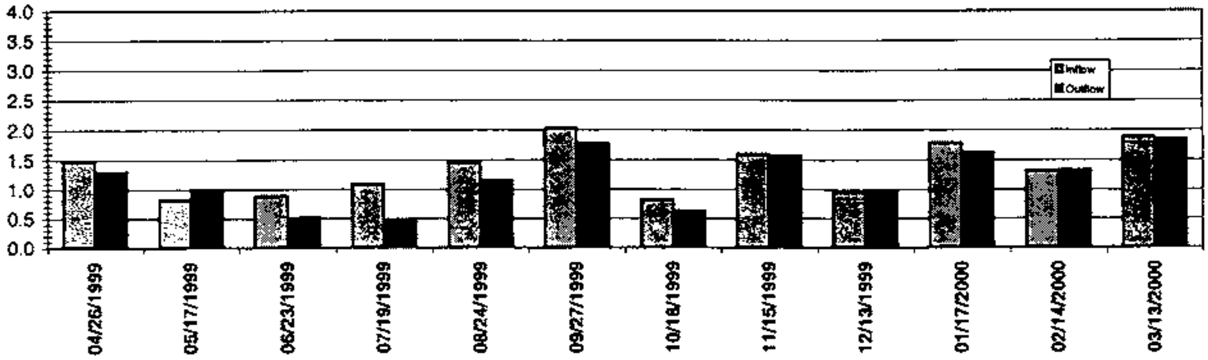


Exhibit D.2-14

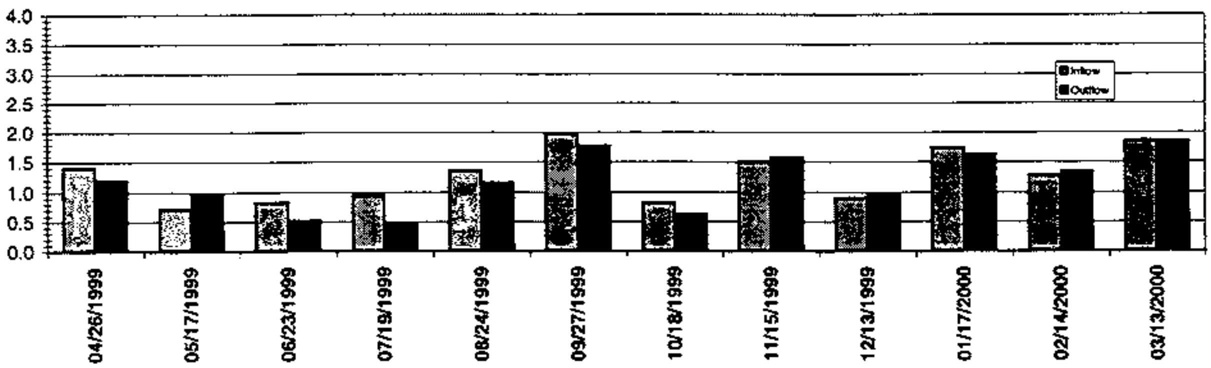
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 2, April 1999 - December 1999.

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day

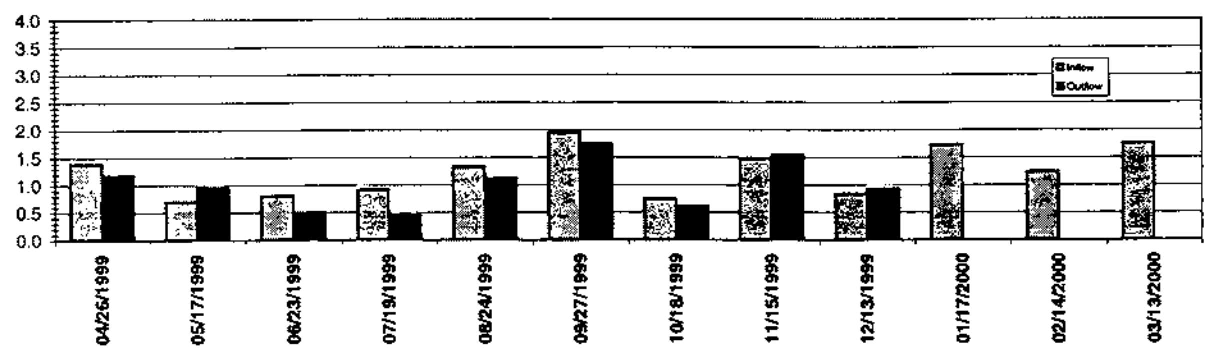
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



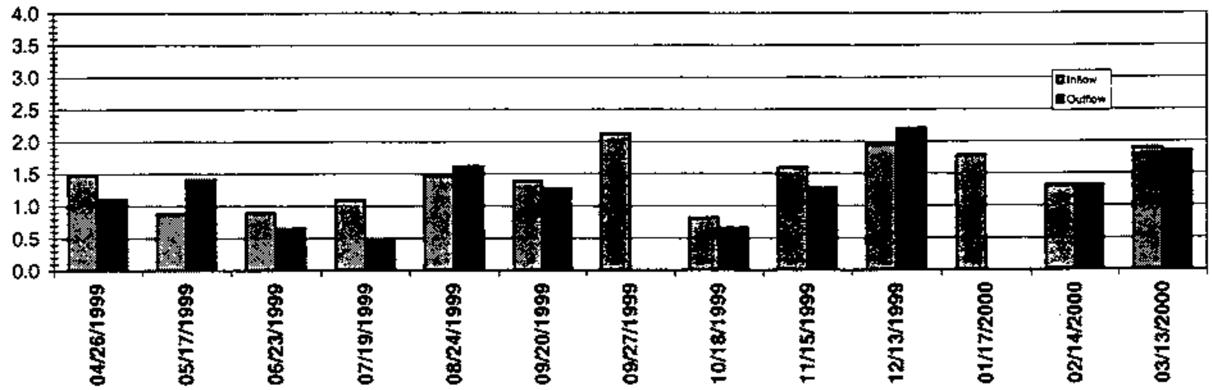
Note: Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-15

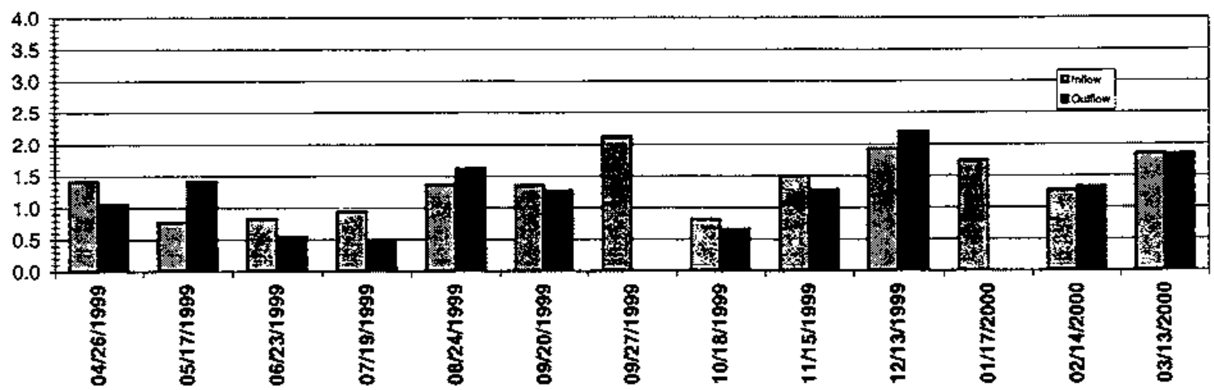
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 3, April 1999 - March 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day

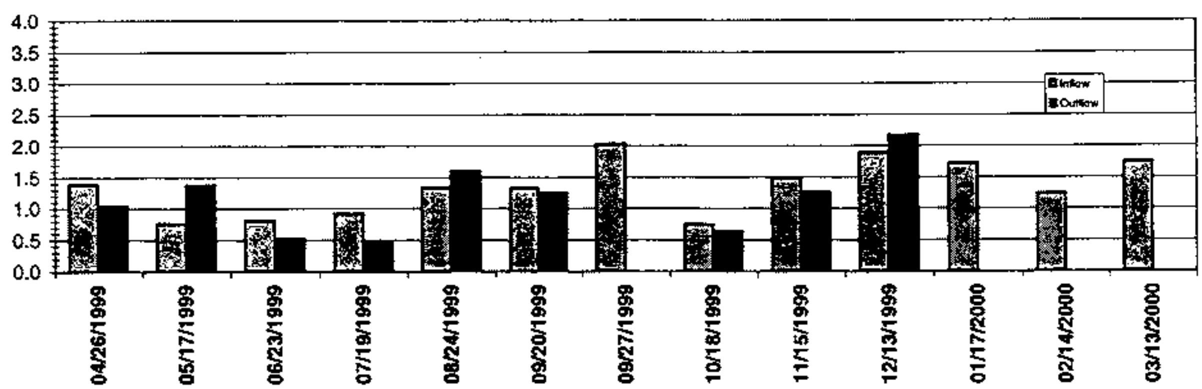
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

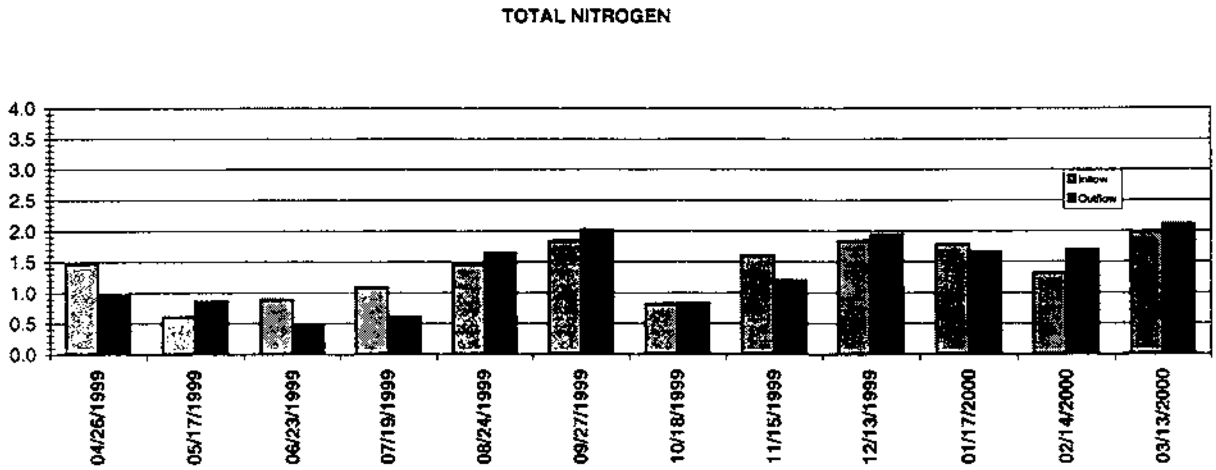


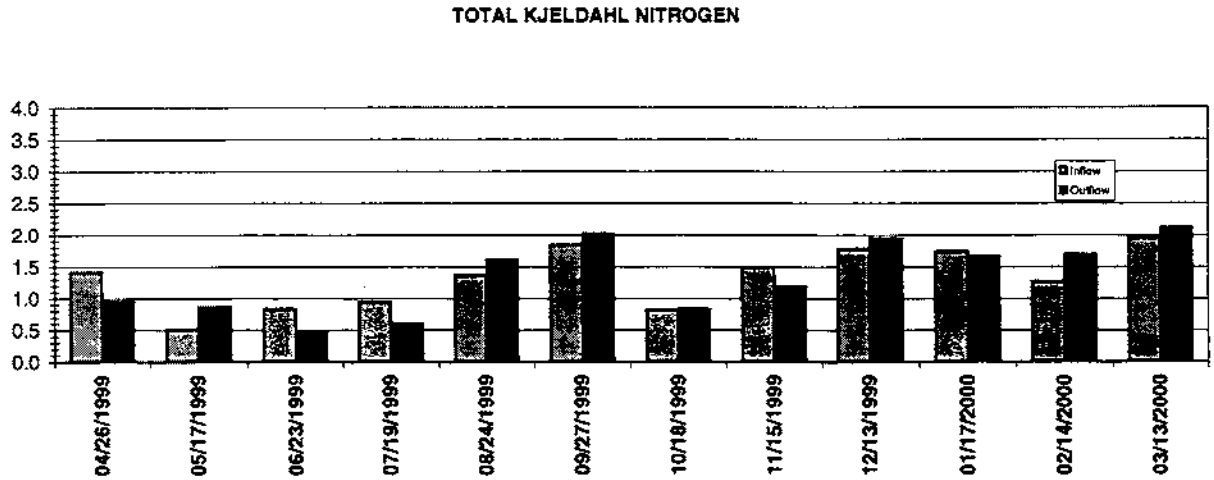
Note: Outflow nitrogen data are not available for monitoring conducted on September 27. 1999.
Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

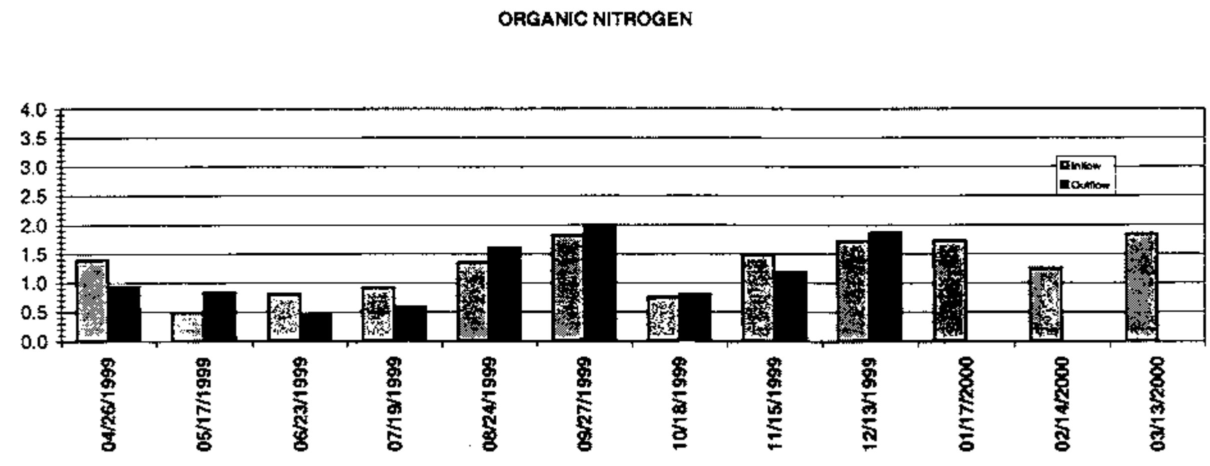
Exhibit D.2-16

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 4, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day







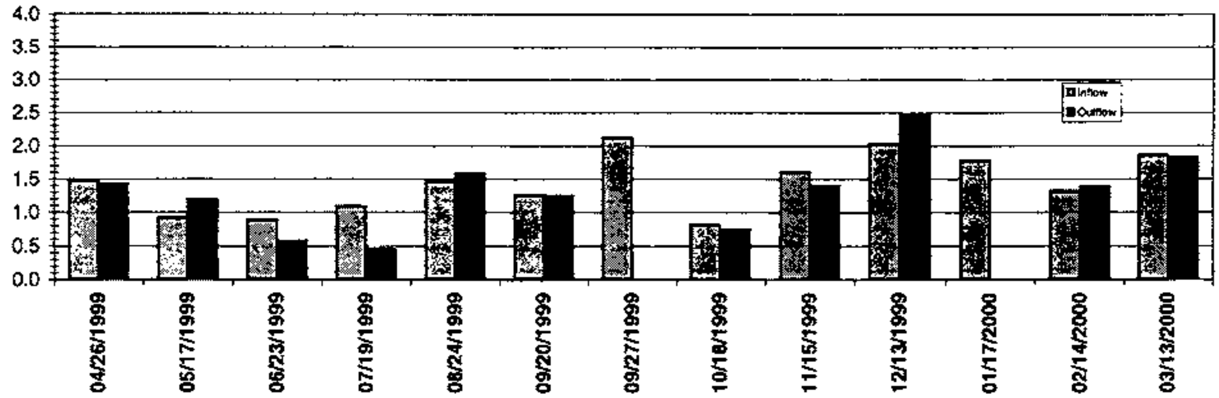
Note: Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-17

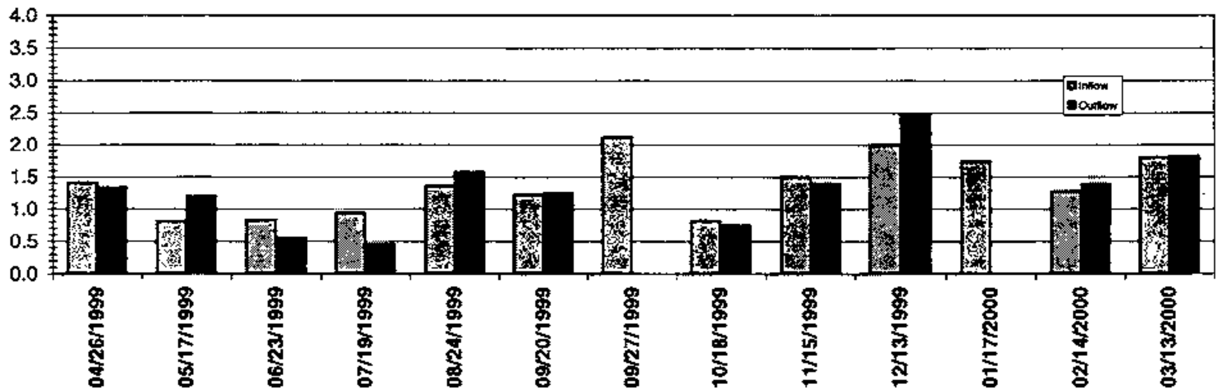
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 5, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 12 cm/day

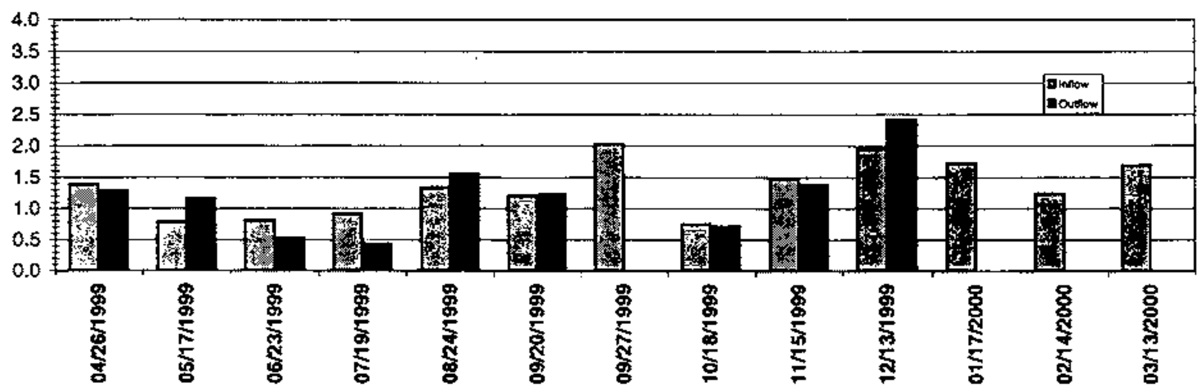
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Outflow nitrogen data are not available for monitoring conducted on September 27, 1999.
Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-18

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 6, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 60cm
HLR: 12 cm/day

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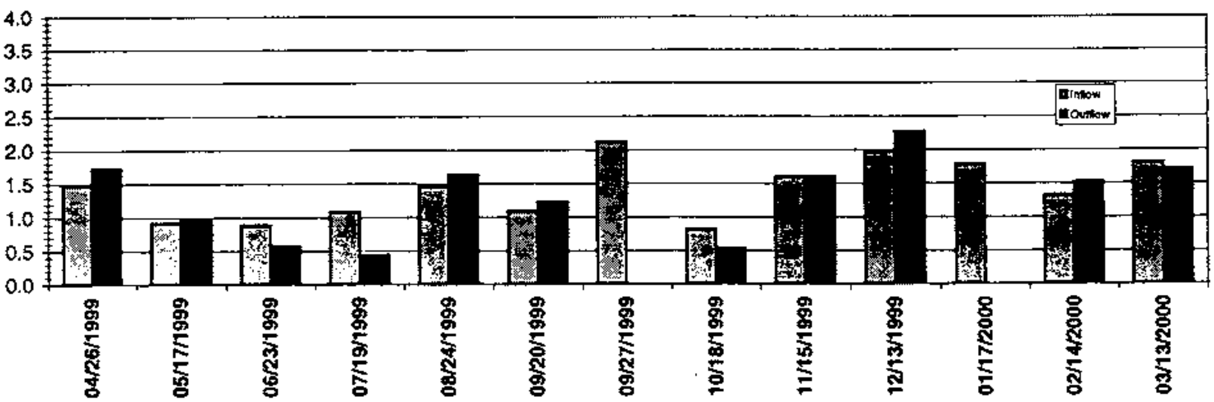
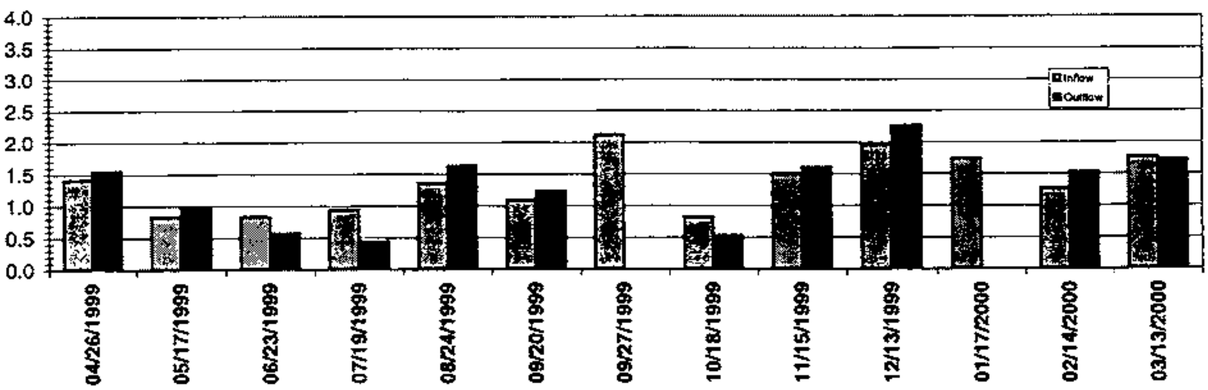
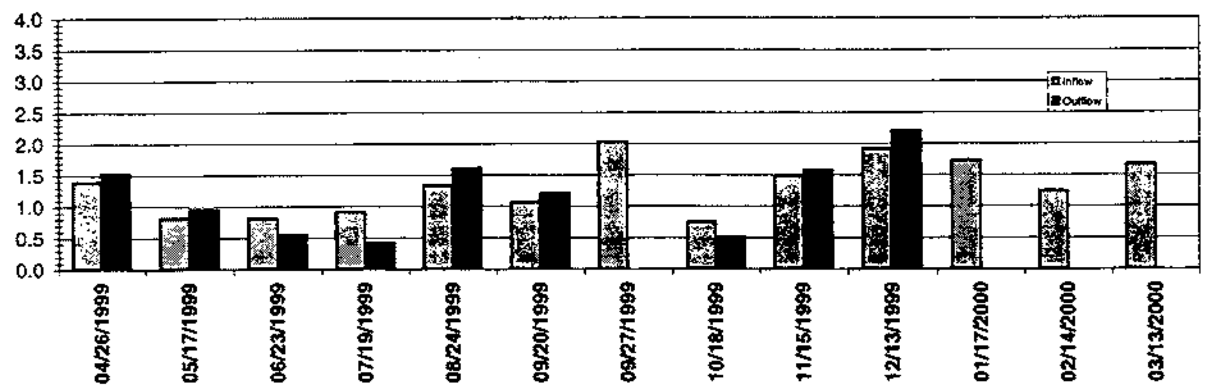
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



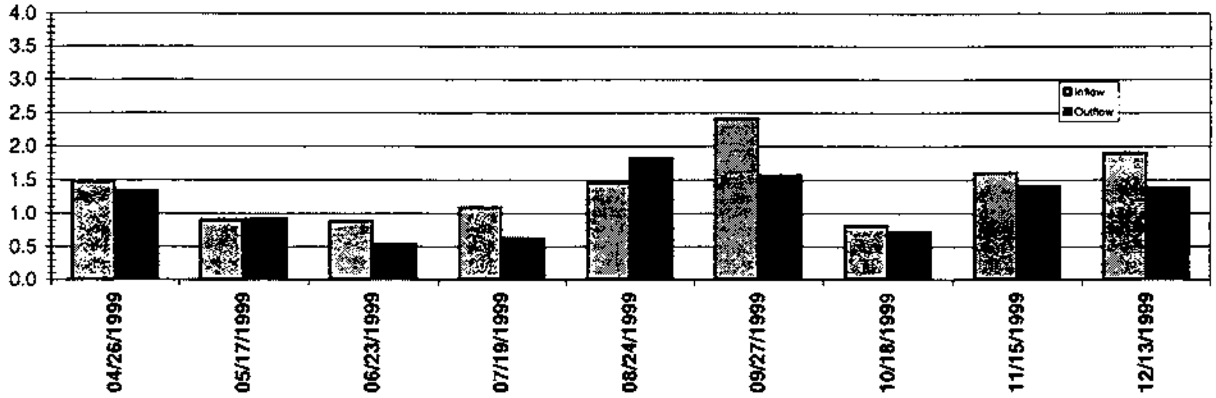
Note: Outflow nitrogen data are not available for monitoring conducted on September 27. 1999.
Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-19

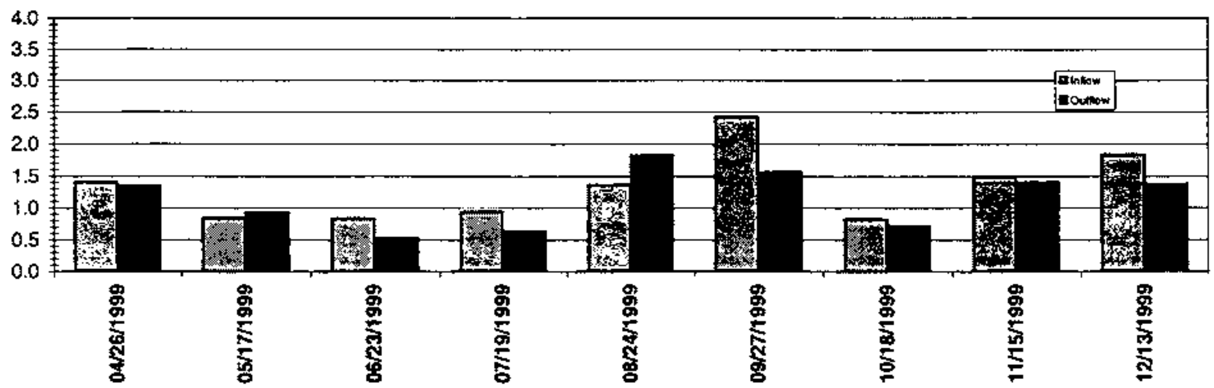
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 7, April 1999 - March 2000.

Key Conditions:
Substrate: Sand
Depth: 30cm
HLR: 6 cm/day

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

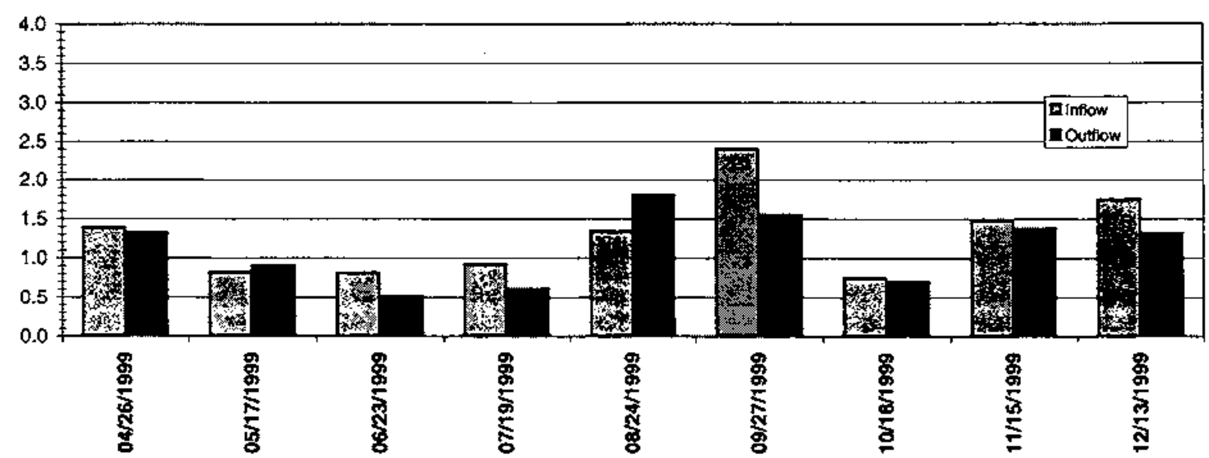


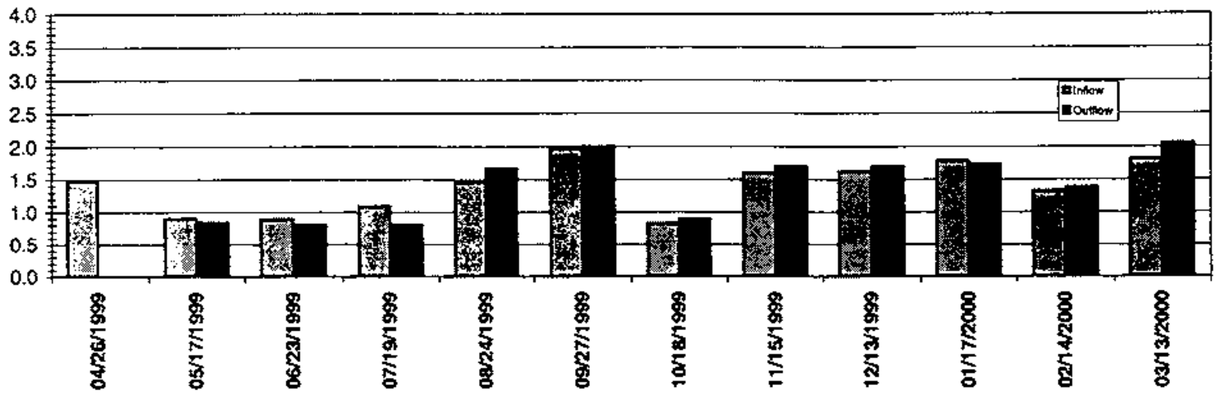
Exhibit D.2-20

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 8, April 1999 - December 1999.

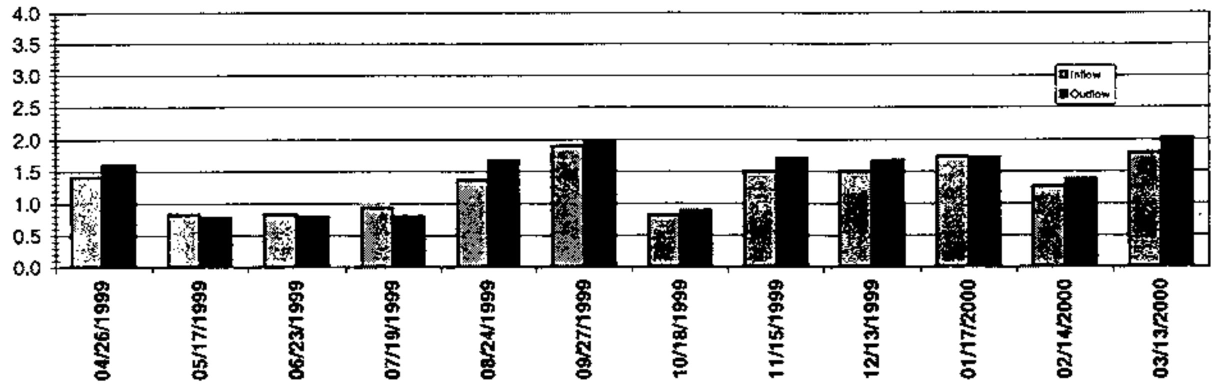
Key Conditions:
Substrate: Sand
Depth: 60cm
HLR: 6 cm/day

DFB/17099.xls

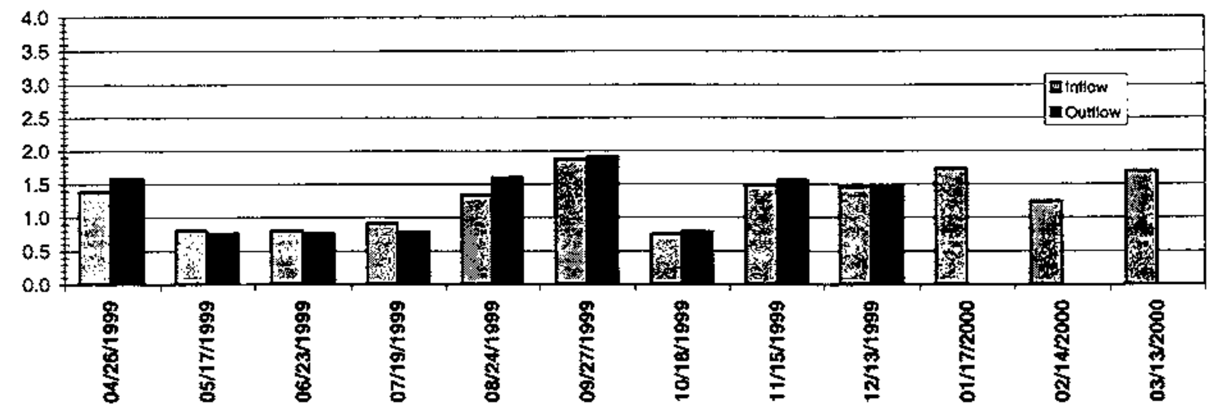
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

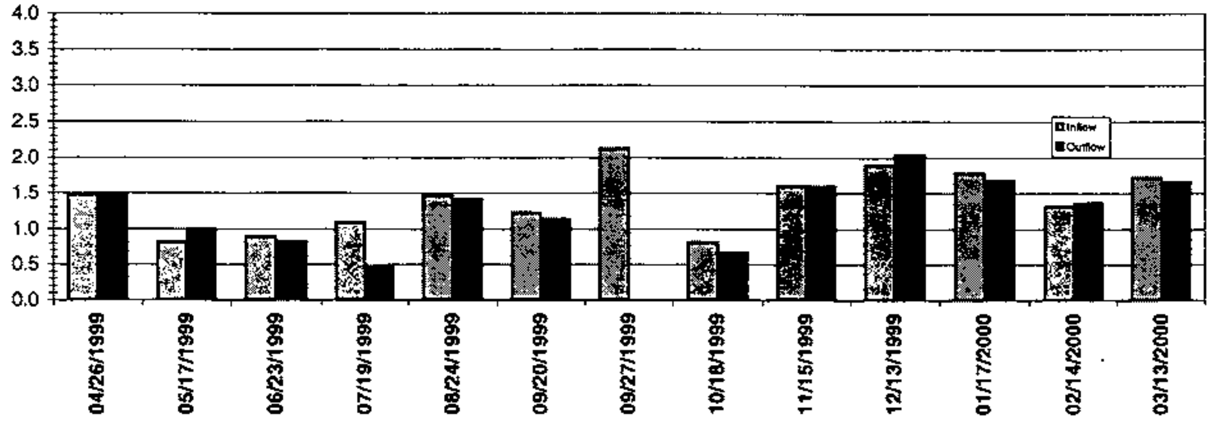
Exhibit D.2-21

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 9, April 1999 - March 2000.

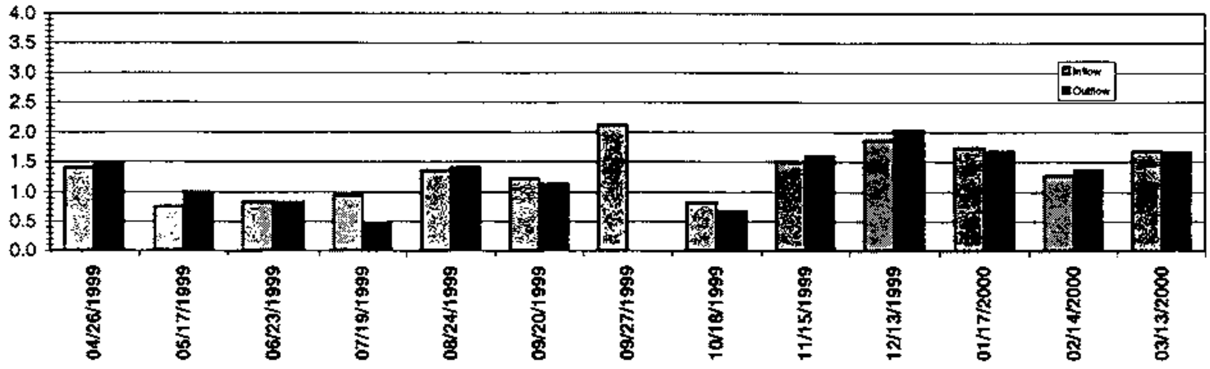
Key Conditions:
Substrate: Peat
Depth: 60cm
HLR: 6 cm/day
Other: Aquashade

DFB/17099.xls

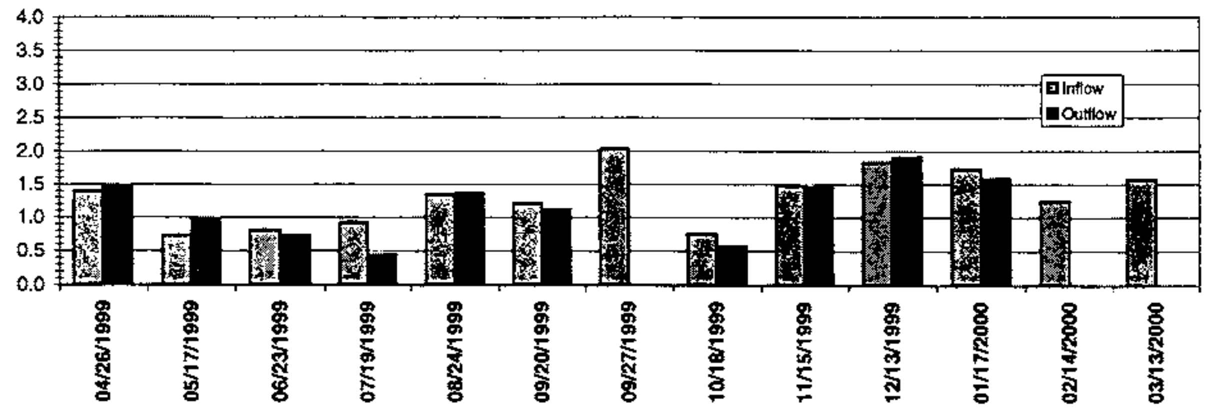
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



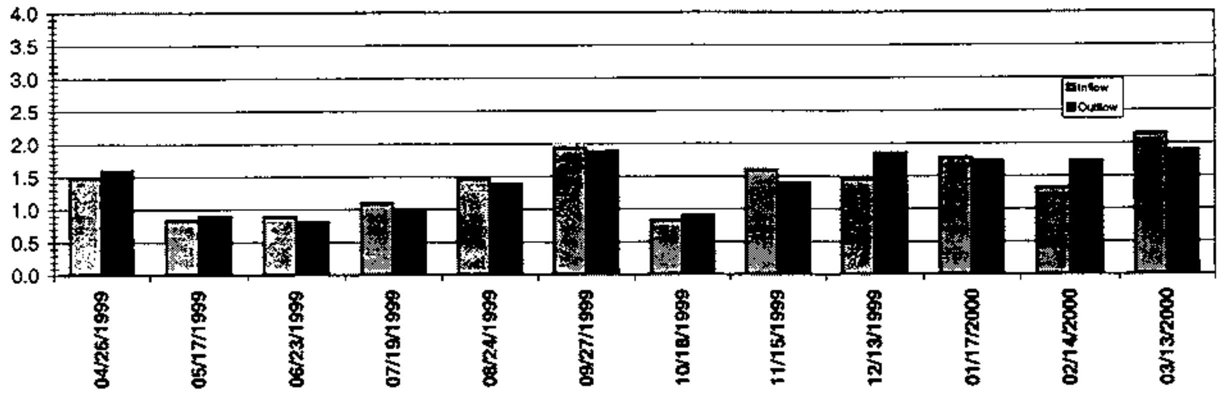
Note: Outflow nitrogen data are not available for monitoring conducted on September 27. 1999.
Organic nitrogen data are not availabe from February to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-22

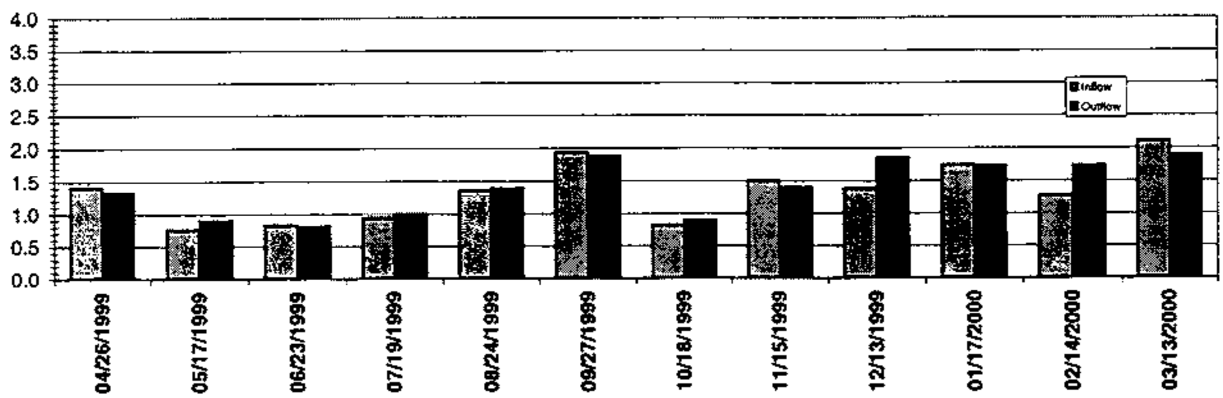
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 10, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 60cm
HLR: 6 cm/day
Other: Aquashade

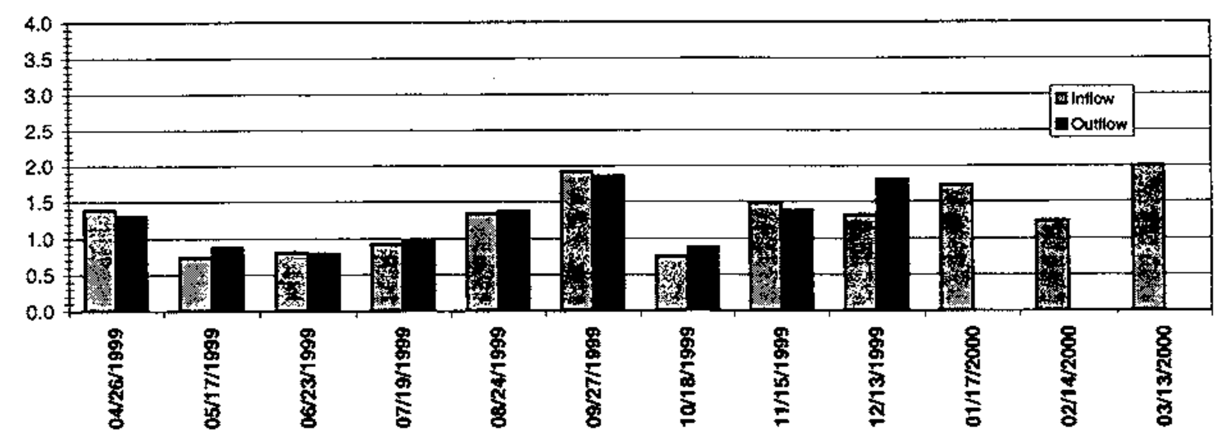
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



Note: Organic nitrogen data are not availabe from January to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-23

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 11, April 1999 - March 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30cm
HLR: 6 cm/day
Other: 3 Meter Width

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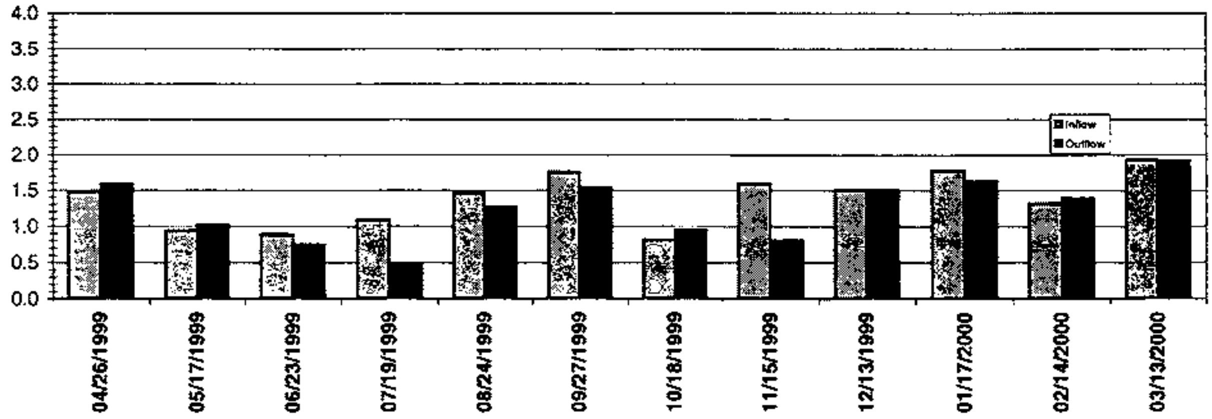
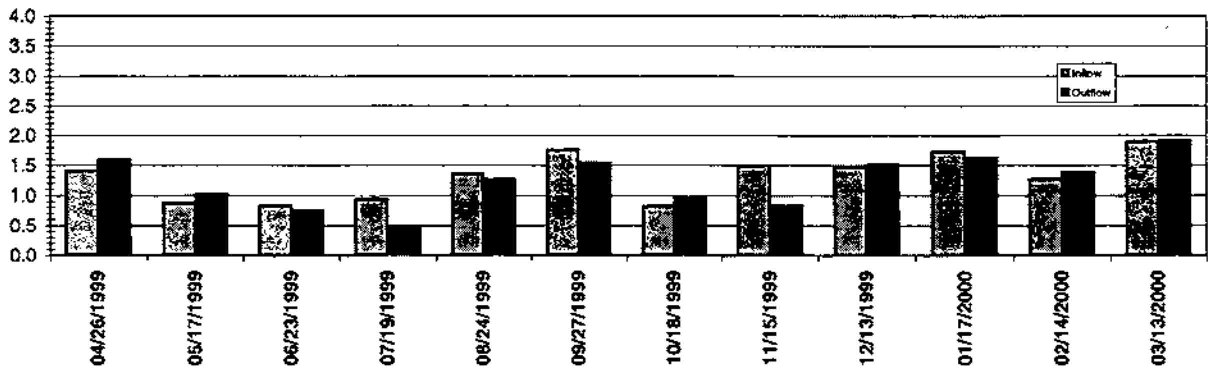
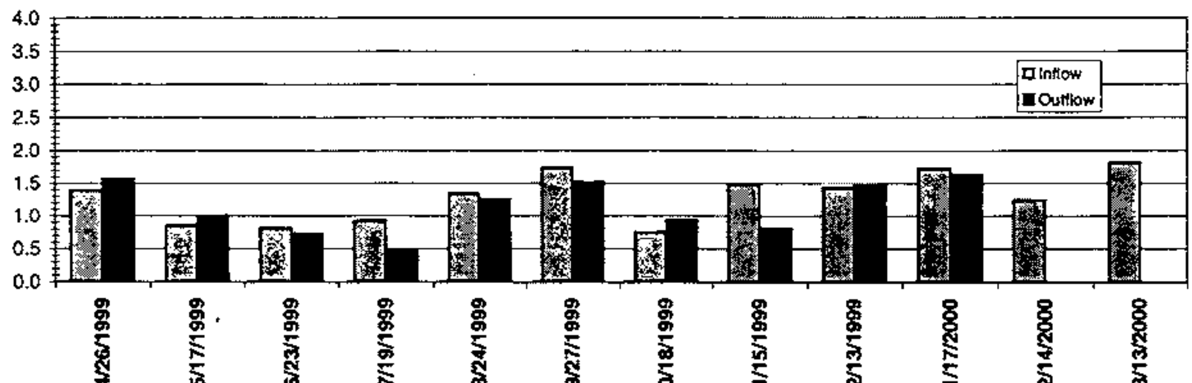
TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN



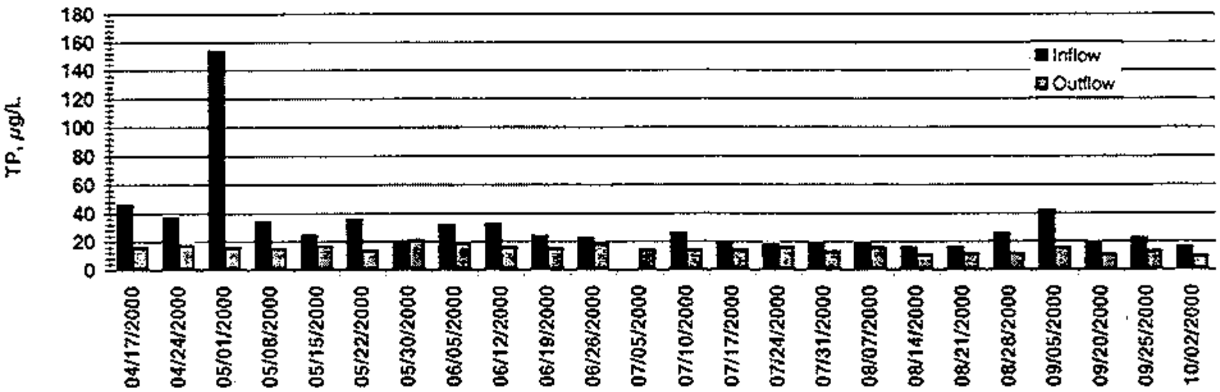
Note: Organic nitrogen data are not availabe from February to March 2000 because corresponding ammonia data required for the calculation were not collected for this time period.

Exhibit D.2-24

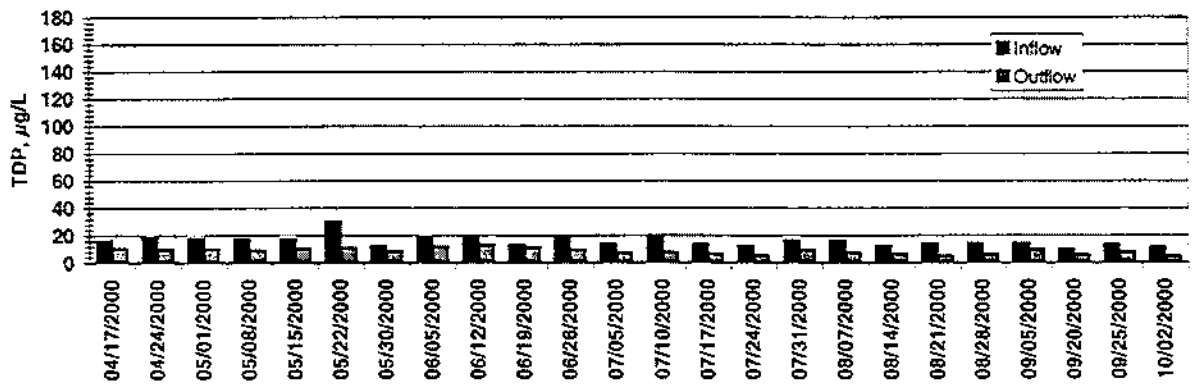
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 12, April 1999 - March 2000.

Key Conditions:
Substrate: Peat
Depth: 30cm
HLR: 6 cm/day
Other: 3 Meter Width

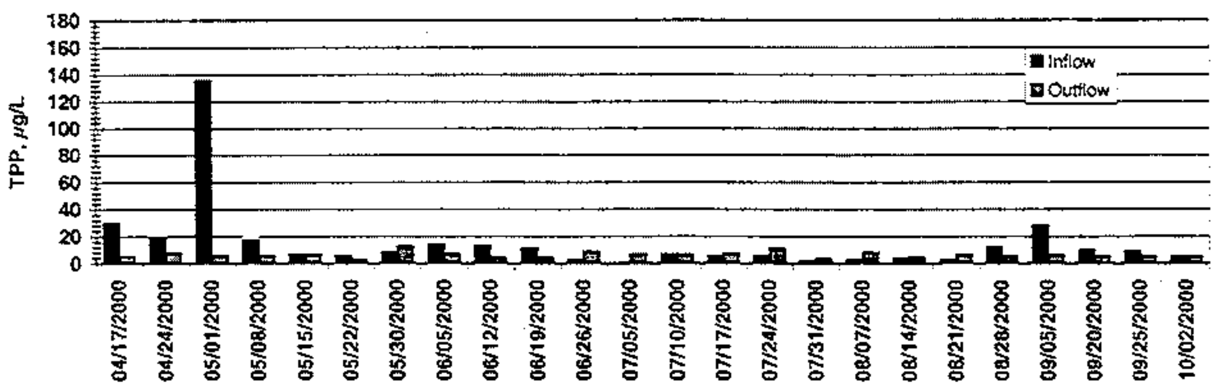
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

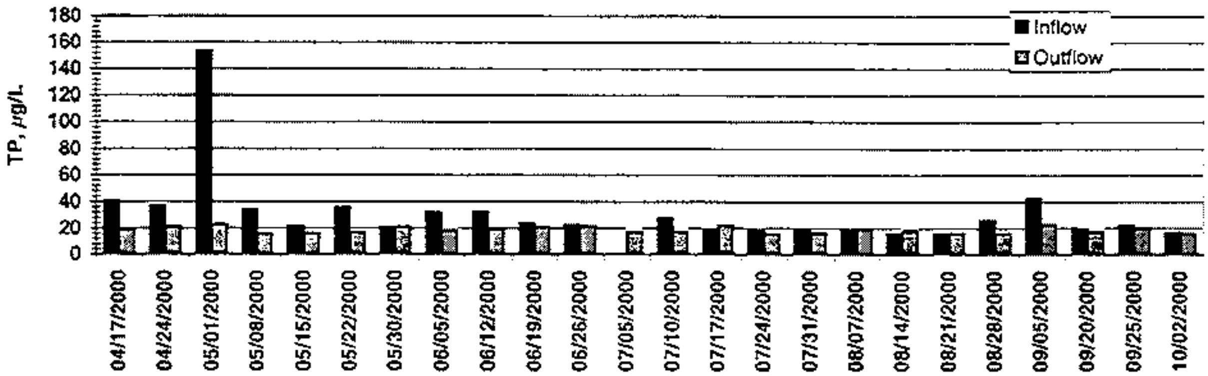


EXHBIIT D.2-26

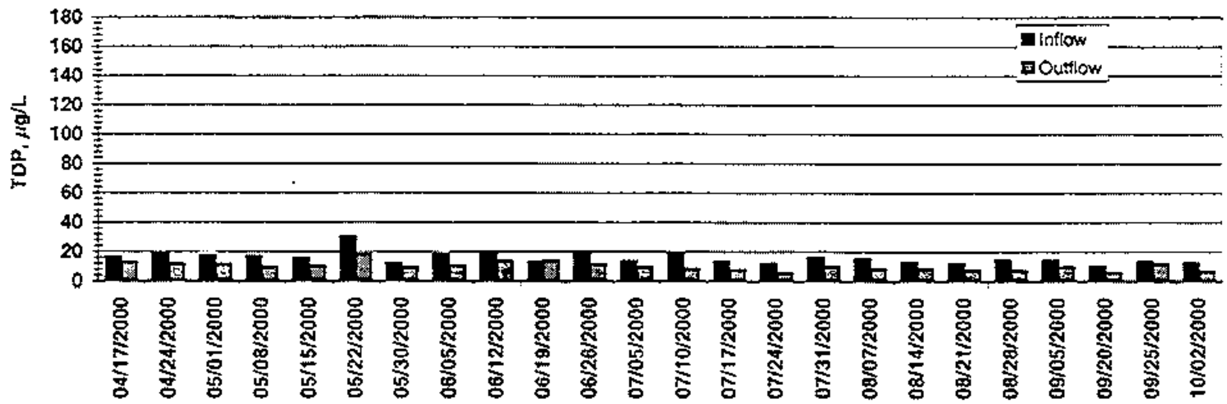
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 4, April 2000 - Oct 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

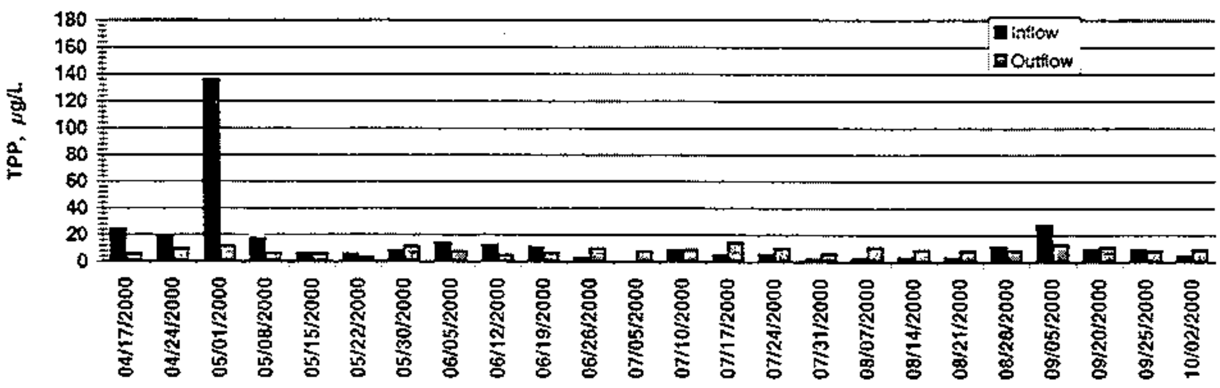
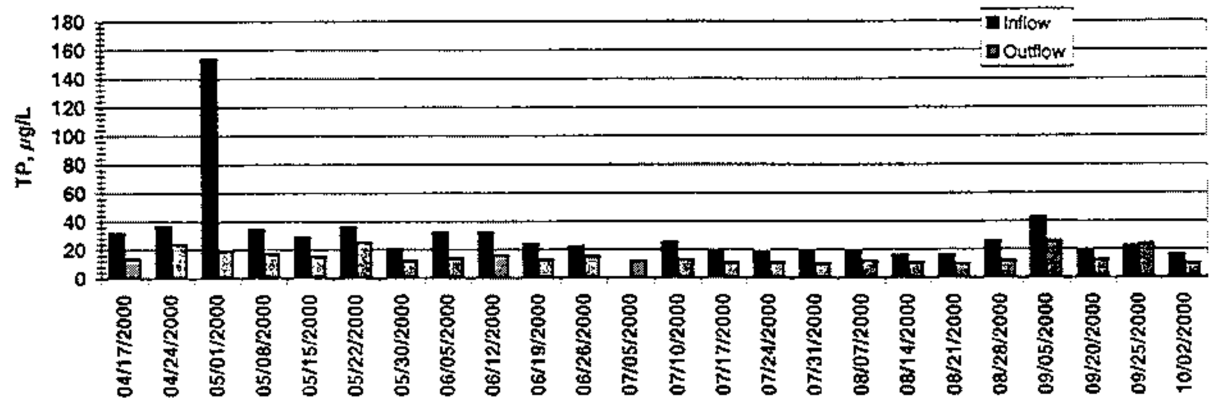


EXHIBIT D.2-25

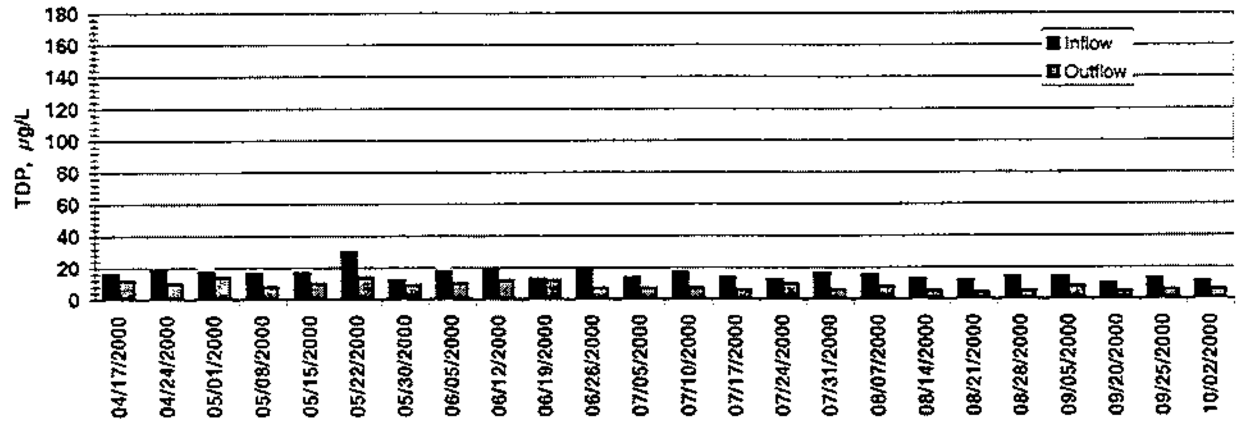
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 3, April 2000 - Oct 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

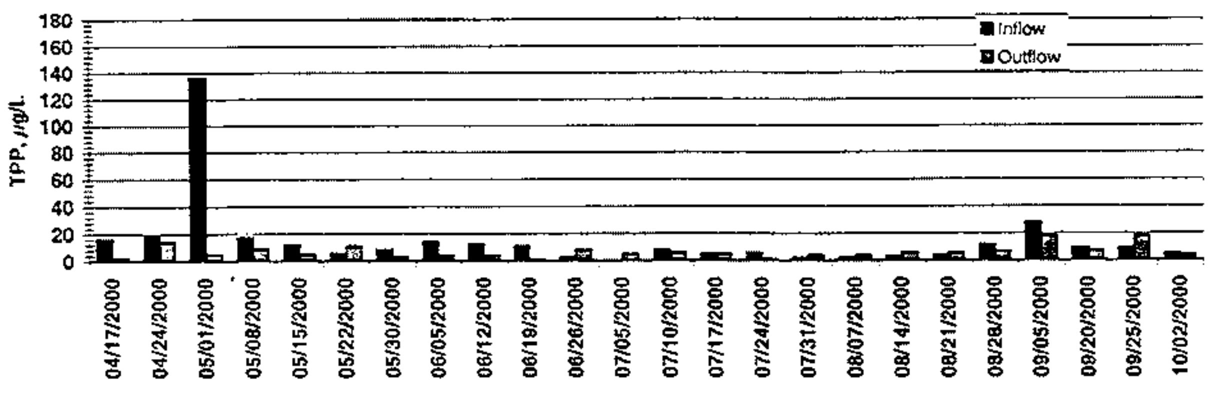
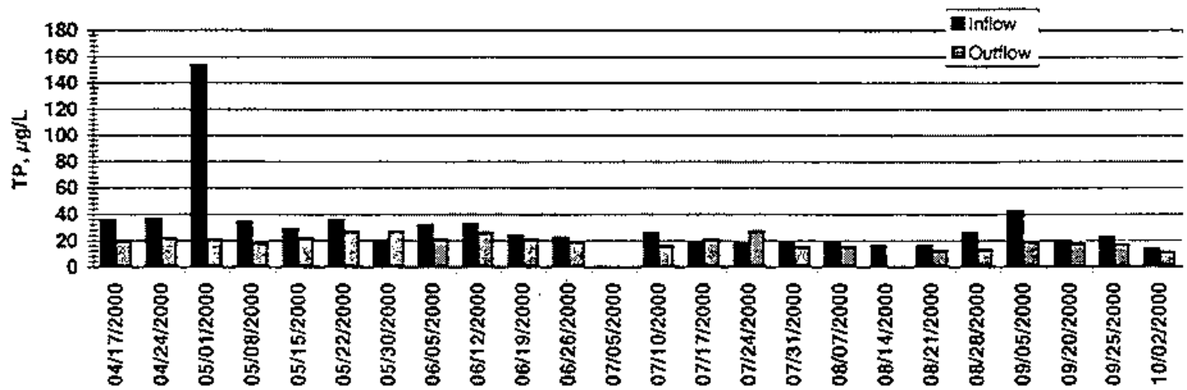


EXHIBIT D.2-27

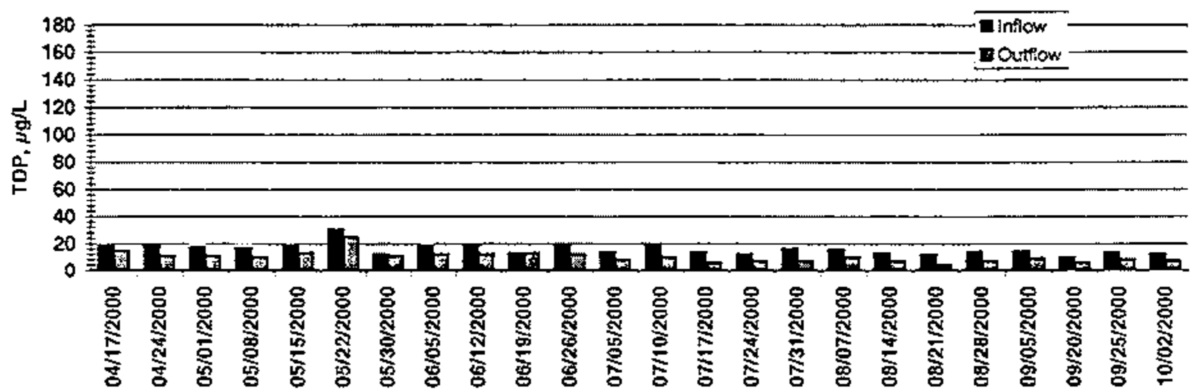
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 13, April 2000 - Sept 2000.

Key Conditions:
Substrate: Peat - Ca
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

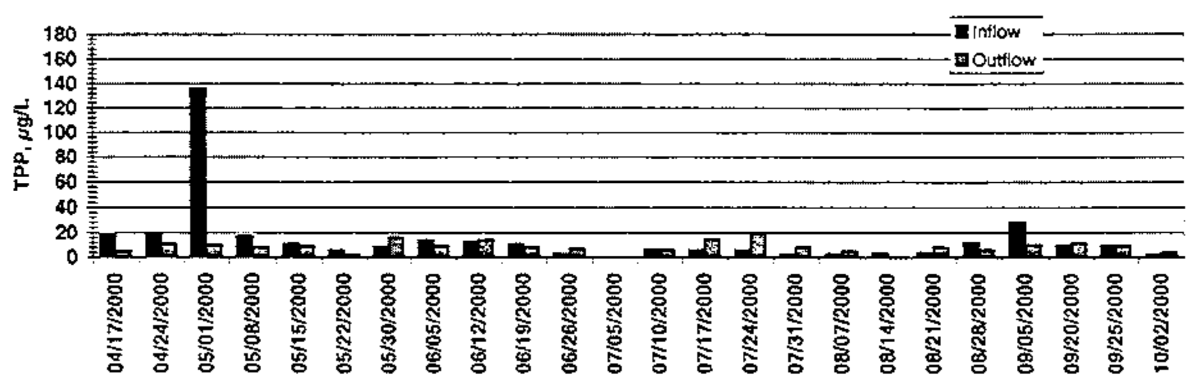
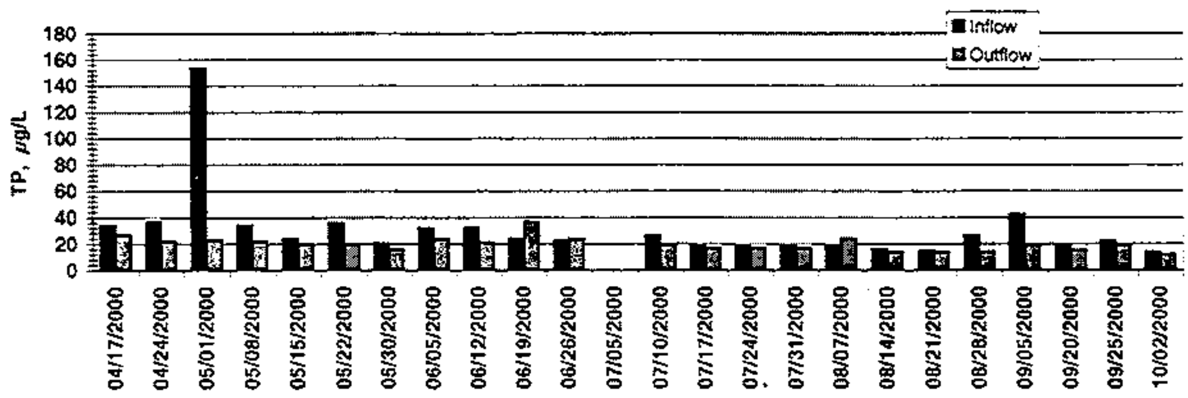


EXHIBIT D.2-28

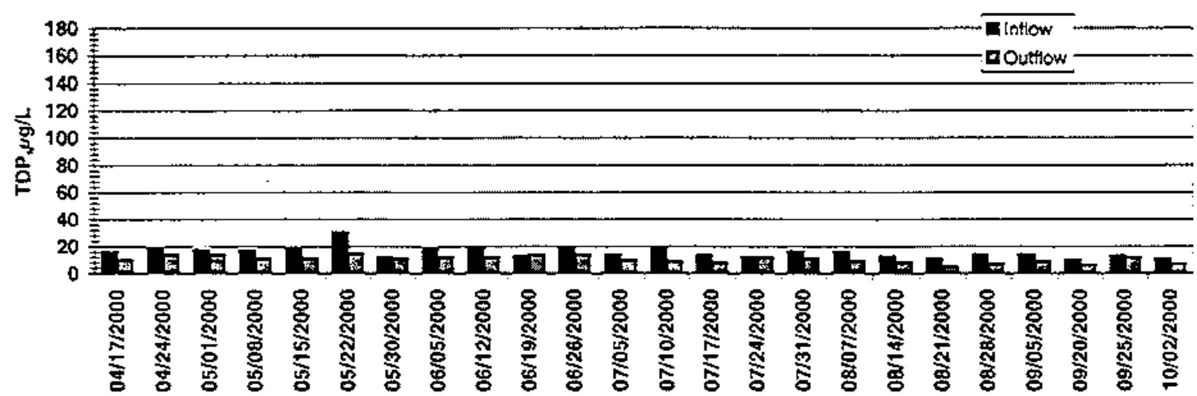
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 11, April 2000 - Oct 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

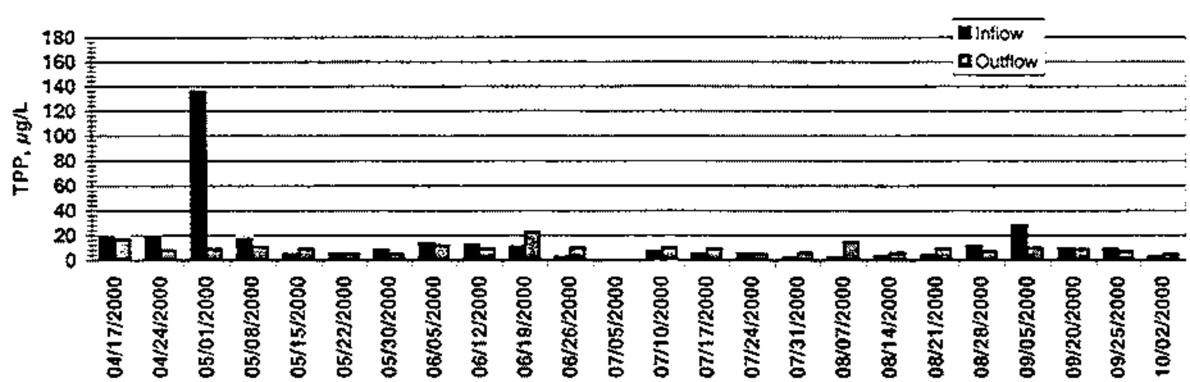
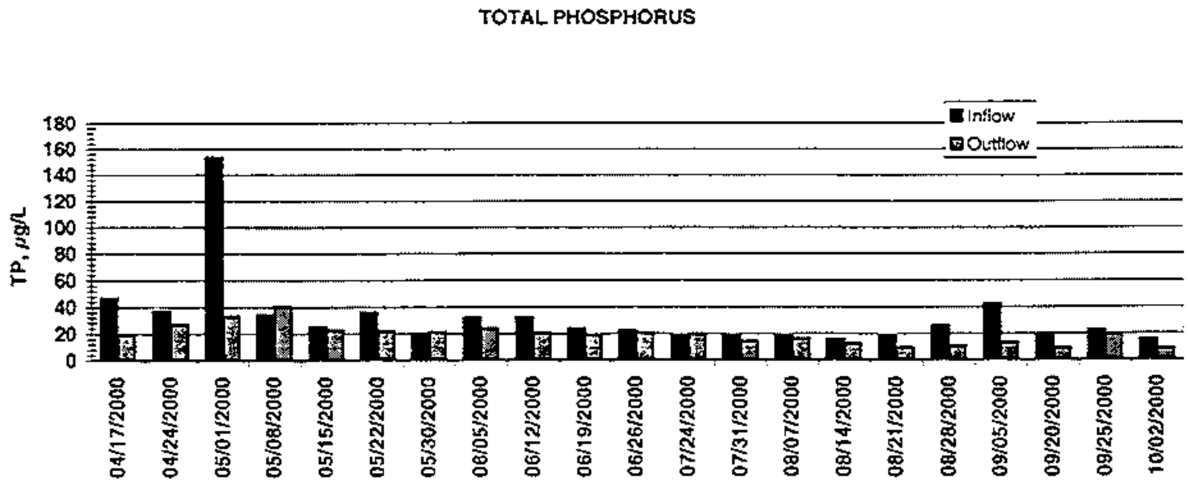
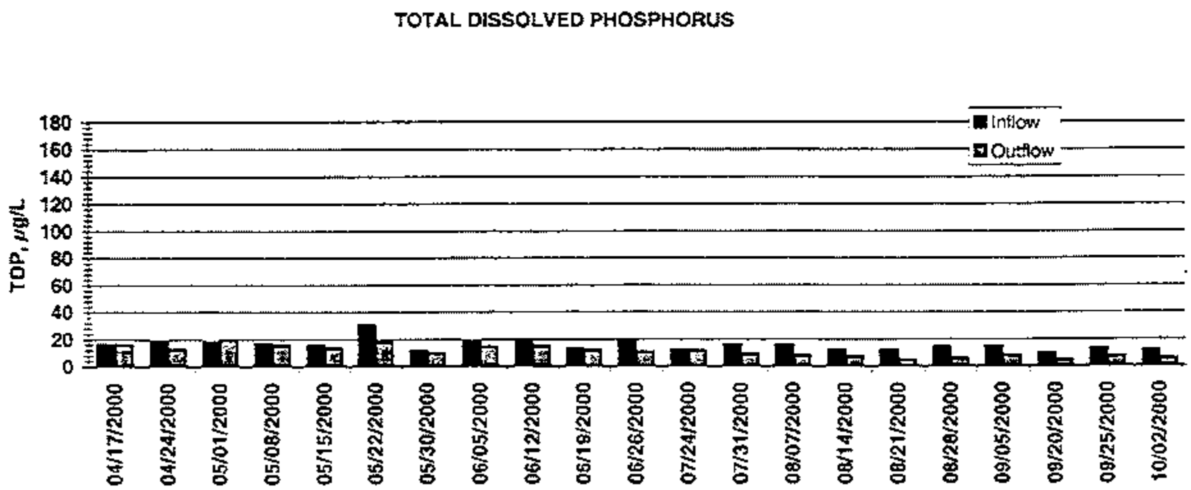


EXHIBIT D.2-29

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 12, April 2000 - Oct 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:





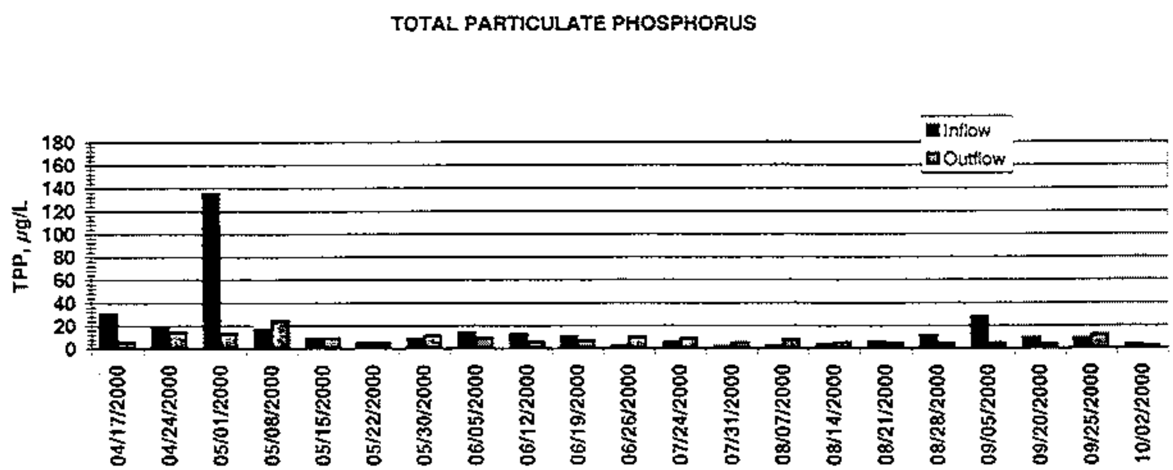
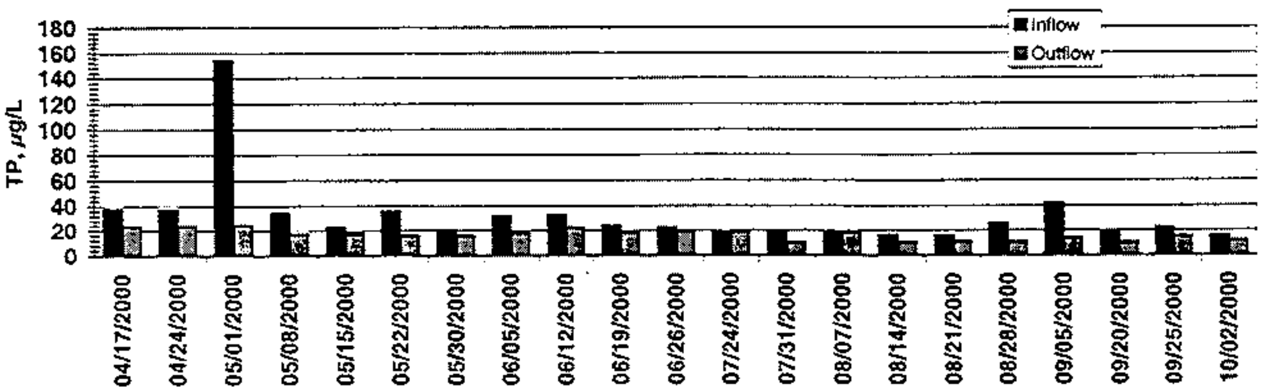


EXHIBIT D.2-30

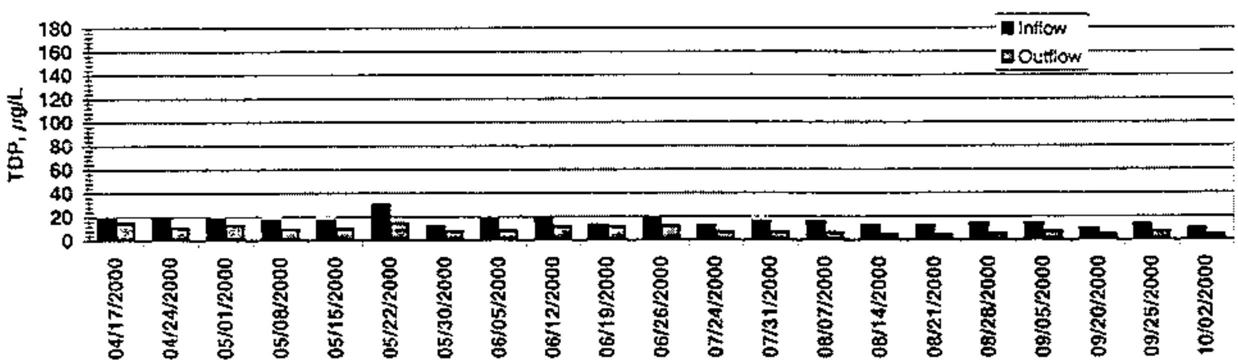
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 13, April 2000 - Oct 2000.

Key Conditions:
Substrate: Peat - Ca
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

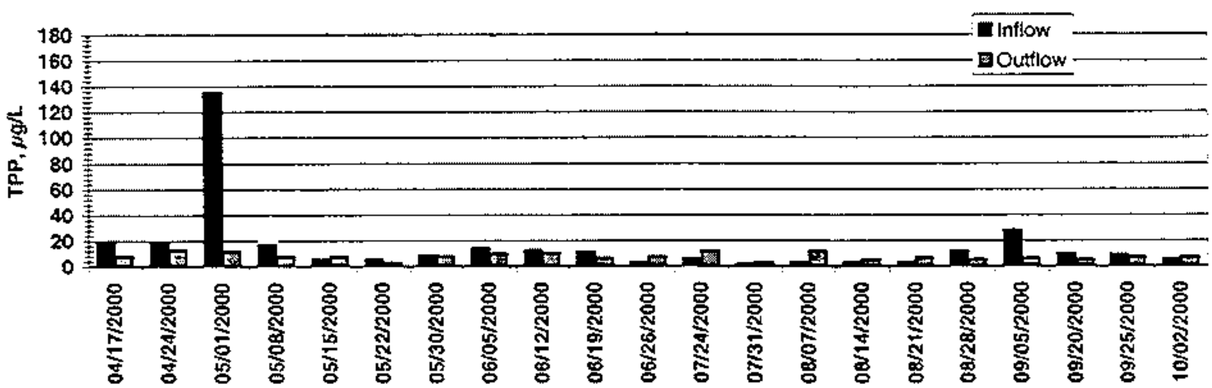
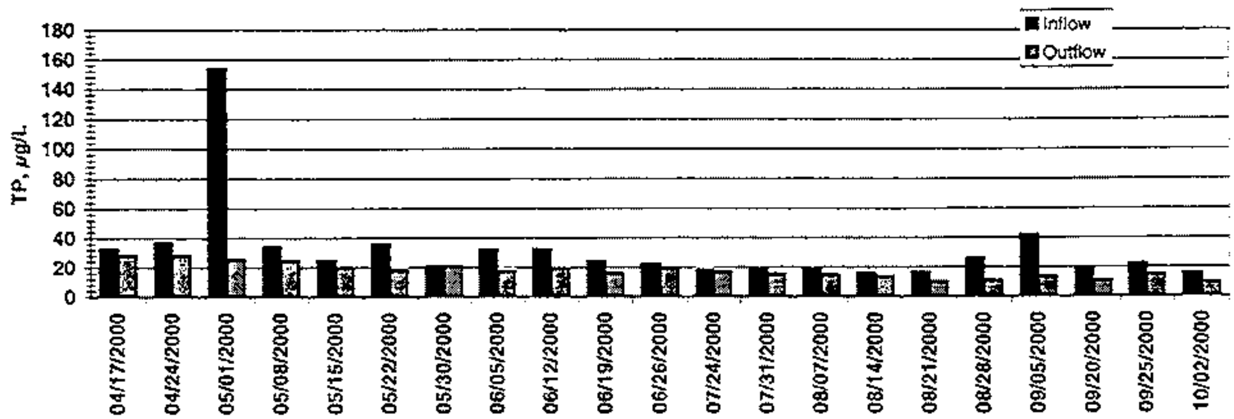


EXHIBIT D.2-31

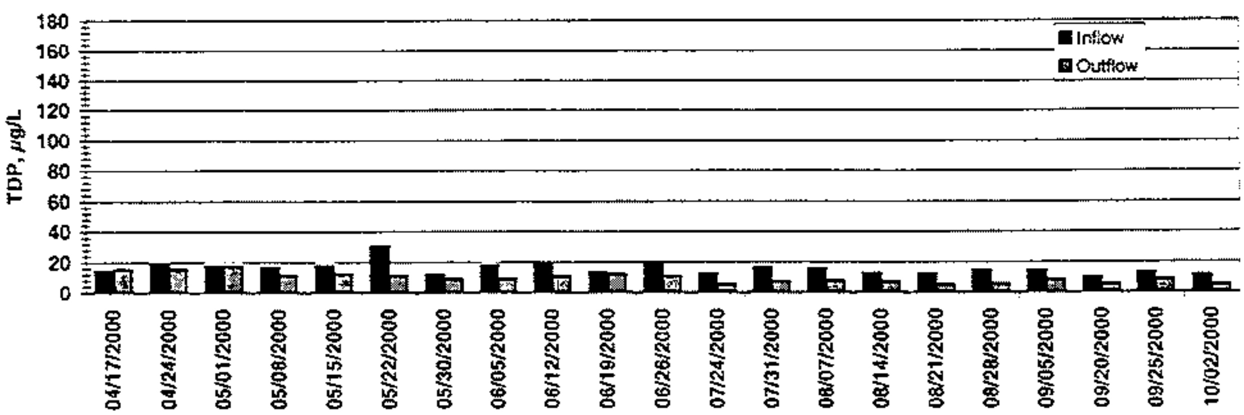
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 14, Arpil 2000 - Oct 2000.

Key Conditions:
Substrate: Limerock
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

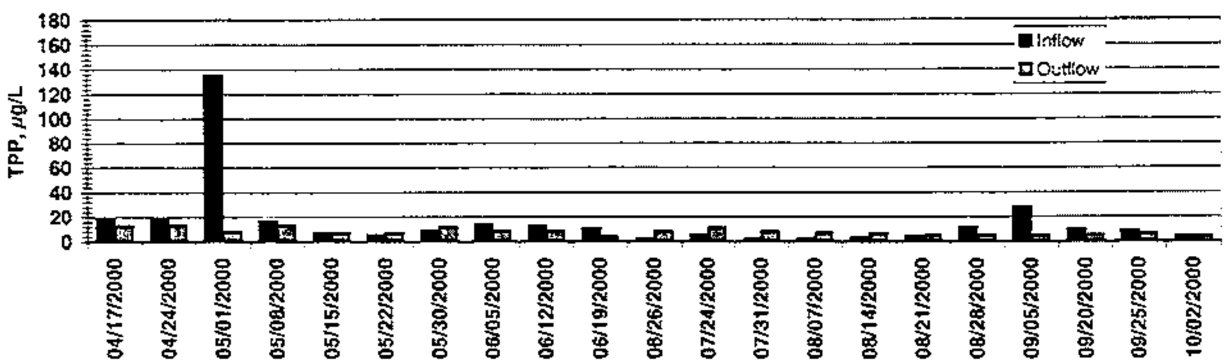
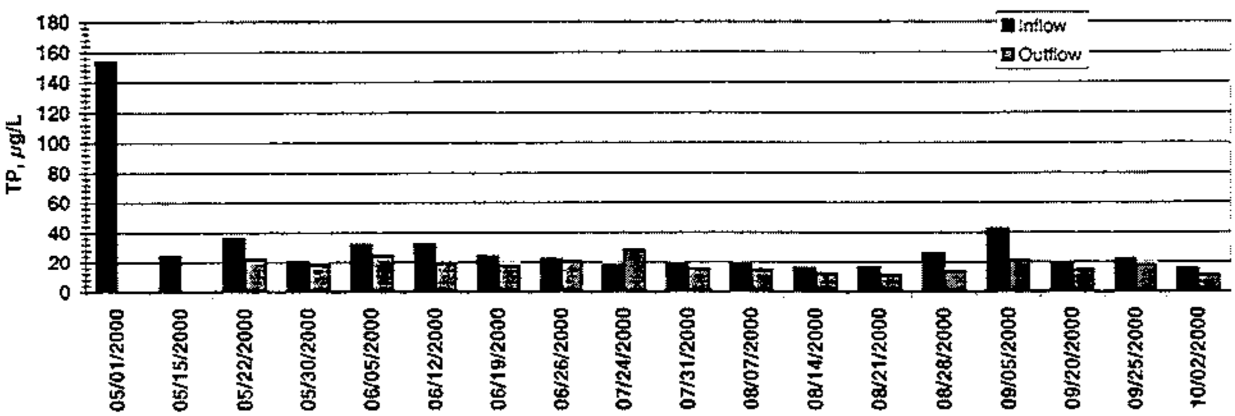


EXHIBIT D.2-32

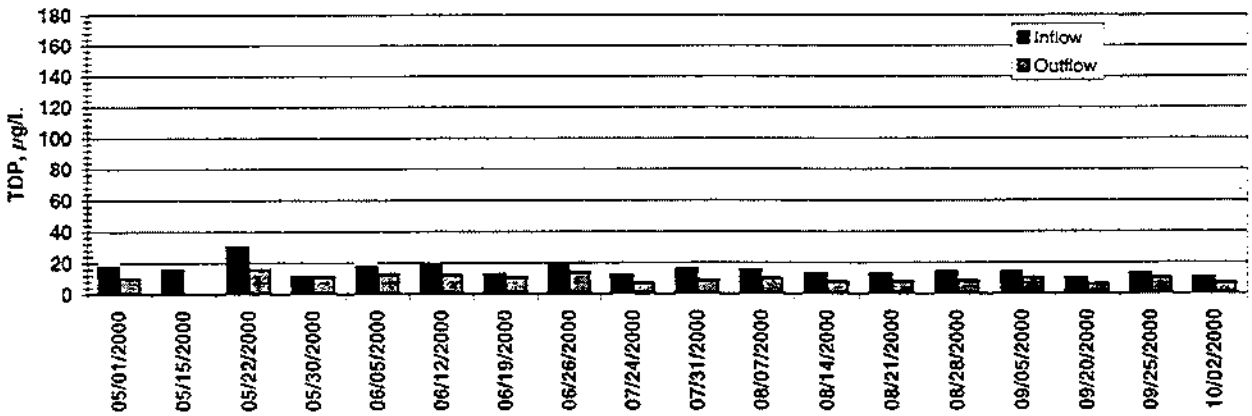
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 15, April 2000 - Oct 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: Recirc
Other:

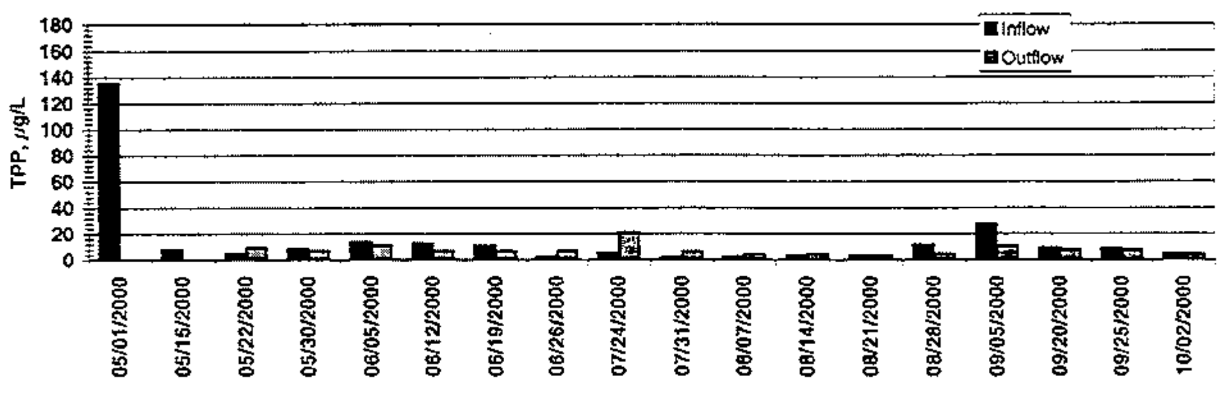
TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS



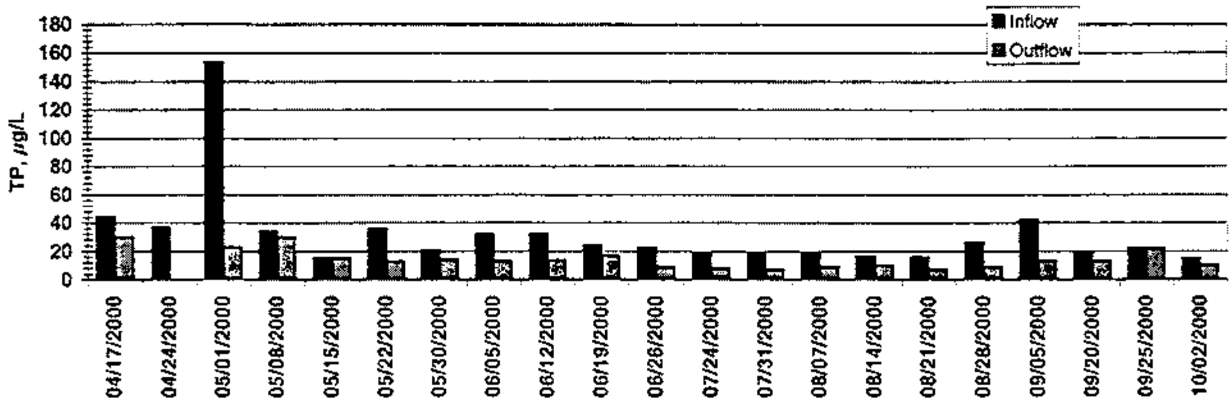
Note: Treatment in dry down from 3/16/2000- 5/15/2000; no water samples taken during this time.

EXHIBIT D.2-33

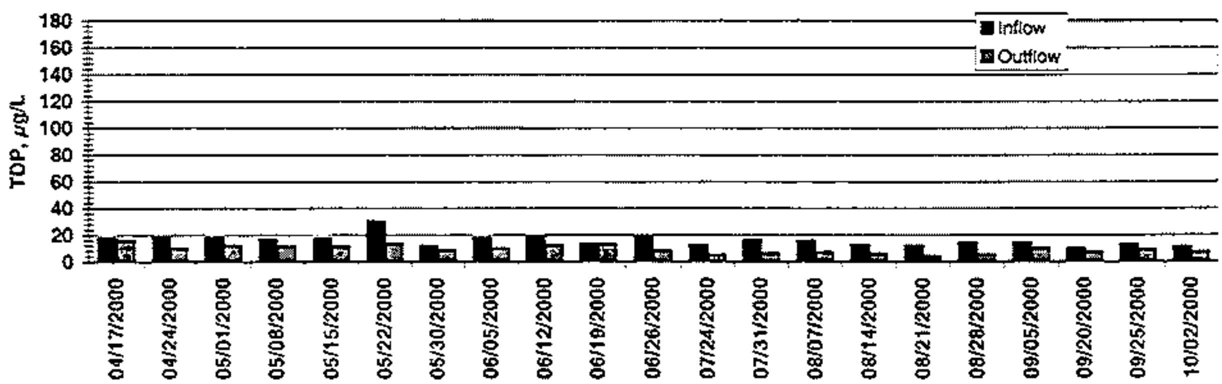
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 16, May 2000 - Sept 2000.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 30 cm
HLR: Seasonal
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

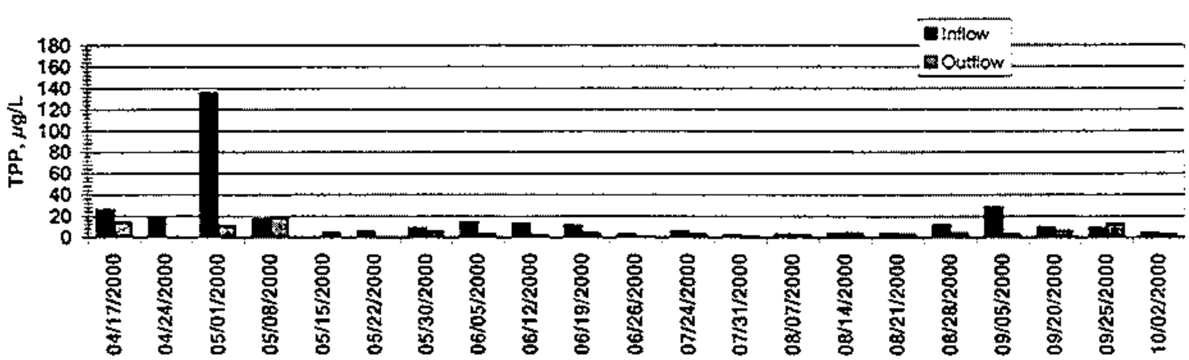
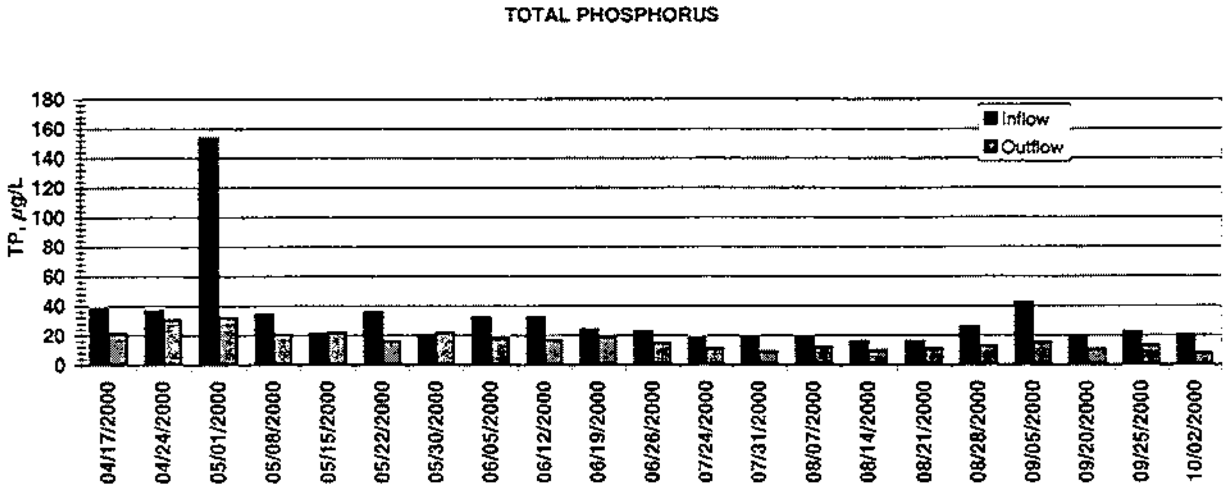
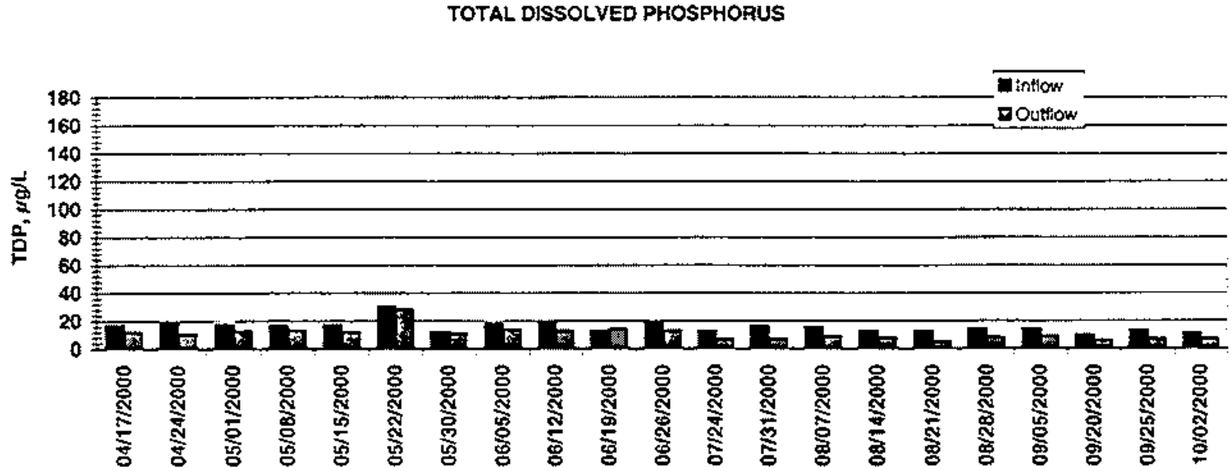


EXHIBIT D.2-34

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 17, April 2000 - Oct 2000.

Key Conditions:
Substrate: Sand - HCl
Depth: 30 cm
HLR: 6 cm/day
Other:





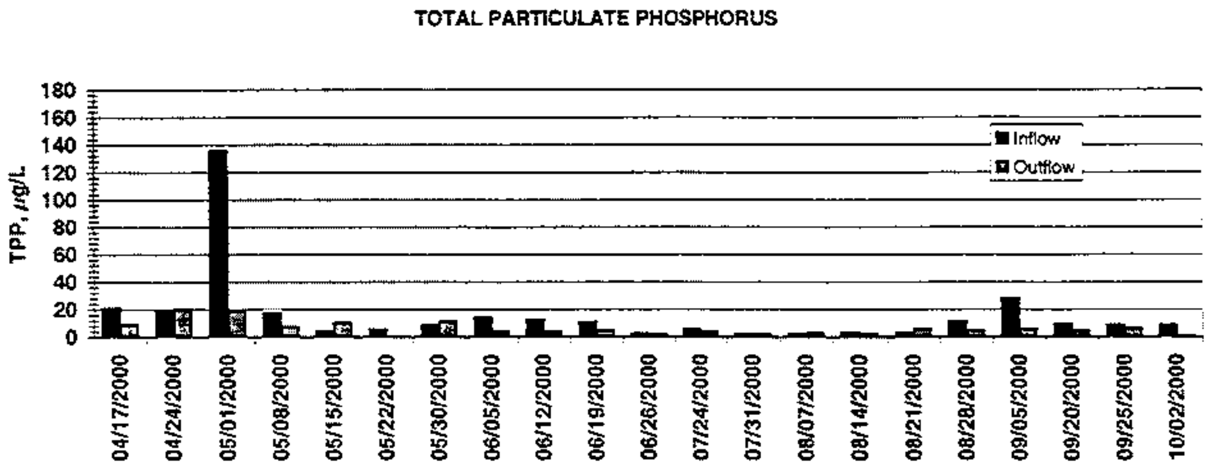


EXHIBIT D.2-35

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 18, April 2000 - Oct 2000.

Key Conditions:
Substrate: None
Depth: 30 cm
HLR: 6 cm/day
Other:

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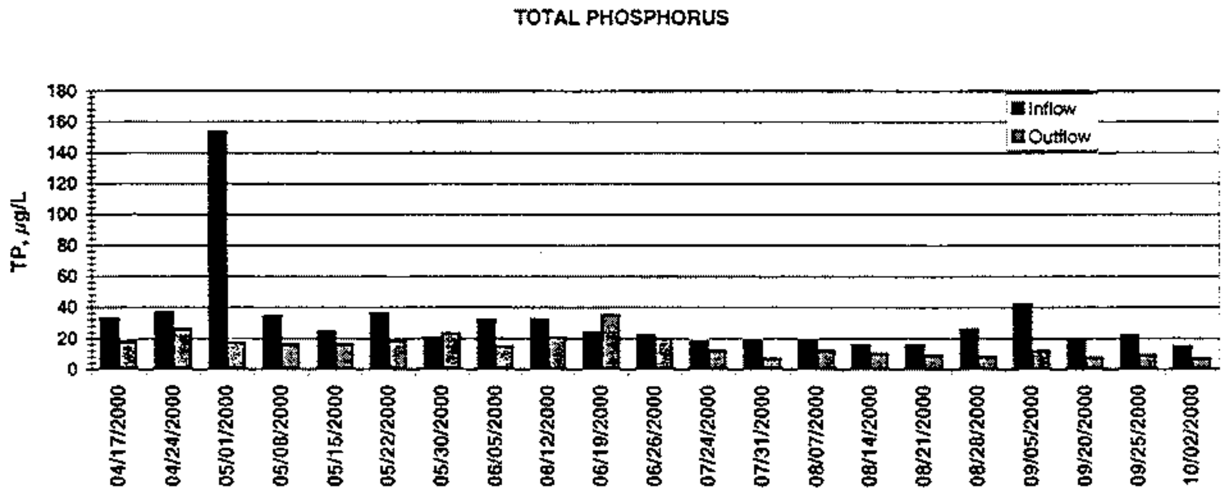
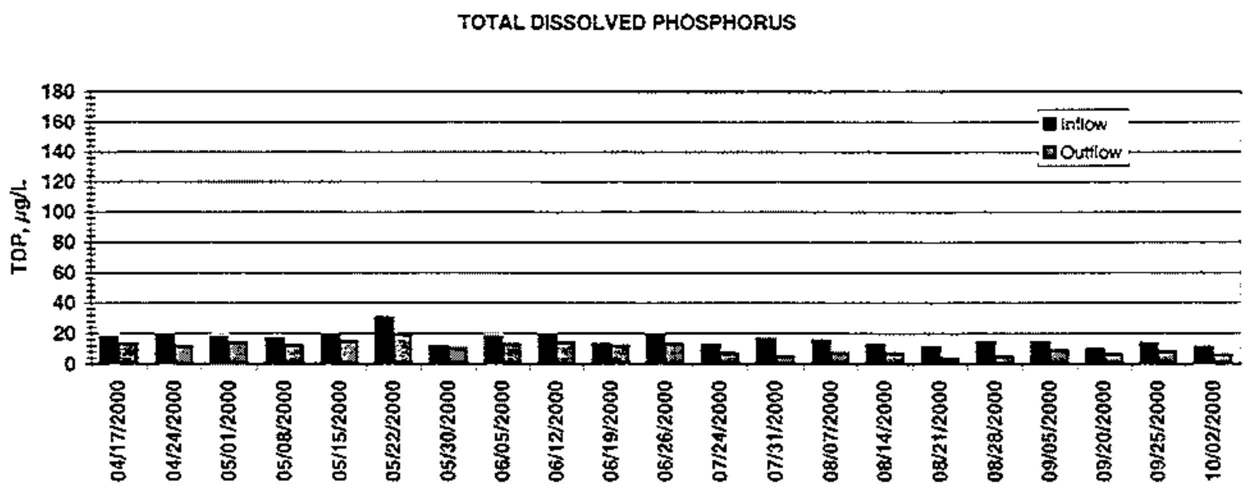




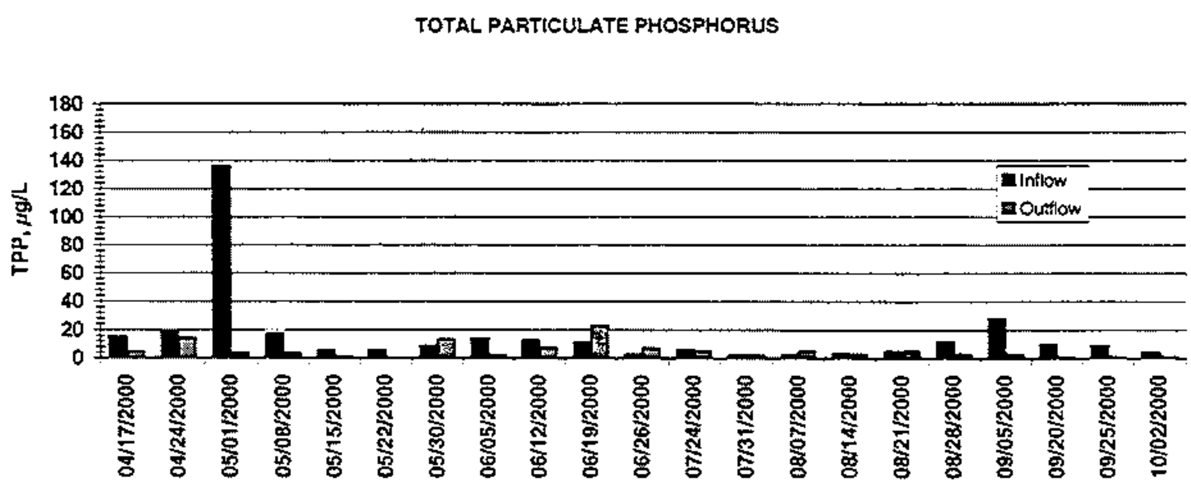
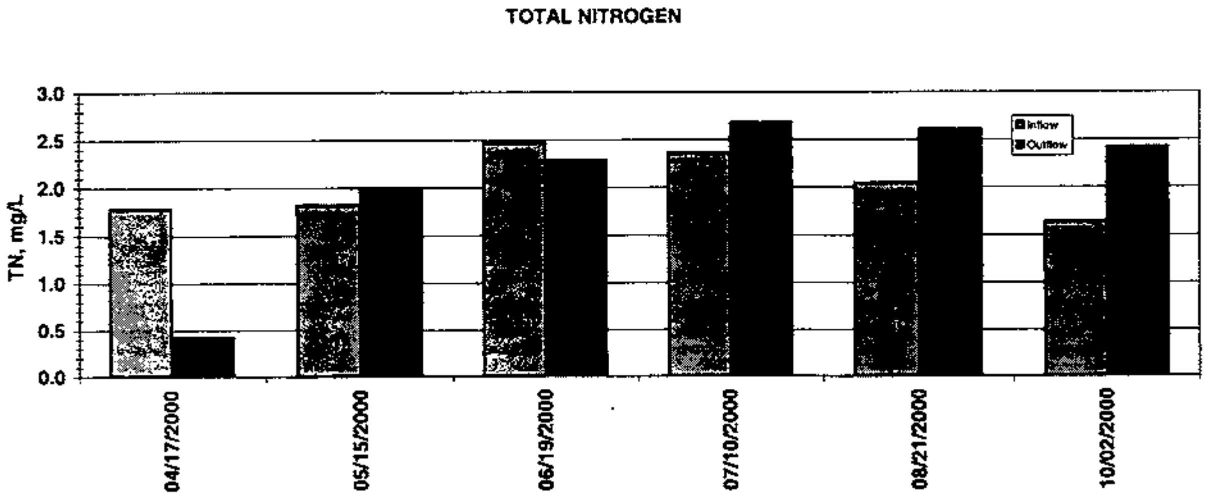


EXHIBIT D.2-36

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 19, April 2000 - Oct 2000.

Key Conditions:
Substrate: Synthetic
Depth: 30 cm
HLR: 6 cm/day
Other:



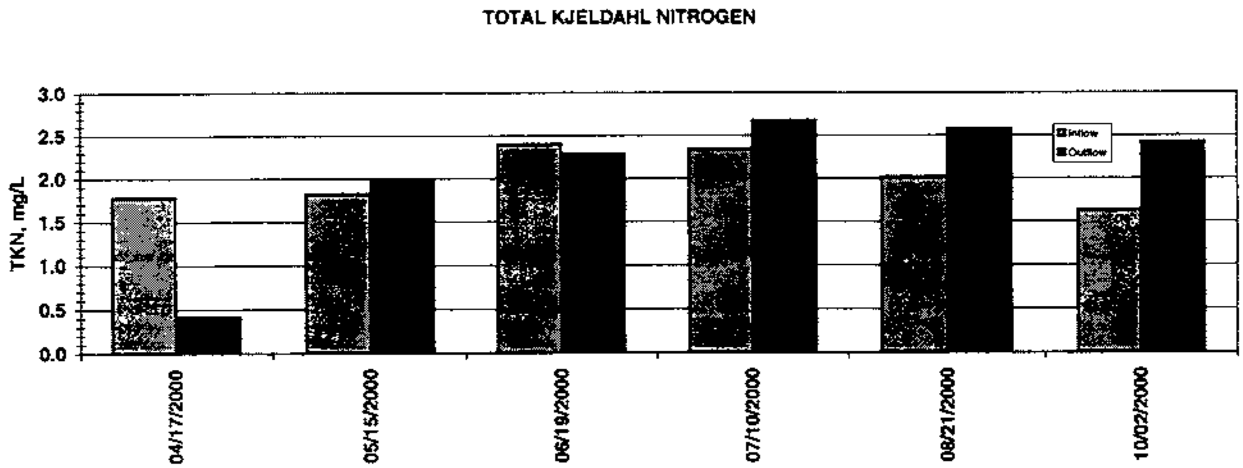
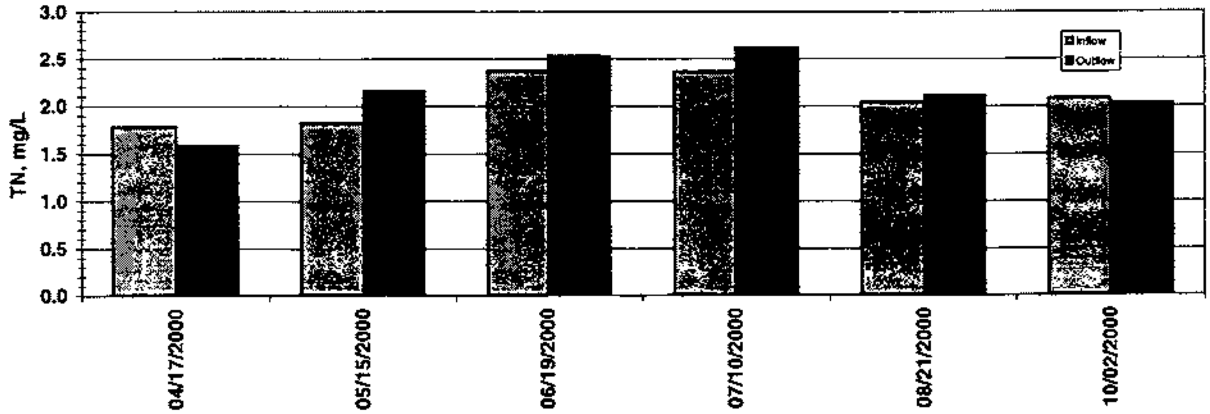


Exhibit D.2-37

Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 3, April 2000 - October 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

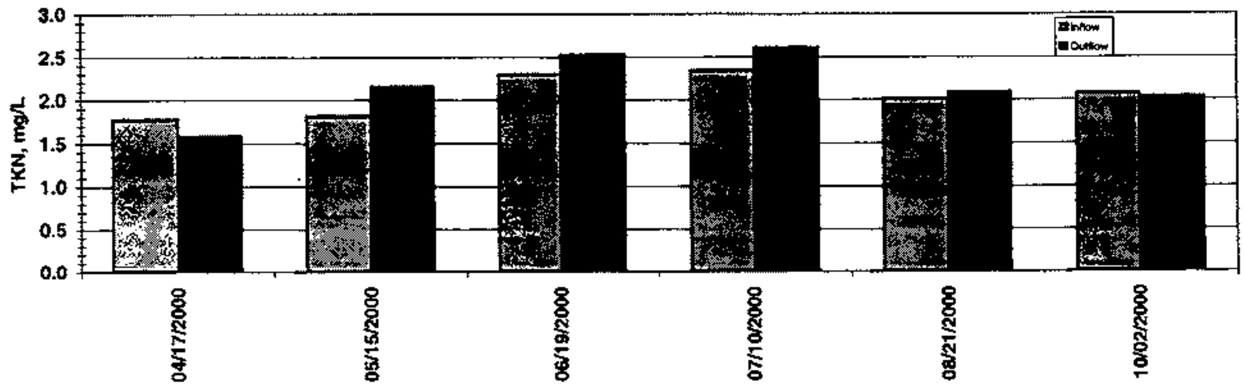
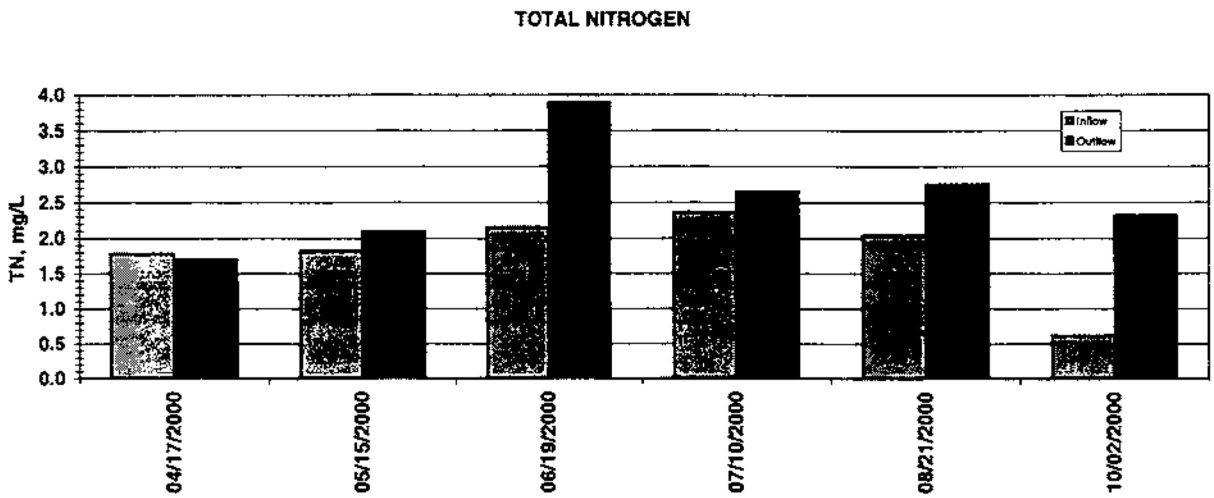


Exhibit D.2-38
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No.4, April 2000 - October 2000.

<u>**Key Conditions**</u>:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:



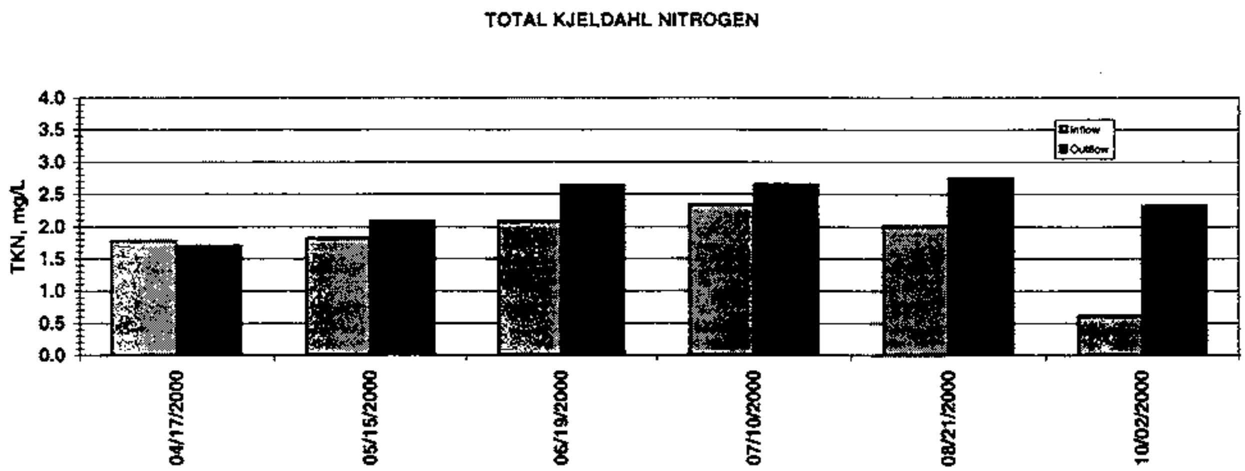
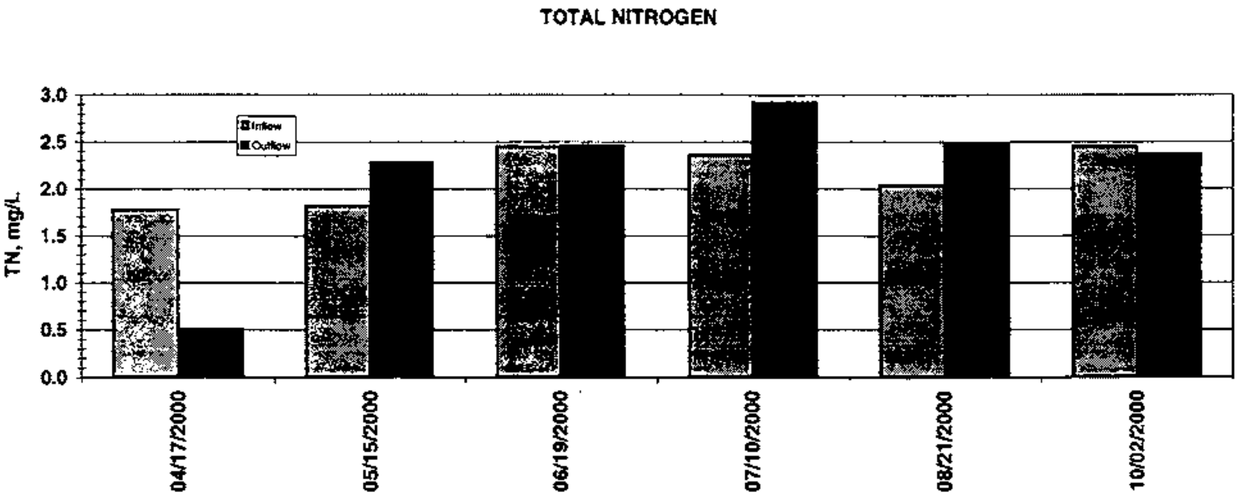


Exhibit D.2-39

Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No.7, April 2000 - October 2000.

Key Conditions:
Substrate: Peat - Ca
Depth: 30 cm
HLR: 6 cm/day
Other:



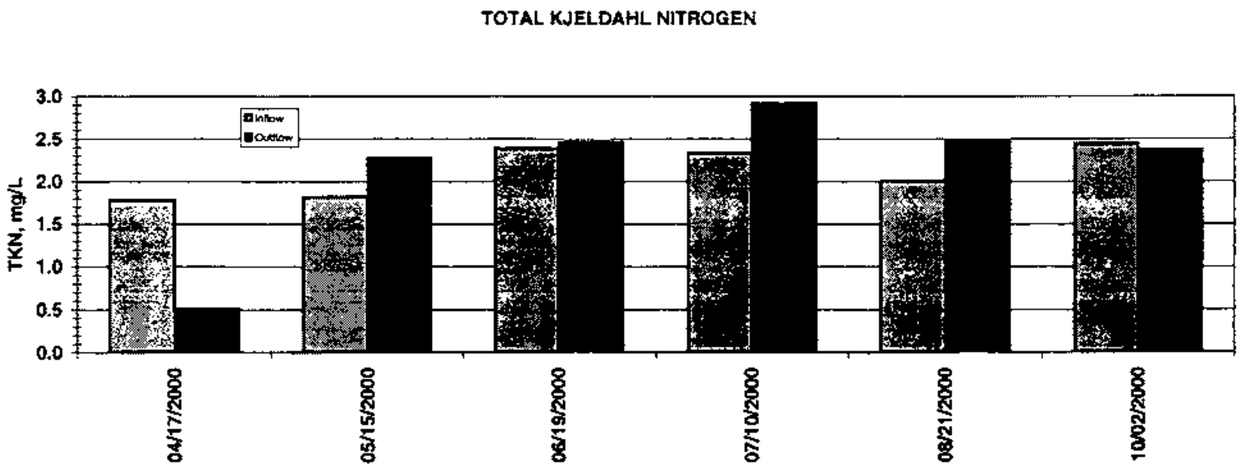
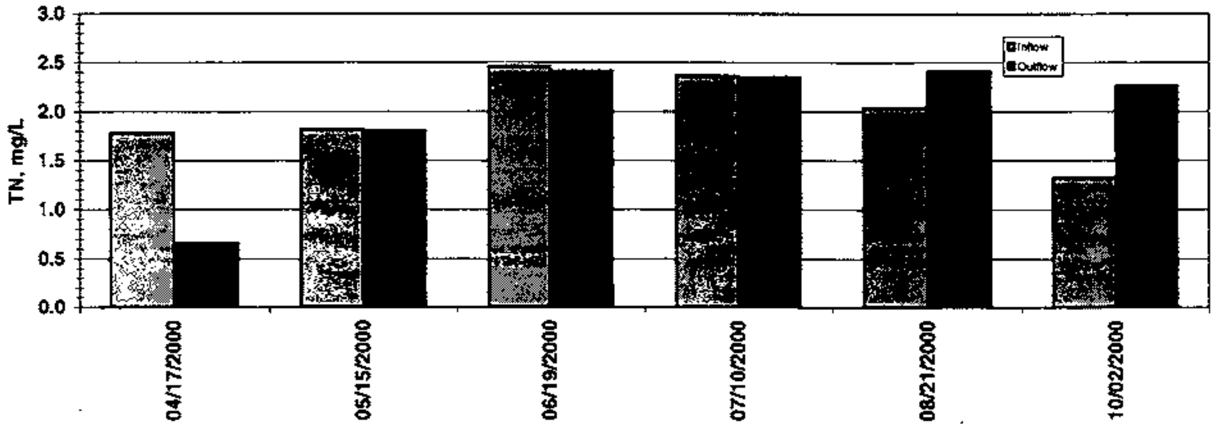


Exhibit D.2-40
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No11, April 2000 - October 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

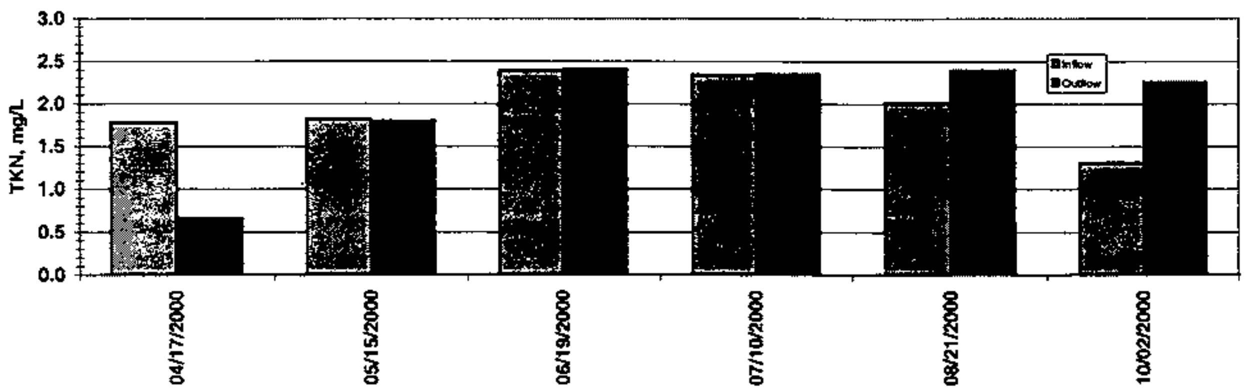
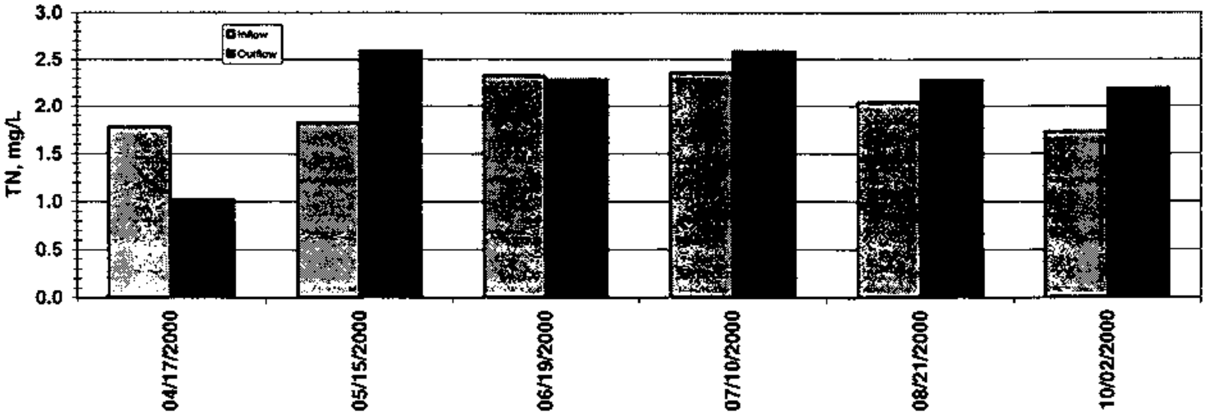


Exhibit D.2-41
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No 12, April 2000 - October 2000.

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

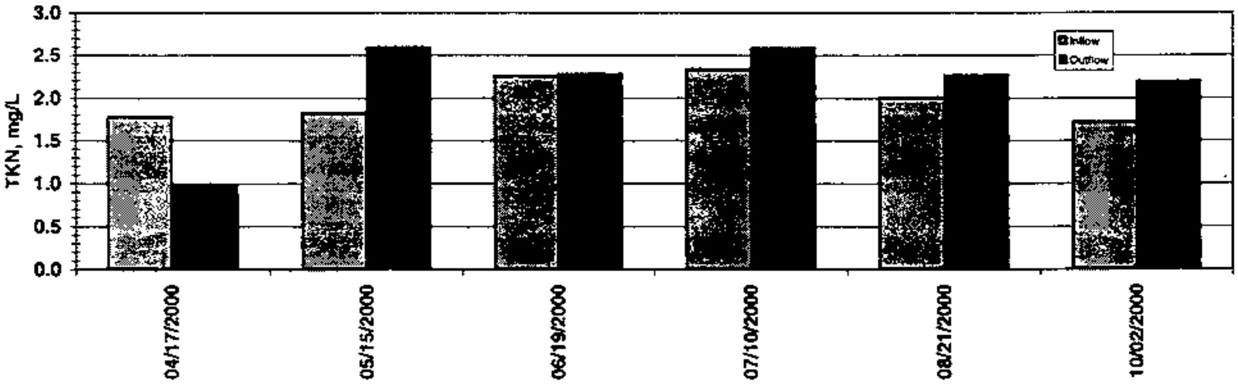
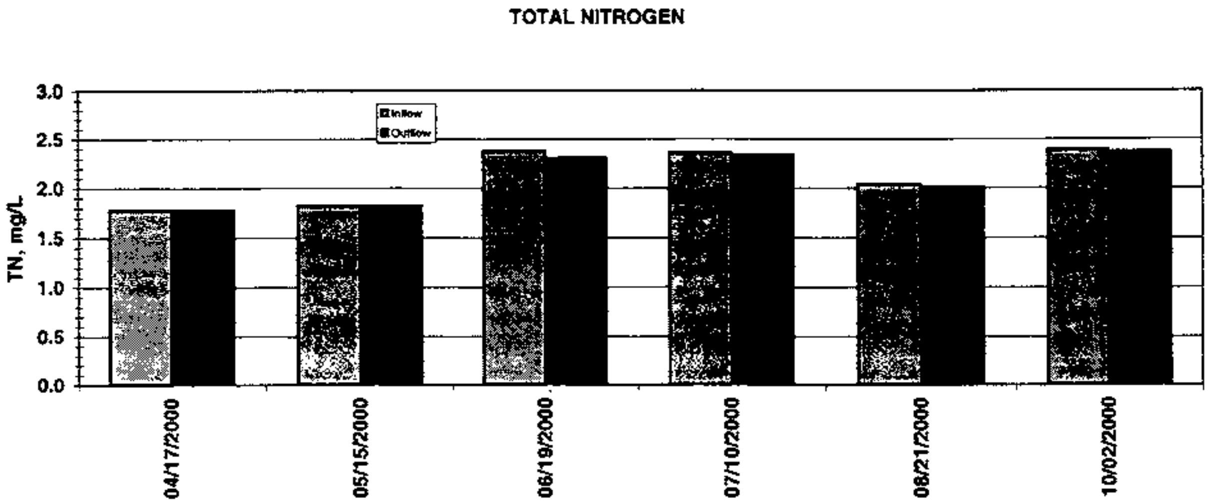
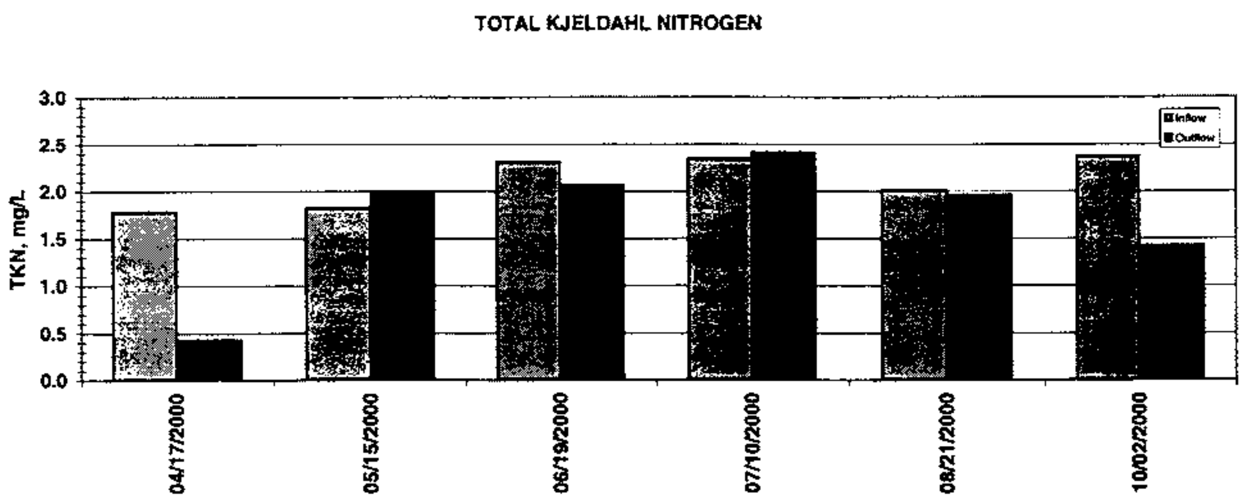


Exhibit D.2-42

Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 13, April 2000 - October 2000.

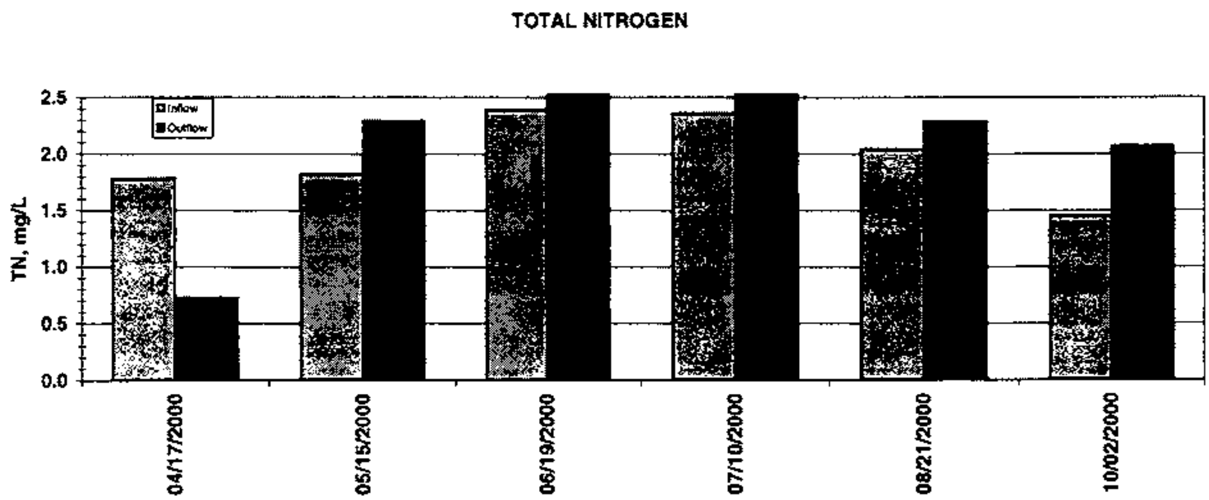
Key Conditions:
Substrate: Peat - Ca
Depth: 30 cm
HLR: 6 cm/day
Other:





Key Conditions:
Substrate: Limerock
Depth: 30 cm
HLR: 6 cm/day
Other:

Exhibit D.2-43
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 14, April 2000 - October 2000.



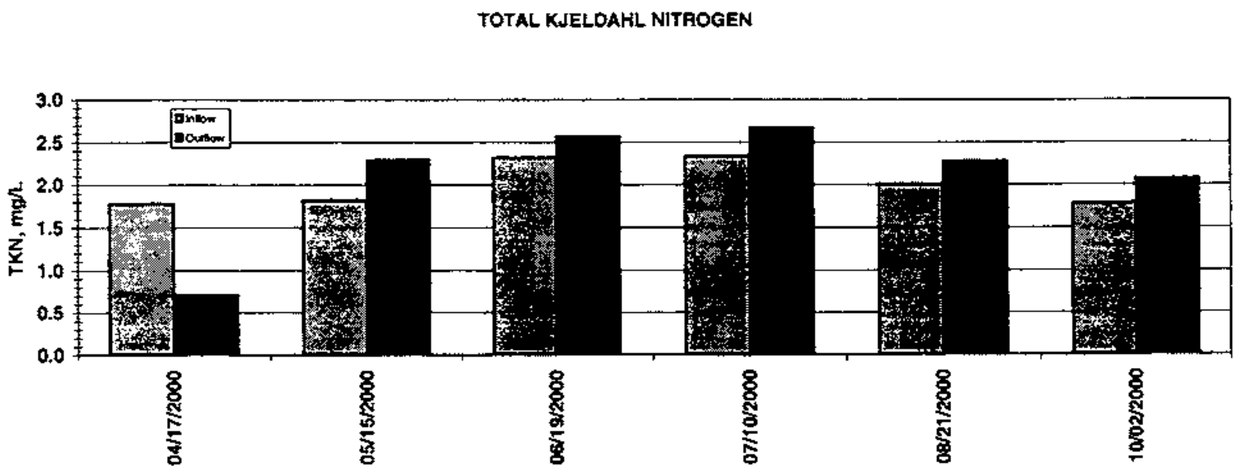
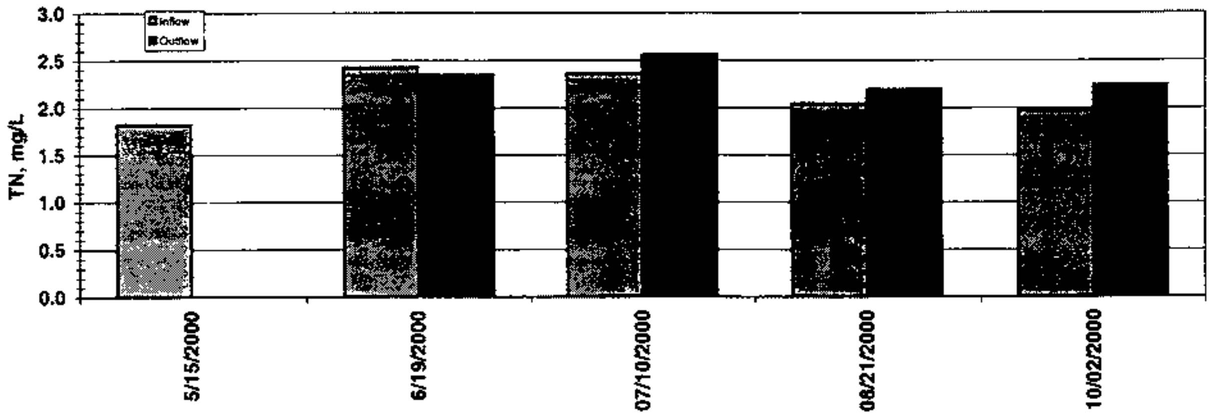


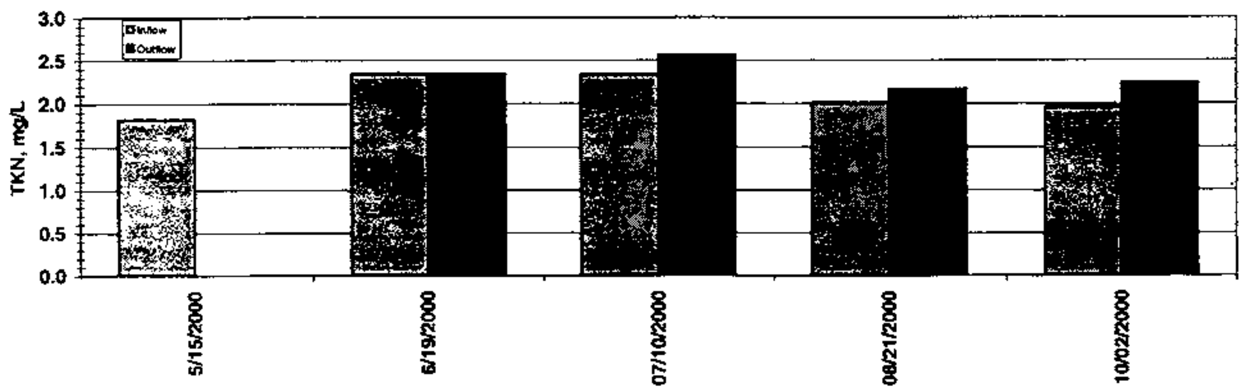
Exhibit D.2-44
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 15, April 2000 - October 2000.

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: Recirc
Other:

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

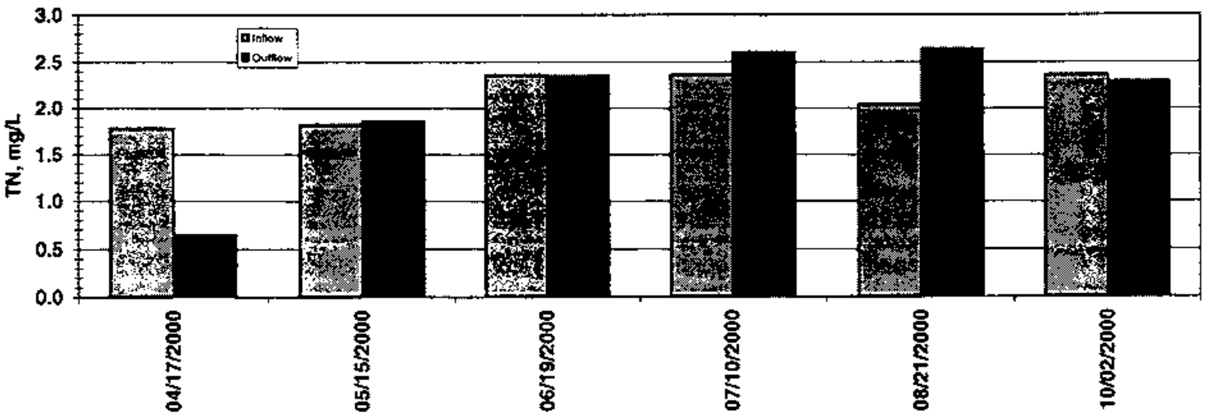


Note: Treatment in dry down from 3/16/2000- 5/15/2000; no water samples taken during this time.

Key Conditions:
Substrate: Shellrock
Depth: 0 - 30 cm
HLR: Seasonal
Other:

EXHIBIT D.2-45
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 16, May 2000 - October 2000.

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

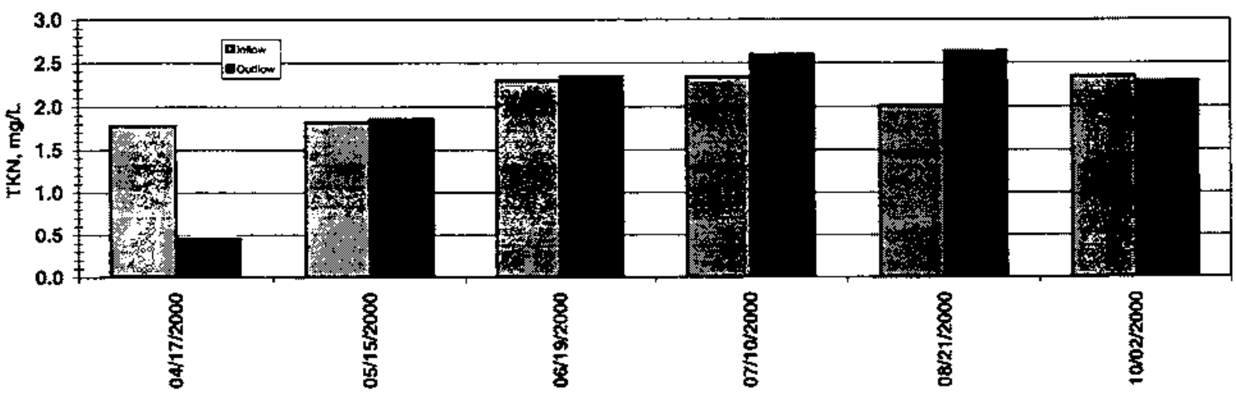
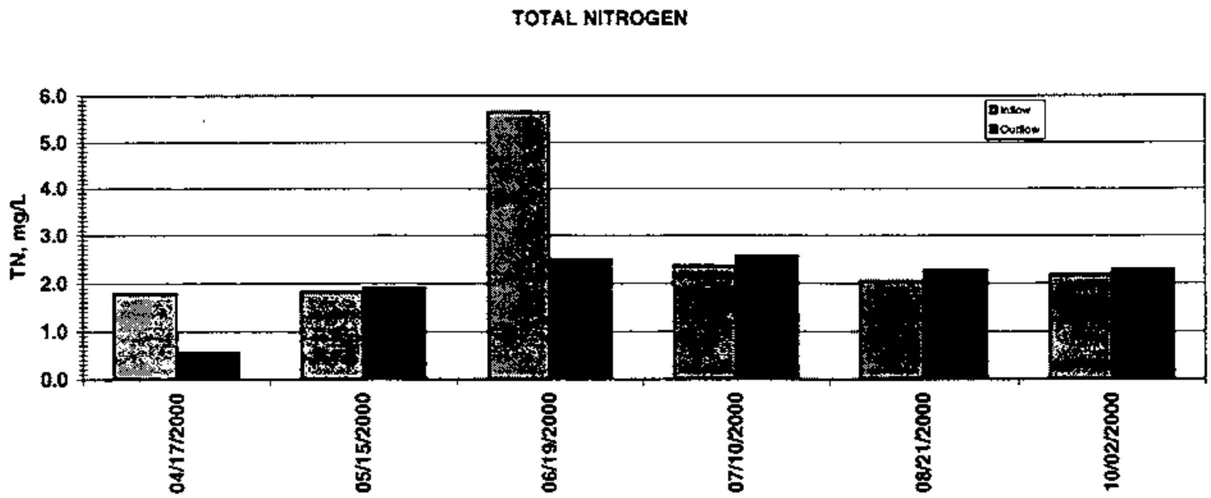
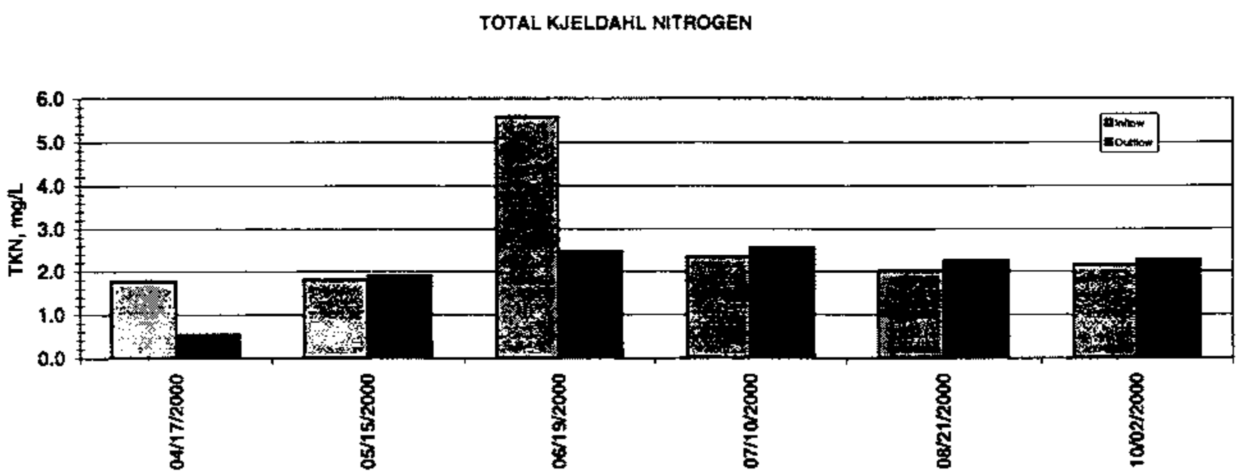


EXHIBIT D.2-46
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 17, April 2000 -October 2000.

Key Conditions:
Substrate: Sand - HCl
Depth: 30 cm
HLR: 6 cm/day
Other:



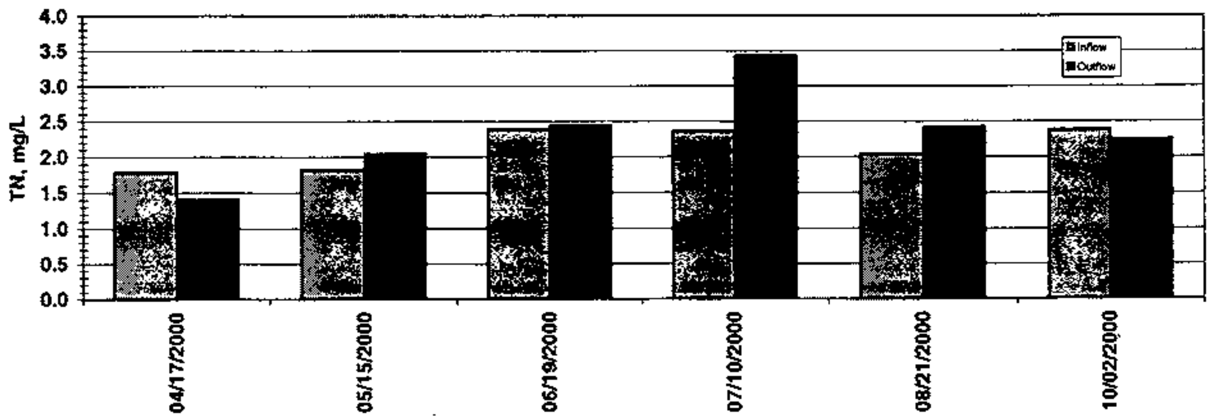


Key Conditions:
Substrate: None
Depth: 30 cm
HLR: 6 cm/day
Other:

EXHIBIT D.2-47

Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 18, April 2000 - October 2000.

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN

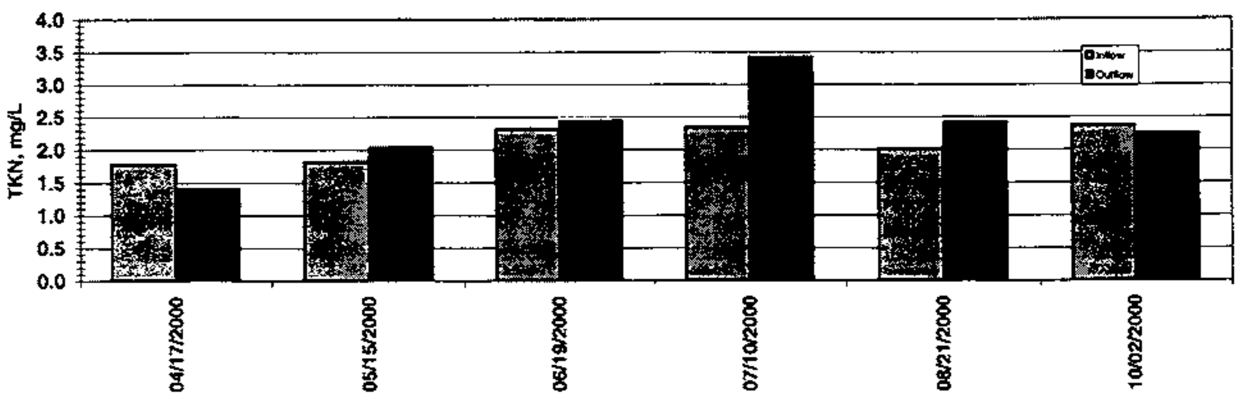


EXHIBIT D.2-48
Inflow and Outflow Weekly Average Values for Total Nitrogen and Total Kjeldahl Nitrogen for Porta-PSTA Treatment No. 19, April 2000 - October 2000.

Key Conditions:
Substrate: Synthetic
Depth: 30 cm
HLR: 6 cm/day
Other:

APPENDIX D.3

Diel Study

APPENDIX D.3

Porta-PSTAs: Diel Study

Diel samples were collected from the Porta-PSTA mesocosms on October 5 and 6, 1999. Sample collection began at 16:32 on October 5 and continued at approximately 4-hour intervals until 15:10 on October 6. Samples were collected for TP, DRP, TDP, and TSS from the Head Tank and from the outflow from each of the following nine tanks:

- Tank 4 – deep shellrock
- Tank 5 – shallow shellrock
- Tank 7 – deep shellrock
- Tank 8 – deep shellrock
- Tank 11 – deep peat
- Tank 15 – variable depth shellrock
- Tank 20 – deep sand
- Tank 21 – deep peat (aquashade)
- Tank 23 – shallow shellrock, 3 x 6 m

Samples were collected from the outflows of six of the tanks (Tanks 4, 7, 8, 11, 20, and 21) twice (00:00 and 12:00 on October 6) for algae identification, counts, and biovolumes and for chlorophyll *a*. This section provides a preliminary summary of some of the data collected during this sampling event.

D.3.1 Phosphorus and TSS Trends

Exhibit D.3-1 illustrates the data trends for TP. Outflow TP from all mesocosms was typically lower than the corresponding inflow concentration measured at the Head Tank. There was no clear overall diurnal trend in TP concentrations. Tanks 4, 5, 7, and 8 (shellrock soils) appeared to have higher exported TP concentrations during the dark hours than during the day.

Exhibit D.3-2 illustrates the data trends for TPP. There was no clear trend in inflow TPP concentrations. Outflow TPP concentrations were generally similar to inflow levels. While there was no clear trend overall, there appear to be higher nighttime outflow TPP concentrations from Tanks 4, 5, 7, and 8.

Exhibit D.3-3 illustrates the data trends for TSS. Note that the inflow TSS is plotted against the scale on the right side of the exhibit while the outflow concentrations are plotted against the scale on the left side. Outflow TSS from all of the monitored Porta-PSTAs was typically lower than inflow concentrations during this period. There was no evident trend in the diel pattern of outflow TSS concentrations for any of the tanks.

Exhibit D.3-4 illustrates the data trends for TDP. Outflow TDP was similar for all of the monitored Porta-PSTAs and typically lower than in the inflow water. There was no consistent diel trend in TDP concentration evident during this 24-hour period.

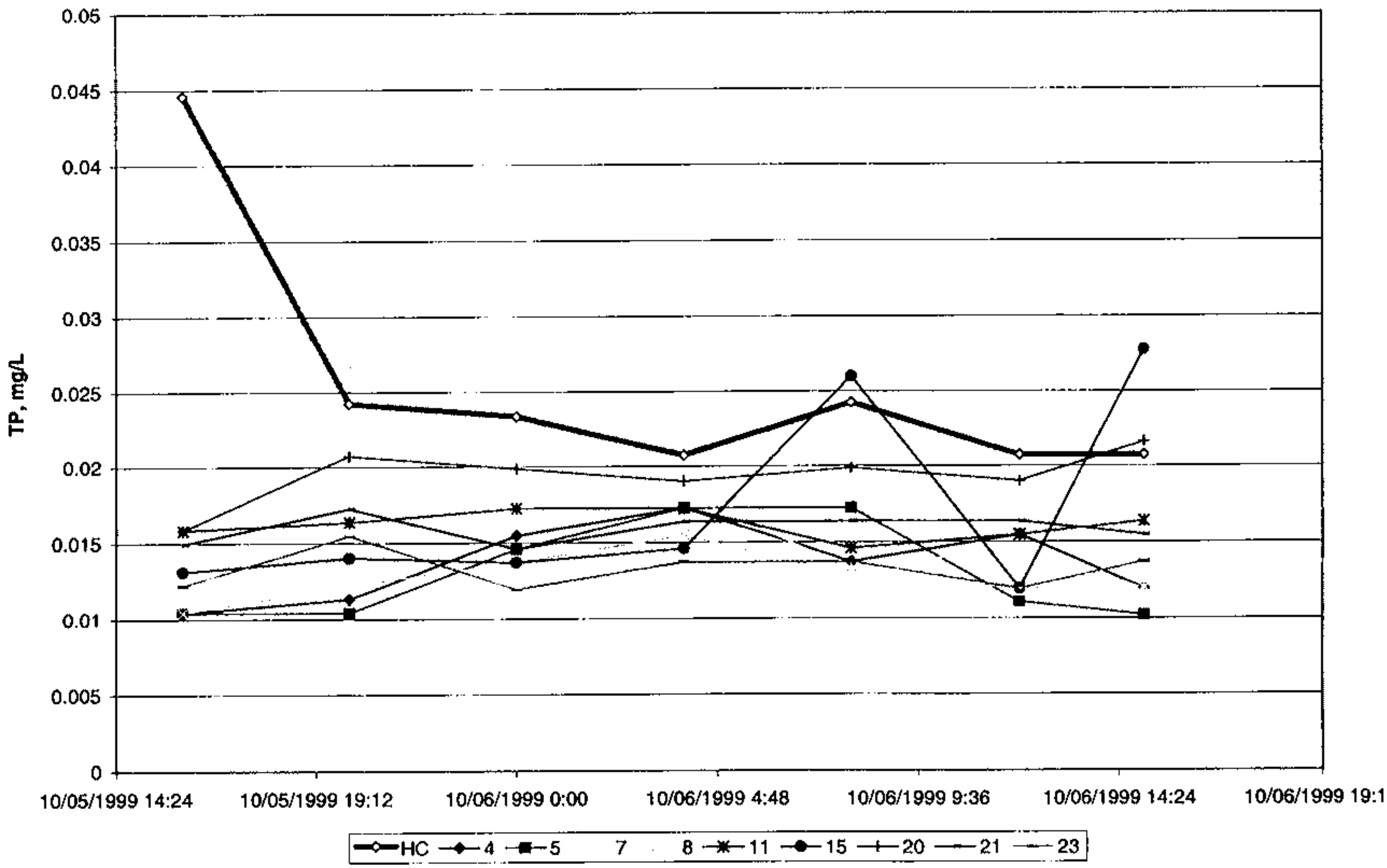


Exhibit D.3-1
Diel Record of TP in the Porta-PSTA Mesocosms on October 5-6, 1999

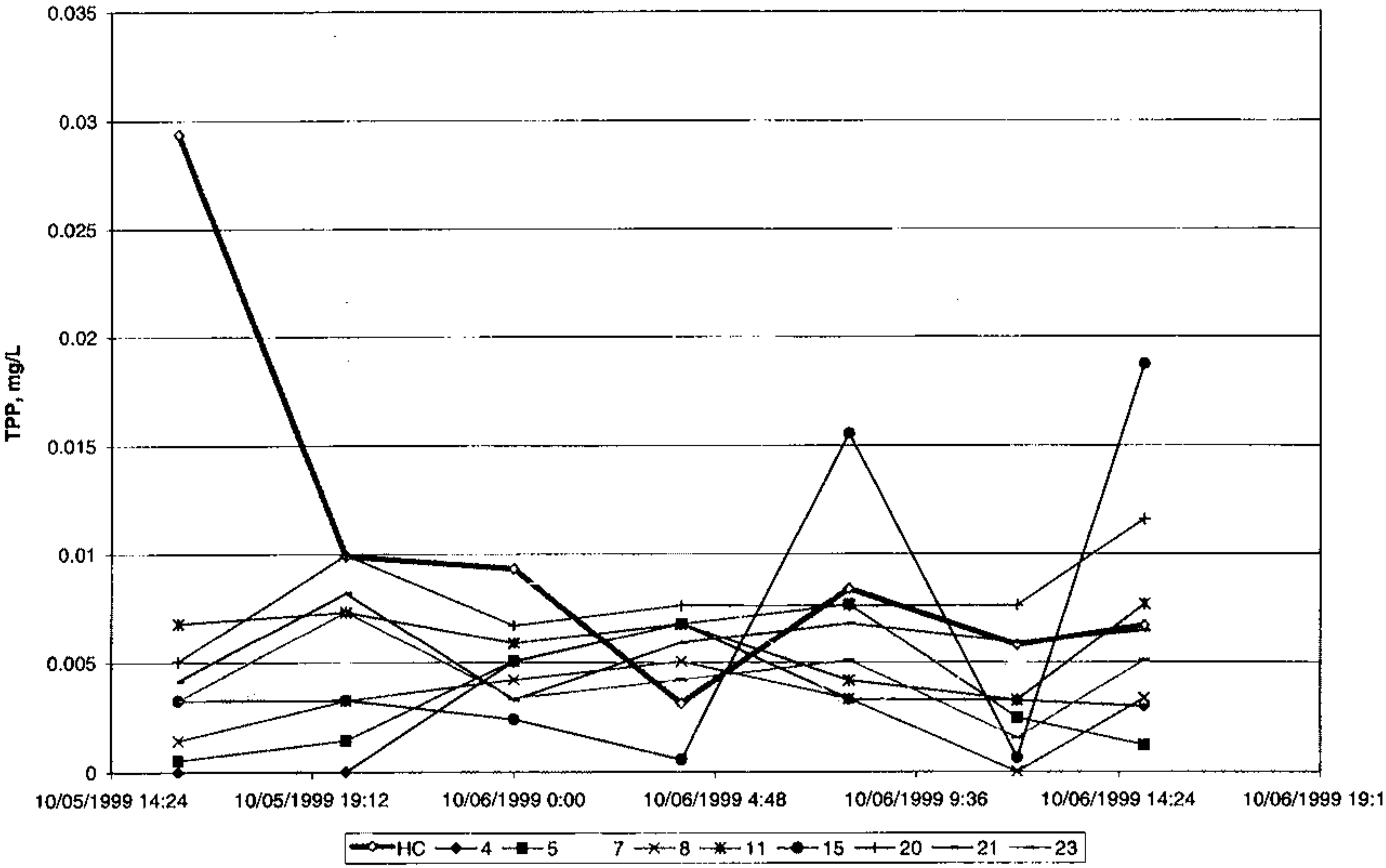


Exhibit D.3-2
Diel Record of TPP in the Porta-PSTA Mesocosms on October 5-6, 1999

DF

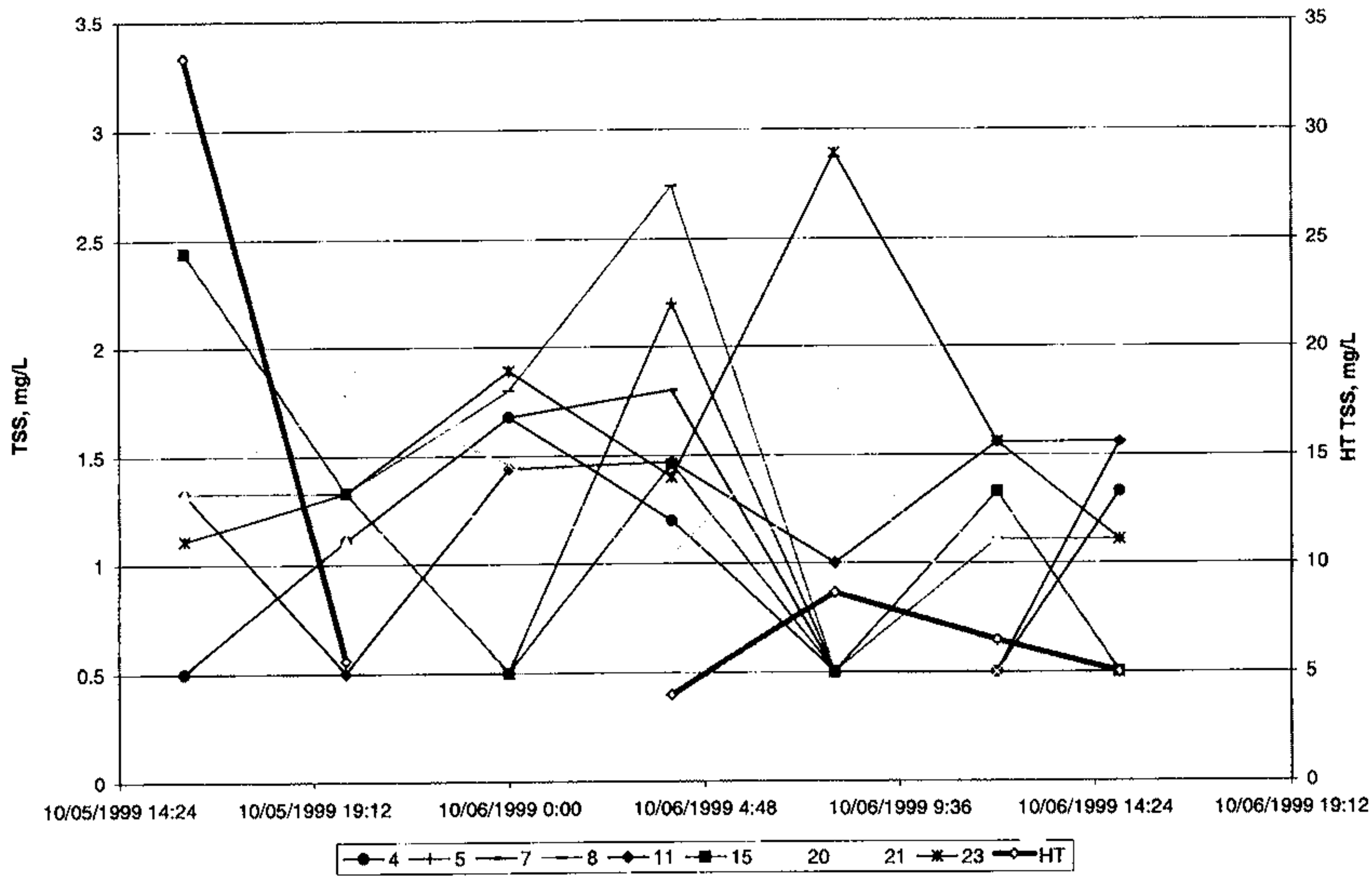


Exhibit D.3-3
Diel Record of TSS in the Porta-PSTA Mesocosms on October 5-6, 1999

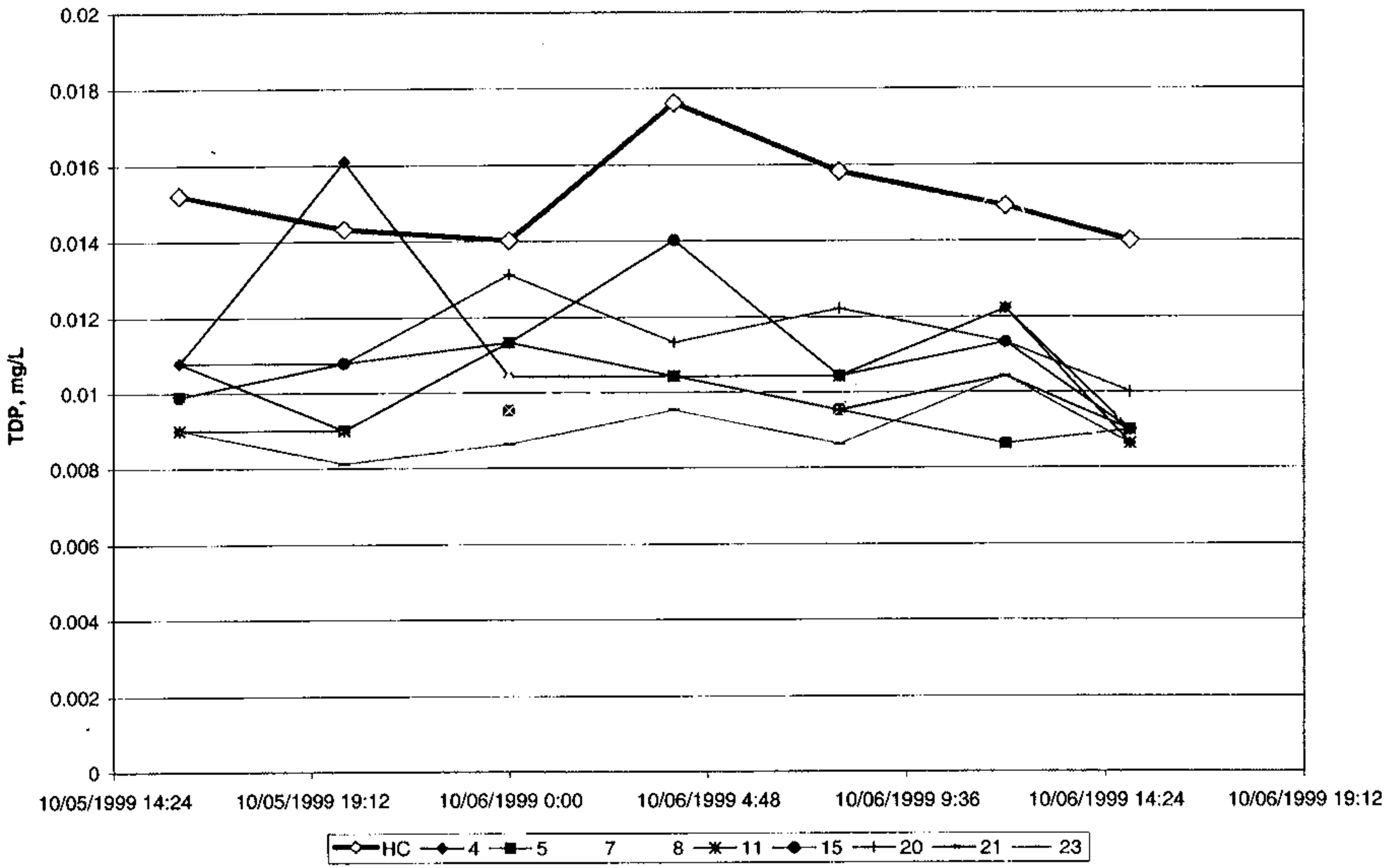


Exhibit D.3-4

Diel Record of TDP in the Porta-PSTA Mesocosms on October 5-6, 1999

Exhibit D.3-5 illustrates the data trends for DRP. Outflow DRP was similar for all of the monitored Porta-PSTAs and typically lower than in the inflow water. There was no consistent diel trend in DRP concentration evident during this 24-hour period.

D.3.2 Algal Samples

Porta-PSTA outflow samples averaged 1.9 μg/L of corrected chlorophyll *a* at midnight and 1.8 μg/L at noon. There was no consistent trend related to sampling time. The exported algal cell counts from the shellrock deep treatment (Tanks 4, 7, and 8) and the peat treatment (Tank 11) were dominated by blue-greens (64 to 80 percent). The exported algal cells from the sand tank were between 46 and 64 percent blue-greens and 29 to 43 greens. The Aquashade control tank exported greens and diatoms during the midnight sampling event and primarily blue-green algae in the daytime sample.

Exported algal biovolume from all tanks was dominated by diatoms and to a lesser extent by greens and euglenoids. As illustrated in Exhibit D.3-6, exported algal biovolume did not show a diel pattern, even for treatment replicates (Tanks 4, 7, and 8).

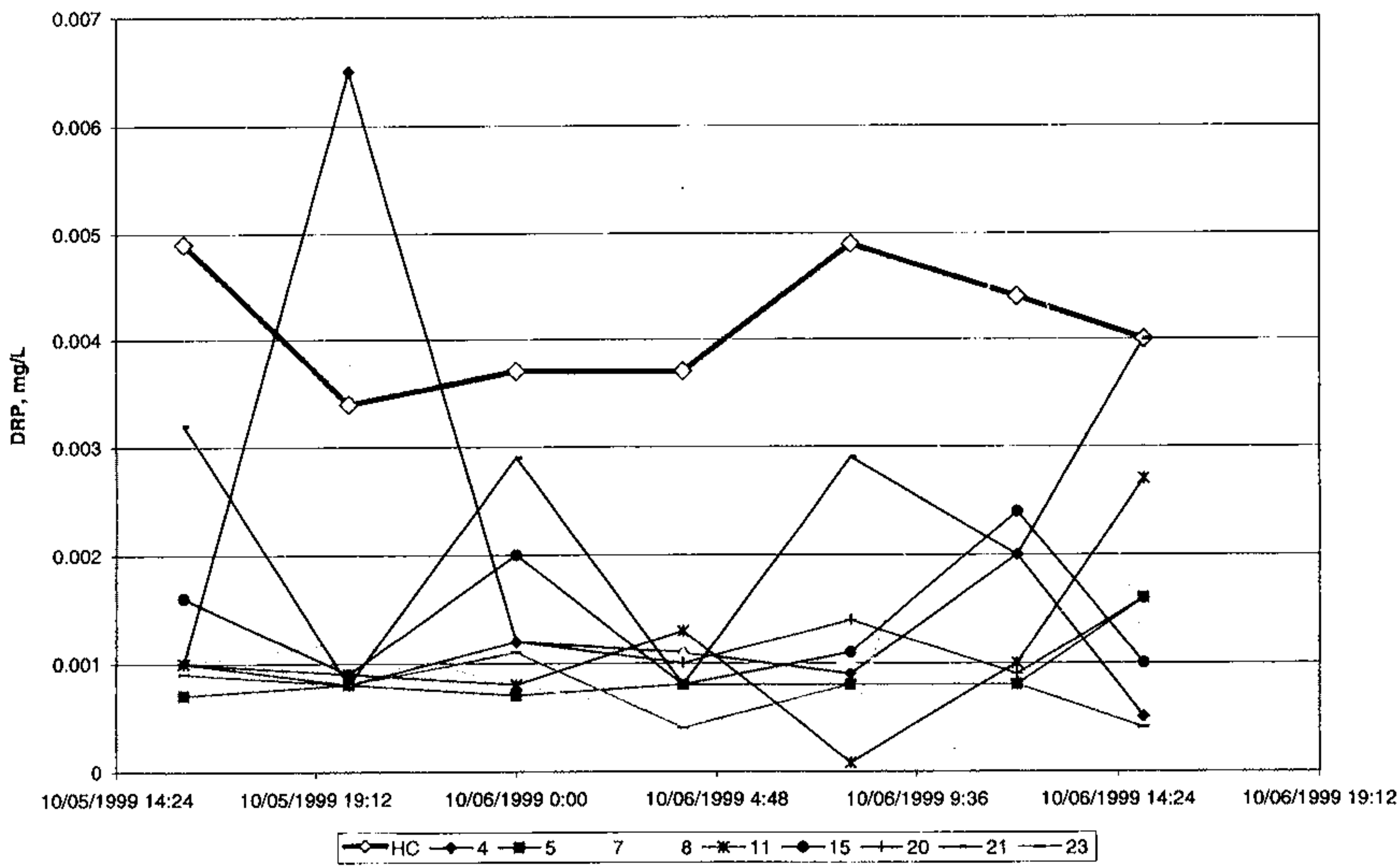


Exhibit D.3-5
Diel Record of DRP in the Porta-PSTA Mesocosms on October 5-6, 1999

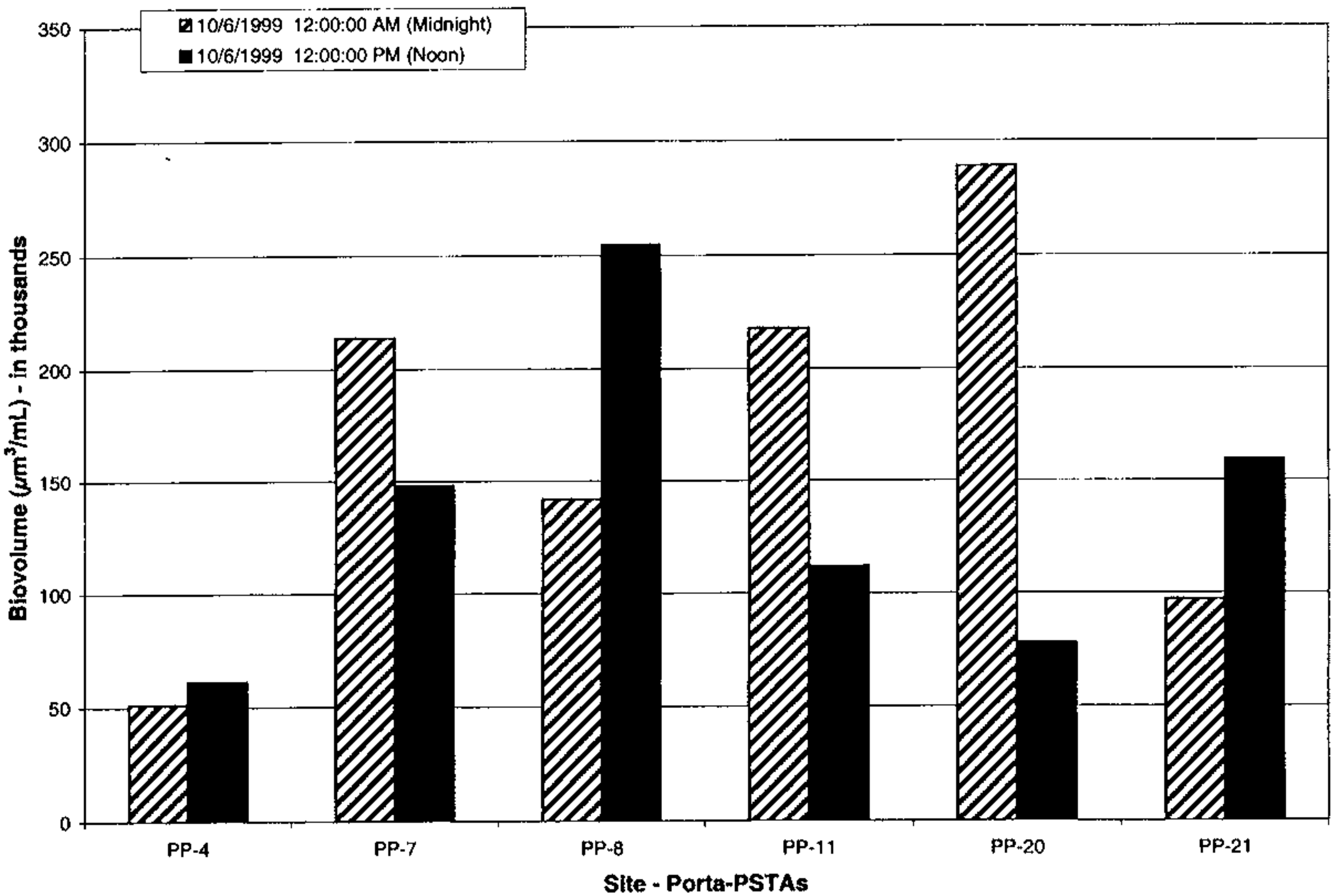


Exhibit D.3-6
Diel Record of Algal Biovolume in the Porta-PSTA Mesocosms on October 5-6, 1999

APPENDIX D.4

Batch Study Data Summary

APPENDIX D.4

Batch Treatments

D.4.1 Batch Treatments

STC 1 (Test Cell 13) and three Porta-PSTA treatments (1, 2 and 8) were converted to batch systems in January 2000. Inflows to the batch systems were stopped for the 3-month testing period, ending in March 2000. Recirculation pumps were installed at the batch Porta-PSTA treatments, and ran continuously throughout the testing period. ENR Test Cell and Porta-PSTA experimental batch treatments are summarized in Exhibit D.4-1.

EXHIBIT D.4-1
ENR Test Cell and Porta-PSTA Batch Treatment Combinations, January 2000 – March 2000

Treatment	Substrate	Periphyton	Macrophytes	Water Depth (cm)	HLR (cm/d)	Width (m)	Tank/ Cell #
ENR Test Cell							
1b	Peat	Yes	Yes	30	0	1	13
Porta-PSTA							
1b-a	Peat	Yes	Yes	30	0	1	9
1b-b	Peat	Yes	Yes	30	0	1	11
1b-c	Peat	Yes	Yes	30	0	1	18
2b-a	Shellrock	Yes	Yes	30	0	1	7
2b-b	Shellrock	Yes	Yes	30	0	1	4
2b-c	Shellrock	Yes	Yes	30	0	1	8
8b	Sand	Yes	Yes	30	0	1	20

D.4.2 Field Parameters

Field parameters (water temperature, pH, DO, percent saturation, salinity, TDS, and specific conductance) were measured weekly. Diel monthly records were taken using a recording data sonde unit, routinely rotated between the mesocosms and test cells.

Exhibit D.4-2 summarizes the field parameter data as monthly averages available for each batch treatment.

EXHIBIT D.4-2
Monthly Averages of Field Measurements Collected from the ENR Test Cell and Porta-PSTA Batch Treatments, January 2000–March 2000

Parameter	Month	Treatment ENR Test Cells 1b (Test Cell 13)	Porta-PSTA 1b (Peat)	2b (Shellrock)	8b (Sand)
Water Temp (°C)	Jan-00	16.46	17.66	16.40	17.96
	Feb-00	19.21	19.46	19.78	20.64
	Mar-00	20.32	22.16	22.40	23.13
pH (units)	Jan-00	7.65	7.88	7.93	7.76
	Feb-00	8.06	7.87	8.32	8.05
	Mar-00	7.67	7.60	8.58	8.44
Conductivity (μmhos/cm)	Jan-00	1,041	983	908	963
	Feb-00	1,007	1023	887	968
	Mar-00	1,082	1150	980	1046
Salinity (ppt)	Jan-00	0.55	0.51	0.47	0.50
	Feb-00	0.53	0.54	0.46	0.51
	Mar-00	0.57	0.61	0.51	--
Total Dissolved Solids (g/L)	Jan-00	0.666	0.629	0.581	0.616
	Feb-00	0.645	0.655	0.568	0.619
	Mar-00	0.697	0.736	0.627	0.678
Dissolved Oxygen Saturation (%)	Jan-00	39.1	87.5	118.6	109.4
	Feb-00	63.6	93.7	123.8	101.5
	Mar-00	42.2	76.2	113.7	92.7
Dissolved Oxygen (mg/L)	Jan-00	3.83	8.40	11.63	10.33
	Feb-00	5.74	8.41	11.28	8.72
	Mar-00	3.77	6.58	9.80	8.03

D.4.3 Water Quality Data

Water quality samples were collected both weekly and monthly within the batch Porta-PSTAs and Test Cells. Monthly average values for water quality data collected from the batch systems are presented in Exhibit D.4-3.

D.4.4 Sediments

In March 2000, pre-existing and newly deposited soils within the Porta-PSTAs and Test Cells were cored at a randomly selected location and analyzed from the depth increment 0 to 10 cm. Sub-samples from each of the cores were analyzed, and key parameter analyses are summarized in Exhibit D.4-4. This monitoring was only performed at the end of the batch experiments to minimize disturbance to the systems.

Exhibit D.4-3

Monthly Average Values of Water Quality Data Collected for ENR Test Cell and Porta-PSTA Batch Treatments, January 2000 to March 2000

		ENR Test Cell Treatment		Porta-PSTA Treatments								
		1b (Test Cell 13) (Peat)		1b (Peat)			2b (Shellrock)			8b (Sand)		
Parameter	Month	Upstream	Downstream	Upstream	Center	Downstream	Upstream	Center	Downstream	Upstream	Center	Downstream
Total Phosphorus as P (mg/L)	Jan-00	0.017	0.016	0.012	--	--	0.011	--	--	0.015	--	--
	Feb-00	0.023	0.023	0.014	--	0.014	0.014	--	--	0.019	--	0.018
	Mar-00	0.023	0.026	0.014	0.015	0.015	0.018	0.017	0.016	0.016	0.014	0.016
Total Particulate Phosphorus (mg/L)	Jan-00	0.007	0.007	0.004	--	--	0.004	--	--	0.005	--	--
	Feb-00	0.014	0.012	0.006	--	0.006	0.005	--	0.005	0.006	--	0.007
	Mar-00	0.013	0.014	0.004	0.004	0.005	0.008	0.007	0.005	0.003	0.003	0.004
Total Dissolved Phosphorus (mg/L)	Jan-00	0.009	0.009	0.008	--	--	0.008	--	--	0.010	--	--
	Feb-00	0.010	0.011	0.009	--	0.009	0.008	--	0.008	0.013	--	0.011
	Mar-00	0.010	0.012	0.010	0.011	0.010	0.010	0.011	0.011	0.013	0.011	0.012
Total Nitrogen as N (mg/L)	Jan-00	1.67	2.02	--	1.80	--	--	1.84	--	--	1.72	--
	Feb-00	2.02	--	--	1.97	--	--	2.34	--	--	1.94	--
	Mar-00	2.49	2.22	2.46	2.41	2.36	3.31	3.28	3.26	2.47	2.49	2.36
Total Kjeldahl Nitrogen, as N (mg/L)	Jan-00	1.66	2.02	--	1.80	--	--	1.84	--	--	1.72	--
	Feb-00	1.95	--	--	1.97	--	--	2.34	--	--	1.94	--
	Mar-00	2.49	2.22	2.46	2.41	2.36	3.31	3.28	3.26	2.47	2.49	2.36
Nitrate/Nitrite, as N (mg/L)	Jan-00	0.08	0.002	--	0.002	--	--	--	--	--	--	--
	Feb-00	0.07	--	--	0.002	--	--	--	--	--	--	--
	Mar-00	0.00	0.002	0.002	0.002	0.002	--	--	--	--	--	--
Ammonia, as NH_3 (mg/L)	Jan-00	0.01	--	--	--	--	--	0.002	--	--	0.002	--
	Feb-00	0.10	--	--	--	--	--	0.002	--	--	0.002	--
	Mar-00	0.11	--	--	--	--	0.002	0.002	0.003	0.002	0.002	0.002
TOC (mg/L)	Jan-00	34.67	34.00	--	40.33	--	--	31.67	--	--	30.00	--
	Feb-00	33.05	--	--	38.07	--	--	33.00	--	--	31.60	--
	Mar-00	42.20	38.20	39.72	39.10	40.87	45.43	44.37	47.00	34.30	33.00	34.20
TSS (mg/L)	Jan-00	1.88	--	--	1.10	--	--	1.47	--	--	1.20	--
	Feb-00	2.30	--	--	3.27	--	--	1.80	--	--	2.20	--
	Mar-00	0.50	1.60	1.80	1.87	2.07	2.93	2.73	2.80	1.40	1.00	0.50
Calcium (mg/L)	Jan-00	54.38	--	--	56.50	--	--	44.00	--	--	51.00	--
	Feb-00	66.00	--	--	52.67	--	--	26.67	--	--	43.00	--
	Mar-00	34.00	51.00	48.33	48.67	48.67	23.67	23.67	24.00	34.00	34.00	34.00
Alkalinity (mg/L)	Jan-00	215.00	--	--	210	--	--	170	--	--	200	--
	Feb-00	260.00	--	--	197	--	--	110	--	--	150	--
	Mar-00	180.00	140.00	190	190	190	100	99	101	150	150	150

EXHIBIT D.4-4
Sediment Data from the ENR Test Cell and Porta-PSTA Batch Treatments, March 2000

Treatment	Density (g/cm^3)	Solids (%)	Bulk Den (g/cm^3)	TP (mg/kg)	TIP (mg/kg)
ENR Test Cell 13					
1b	1.35	43.00	0.58	--	--
Porta-PSTAs					
1b	1.18	17.00	0.20	221.9	167.0
2b	1.97	75.67	1.49	970.6	1030.9
8b	2.00	83.00	1.66	16.7	8.5

Note: Sediment sampling was done at the end of the batch experiments to reduce disturbance to the cells.

D.4.5 Biological Analyses

Algal and macrophytic plant communities are being monitored in the Porta-PSTAs and the Test Cells. Measured parameters include percent cover, macrophyte stem counts, biomass, species composition, algal cell counts and biovolumes, chlorophyll, and nutrient content with an emphasis on phosphorus. In addition to these population-level studies, ecosystem-level response is being estimated using DO dynamics as an indicator of community metabolism.

D.4.5.1 Plant Cover and Macrophyte Stem Counts

Plant cover in the Porta-PSTAs and Test Cells is estimated visually on a monthly basis. The method is the same as described in Appendix A.2. Exhibit D.4-5 summarizes the plant cover estimates for the batch treatments.

D.4.5.2 Periphyton Community

In March 2000, periphyton cores were collected from the batch systems. This monitoring was only performed at the end of the batch experiments to minimize disturbance to the systems. The methods for sampling are the same as those described in Appendix A.2. It is difficult to sample the benthic algae without incorporating an unwanted and unquantified amount of soil in the samples. All periphyton data must be evaluated with this sampling difficulty in mind. All biomass samples include a component of soil; however, the nature of this soil is very different between the shellrock, peat, and sand treatments. Exhibit D.4-6 summarizes periphyton sample data for the batch treatments.

D.4.6 Ecosystem Metabolism

Exhibits D.4-7 and D.4-8 summarize the ecosystem metabolism estimates and PAR extinction data for the batch treatments.

Exhibit D.4-5

Period-of-Record and Monthly Summaries of Algae and Macrophyte Percent Cover Estimates from the ENR Test Cell and Porta-PSTA Batch Treatments, January 2000 - March 2000

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algal Mat % Cover	Macrophyte % Cover	Total % Cover	No. Stems/ m²
ENR Test Cell 13										
Period of Record	1999- 2000	26%	0%	51%	0%	86%	26%	138%	163%	--
Monthly										
1b	Jan-2000	24%	0%	46%	0%	92%	24%	138%	162%	--
	Feb-2000	21%	0%	54%	0%	76%	21%	130%	151%	--
	Mar-2000	33%	0%	54%	0%	91%	33%	145%	177%	--
Porta-PSTAs										
Period of Record										
1b	1999 - 2000	5%	0%	16%	0%	20%	5%	36%	41%	156.85
2b	1999 - 2000	2%	0%	2%	0%	24%	2%	25%	27%	12.22
8b	1999 - 2000	0%	0%	2%	0%	0%	0%	2%	2%	7.33
Monthly										
1b	Jan-2000	1%	0%	23%	0%	18%	1%	41%	43%	103.89
	Feb-2000	4%	0%	12%	0%	18%	4%	30%	34%	269.28
	Mar-2000	11%	0%	13%	0%	23%	11%	37%	47%	97.39
2b	Jan-2000	2%	0%	2%	0%	23%	2%	24%	26%	10.78
	Feb-2000	2%	0%	2%	0%	24%	2%	26%	28%	10.33
	Mar-2000	1%	0%	2%	0%	24%	1%	25%	27%	15.56
8b	Jan-2000	0%	0%	1%	0%	0%	0%	1%	1%	5.33
	Feb-2000	1%	0%	1%	0%	0%	1%	1%	2%	6.67
	Mar-2000	0%	0%	3%	0%	0%	0%	3%	3%	10.00

Exhibit D.4-6
Periphyton Data from the ENR Test Cell and Porta-PSTA Batch Treatments, March 200(

Treatment	Periphyton Biomass (g/m^2) Dry Wt	Ash Wt	AFDW	Ca (g/m^2)	Chl_a (corr) (mg/m^2)	Pheo_a (mg/m^2)	TP (g/m^2)	TIP (g/m^2)	Blue Green Algae (# cells/m^2)*10^6	(# taxa)	Diatoms (# cells/m^2)*10^6	(# taxa)	Green Algae (# cells/m^2)*10^6	(# taxa)	Other Taxa (# cells/m^2)*10^6	(# taxa)	Total Taxa (# cells/m^2)*10^6	(# taxa)	Biovolume (cm^3/m^2)	Evenness	SWDI
ENR Test Cell 13																					
1b	1113.0	783 7	329.3	190.1	235.5	32.4	0.491	0.227	372,916	12.5	2,751	4 0	2,847	2.0	0.0	0.0	2,787,974	16.5	14.77	0.717	3.02
Porta-PSTAs																					
1b	1314.5	1957 1	642.6	152.6	68 2	49.4	0.768	0.330	36,042	11.0	3,610	14.7	527	4.0	0.0	0.0	42,179	29.7	16.50	0 719	3.49
2b	271.5	331.7	60.2	95.0	96.6	0 0	0.324	0.126	328,127	17 0	6,815	10.0	3,208	2.7	0 0	0 0	336,150	29.7	14.69	0.715	3.49
8b	465.1	563.0	118.0	151.2	75.9	0 6	0.206	0.009	1,045,874	13.0	5,489	5.0	6,098	3.0	0 0	0.0	1,057,462	21.0	17.79	0.715	3.14

Note: Periphyton sampling was done at the end of the batch experiments to reduce disturbance to the cells.
SWDI = Shannon-Weaver Diversity Index

Exhibit D.4-7

Period-of-Record and Monthly Summaries of Ecosystem Metabolism Data from the ENR Test Cell and Porta-PSTA Batch Treatments, Janury 2000 - March 2000

Treatment	Date	NPP(day) g/m²/d	GPP(day) g/m²/d	CR(24hr) g/m²/d	CM(24hr) g/m²/d	NPP(24hr) g/m²/d	Avg Night Res g/m²/hr	PAR(24hr) E/m²/d	Efficiency %
ENR Test Cell 13									
Period of Record	1999- 2000	0.091	2.311	3.277	2.311	-0.967	0.137	26.7	1.653
Monthly									
1b	Jan-2000	-1.126	0.380	1.970	0.380	-1.591	0.082	21.9	0.331
	Feb-2000	1.532	5.120	5.604	5.120	-0.484	0.233	27.2	3.602
	Mar-2000	-0.663	0.072	0.912	0.072	-0.841	0.038	34.3	0.040
Porta-PSTAs									
Period of Record									
1b	1999 - 2000	0.833	2.086	2.269	2.086	-0.184	0.095	25.4	1.569
2b	1999 - 2000	1.425	2.385	1.726	2.385	0.659	0.072	28.2	1.616
8b	1999 - 2000	0.068	0.501	0.447	0.501	0.054	0.019	26.7	0.360
Monthly									
1b	Jan-2000	0.895	1.866	1.924	1.866	-0.059	0.080	22.4	1.593
	Feb-2000	0.890	2.267	2.394	2.267	-0.128	0.100	26.5	1.637
	Mar-2000	0.009	1.954	3.335	1.954	-1.381	0.139	35.1	1.066
2b	Jan-2000	1.375	1.941	1.180	1.941	0.761	0.049	21.4	1.731
	Feb-2000	1.436	2.362	1.623	2.362	0.739	0.068	29.1	1.551
	Mar-2000	1.470	2.980	2.589	2.980	0.391	0.108	35.1	1.623
8b	Jan-2000	0.579	0.883	0.583	0.883	0.300	0.024	20.2	0.838
	Feb-2000	-0.443	0.119	0.311	0.119	-0.192	0.013	33.2	0.069
	Mar-2000	--	--	--	--	--	--	--	--

EXHIBIT D.4-8
Period-of-Record and Monthly Summaries of PAR Extinction Measurements from the ENR Test Cell and Porta-PSTA Batch Treatments, January 2000 - March 2000

Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$)		Z (m)	Ext Coeff (m^{-1})
			Surface	Bottom		
ENR Test Cell 13						
Period of Record						
1b	1999- 2000	0.48	529.8	37.5	0.36	11.06
Monthly						
1b	Jan-2000	0.62	511.5	14.9	0.49	9.12
	Feb-2000	0.58	848.1	53.6	0.45	8.09
	Mar-2000	0.24	229.8	43.9	0.12	15.97
Porta-PSTAs						
Period of Record						
1	1999 - 2000	0.58	1191.1	210.4	0.46	4.33
2	1999 - 2000	0.56	1449.9	603.5	0.44	2.47
8	1999 - 2000	0.59	1584.3	506.3	0.47	2.66
Monthly						
1	Jan-2000	0.63	1289.7	336.6	0.51	3.19
	Feb-2000	0.57	871.3	91.4	0.45	5.03
	Mar-2000	0.53	1412.5	203.1	0.41	4.78
2	Jan-2000	0.61	1573.7	707.0	0.49	1.64
	Feb-2000	0.59	946.4	147.0	0.47	4.00
	Mar-2000	0.50	1829.5	956.6	0.37	1.78
8	Jan-2000	0.67	1733.0	763.5	0.55	1.49
	Feb-2000	0.59	1259.5	303.9	0.47	3.01
	Mar-2000	0.51	1760.5	451.4	0.39	3.49

APPENDIX E

Field-Scale PSTAs

APPENDIX E.1

Detailed Data

EXHIBIT E.1-1

Water Balances for the Field-Scale Cells, August 2001 - September 2002

		Rainfall		ET		Inflow		Outflow		ChngStor	Residual		
Treatment	**Month**	**(in)**	**(m^3)**	**(mm)**	**(m^3)**	**(m^3/d)**	**(m^3)**	**(m^3/d)**	**(m^3)**	**(m^3)**	**(m^3)**	**(% inflow)**	**(cm/d)**
FSC-1	Aug-01	4.65	2,390	132	2,666	1,469	45,540	1,304	40,423	-1,732	6,573	13.71	1.05
	Sep-01	14.57	7,488	100	2,031	843	25,300	178	5,353	-2,734	28,139	85.82	4.64
	Oct-01	4.11	2,112	94	1,910	1,387	43,010	565	17,514	-786	26,484	58.69	4.22
	Nov-01	1.48	761	86	1,735	425	12,738	89	2,664	-1,126	10,225	75.74	1.68
	Dec-01	2.49	1,280	75	1,524	657	20,380	48	1,503	1,388	17,246	79.62	2.75
	Jan-02	0.53	272	87	1,753	2,259	70,025	793	24,596	3,320	40,629	57.80	6.48
	Feb-02	4.78	2,457	65	1,305	2,651	74,236	1,312	36,737	565	38,086	49.66	6.72
	Mar-02	0.48	247	136	2,746	2,223	68,917	963	29,838	-360	36,940	53.41	5.89
	Apr-02	1.98	1,018	150	3,044	1,882	56,464	667	20,014	-2,477	36,901	64.20	6.08
	May-02	2.24	1,151	164	3,317	2	72	0	0	-6,606	4,513	368.92	0.72
	Jun-02	12.39	6,368	107	2,156	0	0	0	0	917	3,295	51.75	0.54
	Jul-02	11.18	5,746	139	2,816	783	24,280	103	3,194	8,322	15,694	52.27	2.50
	Aug-02	5.53	2,842	111	2,254	1,801	55,846	569	17,644	-298	39,088	66.60	6.23
	Sep-02	5.29	2,719	88	1,783	2,530	75,912	1,143	34,288	-103	42,662	54.26	7.03
FSC-2	Aug-01	4.65	2,390	132	2,666	1,088	33,730	46	1,413	1,208	30,833	85	5
	Sep-01	14.57	7,488	100	2,031	1,687	50,595	796	23,884	1,753	30,416	52	5
	Oct-01	4.11	2,112	94	1,910	3,373	104,563	1,802	55,874	-401	49,292	46	8
	Nov-01	1.48	761	86	1,735	2,195	65,858	863	25,904	-5,032	44,011	66	7
	Dec-01	2.49	1,280	75	1,524	2,357	73,064	712	22,076	5,494	45,250	61	7
	Jan-02	0.53	272	87	1,753	2,239	69,395	786	24,374	-827	44,368	64	7
	Feb-02	4.78	2,457	65	1,305	2,923	81,844	1,009	28,264	206	54,526	65	10
	Mar-02	0.48	247	136	2,746	3,041	94,260	1,152	35,700	164	55,896	59	9
	Apr-02	1.98	1,018	150	3,044	2,828	84,838	1,245	37,352	-2,374	47,834	56	8
	May-02	2.24	1,151	164	3,317	0	3	0	0	-6,505	4,342	376	1
	Jun-02	12.39	6,368	107	2,156	0	0	0	0	769	3,443	54	1
	Jul-02	11.18	5,746	139	2,816	543	16,818	138	4,269	8,077	7,401	33	1
	Aug-02	5.53	2,842	111	2,254	2,045	63,387	1,025	31,778	545	31,653	48	5
	Sep-02	5.29	2,719	88	1,783	3,460	103,792	1,950	58,489	62	46,176	43	8
FSC-3	Aug-01	4.65	2,390	132	2,666	1,915	59,371	2,285	70,834	-2,215	-9,524	-15	-2
	Sep-01	14.57	7,488	100	2,031	1,771	53,122	1,992	59,773	1,367	-2,561	-4	0
	Oct-01	4.11	2,112	94	1,910	2,218	68,746	2,550	79,056	-41	-10,067	-14	-2
	Nov-01	1.48	761	86	1,735	2,672	80,166	2,628	78,850	-2,539	2,881	4	0
	Dec-01	2.49	1,280	75	1,524	754	23,374	389	12,047	1,187	9,896	40	2
	Jan-02	0.53	272	87	1,753	717	22,226	436	13,504	57	7,186	32	1
	Feb-02	4.78	2,457	65	1,305	2,135	59,784	1,754	49,100	483	11,353	18	2
	Mar-02	0.48	247	136	2,746	1,674	51,887	1,622	50,280	-1,568	676	1	0
	Apr-02	1.98	1,018	150	3,044	2,535	76,049	1,540	46,207	41	27,774	36	5
	May-02	2.24	1,151	164	3,317	0	0	0	15	-5,967	3,786	329	1
	Jun-02	12.39	6,368	107	2,156	0	0	99	2,983	5,938	-4,709	-74	-1
	Jul-02	11.18	5,746	139	2,816	1,236	38,330	670	20,777	863	19,618	45	3
	Aug-02	5.53	2,842	111	2,254	1,690	52,376	1,921	59,553	848	-7,437	-13	-1
	Sep-02	5.29	2,719	88	1,783	2,284	68,514	2,390	71,699	427	-2,676	-4	0
FSC-4	Aug-01	4.65	2,390	132	2,666	0	0	0	0	-1,638	1,362	57	0
	Sep-01	14.57	7,488	100	2,031	1,224	36,720	31	928	7,110	34,139	77	6
	Oct-01	4.11	2,112	94	1,910	1,812	56,160	0	0	-3,037	59,399	102	9
	Nov-01	1.48	761	86	1,735	1,155	34,649	0	0	-2,948	36,623	103	6
	Dec-01	2.49	1,280	75	1,524	2,708	83,941	1,029	31,896	8,884	42,916	50	7
	Jan-02	0.53	272	87	1,753	2,866	88,857	968	30,020	-4,163	61,520	69	10
	Feb-02	4.78	2,457	65	1,305	2,902	81,243	605	16,932	2,678	62,785	75	11
	Mar-02	0.48	247	136	2,746	2,671	82,793	262	8,123	242	71,930	87	11
	Apr-02	1.98	1,018	150	3,044	2,522	75,666	583	17,505	-6,620	62,755	82	10
	May-02	2.24	1,151	164	3,317	0	0	0	0	-2,217	52	4	0
	Jun-02	12.39	6,368	107	2,156	0	0	0	0	1,034	3,178	50	1
	Jul-02	11.18	5,746	139	2,816	2	56	0	0	-769	3,755	65	1
	Aug-02	5.53	2,842	111	2,254	1,710	52,995	399	12,371	3,392	37,820	68	6
	Sep-02	5.29	2,719	88	1,783	1,841	55,227	138	4,142	5,211	46,809	81	8

Note:

ET estimated from July - September 2002

ET station updated quarterly in DBHYDRO

EXHIBIT E.1-2

Monthly Averages of Field Measurements Collected from the Field-Scale Cells, August 2001 - September 2002

CELL	Month	Water Temp (°C)	pH (units)	Conductivity (μmhos/cm)	Total Dissolved Solids (g/L)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen (mg/L)
FSC-1	Aug-01	31.24	8.22	894	0.57	99.84	7.34
	Sep-01	28.76	8.49	865	0.55	106.01	8.13
	Oct-01	25.97	8.34	1,038	0.66	110.39	8.90
	Nov-01	22.49	8.41	1,172	0.62	118.84	10.24
	Dec-01	20.21	8.24	1,287	0.82	111.44	10.03
	Jan-02	21.36	8.09	1,258	0.80	104.21	9.17
	Feb-02	21.78	8.11	1,233	0.79	103.37	9.00
	Mar-02	23.71	8.11	1,238	0.79	84.86	7.19
	Apr-02	26.35	8.32	1,371	0.88	127.22	10.17
	May-02	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--
	Jul-02	31.28	8.37	1,164	0.74	114.64	8.35
	Aug-02	29.84	8.42	1,186	0.76	121.68	9.19
	Sep-02	29.69	8.40	1,079	0.69	120.18	9.09
FSC-2	Aug-01	28.42	7.76	958	0.61	51.60	4.03
	Sep-01	25.96	7.91	1,089	0.70	93.70	7.58
	Oct-01	26.93	7.99	1,153	0.74	111.52	8.80
	Nov-01	21.84	8.10	1,559	1.00	119.69	10.32
	Dec-01	21.03	7.77	1,501	0.96	77.61	7.01
	Jan-02	19.60	8.11	1,167	0.75	147.39	13.92
	Feb-02	21.11	8.06	1,196	0.77	115.80	10.24
	Mar-02	24.96	8.15	1,265	0.81	101.35	8.35
	Apr-02	26.83	8.18	1,341	0.86	119.72	9.53
	May-02	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--
	Jul-02	31.26	8.09	1,222	0.78	88.70	6.46
	Aug-02	29.58	8.17	1,251	0.80	80.56	6.11
	Sep-02	29.89	8.04	1,159	0.73	98.33	7.44
	Oct-02	28.63	7.77		0.51	89.54	6.83
FSC-3	Aug-01	29.58	7.87	732	0.47	95.35	7.23
	Sep-01	29.24	8.09	970	0.62	95.81	7.29
	Oct-01	24.95	7.77	1,127	0.72	81.06	6.70
	Nov-01	21.96	7.98	1,303	0.83	95.72	8.31
	Dec-01	21.07	7.95	1,452	0.93	82.01	7.35
	Jan-02	23.66	8.22	1,200	0.77	101.11	8.49
	Feb-02	20.97	8.20	1,196	0.77	99.76	8.86
	Mar-02	24.83	8.19	1,258	0.81	106.11	8.76
	Apr-02	26.12	8.22	1,317	0.84	86.97	7.00
	May-02	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--
	Jul-02	31.54	8.35	939	0.60	102.20	7.45
	Aug-02	30.08	8.11	1,216	0.78	99.63	7.46
	Sep-02	30.23	8.07	1,135	0.73	108.66	8.09
FSC-4	Sep-01	27.35	7.53	965	0.62	59.74	4.64
	Oct-01	26.49	7.63	1,101	0.70	68.26	5.33
	Nov-01	21.90	7.60	1,245	0.78	71.88	6.13
	Dec-01	24.21	7.76	1,348	0.87	72.56	6.03
	Jan-02	23.96	7.58	1,345	0.86	52.10	4.29
	Feb-02	21.69	7.80	1,270	0.81	76.24	6.63
	Mar-02	23.70	7.85	1,260	0.81	85.88	7.21
	Apr-02	26.45	7.76	1,319	0.84	74.52	5.82
	May-02	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--
	Jul-02	29.53	7.70	1,111	0.71	108.10	8.22
	Aug-02	29.05	7.84	1,250	0.80	66.05	5.06
	Sep-02	29.34	7.99	1,063	0.69	63.76	4.96
Inflow Canal	Aug-01	28.43	7.40	938	0.60	44.98	3.52
	Sep-01	28.84	7.62	1,036	0.66	54.68	4.22
	Oct-01	25.15	7.64	1,189	0.76	66.57	5.50
	Nov-01	21.90	7.78	1,334	0.86	87.54	7.63
	Dec-01	21.43	7.74	1,537	0.99	73.70	6.59
	Jan-02	20.54	7.66	1,299	0.83	70.14	6.40
	Feb-02	19.96	7.77	1,299	0.84	78.40	7.10
	Mar-02	23.15	8.00	1,308	0.84	84.93	7.36
	Apr-02	25.50	8.00	1,333	0.85	74.00	6.05
	May-02	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--
	Jul-02	30.30	7.95	1,253	0.80	62.43	4.84
	Aug-02	30.05	7.97	1,297	0.83	77.91	5.92
	Sep-02	29.17	7.99	1,138	0.73	67.81	4.98

Note:
Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-3

Monthly Averages of Phosphorus Data Collected at the Field-Scale Cells, August 2001 - September 2002

		TP (mg/L)				TDP (mg/L)				SRP (mg/L)				TPP (mg/L)				DOP (mg/L)			
Treatment	**Month**	**InfCnl**	**Inflow**	**stn_1/2**	**Outflow**	**InfCnl**	**Inflow**	**stn_1/2**	**Outflow**	**InfCnl**	**Inflow**	**stn_1/2**	**Outflow**	**InfCnl**	**Inflow**	**stn_1/2**	**Outflow**	**InfCnl**	**Inflow**	**stn_1/2**	**Outflow**
FSC-1	Aug-01	0.019	0.024	0.019	0.019	0.008	0.009	0.008	0.006	0.003	0.001	0.001	0.001	0.011	0.015	0.011	0.011	0.006	0.008	0.007	0.005
	Sep-01	0.021	---	---	0.021	0.008	---	---	0.008	0.003	---	---	0.003	0.014	---	---	0.019	0.006	---	---	0.006
	Oct-01	0.016	0.026	0.015	0.014	0.008	0.012	0.007	0.006	0.009	0.003	0.003	0.003	0.007	0.015	0.008	0.008	0.002	0.009	0.004	0.004
	Nov-01	0.013	0.017	---	0.020	0.007	0.007	---	0.008	0.002	0.001	---	0.002	0.007	0.010	---	0.015	0.005	0.006	---	0.006
	Dec-01	0.015	0.021	---	0.045	0.008	0.009	---	---	0.001	0.001	---	---	0.008	0.012	---	---	0.007	0.008	---	---
	Jan-02	0.013	0.022	0.017	0.018	0.006	0.008	0.007	0.006	0.002	0.001	0.001	0.001	0.007	0.014	0.010	0.012	0.004	0.007	0.006	0.005
	Feb-02	0.018	0.016	0.014	0.018	0.010	0.008	0.007	0.007	0.003	0.002	0.002	0.001	0.008	0.008	0.007	0.010	0.007	0.006	0.005	0.007
	Mar-02	0.038	0.025	---	0.017	0.011	0.010	---	0.007	0.004	0.007	---	0.004	0.027	0.015	---	0.010	0.008	0.003	---	0.004
	Apr-02	0.046	0.025	0.021	0.030	0.011	0.012	0.010	0.009	0.003	0.001	0.005	0.002	0.035	0.013	0.011	0.021	0.008	0.011	0.005	0.007
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.035	0.040	0.026	0.024	0.016	0.011	0.012	0.007	0.004	0.002	0.001	0.001	0.019	0.029	0.014	0.017	0.012	0.009	0.011	0.006
	Aug-02	0.027	0.040	0.016	0.019	0.009	0.007	0.006	0.007	0.006	0.002	0.004	0.004	0.018	0.033	0.010	0.012	0.005	0.005	0.002	0.004
	Sep-02	0.025	0.019	0.014	0.012	0.012	0.012	0.009	0.010	0.007	0.004	0.004	0.007	0.013	0.008	0.005	0.003	0.001	0.008	0.007	0.003
FSC-2	Sep-01	0.021	0.018	0.015	0.018	0.008	0.007	0.007	0.009	0.002	0.003	0.003	0.003	0.013	0.011	0.008	0.010	0.006	0.005	0.004	0.006
	Oct-01	0.015	0.026	0.014	0.012	0.007	0.009	0.008	0.013	0.006	0.003	0.003	0.002	0.007	0.017	0.006	0.004	0.003	0.006	0.005	0.012
	Nov-01	0.014	0.017	---	0.011	0.006	0.007	---	0.006	0.002	0.002	---	0.002	0.006	0.010	---	0.005	0.005	0.005	---	0.004
	Dec-01	0.016	0.020	0.017	0.022	0.009	0.009	0.009	0.014	0.002	0.002	0.001	0.002	0.007	0.011	0.008	0.010	0.008	0.007	0.008	0.012
	Jan-02	0.013	0.019	0.014	0.015	0.006	0.006	0.006	0.006	0.002	0.002	0.001	0.002	0.007	0.013	0.008	0.009	0.004	0.004	0.005	0.004
	Feb-02	0.018	0.019	0.012	0.014	0.010	0.008	0.008	0.007	0.003	0.003	0.001	0.002	0.008	0.011	0.004	0.008	0.007	0.005	0.007	0.005
	Mar-02	0.038	0.023	0.017	0.016	0.011	0.010	0.016	0.009	0.004	0.008	0.009	0.002	0.027	0.013	0.001	0.007	0.008	0.002	0.007	0.007
	Apr-02	0.046	0.028	0.017	0.019	0.011	0.014	0.012	0.010	0.003	0.010	0.003	0.006	0.035	0.014	0.005	0.008	0.008	0.004	0.009	0.005
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.035	0.030	0.021	0.019	0.016	0.013	0.009	0.009	0.004	0.003	0.001	0.001	0.019	0.017	0.012	0.010	0.012	0.010	0.008	0.008
	Aug-02	0.027	---	---	0.021	0.010	---	---	0.008	0.008	---	---	0.003	0.018	---	---	0.013	0.005	---	---	0.005
	Sep-02	0.025	0.019	0.012	0.010	0.012	0.011	0.010	0.013	0.007	0.001	0.005	0.002	0.013	0.008	0.003	0.001	0.001	0.010	0.006	0.010
FSC-3	Aug-01	0.019	0.021	0.017	0.015	0.008	0.009	0.008	0.007	0.003	0.002	0.001	0.002	0.011	0.012	0.009	0.009	0.006	0.007	0.007	0.005
	Sep-01	0.021	0.015	0.014	0.013	0.007	0.007	0.006	0.006	0.004	0.002	0.003	0.003	0.013	0.008	0.008	0.007	0.004	0.005	0.003	0.002
	Oct-01	0.015	0.018	0.011	0.013	0.007	0.007	0.006	0.006	0.006	0.003	0.002	0.002	0.007	0.011	0.005	0.007	0.003	0.004	0.004	0.004
	Nov-01	0.013	0.014	0.014	0.011	0.007	0.007	0.006	0.006	0.003	0.001	0.001	0.001	0.005	0.007	0.008	0.006	0.004	0.006	0.005	0.005
	Dec-01	0.016	0.025	0.018	0.016	0.009	0.008	0.007	0.008	0.002	0.001	0.001	0.002	0.007	0.017	0.011	0.008	0.008	0.007	0.006	0.008
	Jan-02	0.014	0.027	0.028	0.017	0.006	0.007	0.006	0.005	0.002	0.001	0.002	0.002	0.008	0.020	0.022	0.012	0.004	0.006	0.004	0.004
	Feb-02	0.018	0.015	0.014	0.014	0.010	0.008	0.006	0.007	0.003	0.002	0.003	0.002	0.008	0.007	0.008	0.008	0.007	0.006	0.004	0.005
	Mar-02	0.038	0.024	0.021	0.016	0.011	0.010	0.011	0.007	0.004	0.007	0.002	0.003	0.027	0.014	0.010	0.009	0.008	0.003	0.009	0.004
	Apr-02	0.046	0.032	0.025	0.022	0.011	0.009	0.010	0.010	0.003	0.002	0.007	0.006	0.035	0.023	0.015	0.012	0.008	0.007	0.003	0.006
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.029	0.022	0.015	0.020	0.015	0.007	0.008	0.008	0.006	0.001	0.002	0.003	0.014	0.015	0.007	0.012	0.010	0.006	0.006	0.006
	Aug-02	0.027	0.021	0.017	0.017	0.009	0.007	0.005	0.007	0.006	0.003	0.001	0.002	0.018	0.014	0.012	0.010	0.005	0.004	0.004	0.005
	Sep-02	0.025	0.017	0.015	0.013	0.012	0.008	0.011	0.010	0.007	0.009	0.001	0.005	0.013	0.010	0.005	0.004	0.001	0.000	0.010	0.004
FSC-4	Nov-01	0.015	0.011	---	---	0.007	0.006	---	---	0.002	0.003	---	---	0.008	0.005	---	---	0.005	0.003	---	---
	Dec-01	0.015	0.037	0.024	0.023	0.008	0.021	0.010	0.010	0.001	0.012	0.001	0.002	0.008	0.016	0.014	0.012	0.007	0.009	0.009	0.009
	Jan-02	0.014	0.016	0.022	0.017	0.006	0.008	0.010	0.010	0.002	0.002	0.001	0.003	0.008	0.008	0.012	0.007	0.005	0.006	0.009	0.007
	Feb-02	0.020	0.016	0.017	0.020	0.011	0.006	0.007	0.009	0.003	0.003	0.002	0.002	0.008	0.010	0.010	0.010	0.008	0.003	0.005	0.007
	Mar-02	0.045	0.024	---	0.021	0.013	0.011	---	0.011	0.003	0.004	---	0.004	0.032	0.013	---	0.011	0.009	0.007	---	0.007
	Apr-02	0.044	0.017	0.041	0.035	0.010	0.008	0.014	0.016	0.003	0.002	0.008	0.009	0.034	0.009	0.027	0.019	0.007	0.006	0.006	0.006
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-02	0.023	0.024	0.038	0.042	0.008	0.005	0.006	0.013	0.007	0.002	0.003	0.005	0.015	0.019	0.032	0.029	0.004	0.003	0.003	0.008
	Sep-02	0.026	0.018	0.024	0.032	0.012	0.021	0.017	0.015	0.007	0.002	0.002	0.006	0.014	0.000	0.007	0.017	0.002	0.019	0.015	0.009

Note:

Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-4

Monthly Averages of Nitrogen Data Collected at the Field-Scale Cells, August 2001 - September 2002

Treatment	Month	TN (mg/L)		TKN (mg/L)		NO_2/NO_3 (mg/L)		NH_3 (mg/L)		Organic Nitrogen (mg/L)	
		Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
FSC-1	Aug-01	2.53	2.86	2.53	2.86	0.03	0.03	0.08	0.09	2.45	2.78
	Oct-01	3.26	3.23	3.14	3.23	0.12	0.03	0.14	0.06	3.00	3.17
	Dec-01	0.50	---	0.50	---	---	---	---	---	---	---
	Feb-02	1.75	1.50	1.45	1.35	0.69	0.37	0.06	0.03	1.39	1.32
	Mar-02	0.24	---	0.50	---	0.24	---	0.10	---	0.40	---
	Apr-02	1.12	1.40	1.12	1.40	0.10	0.10	0.10	0.09	1.03	1.31
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.54	0.75	0.46	0.71	0.08	0.04	0.13	0.08	0.33	0.63
	Aug-02	1.43	2.47	1.43	2.43	0.10	0.10	0.09	0.10	1.34	2.33
	Sep-02	1.96	1.91	1.85	1.89	0.15	0.08	0.08	0.07	1.77	1.82
FSC-2	Sep-01	2.68	2.45	2.63	2.45	0.05	0.03	0.10	0.05	2.53	2.40
	Oct-01	3.63	2.48	3.45	2.39	0.18	0.09	0.08	0.05	3.37	2.34
	Dec-01	0.50	0.50	0.50	0.50	---	---	---	---	---	---
	Feb-02	2.36	2.24	1.66	1.85	0.71	0.38	0.03	0.03	1.63	1.82
	Mar-02	0.23	2.27	0.50	1.96	0.23	0.31	0.12	0.08	0.38	1.88
	Apr-02	1.36	0.70	1.26	0.70	0.10	0.10	0.12	0.06	1.14	0.64
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.59	0.86	0.51	0.20	0.08	0.05	0.13	0.05	0.38	0.15
	Sep-02	2.30	2.28	2.17	2.26	0.15	0.08	0.07	0.08	2.10	2.18
FSC-3	Aug-01	2.57	2.97	2.57	2.97	0.03	0.03	0.11	0.07	2.46	2.90
	Sep-01	2.91	2.53	2.91	2.53	0.03	0.03	0.07	0.05	2.84	2.48
	Oct-01	3.20	2.24	2.98	2.24	0.22	0.03	0.13	0.08	2.85	2.16
	Dec-01	0.50	0.50	0.50	0.50	---	---	---	---	---	---
	Feb-02	1.70	2.42	1.40	1.76	0.69	0.63	0.03	0.03	1.37	1.73
	Mar-02	0.20	0.06	0.50	0.50	0.20	0.06	0.10	0.70	0.41	0.00
	Apr-02	1.40	1.22	1.40	1.19	0.10	0.07	0.10	0.10	1.30	1.09
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	1.27	1.41	1.22	1.36	0.05	0.05	0.14	0.10	1.08	1.26
	Aug-02	2.32	2.17	2.24	2.17	0.10	0.10	0.10	0.10	2.14	2.07
	Sep-02	2.18	2.44	2.07	2.39	0.15	0.08	0.09	0.08	1.97	2.31
FSC-4	Dec-01	0.50	0.50	0.50	0.50	---	---	---	---	---	---
	Feb-02	3.13	1.85	1.85	1.50	0.81	0.80	0.03	0.03	1.82	1.47
	Mar-02	0.27	---	0.50	---	0.27	---	0.11	---	0.39	---
	Apr-02	1.82	1.68	1.82	1.68	0.05	0.05	0.38	0.26	1.44	1.42
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--	--	--
	Aug-02	1.83	2.18	1.78	2.10	0.10	0.10	0.11	0.08	1.67	2.02
	Sep-02	2.03	1.92	2.00	1.89	0.10	0.10	0.08	0.07	1.93	1.82

Note:

Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-5

Monthly Averages of General Water Quality Data Collected at the Field-Scale Cells, August 2001 - September 2002

		TOC (mg/L)		TSS (mg/L)		Calcium (mg/L)		Alkalinity (mg/L)		Chlorides (mg/L)	
Treatment	Month	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
FSC-1	Aug-01	36.0	32.0	0.8	1.1	45.7	43.5	200	188	---	---
	Oct-01	40.5	40.0	5.3	2.0	53.5	44.1	295	220	167	154
	Nov-01	39.2	---	---	---	76.0	---	228	---	---	---
	Dec-01	36.0	---	---	---	77.9	---	309	---	257	---
	Jan-02	---	---	---	---	80.5	70.7	279	255	252	231
	Feb-02	38.0	38.0	2.3	1.8	81.3	94.0	330	265	221	202
	Mar-02	40.0	---	30.0	---	65.2	---	262	---	208	---
	Apr-02	38.0	41.0	1.0	1.0	61.1	46.2	262	238	174	199
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	32.0	35.5	25.0	2.5	83.7	61.6	318	259	157	95
	Aug-02	29.0	31.0	5.3	2.5	96.9	31.6	310	184	215	290
	Sep-02	38.0	35.5	4.9	2.9	74.5	45.8	318	220	182	192
FSC-2	Sep-01	41.0	41.0	7.5	2.5	79.2	77.2	268	275	155	164
	Oct-01	41.0	40.0	2.8	0.8	62.9	50.4	280	270	166	154
	Nov-01	39.3	---	---	---	103.0	---	235	---	---	---
	Dec-01	34.0	41.0	---	---	83.4	84.3	311	265	263	254
	Jan-02	---	---	---	---	101.0	76.4	276	273	227	235
	Feb-02	38.0	39.0	1.8	1.8	82.4	106.0	335	283	227	218
	Mar-02	41.0	46.0	6.0	3.0	64.0	61.1	272	255	144	154
	Apr-02	37.0	39.0	3.0	1.0	58.2	50.7	267	250	124	124
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	33.0	34.0	65.0	11.0	83.2	71.3	333	297	141	174
	Sep-02	39.0	39.0	2.6	1.8	77.3	71.5	305	291	170	174
FSC-3	Aug-01	40.0	32.0	2.8	1.3	52.5	50.2	210	210	---	---
	Sep-01	42.0	42.0	5.0	5.3	77.4	64.7	270	250	153	158
	Oct-01	42.0	38.0	2.9	2.9	64.0	47.6	270	230	154	143
	Nov-01	40.1	40.0	---	---	66.0	57.4	242	237	---	---
	Dec-01	37.0	40.0	---	---	71.2	68.4	289	245	257	258
	Jan-02	---	---	---	---	68.7	60.2	246	240	240	240
	Feb-02	38.0	39.0	2.8	2.3	96.4	96.8	318	288	222	206
	Mar-02	40.5	43.0	6.5	4.0	92.6	76.6	264	263	139	129
	Apr-02	37.0	37.5	5.0	5.0	60.9	58.8	253	261	165	145
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	38.0	36.0	5.5	2.5	80.7	75.7	308	302	124	174
	Aug-02	29.0	30.0	12.3	2.5	80.6	70.6	303	275	290	265
	Sep-02	40.0	39.0	4.8	3.5	76.9	78.0	338	307	166	165
FSC-4	Nov-01	43.6	---	---	---	85.9	---	288	---	---	---
	Dec-01	36.0	39.5	---	---	85.4	79.3	293	284	248	257
	Jan-02	---	---	---	---	74.0	103.0	276	288	239	221
	Feb-02	39.0	40.0	2.3	1.8	93.7	96.1	333	300	225	205
	Mar-02	42.0	---	6.0	---	76.3	---	275	---	149	---
	Apr-02	37.0	41.0	5.0	5.0	71.3	67.2	287	283	190	143
	May-02	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--	--	--
	Aug-02	32.0	31.0	2.5	6.0	81.1	79.7	305	325	281	281
	Sep-02	---	---	2.3	1.0	52.9	69.3	250	280	215	182

Note:

Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-6

Period-of-Record, Quarterly and Monthly Summaries of Total Phosphorus Mass Balance Data from the Field-Scale Cells, August 2001 - September 2002

		TP (mg/L)		Flow (m^3/d)			HLR (cm/d)			MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Average**	**q_in**	**q_out**	**q_avg**	**Inflow**	**Outflow**	**(g/m2/y)**	**(%)**	**(m/y)**
Period-of-Record														
FSC-1	POR	0.023	0.019	1,344	544	944	6.64	2.69	4.67	0.55	0.18	0.37	66.96	3.46
FSC-2	POR	0.022	0.015	1,977	829	1,403	9.77	4.10	6.93	0.77	0.22	0.54	70.77	9.14
FSC-3	POR	0.021	0.015	1,535	1,421	1,478	7.59	7.02	7.31	0.58	0.38	0.20	33.83	8.96
FSC-4	POR	0.022	0.028	1,522	292	907	7.52	1.44	4.48	0.61	0.15	0.47	76.17	-3.53
Quarterly														
FSC-1	2001-QTR3	0.020	0.020	1,161	701	931	5.74	3.46	4.60	0.42	0.25	0.17	40.57	0.26
	2001-QTR4	0.017	0.020	827	242	535	4.09	1.20	2.64	0.25	0.09	0.16	65.28	-1.64
	2002-QTR1	0.019	0.018	2,369	1,013	1,691	11.71	5.01	8.36	0.81	0.33	0.48	59.42	1.60
	2002-QTR2	0.039	0.030	621	220	421	3.07	1.09	2.08	0.44	0.12	0.32	73.05	2.07
	2002-QTR3	0.028	0.016	1,696	599	1,148	8.38	2.96	5.67	0.85	0.17	0.68	79.89	11.67
FSC-2	2001-QTR3	0.021	0.018	1,382	448	915	6.83	2.21	4.52	0.53	0.14	0.38	72.83	2.90
	2001-QTR4	0.016	0.014	2,647	1,141	1,894	13.08	5.64	9.36	0.74	0.29	0.46	61.57	3.92
	2002-QTR1	0.019	0.015	2,728	982	1,855	13.48	4.85	9.17	0.95	0.26	0.68	72.33	8.78
	2002-QTR2	0.040	0.019	932	410	671	4.61	2.03	3.32	0.67	0.14	0.54	79.64	9.34
	2002-QTR3	0.026	0.015	2,000	1,028	1,514	9.88	5.08	7.48	0.95	0.28	0.68	71.04	15.66
FSC-3	2001-QTR3	0.020	0.014	1,844	2,128	1,986	9.11	10.52	9.82	0.66	0.53	0.13	19.65	12.97
	2001-QTR4	0.015	0.013	1,873	1,812	1,842	9.26	8.95	9.10	0.50	0.42	0.08	16.74	4.99
	2002-QTR1	0.019	0.016	1,488	1,254	1,371	7.35	6.20	6.78	0.51	0.36	0.16	30.15	4.65
	2002-QTR2	0.041	0.022	836	541	688	4.13	2.67	3.40	0.62	0.22	0.40	64.89	7.59
	2002-QTR3	0.026	0.016	1,731	1,652	1,692	8.55	8.17	8.36	0.80	0.46	0.33	41.96	15.19
FSC-4	2001-QTR4	0.019	0.023	1,899	362	1,131	9.39	1.79	5.59	0.65	0.15	0.50	77.07	-3.75
	2002-QTR1	0.020	0.018	2,810	612	1,711	13.89	3.02	8.46	0.99	0.20	0.79	79.48	1.84
	2002-QTR2	0.028	0.035	831	192	512	4.11	0.95	2.53	0.42	0.12	0.30	71.69	-1.86
	2002-QTR3	0.025	0.037	1,177	179	678	5.82	0.89	3.35	0.53	0.12	0.41	77.67	-4.66
Monthly														
FSC-1	Aug-01	0.019	0.019	1,469	1,304	1,387	7.26	6.44	6.85	0.51	0.44	0.07	14.12	0.83
	Sep-01	0.021	0.021	843	178	511	4.17	0.88	2.52	0.32	0.07	0.25	78.84	0.00
	Oct-01	0.018	0.014	1,387	565	976	6.86	2.79	4.82	0.45	0.15	0.30	67.42	3.93
	Nov-01	0.013	0.020	425	89	257	2.10	0.44	1.27	0.10	0.03	0.07	68.62	-1.88
	Dec-01	0.018	0.045	657	48	353	3.25	0.24	1.74	0.21	0.04	0.17	81.25	-5.94
	Jan-02	0.014	0.018	2,259	793	1,526	11.16	3.92	7.54	0.57	0.26	0.31	54.37	-7.20
	Feb-02	0.018	0.018	2,651	1,312	1,982	13.10	6.48	9.79	0.87	0.43	0.44	50.71	0.14
	Mar-02	0.029	0.017	2,223	963	1,593	10.99	4.76	7.87	1.16	0.30	0.86	74.12	14.79
	Apr-02	0.039	0.030	1,882	667	1,275	9.30	3.30	6.30	1.33	0.36	0.97	73.02	6.28
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.040	0.024	783	103	443	3.87	0.51	2.19	0.57	0.04	0.52	92.27	4.25
	Aug-02	0.029	0.019	1,801	569	1,185	8.90	2.81	5.86	0.94	0.19	0.75	79.69	9.45
	Sep-02	0.025	0.012	2,530	1,143	1,837	12.51	5.65	9.08	1.16	0.26	0.90	77.81	23.55
FSC-2	Sep-01	0.021	0.018	1,687	796	1,241	8.33	3.93	6.13	0.64	0.25	0.39	60.40	3.93
	Oct-01	0.016	0.012	3,373	1,802	2,588	16.67	8.91	12.79	0.99	0.40	0.59	59.74	13.22
	Nov-01	0.014	0.011	2,195	863	1,529	10.85	4.27	7.56	0.55	0.17	0.39	70.22	7.68
	Dec-01	0.017	0.022	2,357	712	1,535	11.65	3.52	7.58	0.70	0.28	0.42	60.17	-7.65
	Jan-02	0.014	0.015	2,239	786	1,512	11.06	3.89	7.47	0.56	0.21	0.35	62.97	-1.44
	Feb-02	0.019	0.014	2,923	1,009	1,966	14.45	4.99	9.72	0.98	0.26	0.72	73.70	9.66
	Mar-02	0.029	0.016	3,041	1,152	2,096	15.03	5.69	10.36	1.56	0.34	1.23	78.41	21.24
	Apr-02	0.040	0.019	2,828	1,245	2,036	13.98	6.15	10.06	2.04	0.42	1.62	79.64	28.33
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.030	0.019	543	138	340	2.68	0.68	1.68	0.29	0.05	0.25	83.92	2.80
	Aug-02	0.027	0.021	2,045	1,025	1,535	10.11	5.07	7.59	1.01	0.39	0.62	61.55	7.34
	Sep-02	0.025	0.010	3,460	1,950	2,705	17.10	9.64	13.37	1.57	0.34	1.23	78.40	46.79
FSC-3	Aug-01	0.019	0.015	1,915	2,285	2,100	9.47	11.29	10.38	0.64	0.63	0.01	1.65	7.32
	Sep-01	0.020	0.013	1,771	1,992	1,882	8.75	9.85	9.30	0.65	0.47	0.18	28.21	15.25
	Oct-01	0.015	0.013	2,218	2,550	2,384	10.96	12.60	11.78	0.61	0.59	0.02	3.75	7.65
	Nov-01	0.013	0.011	2,672	2,628	2,650	13.21	12.99	13.10	0.62	0.53	0.09	15.01	6.98
	Dec-01	0.018	0.016	754	389	571	3.73	1.92	2.82	0.24	0.11	0.13	53.54	1.07
	Jan-02	0.016	0.017	717	436	576	3.54	2.15	2.85	0.20	0.14	0.06	32.39	-1.11
	Feb-02	0.018	0.014	2,135	1,754	1,944	10.55	8.67	9.61	0.69	0.45	0.24	34.82	8.11
	Mar-02	0.029	0.016	1,674	1,622	1,648	8.27	8.02	8.14	0.86	0.47	0.40	45.84	17.29
	Apr-02	0.041	0.022	2,535	1,540	2,038	12.53	7.61	10.07	1.87	0.62	1.26	67.03	22.47
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.025	0.020	1,236	670	953	6.11	3.31	4.71	0.55	0.24	0.31	57.15	4.04
	Aug-02	0.027	0.017	1,690	1,921	1,805	8.35	9.49	8.92	0.81	0.58	0.23	28.40	15.06
	Sep-02	0.025	0.013	2,284	2,390	2,337	11.29	11.81	11.55	1.03	0.57	0.46	44.87	27.02
FSC-4	Nov-01	0.011	---	1,155	0	577	5.71	0.00	2.85	0.23	---	---	---	---
	Dec-01	0.022	0.023	2,708	1,029	1,868	13.38	5.09	9.23	1.06	0.42	0.63	59.96	-1.77
	Jan-02	0.014	0.017	2,866	968	1,917	14.17	4.79	9.48	0.72	0.29	0.43	59.32	-6.42
	Feb-02	0.020	0.020	2,902	605	1,753	14.34	2.99	8.66	1.03	0.21	0.81	79.05	-0.16
	Mar-02	0.033	0.021	2,671	262	1,466	13.20	1.29	7.25	1.57	0.10	1.47	93.69	11.69
	Apr-02	0.028	0.035	2,522	583	1,553	12.47	2.88	7.67	1.29	0.36	0.92	71.69	-5.65
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-02	0.024	0.042	1,710	399	1,054	8.45	1.97	5.21	0.72	0.30	0.42	58.28	-11.04
	Sep-02	0.026	0.032	1,841	138	989	9.10	0.68	4.89	0.86	0.08	0.78	90.66	-3.91

Note:

Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-7

Period-of-Record, Quarterly and Monthly Summaries of Total Nitrogen Mass Balance Data from the Field-Scale Cells, August 2001 - September 2002

		TN (mg/L)		Flow (m^3/d)			HLR (cm/d)			MB_TP (g/m^2/y)		Removal		Calc_k
Treatment	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Average**	**q_in**	**q_out**	**q_avg**	**Inflow**	**Outflow**	**(g/m2/y)**	**(%)**	**(m/y)**
Period-of-Record														
FSC-1	POR	1.53	2.00	1344.4	544.1	944.3	6.64	2.69	4.67	37.06	19.66	17.41	46.97	-4.60
FSC-2	POR	1.77	1.78	1976.9	829.0	1402.9	9.77	4.10	6.93	63.13	26.69	36.45	57.73	-0.20
FSC-3	POR	1.86	1.85	1535.1	1421.4	1478.3	7.59	7.02	7.31	51.42	47.53	3.89	7.56	0.05
FSC-4	POR	1.60	1.63	1521.9	292.4	907.1	7.52	1.44	4.48	43.83	8.58	35.26	80.44	-0.30
Quarterly														
FSC-1	2001-QTR3	2.53	2.86	1161.3	701.0	931.2	5.74	3.46	4.60	53.00	36.17	16.83	31.76	-2.06
	2001-QTR4	1.88	3.23	827.5	242.3	534.9	4.09	1.20	2.64	28.03	14.12	13.91	49.62	-5.24
	2002-QTR1	1.00	1.50	2368.6	1013.0	1690.8	11.71	5.01	8.36	42.51	27.41	15.10	35.53	-12.52
	2002-QTR2	1.12	1.40	621.3	219.9	420.6	3.07	1.09	2.08	12.55	5.55	7.00	55.75	-1.69
	2002-QTR3	1.47	1.76	1696.1	599.2	1147.6	8.38	2.96	5.67	45.03	19.00	26.03	57.81	-3.67
FSC-2	2001-QTR3	2.68	2.45	1382.4	447.7	915.0	6.83	2.21	4.52	66.83	19.78	47.05	70.40	1.48
	2001-QTR4	2.07	1.49	2646.6	1140.9	1893.7	13.08	5.64	9.36	98.59	30.66	67.92	68.90	11.15
	2002-QTR1	1.29	2.26	2727.8	981.5	1854.6	13.48	4.85	9.17	63.60	39.93	23.67	37.22	-18.62
	2002-QTR2	1.36	0.70	932.3	410.5	671.4	4.61	2.03	3.32	22.87	5.18	17.69	77.34	8.04
	2002-QTR3	1.73	1.81	2000.0	1027.6	1513.8	9.88	5.08	7.48	62.28	33.50	28.78	46.21	-1.25
FSC-3	2001-QTR3	2.74	2.75	1844.1	2128.3	1986.2	9.11	10.52	9.82	91.15	105.58	-14.43	-15.83	-0.13
	2001-QTR4	1.85	1.37	1872.7	1811.8	1842.2	9.26	8.95	9.10	62.49	44.78	17.72	28.35	9.98
	2002-QTR1	0.95	1.24	1487.8	1254.3	1371.0	7.35	6.20	6.78	25.43	28.00	-2.57	-10.11	-6.60
	2002-QTR2	1.40	1.22	835.7	540.7	688.2	4.13	2.67	3.40	21.11	11.85	9.25	43.85	1.76
	2002-QTR3	1.99	2.12	1730.6	1652.5	1691.6	8.55	8.17	8.36	62.05	63.05	-1.00	-1.61	-1.90
FSC-4	2001-QTR4	0.50	0.50	1899.5	362.5	1131.0	9.39	1.79	5.59	17.13	3.27	13.86	80.92	0.00
	2002-QTR1	1.70	1.85	2809.9	611.9	1710.9	13.89	3.02	8.46	86.17	20.42	65.75	76.30	-2.61
	2002-QTR2	1.82	1.68	831.5	192.4	511.9	4.11	0.95	2.53	27.30	5.83	21.47	78.65	0.74
	2002-QTR3	1.93	2.05	1176.9	179.5	678.2	5.82	0.89	3.35	40.97	6.64	34.34	83.80	-0.74
Monthly														
FSC-1	Aug-01	2.53	2.86	1469.0	1304.0	1386.5	7.26	6.44	6.85	67.04	67.27	-0.23	-0.34	-3.07
	Sep-01	2.68	2.45	1686.5	796.1	1241.3	8.33	3.93	6.13	81.53	35.18	46.35	56.85	2.01
	Oct-01	3.255	3.23	1387.4	565.0	976.2	6.86	2.79	4.82	81.46	32.92	48.55	59.59	0.14
	Nov-01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Dec-01	0.5	---	657.4	48.5	352.9	3.25	0.24	1.74	5.93	---	---	---	---
	Jan-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Feb-02	1.75	1.50	2651.3	1312.0	1981.7	13.10	6.48	9.79	83.70	35.50	48.20	57.58	5.51
	Mar-02	0.24	---	2223.1	962.5	1592.8	10.99	4.76	7.87	9.62	---	---	---	---
	Apr-02	1.12	1.40	1882.1	667.1	1274.6	9.30	3.30	6.30	38.03	16.85	21.18	55.69	-5.13
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.537	0.75	783.2	103.0	443.1	3.87	0.51	2.19	7.59	1.39	6.19	81.62	-2.68
	Aug-02	1.43	2.47	1801.5	569.2	1185.3	8.90	2.81	5.86	46.47	25.36	21.11	45.43	-11.69
	Sep-02	1.96	1.91	2530.4	1142.9	1836.7	12.51	5.65	9.08	89.47	39.28	50.19	56.10	0.94
FSC-2	Sep-01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-01	3.63	2.48	3373.0	1802.4	2587.7	16.67	8.91	12.79	220.87	80.63	140.24	63.49	17.78
	Nov-01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Dec-01	0.5	0.50	2356.9	712.1	1534.5	11.65	3.52	7.58	21.26	6.42	14.84	69.79	0.00
	Jan-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Feb-02	2.355	2.24	2923.0	1009.4	1966.2	14.45	4.99	9.72	124.17	40.79	83.39	67.15	1.78
	Mar-02	0.23	2.27	3040.6	1151.6	2096.1	15.03	5.69	10.36	12.62	47.16	-34.54	-273.80	-86.57
	Apr-02	1.36	0.70	2827.9	1245.1	2036.5	13.98	6.15	10.06	69.38	15.72	53.66	77.34	24.40
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	0.589	0.86	542.5	137.7	340.1	2.68	0.68	1.68	5.76	2.14	3.62	62.85	-2.34
	Aug-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Sep-02	2.295	2.28	3459.7	1949.6	2704.7	17.10	9.64	13.37	143.23	80.19	63.04	44.02	0.32
FSC-3	Aug-01	2.91	2.53	1770.7	1992.4	1881.6	8.75	9.85	9.30	92.95	90.93	2.02	2.17	4.75
	Sep-01	2.57	2.97	1915.2	2285.0	2100.1	9.47	11.29	10.38	88.79	122.42	-33.63	-37.88	-5.48
	Oct-01	3.2	2.24	2217.6	2550.2	2383.9	10.96	12.60	11.78	128.01	103.05	24.96	19.50	15.34
	Nov-01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Dec-01	0.5	0.50	754.0	388.6	571.3	3.73	1.92	2.82	6.80	3.50	3.30	48.46	0.00
	Jan-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Feb-02	1.7	2.42	2135.2	1753.6	1944.4	10.55	8.67	9.61	65.48	76.39	-10.92	-16.67	-12.31
	Mar-02	0.195	0.06	1673.8	1621.9	1647.8	8.27	8.02	8.14	5.89	1.76	4.13	70.18	35.04
	Apr-02	1.4	1.22	2535.0	1540.2	2037.6	12.53	7.61	10.07	64.02	33.76	30.26	47.27	5.21
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	1.27	1.41	1236.4	670.2	953.3	6.11	3.31	4.71	28.33	17.05	11.28	39.82	-1.80
	Aug-02	2.32	2.17	1689.5	1921.1	1805.3	8.35	9.49	8.92	70.71	75.20	-4.49	-6.35	2.18
	Sep-02	2.18	2.44	2283.8	2390.0	2336.9	11.29	11.81	11.55	89.81	105.19	-15.38	-17.13	-4.75
FSC-4	Nov-01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Dec-01	0.5	0.50	2707.8	1028.9	1868.3	13.38	5.09	9.23	24.42	9.28	15.14	62.00	0.00
	Jan-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Feb-02	3.13	1.85	2901.5	604.7	1753.1	14.34	2.99	8.66	163.83	20.18	143.65	87.68	16.63
	Mar-02	0.27	---	2670.8	262.0	1466.4	13.20	1.29	7.25	13.01	---	---	---	---
	Apr-02	1.82	1.68	2522.2	583.5	1552.9	12.47	2.88	7.67	82.81	17.68	65.12	78.65	2.24
	May-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-02	1.83	2.18	1709.5	399.1	1054.3	8.45	1.97	5.21	56.43	15.69	40.74	72.19	-3.33
	Sep-02	2.03	1.92	1840.9	138.1	989.5	9.10	0.68	4.89	67.41	4.78	62.63	92.91	0.99

Note:

Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-8

Period-of-Record, Quarterly and Monthly Summaries of Algal and Macrophyte Percent Cover Estimates for the Field-Scale Cells, August 2001 - September 20

Treatment	Date	Blue-Green Algal Mat	Green Algal Mat	Emergent Macrophytes	Floating Aquatic Plants	Submerged Aquatic Plants	Algae Mat % Cover	Macrophyte % Cover	Total % Cover
Period-of-Record									
FSC-1	POR	1%	0%	19%	0%	29%	1%	48%	49%
FSC-2	POR	1%	1%	24%	0%	18%	2%	42%	44%
FSC-3	POR	1%	0%	5%	0%	8%	1%	12%	13%
FSC-4	POR	0%	0%	5%	0%	1%	0%	5%	5%
Quarterly									
FSC-1	2001-QTR3	1%	0%	25%	0%	15%	1%	40%	41%
	2001-QTR4	1%	0%	18%	0%	38%	1%	55%	56%
	2002-QTR1	3%	0%	11%	0%	30%	3%	41%	44%
	2002-QTR2	0%	0%	18%	0%	13%	0%	30%	30%
	2002-QTR3	0%	0%	24%	0%	36%	0%	60%	60%
FSC-2	2001-QTR3	1%	1%	23%	1%	7%	1%	30%	31%
	2001-QTR4	2%	0%	23%	0%	13%	2%	36%	37%
	2002-QTR1	0%	4%	20%	0%	16%	4%	36%	39%
	2002-QTR2	0%	0%	31%	0%	24%	0%	55%	55%
	2002-QTR3	0%	0%	28%	0%	31%	0%	60%	60%
FSC-3	2001-QTR3	1%	1%	4%	1%	6%	1%	10%	11%
	2001-QTR4	1%	0%	8%	0%	11%	1%	18%	19%
	2002-QTR1	0%	0%	5%	0%	10%	0%	15%	15%
	2002-QTR2	0%	0%	5%	0%	13%	0%	18%	18%
	2002-QTR3	3%	0%	3%	0%	1%	3%	4%	7%
FSC-4	2001-QTR3	1%	1%	5%	1%	1%	2%	6%	8%
	2001-QTR4	0%	0%	3%	0%	0%	0%	2%	2%
	2002-QTR1	0%	0%	3%	0%	1%	0%	4%	4%
	2002-QTR2	0%	0%	18%	0%	3%	0%	21%	21%
	2002-QTR3	0%	0%	4%	0%	0%	0%	4%	4%
Monthly									
FSC-1	Aug-01	1%	1%	23%	0%	2%	2%	25%	26%
	Sep-01	1%	0%	28%	0%	28%	1%	55%	56%
	Oct-01	1%	0%	18%	0%	38%	1%	55%	56%
	Nov-01	2%	0%	18%	0%	38%	2%	55%	57%
	Dec-01	0%	0%	18%	0%	38%	0%	55%	55%
	Jan-02	9%	0%	13%	0%	23%	9%	35%	44%
	Feb-02	0%	0%	8%	0%	19%	0%	26%	26%
	Mar-02	0%	0%	13%	0%	50%	0%	63%	63%
	Apr-02	0%	0%	18%	0%	13%	0%	30%	30%
	Jul-02	0%	0%	28%	0%	28%	0%	55%	55%
	Aug-02	0%	0%	28%	0%	8%	0%	35%	35%
	Sep-02	0%	0%	18%	0%	73%	0%	90%	90%
FSC-2	Aug-01	1%	1%	31%	1%	1%	2%	33%	35%
	Sep-01	1%	0%	14%	0%	13%	1%	27%	27%
	Oct-01	5%	0%	21%	0%	13%	5%	33%	38%
	Nov-01	0%	0%	24%	0%	18%	0%	42%	42%
	Dec-01	0%	0%	24%	0%	8%	0%	32%	32%
	Jan-02	0%	9%	14%	0%	28%	9%	42%	50%
	Feb-02	0%	1%	14%	0%	9%	1%	24%	25%
	Mar-02	0%	1%	31%	0%	11%	1%	42%	43%
	Apr-02	0%	0%	31%	0%	24%	0%	55%	55%
	Jul-02	0%	0%	31%	0%	9%	0%	40%	40%
	Aug-02	0%	0%	24%	0%	38%	0%	62%	62%
	Sep-02	0%	0%	29%	0%	48%	0%	77%	77%
FSC-3	Aug-01	1%	1%	3%	1%	10%	2%	14%	16%
	Sep-01	0%	0%	5%	0%	1%	0%	6%	6%
	Oct-01	2%	0%	8%	0%	8%	2%	15%	17%
	Nov-01	0%	0%	8%	0%	13%	0%	20%	20%
	Dec-01	0%	0%	8%	0%	13%	0%	20%	20%
	Jan-02	0%	0%	8%	0%	3%	0%	11%	11%
	Feb-02	0%	0%	1%	0%	10%	0%	11%	11%
	Mar-02	0%	0%	5%	0%	18%	0%	23%	23%
	Apr-02	0%	0%	5%	0%	13%	0%	18%	18%
	Jul-02	0%	0%	3%	0%	3%	0%	6%	6%
	Aug-02	0%	0%	3%	0%	0%	0%	3%	3%
	Sep-02	8%	0%	3%	0%	0%	8%	3%	11%
FSC-4	Aug-01	1%	1%	3%	1%	1%	2%	5%	7%
	Sep-01	1%	0%	8%	0%	0%	1%	8%	9%
	Oct-01	0%	0%	3%	0%	0%	0%	3%	3%
	Nov-01	0%	0%	3%	0%	0%	0%	2%	2%
	Dec-01	0%	0%	3%	0%	0%	0%	3%	3%
	Jan-02	0%	0%	2%	0%	1%	0%	3%	3%
	Feb-02	0%	0%	3%	0%	0%	0%	3%	3%
	Mar-02	0%	0%	5%	0%	1%	0%	6%	6%
	Apr-02	0%	0%	18%	0%	3%	0%	21%	21%
	Jul-02	0%	0%	5%	0%	0%	0%	5%	5%
	Aug-02	0%	0%	3%	0%	0%	0%	3%	3%
	Sep-02	0%	0%	3%	0%	1%	0%	4%	4%

EXHIBIT E.1-9

Period-of-Record, Quarterly and Monthly Summaries of Periphyton Data for the Field-Scale Cells, August 2001 - September 2002

		Periphyton Biomass (g/m^2)			Ca		Chl_a		TP		TIP		TKN		Blue-Green Algae			Diatoms			Green Algae			Total Taxa			Evenness	SWDI
Treatment	Date	Dry Wt	Ash Wt	AFDW	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(g/m^2)	(mg/kg)	(# cells/m^2) *109	(cm3/cm^2)	(# taxa)	(# cells/m^2) *109	(cm3/cm^2)	(# taxa)	(# cells/m^2) *109	(cm3/cm^2)	(# taxa)	(# cells/m^2) *109	(cm3/cm^2)	(# taxa)	---	---
Period-of-Record																												
FSC-1	POR	345	249	87	56.9	283,888	0.04	132	0.102	388	0.015	63	2.1	4,629	86	4.02	18	1.1	0.71	8	0.88	0.35	5	88	6.21	29	0.71	3.57
FSC-2	POR	622	496	120	143.0	288,295	0.08	128	0.248	304	0.048	58	2.0	4,715	98	1.83	16	5.0	3.70	13	2.24	18.88	6	105	24.73	35	0.67	3.56
FSC-3	POR	362	302	63	74.1	214,289	0.05	131	0.106	302	0.017	51	1.3	4,359	86	1.32	16	2.2	1.53	11	1.10	0.08	4	90	3.28	31	0.66	3.36
FSC-4	POR	35	21	14	10.2	334,735	0.01	354	0.032	1219	0.002	67	---	---	2	0.02	16	0.3	0.14	15	0.06	0.02	5	2	0.18	36	0.76	4.07
Quarterly																												
FSC-1	2001-QTR3	---	---	43	48.0	---	0.04	---	0.090	---	0.021	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2001-QTR4	404	295	103	62.4	205,390	0.09	187	0.183	436	0.019	47	6.3	11,250	124	14.69	14	1.9	1.08	9	1.46	0.29	5	127	16.05	21	0.69	3.33
	2002-QTR1	409	265	137	108.1	264,118	0.04	94	0.167	408	0.028	69	0.6	1,518	38	1.05	19	1.1	1.75	11	0.70	1.10	8	40	3.91	38	0.71	3.86
	2002-QTR2	24	18	5	11.0	485,823	0.01	206	0.008	335	0.002	77	0.0	1,852	16	0.31	20	0.2	0.02	7	0.07	0.00	3	17	0.71	31	0.70	3.54
	2002-QTR3	588	427	151	86.0	167,042	0.01	17	---	---	---	---	3.1	6,236	166	0.00	19	1.3	0.00	5	1.32	0.00	3	169	4.16	27	0.73	3.55
FSC-2	2001-QTR3	---	---	78	128.8	---	---	---	0.206	---	0.057	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2001-QTR4	1005	806	197	163.7	158,871	0.15	153	0.332	328	0.054	53	7.4	7,933	232	2.13	12	11.0	6.14	15	2.50	50.30	5	246	58.57	32	0.58	2.88
	2002-QTR1	695	549	154	181.5	261,053	0.08	116	0.220	316	0.065	93	0.9	1,326	18	2.70	13	3.0	2.29	16	3.70	24.95	9	25	29.94	38	0.79	4.31
	2002-QTR2	561	454	103	177.0	312,031	0.09	164	0.156	261	0.025	49	0.4	825	114	2.48	15	5.8	6.38	14	2.50	0.26	5	122	9.12	34	0.67	3.60
	2002-QTR3	255	197	58	91.5	410,975	0.01	84	---	---	---	---	1.7	7,364	27	0.00	22	0.4	0.00	7	0.27	0.00	6	28	1.30	35	0.66	3.46
FSC-3	2001-QTR3	---	---	62	80.1	---	0.06	---	0.081	---	0.019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2001-QTR4	362	297	64	44.9	139,659	0.08	223	0.163	449	0.020	56	3.7	10,029	157	1.68	10	4.6	1.87	8	2.89	0.16	4	165	3.71	22	0.62	2.78
	2002-QTR1	359	302	77	97.9	272,500	0.05	140	0.084	234	0.019	52	---	---	66	1.83	17	1.3	1.90	11	0.52	0.14	4	68	3.87	32	0.68	3.48
	2002-QTR2	465	409	63	93.1	221,820	0.03	74	0.073	178	0.012	46	0.1	399	102	1.77	19	2.4	2.34	9	0.92	0.01	2	105	4.12	30	0.67	3.46
	2002-QTR3	260	201	58	72.3	261,986	0.02	94	---	---	---	---	1.7	6,429	20	0.00	19	0.6	0.00	15	0.08	0.00	4	21	1.41	38	0.69	3.72
FSC-4	2001-QTR4	48	29	19	12.9	279,375	0.01	281	0.038	863	0.003	60	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2002-QTR1	11	6	5	4.9	445,455	0.01	500	0.021	1932	0.001	82	---	---	2	0.02	16	0.3	0.14	15	0.06	0.02	5	2	0.18	36	0.76	4.07
Monthly																												
FSC-1	Aug-01	---	---	---	44.7	---	0.04	---	0.101	---	0.027	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Sep-01	---	---	43	51.3	---	---	---	0.078	---	0.016	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Oct-01	562	381	163	20.3	36,071	0.24	425	0.328	584	0.030	53	6.3	11,250	124	14.69	14	1.9	1.08	9	1.46	0.29	5	127	16.05	21	0.69	3.33
	Nov-01	408	331	80	66.7	163,333	0.02	52	0.115	281	0.016	39	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dec-01	241	174	66	100.2	416,766	0.02	84	0.106	441	0.011	48	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Jan-02	409	265	137	108.1	264,118	0.04	94	0.167	408	0.028	69	0.6	1,518	38	1.05	19	1.1	1.75	11	0.70	1.10	8	40	3.91	38	0.71	3.86
	Apr-02	24	18	5	11.0	485,823	0.01	206	0.008	335	0.002	77	0.0	1,852	16	0.31	20	0.2	0.02	7	0.07	0.00	3	17	0.71	31	0.70	3.54
	Aug-02	588	427	151	86.0	167,042	0.01	17	---	---	---	---	3.1	6,236	166	0.00	19	1.3	0.00	5	1.32	0.00	3	169	4.16	27	0.73	3.55
FSC-2	Sep-01	---	---	78	128.8	---	---	---	0.206	---	0.057	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Oct-01	929	712	189	23.1	24,833	0.33	353	0.353	380	0.038	41	7.4	7,933	232	2.13	12	11.0	6.14	15	2.50	50.30	5	246	58.57	32	0.58	2.88
	Nov-01	1207	990	241	260.9	216,154	0.06	51	0.407	337	0.081	67	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dec-01	879	714	162	207.2	235,625	0.05	53	0.235	268	0.044	50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Jan-02	695	549	154	181.5	261,053	0.08	116	0.220	316	0.065	93	0.9	1,326	18	2.70	13	3.0	2.29	16	3.70	24.95	9	25	29.94	38	0.79	4.31
	Apr-02	561	454	103	177.0	312,031	0.09	164	0.156	261	0.025	49	0.4	825	114	2.48	15	5.8	6.38	14	2.50	0.26	5	122	9.12	34	0.67	3.60
	Aug-02	255	197	58	91.5	410,975	0.01	84	---	---	---	---	1.7	7,364	27	0.00	22	0.4	0.00	7	0.27	0.00	6	28	1.30	35	0.66	3.46
FSC-3	Aug-01	---	---	85	107.5	---	0.06	---	0.093	---	0.018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Sep-01	---	---	40	52.7	---	---	---	0.068	---	0.021	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Oct-01	368	294	77	11.4	30,976	0.14	380	0.331	900	0.026	70	3.7	10,029	157	1.68	10	4.6	1.87	8	2.89	0.16	4	165	3.71	22	0.62	2.78
	Nov-01	442	375	71	42.7	96,667	0.07	161	0.094	212	0.022	49	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dec-01	277	222	42	80.7	291,333	0.04	127	0.065	235	0.014	49	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Jan-02	359	302	77	97.9	272,500	0.05	140	0.084	234	0.019	52	---	---	66	1.83	17	1.3	1.90	11	0.52	0.14	4	68	3.87	32	0.68	3.48
	Apr-02	465	409	63	93.1	221,820	0.03	74	0.073	178	0.012	46	0.1	399	102	1.77	19	2.4	2.34	9	0.92	0.01	2	105	4.12	30	0.67	3.46
	Aug-02	260	201	58	72.3	261,986	0.02	94	---	---	---	---	1.7	6,429	20	0.00	19	0.6	0.00	15	0.08	0.00	4	21	1.41	38	0.69	3.72
FSC-4	Nov-01	68	46	22	17.6	260,000	0.02	350	0.048	713	0.005	69	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dec-01	27	12	15	8.1	298,750	0.01	213	0.028	1013	0.001	50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Jan-02	11	6	5	4.9	445,455	0.01	500	0.021	1932	0.001	82	---	---	2	0.02	16	0.3	0.14	15	0.06	0.02	5	2	0.18	36	0.76	4.07

Note:
Field Scale Cells were in dry-out mode during May and June 2002.

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
Period-of-Record									
FSC-1	POR	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	282,250	0.0057	2,016	40.5	4
		AMP LIN	4	AMPHORA LINEOLATA?	7,645,750	0.1756	1,406	32.3	4
		ANA AFF	1	ANABAENA AFFINIS	301,250	0.0073	6,024	145.1	4
		ANK FAL	3	ANKISTRODESMUS FALCATUS	83,500	0.0020	1,607	38.7	4
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	1,500	0.0000	402	9.7	4
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	24,250	0.0005	2,016	40.5	4
		APH CON	1	APHANOCAPSA CONFERTA	160,750	0.0039	40,161	967.1	4
		APH DEL	1	APHANOCAPSA DELICATISSIMA	4,000	0.0001	4,016	65.4	4
		APH HOL	1	APHANOCAPSA HOLSATICA	510,250	0.0108	127,601	2701.7	4
		APH INC	1	APHANOCAPSA INCERTA	25,000	0.0006	24,900	599.6	4
		APH PLA	1	APHANOCAPSA PLANCTONICA?	242,000	0.0056	30,242	705.4	4
		APHA SMI	1	APHANOTHECE SMITHII	9,750	0.0002	1,607	26.2	4
		APHA STA	1	APHANOTHECE STAGNINA	589,750	0.0130	24,579	542.2	4
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	744,750	0.0174	33,857	792.4	4
		BAC PAX	4	BACILLARIA PAXILLIFER	567,750	0.0137	402	9.7	4
		BRA VIT	4	BRACHYSIRA VITREA	92,000	0.0015	201	3.3	4
		CHR DIS	1	CHROOCOCCUS DISPERSUS	113,000	0.0023	8,065	161.8	4
		CHR MIN	1	CHROOCOCCUS MINUTUS	541,000	0.0125	49,190	1134.8	4
		CHR MINI	1	CHROOCOCCUS MINIMUS	801,500	0.0172	200,311	4297.7	4
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	9,145,000	0.1963	56,452	1211.6	4
		CHR TUR	1	CHROOCOCCUS TURGIDUS	1,188,250	0.0234	4,434	87.4	4
		COS BOT	3	COSMARIUM BOTRYTIS	10,648,500	0.2564	402	9.7	4
		CYC ATO	4	CYCLOTELLA ATOMUS	284,250	0.0066	2,016	47.0	4
		CYM MIC	4	CYMBELLA MICROCEPHALA	204,750	0.0049	1,205	29.0	4
		DIP OBL	4	DIPLONEIS OBLONGELLA	135,000	0.0033	402	9.7	4
		DIP OVA	4	DIPLONEIS OVALIS	974,250	0.0202	2,418	50.1	4
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	758,000	0.0152	4,032	80.9	4
		ENC MIN	4	ENCYONEMA MINUTUM	70,750	0.0017	402	9.7	4
		ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	354,750	0.0058	201	3.3	4
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	2,376,750	0.0539	2,217	50.3	4
		G ANA	1	ANABAENA SP	306,500	0.0071	16,129	376.2	4
		G CHLA	3	CHLAMYDOMONAS SP	1,188,000	0.0260	4,434	97.2	4
		G CYC	4	CYCLOTELLA SP	798,500	0.0186	4,032	94.1	4
		G EUG	10	EUGLENA SP	2,585,500	0.0421	201	3.3	4
		G GLO	1	GLOEOCAPSA SP	6,500	0.0001	1,607	26.2	4
		G NIT SM	4	NITZSCHIA SP (SMALL)	213,750	0.0043	2,016	40.5	4
		G SCY	1	SCYTONEMA SP?	150,786,250	3.0255	108,871	2184.5	4
		G SYNE	1	SYNECHOCCOCCUS SP	15,352,250	0.3437	239,884	5370.9	4
		GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	877,000	0.0211	402	9.7	4
		GOM PAR	4	GOMPHONEMA PARVULUM	3,601,000	0.0723	2,016	40.5	4
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	640,750	0.0137	320,476	6848.3	4
		KIR LUN	3	KIRCHNERIELLA LUNARIS	10,500	0.0003	803	19.3	4
		LEI EPI	1	LEIBLEINIA EPIPHYTICA	48,250	0.0012	8,032	193.4	4
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	4,115,750	0.0907	685,973	15114.8	4
		LEP PER	1	LEPTOLYNGBYA PERELEGANS?	995,250	0.0221	52,387	1165.4	4
		LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	83,500	0.0020	5,221	125.7	4
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	14,878,500	0.3484	9,253	216.6	4
		MER DUP	1	MERISMOPEDIA DUPLEX	24,000	0.0004	1,607	26.2	4
		MER GLA	1	MERISMOPEDIA GLAUCA	479,250	0.0109	34,234	777.9	4
		MER PUN	1	MERISMOPEDIA PUNCTATA	4,750	0.0001	1,607	26.2	4
		MER TEN	1	MERISMOPEDIA TENUISSIMA	105,750	0.0023	105,561	2250.8	4
		NAV CRY	4	NAVICULA CRYPTOCEPHALA	855,000	0.0172	2,016	40.5	4
		NIT CON	4	NITZSCHIA CONSTRICTA	243,000	0.0059	402	9.7	4
		NIT PAL	4	NITZSCHIA PALEA	1,058,500	0.0212	2,016	40.5	4
		NIT PALF	4	NITZSCHIA PALEAFORMIS	5,330,000	0.1105	6,241	129.4	4
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	4,382,750	0.0905	7,454	154.0	4
		OOC PAR	3	OOCYSTIS PARVA	25,000	0.0006	1,004	22.6	4
		OOC SOL	3	OOCYSTIS SOLITARIA	3,280,750	0.0680	2,418	50.1	4
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	2,843,500	0.0633	24,097	536.4	4
		PHO FOR	1	PHORMIDIUM FORMOSUM	24,045,000	0.5161	304,371	6533.2	4
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	7,491,500	0.1489	416,204	8274.1	4
		PSE LIM	1	PSEUDANABAENA LIMNETICA	4,919,500	0.1073	702,782	15323.9	4
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	4,074,750	0.0926	313,439	7123.9	4
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	388,000	0.0093	18,474	444.9	4
		SCE BIJ	3	SCENEDESMUS BIJUGA	68,250	0.0015	6,844	145.5	4
		SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	258,000	0.0052	8,065	161.8	4
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	452,250	0.0103	4,434	100.6	4
		SCE SEM	3	SCENEDESMUS SEMIPULCHER	306,500	0.0071	8,065	188.1	4
		SPI SUB	1	SPIRULINA SUBSALSA	139,750	0.0032	2,217	50.3	4

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
FSC-2	POR	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	338,500	0.0108	2,418	77.1	4
		AMP LIN	4	AMPHORA LINEOLATA?	21,935,500	0.5228	4,032	96.1	4
		ANA AFF	1	ANABAENA AFFINIS	403,000	0.0109	8,057	217.6	4
		ANK FAL	3	ANKISTRODESMUS FALCATUS	21,000	0.0008	402	14.7	4
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	16,000	0.0004	4,033	110.5	4
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	24,250	0.0006	2,016	48.1	4
		APH HOL	1	APHANOCAPSA HOLSATICA	14,500	0.0004	3,615	87.8	4
		APH PLA	1	APHANOCAPSA PLANCTONICA?	25,750	0.0006	3,213	78.0	4
		APHA SMI	1	APHANOTHECE SMITHII	314,500	0.0075	52,419	1249.4	4
		APHA STA	1	APHANOTHECE STAGNINA	1,410,500	0.0454	58,764	1889.9	4
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	2,563,250	0.0691	116,510	3139.4	4
		BAC PAX	4	BACILLARIA PAXILLIFER	567,750	0.0208	402	14.7	4
		BRA VIT	4	BRACHYSIRA VITREA	11,080,750	0.3366	24,194	735.0	4
		CHR MIN	1	CHROOCOCCUS MINUTUS	8,750	0.0002	803	19.5	4
		CHR MINI	1	CHROOCOCCUS MINIMUS	603,000	0.0178	150,752	4448.4	4
		COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	47,000	0.0011	5,221	126.8	4
		COE MIC	3	COELASTRUM MICROPORUM	939,750	0.0344	14,458	528.9	4
		COE PUS	1	COELOMORON PUSILLUM	338,750	0.0105	56,452	1748.6	4
		COE SPH	3	COELASTRUM SPHAERICUM	629,000	0.0150	8,065	192.2	4
		COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	1,186,750	0.0434	402	14.7	4
		CYM MIC	4	CYMBELLA MICROCEPHALA	2,123,250	0.0648	12,490	381.1	4
		DIP OVA	4	DIPLONEIS OVALIS	812,500	0.0252	2,016	62.5	4
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	2,384,500	0.0783	12,683	416.3	4
		ENC MIN	4	ENCYONEMA MINUTUM	709,750	0.0169	4,032	96.1	4
		ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	354,750	0.0086	201	4.9	4
		FRA FAM	4	FRAGILARIA FAMELICA	3,626,250	0.0957	10,073	265.7	4
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	8,636,500	0.2642	8,057	246.4	4
		G ACH	4	ACHNANTHES SP	17,000	0.0004	201	4.9	4
		G DES	3	DESMIDIUM SP	6,505,750	0.2380	1,205	44.1	4
		G GLO	1	GLOEOCAPSA SP	106,750	0.0030	26,603	751.2	4
		G NIT SM	4	NITZSCHIA SP (SMALL)	1,282,250	0.0382	12,097	360.3	4
		G PHO	1	PHORMIDIUM SP	135,500	0.0033	5,422	131.7	4
		G SCY	1	SCYTONEMA SP?	15,574,250	0.5698	11,245	411.4	4
		G SPI	3	SPIROGYRA SP	564,213,500	18.3786	5,639	183.7	4
		G SYNE	1	SYNECHOCCOCCUS SP	8,121,750	0.2044	126,901	3193.2	4
		GOM GRA	4	GOMPHONEMA GRACILE	210,750	0.0068	602	19.6	4
		GOM PAR	4	GOMPHONEMA PARVULUM	7,918,500	0.2493	4,434	139.6	4
		GYR NOD	4	GYROSIGMA NODIFERUM	1,987,500	0.0727	402	14.7	4
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	516,000	0.0146	258,000	7308.3	4
		LEI EPI	1	LEIBLEINIA EPIPHYTICA	483,750	0.0115	80,645	1922.2	4
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	1,643,250	0.0425	273,863	7088.9	4
		LEP PER	1	LEPTOLYNGBYA PERELEGANS?	87,750	0.0021	4,619	112.1	4
		MAS SMI	4	MASTOGLOIA SMITHII	14,024,250	0.3343	4,032	96.1	4
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	19,761,750	0.5117	12,290	318.2	4
		MER DUP	1	MERISMOPEDIA DUPLEX	242,000	0.0058	16,129	384.4	4
		MER GLA	1	MERISMOPEDIA GLAUCA	135,000	0.0049	9,639	352.6	4
		MER PUN	1	MERISMOPEDIA PUNCTATA	2,500	0.0001	803	19.5	4
		MER TEN	1	MERISMOPEDIA TENUISSIMA	20,750	0.0006	20,916	642.6	4
		NAV CRY	4	NAVICULA CRYPTOCEPHALA	2,564,500	0.0794	6,049	187.4	4
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	1,496,000	0.0463	2,016	62.5	4
		NAV POD	4	NAVICULA PODZORSKII	4,445,750	0.1377	2,016	62.5	4
		NIT AMP	4	NITZSCHIA AMPHIBIA	192,750	0.0071	803	29.4	4
		NIT FRU	4	NITZSCHIA FRUSTULUM	453,750	0.0108	2,016	48.1	4
		NIT PAL	4	NITZSCHIA PALEA	1,269,250	0.0329	2,418	62.7	4
		NIT PALE	4	NITZSCHIA PALEACEA	634,500	0.0176	10,073	280.1	4
		NIT PALF	4	NITZSCHIA PALEAFORMIS	11,703,000	0.3579	13,704	419.1	4
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	11,609,250	0.3091	19,744	525.7	4
		NIT SERP	4	NITZSCHIA SERPENTIRAPHE	3,732,250	0.1365	402	14.7	4
		NOD SPU	1	NODULARIA SPUMIGENA?	1,163,750	0.0283	8,434	204.8	4
		OOC PAR	3	OOCYSTIS PARVA	5,000	0.0001	201	4.9	4
		OOC SOL	3	OOCYSTIS SOLITARIA	544,750	0.0199	402	14.7	4
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	12,604,000	0.3009	106,815	2550.4	4
		PHO FOR	1	PHORMIDIUM FORMOSUM	1,967,000	0.0603	24,900	762.7	4
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	8,494,750	0.2192	471,918	12177.7	4
		PSE LIM	1	PSEUDANABAENA LIMNETICA	7,699,250	0.2261	1,099,872	32300.6	4
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	680,250	0.0217	52,330	1667.1	4
		SCE BIJ	3	SCENEDESMUS BIJUGA	246,000	0.0069	24,579	684.9	4
		SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	122,000	0.0042	3,815	132.2	4
		SCE GUT	3	SCENEDESMUS GUTWINSKII	10,500	0.0003	402	9.7	4
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	431,750	0.0132	4,233	129.8	4

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		SCH ARE	1	SCHIZOTHRIX ARENARIA?	5,242,000	0.1624	403,226	12490.2	4
		SNO LAC	1	SNOWELLA LACUSTRIS	100,500	0.0024	4,016	97.5	4
		SPI SUB	1	SPIRULINA SUBSALSA	177,500	0.0055	2,819	86.9	4
		TET TRI	3	TETRAEDRON TRIGONUM	4,509,500	0.1266	4,635	130.1	4
FSC-3	POR	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	282,250	0.0101	2,016	72.3	4
		AMP LIN	4	AMPHORA LINEOLATA?	24,076,000	0.5923	4,426	108.9	4
		ANA AFF	1	ANABAENA AFFINIS	1,209,750	0.0277	24,194	554.8	4
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	82,000	0.0019	6,852	159.6	4
		APH HOL	1	APHANOCAPSA HOLSATICA	71,000	0.0016	17,736	395.7	4
		APHA SMI	1	APHANOTHECE SMITHII	96,750	0.0022	16,129	369.9	4
		APHA STA	1	APHANOTHECE STAGNINA	1,689,250	0.0418	70,387	1742.7	4
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	960,750	0.0251	43,671	1139.0	4
		BRA VIT	4	BRACHYSIRA VITREA	7,479,000	0.2426	16,330	529.7	4
		CHR MIN	1	CHROOCOCCUS MINUTUS	79,500	0.0023	7,245	212.2	4
		CHR MINI	1	CHROOCOCCUS MINIMUS	1,107,500	0.0335	276,964	8388.9	4
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	2,873,250	0.0693	17,736	427.6	4
		CYC ATO	4	CYCLOTELLA ATOMUS	284,250	0.0065	2,016	46.2	4
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,061,000	0.0330	6,241	194.0	4
		DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	113,000	0.0041	8,065	289.3	4
		DIP OBL	4	DIPLONEIS OBLONGELLA	880,000	0.0302	2,619	90.0	4
		DIP PARM	4	DIPLONEIS PARMA	416,250	0.0067	201	3.2	4
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	2,159,500	0.0718	11,486	382.1	4
		ENC MIN	4	ENCYONEMA MINUTUM	70,750	0.0011	402	6.4	4
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	646,000	0.0104	603	9.7	4
		G ANA	1	ANABAENA SP	68,750	0.0011	3,615	58.0	4
		G GLO	1	GLOEOCAPSA SP	37,000	0.0009	9,269	220.3	4
		G NIT SM	4	NITZSCHIA SP (SMALL)	235,000	0.0080	2,217	75.6	4
		G PHO	1	PHORMIDIUM SP	854,500	0.0274	34,177	1097.1	4
		G SYNE	1	SYNECHOCCOCCUS SP	18,105,000	0.5260	282,887	8219.3	4
		GOM APO	1	GOMPHOSPHAERIA APONINA	270,000	0.0043	9,639	154.8	4
		GOM PAR	4	GOMPHONEMA PARVULUM	1,075,500	0.0315	602	17.7	4
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	549,500	0.0197	274,867	9863.6	4
		JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	90,000	0.0014	1,607	25.8	4
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	604,000	0.0141	100,645	2351.2	4
		LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	64,500	0.0015	4,032	92.5	4
		MAS LANC	4	MASTOGLOIA LANCEOLATA	2,696,000	0.0969	402	14.4	4
		MAS SMI	4	MASTOGLOIA SMITHII	1,396,500	0.0224	402	6.4	4
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	11,986,500	0.3270	7,454	203.3	4
		MER DUP	1	MERISMOPEDIA DUPLEX	368,000	0.0117	24,530	776.6	4
		MER GLA	1	MERISMOPEDIA GLAUCA	479,250	0.0124	34,234	883.7	4
		MER TEN	1	MERISMOPEDIA TENUISSIMA	43,250	0.0011	43,053	1133.3	4
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	1,496,000	0.0343	2,016	46.2	4
		NAV RAD PA	4	NAVICULA RADIOSA V PARVA	379,500	0.0136	402	14.4	4
		NIT GRA	4	NITZSCHIA GRACILIS	317,250	0.0114	402	14.4	4
		NIT PAL	4	NITZSCHIA PALEA	1,370,500	0.0220	2,611	41.9	4
		NIT PALE	4	NITZSCHIA PALEACEA	215,750	0.0058	3,422	92.8	4
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	6,395,000	0.1600	10,876	272.2	4
		OOC SOL	3	OOCYSTIS SOLITARIA	544,750	0.0196	402	14.4	4
		PHO WIL	1	PHORMIDIUM WILLEI?	4,498,750	0.1407	214,222	6700.1	4
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	7,270,500	0.1848	403,916	10265.2	4
		PSE LIM	1	PSEUDANABAENA LIMNETICA	4,820,500	0.1536	688,677	21946.8	4
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	3,054,750	0.0732	234,979	5632.3	4
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	2,427,750	0.0679	115,608	3231.4	4
		SCE BIJ	3	SCENEDESMUS BIJUGA	124,750	0.0040	12,491	396.1	4
		SCE DEN	3	SCENEDESMUS DENTICULATUS	834,750	0.0299	4,032	144.7	4
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	41,000	0.0007	402	6.4	4
		SCH ARE	1	SCHIZOTHRIX ARENARIA?	156,750	0.0025	12,048	193.5	4
		SNO LAC	1	SNOWELLA LACUSTRIS	241,000	0.0039	9,639	154.8	4
		SPI SUB	1	SPIRULINA SUBSALSA	127,000	0.0046	2,016	72.3	4
		TET MIN	3	TETRAEDRON MINIMUM	102,000	0.0035	2,217	75.6	4
		TET TRI	3	TETRAEDRON TRIGONUM	586,000	0.0172	602	17.7	4
FSC-4	POR	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	23,000	0.0006	161	4.0	1
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	1,000	0.0000	161	4.0	1
		APH DEL	1	APHANOCAPSA DELICATISSIMA	8,000	0.0002	7,711	192.3	1
		APH HOL	1	APHANOCAPSA HOLSATICA	33,000	0.0008	8,353	208.3	1
		APHA CLA	1	APHANOTHECE CLATHRATA	28,000	0.0007	9,317	232.3	1
		APHA SMI	1	APHANOTHECE SMITHII	15,000	0.0004	2,570	64.1	1
		APHA STA	1	APHANOTHECE STAGNINA	85,000	0.0021	3,534	88.1	1
		BRA VIT	4	BRACHYSIRA VITREA	809,000	0.0202	1,767	44.1	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	4,000	0.0001	321	8.0	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	8,000	0.0002	1,928	48.1	1
		CYC MEN	4	CYCLOTELLA MENEGHINIANA	174,000	0.0043	161	4.0	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	191,000	0.0048	1,124	28.0	1
		DIP OVA	4	DIPLONEIS OVALIS	129,000	0.0032	321	8.0	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	362,000	0.0090	1,928	48.1	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	861,000	0.0215	803	20.0	1
		G GLO	1	GLOEOCAPSA SP	4,000	0.0001	964	24.0	1
		G SYNE	1	SYNECHOCCOCCUS SP	103,000	0.0026	1,606	40.0	1
		GOM GRA	4	GOMPHONEMA GRACILE	56,000	0.0014	161	4.0	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		GOM PAR	4	GOMPHONEMA PARVULUM	288,000	0.0072	161	4.0	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	4,000	0.0001	1,928	48.1	1
		MER GLA	1	MERISMOPEDIA GLAUCA	18,000	0.0004	1,285	32.0	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	3,000	0.0001	2,570	64.1	1
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	119,000	0.0030	161	4.0	1
		NIT FRU	4	NITZSCHIA FRUSTULUM	72,000	0.0018	321	8.0	1
		NIT PALE	4	NITZSCHIA PALEACEA	20,000	0.0005	321	8.0	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	274,000	0.0068	321	8.0	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	1,322,000	0.0330	2,249	56.1	1
		OOC SOL	3	OOCYSTIS SOLITARIA	218,000	0.0054	161	4.0	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	315,000	0.0079	17,510	436.6	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	78,000	0.0019	11,084	276.4	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	104,000	0.0026	8,032	200.3	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	6,000	0.0001	643	16.0	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	66,000	0.0016	643	16.0	1
		SNO LAC	1	SNOWELLA LACUSTRIS	129,000	0.0032	5,141	128.2	1
		TET TRI	3	TETRAEDRON TRIGONUM	626,000	0.0156	643	16.0	1
		THA BRA	4	THALASSIOSIRA BRAMAPUTRAE	734,000	0.0183	161	4.0	1
Monthly									
FSC-1	Oct-01	CHR DIS	1	CHROOCOCCUS DISPERSUS	452,000	0.0091	32,258	647.3	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	177,000	0.0036	16,129	323.6	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	1,355,000	0.0272	338,710	6796.2	1
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	20,903,000	0.4194	129,032	2589.0	1
		CHR TUR	1	CHROOCOCCUS TURGIDUS	4,323,000	0.0867	16,129	323.6	1
		G SCY	1	SCYTONEMA SP?	603,145,000	12.1021	435,484	8738.0	1
		G SYNE	1	SYNECHOCCOCCUS SP	5,161,000	0.1036	80,645	1618.1	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	1,387,000	0.0278	693,548	13916.1	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	5,032,000	0.1010	838,710	16828.8	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	210,000	0.0042	209,677	4207.2	1
		PHO FOR	1	PHORMIDIUM FORMOSUM	56,064,000	1.1249	709,677	14239.7	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	22,935,000	0.4602	1,274,194	25566.8	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	8,468,000	0.1699	1,209,677	24272.2	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	2,516,000	0.0505	193,548	3883.5	1
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	97,000	0.0019	8,065	161.8	1
		G CHLA	3	CHLAMYDOMONAS SP	2,161,000	0.0434	8,065	161.8	1
		OOC SOL	3	OOCYSTIS SOLITARIA	10,944,000	0.2196	8,065	161.8	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	161,000	0.0032	16,129	323.6	1
		SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	1,032,000	0.0207	32,258	647.3	1
		ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	1,129,000	0.0227	8,065	161.8	1
		DIP OVA	4	DIPLONEIS OVALIS	3,250,000	0.0652	8,065	161.8	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	3,032,000	0.0608	16,129	323.6	1
		G NIT SM	4	NITZSCHIA SP (SMALL)	855,000	0.0172	8,065	161.8	1
		GOM PAR	4	GOMPHONEMA PARVULUM	14,404,000	0.2890	8,065	161.8	1
		NAV CRY	4	NAVICULA CRYPTOCEPHALA	3,420,000	0.0686	8,065	161.8	1
		NIT PAL	4	NITZSCHIA PALEA	4,234,000	0.0850	8,065	161.8	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	13,774,000	0.2764	16,129	323.6	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	9,484,000	0.1903	16,129	323.6	1
FSC-1	Jan-02	ANA AFF	1	ANABAENA AFFINIS	1,205,000	0.0290	24,096	580.3	1
		APH CON	1	APHANOCAPSA CONFERTA	643,000	0.0155	160,643	3868.5	1
		APH HOL	1	APHANOCAPSA HOLSATICA	231,000	0.0056	57,831	1392.6	1
		APH INC	1	APHANOCAPSA INCERTA	100,000	0.0024	99,598	2398.4	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	318,000	0.0077	14,458	348.2	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	35,000	0.0008	3,213	77.4	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	129,000	0.0031	32,129	773.7	1
		G SYNE	1	SYNECHOCCOCCUS SP	19,945,000	0.4803	311,647	7504.9	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	96,000	0.0023	48,193	1160.6	1
		LEI EPI	1	LEIBLEINIA EPIPHYTICA	193,000	0.0046	32,129	773.7	1
		LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	334,000	0.0080	20,884	502.9	1
		MER GLA	1	MERISMOPEDIA GLAUCA	360,000	0.0087	25,703	619.0	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	55,000	0.0013	54,618	1315.3	1
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	8,720,000	0.2100	73,896	1779.5	1
		PHO FOR	1	PHORMIDIUM FORMOSUM	5,076,000	0.1222	64,257	1547.4	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	1,648,000	0.0397	91,566	2205.0	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	2,485,000	0.0598	355,020	8549.3	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	606,000	0.0146	46,586	1121.9	1
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	1,552,000	0.0374	73,896	1779.5	1
		ANK FAL	3	ANKISTRODESMUS FALCATUS	334,000	0.0080	6,426	154.7	1
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	6,000	0.0001	1,606	38.7	1
		COS BOT	3	COSMARIUM BOTRYTIS	42,594,000	1.0257	1,606	38.7	1
		G CHLA	3	CHLAMYDOMONAS SP	430,000	0.0104	1,606	38.7	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		KIR LUN	3	KIRCHNERIELLA LUNARIS	42,000	0.0010	3,213	77.4	1
		OOC PAR	3	OOCYSTIS PARVA	80,000	0.0019	3,213	77.4	1
		OOC SOL	3	OOCYSTIS SOLITARIA	2,179,000	0.0525	1,606	38.7	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	96,000	0.0023	9,639	232.1	1
		AMP LIN	4	AMPHORA LINEOLATA?	26,215,000	0.6313	4,819	116.0	1
		BAC PAX	4	BACILLARIA PAXILLIFER	2,271,000	0.0547	1,606	38.7	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	819,000	0.0197	4,819	116.0	1
		DIP OBL	4	DIPLONEIS OBLONGELLA	540,000	0.0130	1,606	38.7	1
		DIP OVA	4	DIPLONEIS OVALIS	647,000	0.0156	1,606	38.7	1
		ENC MIN	4	ENCYONEMA MINUTUM	283,000	0.0068	1,606	38.7	1
		GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	3,508,000	0.0845	1,606	38.7	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	30,997,000	0.7464	19,277	464.2	1
		NIT CON	4	NITZSCHIA CONSTRICTA	972,000	0.0234	1,606	38.7	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	5,488,000	0.1322	6,426	154.7	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	944,000	0.0227	1,606	38.7	1
FSC-1	Apr-02	APH DEL	1	APHANOCAPSA DELICATISSIMA	16,000	0.0003	16,064	261.6	1
		APH HOL	1	APHANOCAPSA HOLSATICA	649,000	0.0106	162,249	2642.5	1
		APHA SMI	1	APHANOTHECE SMITHII	39,000	0.0006	6,426	104.7	1
		APHA STA	1	APHANOTHECE STAGNINA	424,000	0.0069	17,671	287.8	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	238,000	0.0039	59,438	968.0	1
		CHR TUR	1	CHROOCOCCUS TURGIDUS	430,000	0.0070	1,606	26.2	1
		G GLO	1	GLOEOCAPSA SP	26,000	0.0004	6,426	104.7	1
		G SYNE	1	SYNECHOCCOCCUS SP	7,916,000	0.1289	123,695	2014.6	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	80,000	0.0013	40,161	654.1	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	689,000	0.0112	114,859	1870.7	1
		LEP PER	1	LEPTOLYNGBYA PERELEGANS?	610,000	0.0099	32,129	523.3	1
		MER DUP	1	MERISMOPEDIA DUPLEX	96,000	0.0016	6,426	104.7	1
		MER GLA	1	MERISMOPEDIA GLAUCA	202,000	0.0033	14,458	235.5	1
		MER PUN	1	MERISMOPEDIA PUNCTATA	19,000	0.0003	6,426	104.7	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	29,000	0.0005	28,916	470.9	1
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	2,654,000	0.0432	22,490	366.3	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	4,222,000	0.0688	234,538	3819.8	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	596,000	0.0097	85,141	1386.7	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	282,000	0.0046	21,687	353.2	1
		SPI SUB	1	SPIRULINA SUBSALSA	51,000	0.0008	803	13.1	1
		OOC PAR	3	OOCYSTIS PARVA	20,000	0.0003	803	13.1	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	16,000	0.0003	1,606	26.2	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	164,000	0.0027	1,606	26.2	1
		AMP LIN	4	AMPHORA LINEOLATA?	4,368,000	0.0711	803	13.1	1
		BRA VIT	4	BRACHYSIRA VITREA	368,000	0.0060	803	13.1	1
		ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	1,419,000	0.0231	803	13.1	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	861,000	0.0140	803	13.1	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	2,582,000	0.0421	1,606	26.2	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	2,058,000	0.0335	2,410	39.3	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	2,361,000	0.0385	4,016	65.4	1
		G EUG	10	EUGLENA SP	10,342,000	0.1684	803	13.1	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
FSC-1	Aug-02	APH HOL	1	APHANOCAPSA HOLSATICA	1,161,000	0.0271	290,323	6771.8	1
		APH PLA	1	APHANOCAPSA PLANCTONICA?	968,000	0.0226	120,968	2821.6	1
		APHA STA	1	APHANOTHECE STAGNINA	1,935,000	0.0451	80,645	1881.1	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	2,661,000	0.0621	120,968	2821.6	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	1,952,000	0.0455	177,419	4138.3	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	1,484,000	0.0346	370,968	8652.9	1
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	15,677,000	0.3657	96,774	2257.3	1
		G ANA	1	ANABAENA SP	1,226,000	0.0286	64,516	1504.8	1
		G SYNE	1	SYNECHOCCOCCUS SP	28,387,000	0.6621	443,548	10345.8	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	1,000,000	0.0233	500,000	11662.6	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	10,742,000	0.2506	1,790,323	41759.6	1
		LEP PER	1	LEPTOLYNGBYA PERELEGANS?	3,371,000	0.0786	177,419	4138.3	1
		MER GLA	1	MERISMOPEDIA GLAUCA	1,355,000	0.0316	96,774	2257.3	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	129,000	0.0030	129,032	3009.7	1
		PHO FOR	1	PHORMIDIUM FORMOSUM	35,040,000	0.8173	443,548	10345.8	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	1,161,000	0.0271	64,516	1504.8	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	8,129,000	0.1896	1,161,290	27087.3	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	12,895,000	0.3008	991,935	23137.1	1
		SPI SUB	1	SPIRULINA SUBSALSA	508,000	0.0118	8,065	188.1	1
		G CHLA	3	CHLAMYDOMONAS SP	2,161,000	0.0504	8,065	188.1	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	1,645,000	0.0384	16,129	376.2	1
		SCE SEM	3	SCENEDESMUS SEMIPULCHER	1,226,000	0.0286	32,258	752.4	1
		CYC ATO	4	CYCLOTELLA ATOMUS	1,137,000	0.0265	8,065	188.1	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	8,646,000	0.2017	8,065	188.1	1
		G CYC	4	CYCLOTELLA SP	3,194,000	0.0745	16,129	376.2	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	25,935,000	0.6049	16,129	376.2	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	4,742,000	0.1106	8,065	188.1	1
FSC-2	Oct-01	APHA STA	1	APHANOTHECE STAGNINA	3,097,000	0.0959	129,032	3996.8	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	4,435,000	0.1374	201,613	6245.1	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	1,548,000	0.0480	387,097	11990.6	1
		COE PUS	1	COELOMORON PUSILLUM	1,355,000	0.0420	225,806	6994.5	1
		G GLO	1	GLOEOCAPSA SP	194,000	0.0060	48,387	1498.8	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	1,290,000	0.0400	645,161	19984.3	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	1,839,000	0.0570	306,452	9492.5	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	8,710,000	0.2698	483,871	14988.2	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	23,427,000	0.7257	3,346,774	103668.4	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	1,258,000	0.0390	96,774	2997.6	1
		SCH ARE	1	SCHIZOTHRIX ARENARIA?	20,968,000	0.6495	1,612,903	49960.7	1
		SPI SUB	1	SPIRULINA SUBSALSA	508,000	0.0157	8,065	249.8	1
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	32,000	0.0010	8,065	249.8	1
		G SPI	3	SPIROGYRA SP	1,613,868,000	49.9905	16,129	499.6	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	323,000	0.0100	32,258	999.2	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	1,645,000	0.0510	16,129	499.6	1
		TET TRI	3	TETRAEDRON TRIGONUM	7,847,000	0.2431	8,065	249.8	1
		ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	1,129,000	0.0350	8,065	249.8	1
		BRA VIT	4	BRACHYSIRA VITREA	40,629,000	1.2585	88,710	2747.8	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	5,484,000	0.1699	32,258	999.2	1
		DIP OVA	4	DIPLONEIS OVALIS	3,250,000	0.1007	8,065	249.8	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	6,065,000	0.1879	32,258	999.2	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	17,290,000	0.5356	16,129	499.6	1
		G NIT SM	4	NITZSCHIA SP (SMALL)	4,274,000	0.1324	40,323	1249.0	1
		GOM PAR	4	GOMPHONEMA PARVULUM	28,806,000	0.8923	16,129	499.6	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	12,969,000	0.4017	8,065	249.8	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		NAV CRY	4	NAVICULA CRYPTOCEPHALA	10,258,000	0.3177	24,194	749.4	1
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	5,984,000	0.1854	8,065	249.8	1
		NAV POD	4	NAVICULA PODZORSKII	17,783,000	0.5508	8,065	249.8	1
		NIT PALE	4	NITZSCHIA PALEACEA	508,000	0.0157	8,065	249.8	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	34,436,000	1.0667	40,323	1249.0	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	9,484,000	0.2938	16,129	499.6	1
FSC-2	Jan-02	ANA AFF	1	ANABAENA AFFINIS	402,000	0.0147	8,032	293.9	1
		APHA STA	1	APHANOTHECE STAGNINA	1,928,000	0.0705	80,321	2938.6	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	206,000	0.0075	51,406	1880.7	1
		G GLO	1	GLOEOCAPSA SP	39,000	0.0014	9,639	352.6	1
		G SCY	1	SCYTONEMA SP?	62,297,000	2.2792	44,980	1645.6	1
		G SYNE	1	SYNECHOCCOCCUS SP	2,776,000	0.1016	43,373	1586.8	1
		MER GLA	1	MERISMOPEDIA GLAUCA	540,000	0.0198	38,554	1410.5	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	45,000	0.0016	44,980	1645.6	1
		PHO FOR	1	PHORMIDIUM FORMOSUM	4,061,000	0.1486	51,406	1880.7	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	347,000	0.0127	19,277	705.3	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	169,000	0.0062	24,096	881.6	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	1,002,000	0.0367	77,108	2821.0	1
		SPI SUB	1	SPIRULINA SUBSALSA	101,000	0.0037	1,606	58.8	1
		ANK FAL	3	ANKISTRODESMUS FALCATUS	84,000	0.0031	1,606	58.8	1
		COE MIC	3	COELASTRUM MICROPORUM	3,759,000	0.1375	57,831	2115.8	1
		COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	4,747,000	0.1737	1,606	58.8	1
		G DES	3	DESMIDIUM SP	26,023,000	0.9521	4,819	176.3	1
		G SPI	3	SPIROGYRA SP	642,986,000	23.5239	6,426	235.1	1
		OOC SOL	3	OOCYSTIS SOLITARIA	2,179,000	0.0797	1,606	58.8	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	129,000	0.0047	12,851	470.2	1
		SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	411,000	0.0150	12,851	470.2	1
		TET TRI	3	TETRAEDRON TRIGONUM	1,563,000	0.0572	1,606	58.8	1
		ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	225,000	0.0082	1,606	58.8	1
		BAC PAX	4	BACILLARIA PAXILLIFER	2,271,000	0.0831	1,606	58.8	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,365,000	0.0499	8,032	293.9	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	3,322,000	0.1215	17,671	646.5	1
		FRA FAM	4	FRAGILARIA FAMELICA	2,892,000	0.1058	8,032	293.9	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	8,610,000	0.3150	8,032	293.9	1
		GOM GRA	4	GOMPHONEMA GRACILE	562,000	0.0206	1,606	58.8	1
		GOM PAR	4	GOMPHONEMA PARVULUM	2,868,000	0.1049	1,606	58.8	1
		GYR NOD	4	GYROSIGMA NODIFERUM	7,950,000	0.2909	1,606	58.8	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	5,167,000	0.1890	3,213	117.5	1
		NIT AMP	4	NITZSCHIA AMPHIBIA	771,000	0.0282	3,213	117.5	1
		NIT PAL	4	NITZSCHIA PALEA	843,000	0.0308	1,606	58.8	1
		NIT PALE	4	NITZSCHIA PALEACEA	506,000	0.0185	8,032	293.9	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	5,488,000	0.2008	6,426	235.1	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	4,723,000	0.1728	8,032	293.9	1
		NIT SERP	4	NITZSCHIA SERPENTIRAPHE	14,929,000	0.5462	1,606	58.8	1
FSC-2	Apr-02	ANA AFF	1	ANABAENA AFFINIS	1,210,000	0.0288	24,194	576.7	1
		APHA SMI	1	APHANOTHECE SMITHII	1,258,000	0.0300	209,677	4997.7	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	5,323,000	0.1269	241,935	5766.6	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	645,000	0.0154	161,290	3844.4	1
		G GLO	1	GLOEOCAPSA SP	194,000	0.0046	48,387	1153.3	1
		G SYNE	1	SYNECHOCCOCCUS SP	12,387,000	0.2952	193,548	4613.3	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	645,000	0.0154	322,581	7688.8	1
		LEI EPI	1	LEIBLEINIA EPIPHYTICA	1,935,000	0.0461	322,581	7688.8	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	3,968,000	0.0946	661,290	15762.1	1
		MER DUP	1	MERISMOPEDIA DUPLEX	968,000	0.0231	64,516	1537.8	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	32,000	0.0008	32,258	768.9	1
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	45,677,000	1.0887	387,097	9226.6	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	24,242,000	0.5778	1,346,774	32100.9	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	5,081,000	0.1211	725,806	17299.9	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	315,000	0.0075	24,194	576.7	1
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	32,000	0.0008	8,065	192.2	1
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	97,000	0.0023	8,065	192.2	1
		COE SPH	3	COELASTRUM SPHAERICUM	2,516,000	0.0600	32,258	768.9	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	484,000	0.0115	48,387	1153.3	1
		TET TRI	3	TETRAEDRON TRIGONUM	7,847,000	0.1870	8,065	192.2	1
		AMP LIN	4	AMPHORA LINEOLATA?	87,742,000	2.0914	16,129	384.4	1
		BRA VIT	4	BRACHYSIRA VITREA	3,694,000	0.0880	8,065	192.2	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,371,000	0.0327	8,065	192.2	1
		ENC MIN	4	ENCYONEMA MINUTUM	2,839,000	0.0677	16,129	384.4	1
		FRA FAM	4	FRAGILARIA FAMELICA	11,613,000	0.2768	32,258	768.9	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	8,646,000	0.2061	8,065	192.2	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		G NIT SM	4	NITZSCHIA SP (SMALL)	855,000	0.0204	8,065	192.2	1
		MAS SMI	4	MASTOGLOIA SMITHII	56,097,000	1.3371	16,129	384.4	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	51,871,000	1.2364	32,258	768.9	1
		NIT FRU	4	NITZSCHIA FRUSTULUM	1,815,000	0.0433	8,065	192.2	1
		NIT PAL	4	NITZSCHIA PALEA	4,234,000	0.1009	8,065	192.2	1
		NIT PALE	4	NITZSCHIA PALEACEA	1,524,000	0.0363	24,194	576.7	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	6,888,000	0.1642	8,065	192.2	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	28,452,000	0.6782	48,387	1153.3	1
FSC-2	Aug-02	APH HOL	1	APHANOCAPSA HOLSATICA	58,000	0.0014	14,458	351.1	1
		APH PLA	1	APHANOCAPSA PLANCTONICA?	103,000	0.0025	12,851	312.0	1
		APHA STA	1	APHANOTHECE STAGNINA	617,000	0.0150	25,703	624.1	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	495,000	0.0120	22,490	546.1	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	35,000	0.0008	3,213	78.0	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	13,000	0.0003	3,213	78.0	1
		COE KUE	1	COELOSPHAERIUM KUETZINGIANUM	188,000	0.0046	20,884	507.1	1
		G PHO	1	PHORMIDIUM SP	542,000	0.0132	21,687	526.6	1
		G SYNE	1	SYNECHOCCOCCUS SP	17,324,000	0.4207	270,683	6572.7	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	129,000	0.0031	64,257	1560.3	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	766,000	0.0186	127,711	3101.1	1
		LEP PER	1	LEPTOLYNGBYA PERELEGANS?	351,000	0.0085	18,474	448.6	1
		MER PUN	1	MERISMOPEDIA PUNCTATA	10,000	0.0002	3,213	78.0	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	6,000	0.0001	6,426	156.0	1
		NOD SPU	1	NODULARIA SPUMIGENA?	4,655,000	0.1130	33,735	819.1	1
		PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	4,739,000	0.1151	40,161	975.2	1
		PHO FOR	1	PHORMIDIUM FORMOSUM	3,807,000	0.0924	48,193	1170.2	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	680,000	0.0165	37,751	916.7	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	2,120,000	0.0515	302,811	7352.8	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	146,000	0.0035	11,245	273.0	1
		SNO LAC	1	SNOWELLA LACUSTRIS	402,000	0.0098	16,064	390.1	1
		SPI SUB	1	SPIRULINA SUBSALSA	101,000	0.0025	1,606	39.0	1
		OOC PAR	3	OOCYSTIS PARVA	20,000	0.0005	803	19.5	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	48,000	0.0012	4,819	117.0	1
		SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	77,000	0.0019	2,410	58.5	1
		SCE GUT	3	SCENEDESMUS GUTWINSKII	42,000	0.0010	1,606	39.0	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	82,000	0.0020	803	19.5	1
		TET TRI	3	TETRAEDRON TRIGONUM	781,000	0.0190	803	19.5	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	273,000	0.0066	1,606	39.0	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	151,000	0.0037	803	19.5	1
		ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	1,419,000	0.0345	803	19.5	1
		G ACH	4	ACHNANTHES SP	68,000	0.0017	803	19.5	1
		GOM GRA	4	GOMPHONEMA GRACILE	281,000	0.0068	803	19.5	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	9,040,000	0.2195	5,622	136.5	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	3,778,000	0.0917	6,426	156.0	1
FSC-3	Oct-01	APHA STA	1	APHANOTHECE STAGNINA	1,548,000	0.0555	64,516	2314.7	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	177,000	0.0064	16,129	578.7	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	2,548,000	0.0914	637,097	22857.8	1
		G SYNE	1	SYNECHOCCOCCUS SP	11,871,000	0.4259	185,484	6654.8	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	1,935,000	0.0694	967,742	34720.7	1
		PHO WIL	1	PHORMIDIUM WILLEI?	11,855,000	0.4253	564,516	20253.7	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	3,484,000	0.1250	193,548	6944.1	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	11,290,000	0.4051	1,612,903	57867.8	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	1,677,000	0.0602	129,032	4629.4	1
		SPI SUB	1	SPIRULINA SUBSALSA	508,000	0.0182	8,065	289.4	1
		DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	452,000	0.0162	32,258	1157.4	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	242,000	0.0087	24,194	868.0	1
		SCE DEN	3	SCENEDESMUS DENTICULATUS	3,339,000	0.1198	16,129	578.7	1
		TET MIN	3	TETRAEDRON MINIMUM	371,000	0.0133	8,065	289.4	1
		ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	1,129,000	0.0405	8,065	289.4	1
		BRA VIT	4	BRACHYSIRA VITREA	22,161,000	0.7951	48,387	1736.0	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,371,000	0.0492	8,065	289.4	1
		DIP OBL	4	DIPLONEIS OBLONGELLA	2,710,000	0.0972	8,065	289.4	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	6,065,000	0.2176	32,258	1157.4	1
		G NIT SM	4	NITZSCHIA SP (SMALL)	855,000	0.0307	8,065	289.4	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	12,969,000	0.4653	8,065	289.4	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	4,742,000	0.1701	8,065	289.4	1
FSC-3	Jan-02	APHA STA	1	APHANOTHECE STAGNINA	1,080,000	0.0388	44,980	1616.4	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	1,202,000	0.0432	54,618	1962.7	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	35,000	0.0013	3,213	115.5	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	51,000	0.0018	12,851	461.8	1
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	1,041,000	0.0374	6,426	230.9	1
		G GLO	1	GLOEOCAPSA SP	13,000	0.0005	3,213	115.5	1
		G PHO	1	PHORMIDIUM SP	2,410,000	0.0866	96,386	3463.6	1
		G SYNE	1	SYNECHOCCOCCUS SP	31,769,000	1.1416	496,386	17837.6	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	263,000	0.0095	131,727	4733.6	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	386,000	0.0139	64,257	2309.1	1
		MER DUP	1	MERISMOPEDIA DUPLEX	988,000	0.0355	65,863	2366.8	1
		MER GLA	1	MERISMOPEDIA GLAUCA	472,000	0.0170	33,735	1212.3	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	61,000	0.0022	61,044	2193.6	1
		PHO WIL	1	PHORMIDIUM WILLEI?	1,957,000	0.0703	93,173	3348.2	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	2,082,000	0.0748	115,663	4156.3	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	2,361,000	0.0848	337,349	12122.6	1
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	4,757,000	0.1709	226,506	8139.5	1
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	19,000	0.0007	1,606	57.7	1
		OOC SOL	3	OOCYSTIS SOLITARIA	2,179,000	0.0783	1,606	57.7	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	96,000	0.0034	9,639	346.4	1
		TET TRI	3	TETRAEDRON TRIGONUM	1,563,000	0.0562	1,606	57.7	1
		AMP LIN	4	AMPHORA LINEOLATA?	26,215,000	0.9420	4,819	173.2	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,365,000	0.0491	8,032	288.6	1
		DIP OBL	4	DIPLONEIS OBLONGELLA	540,000	0.0194	1,606	57.7	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	906,000	0.0326	4,819	173.2	1
		GOM PAR	4	GOMPHONEMA PARVULUM	2,868,000	0.1031	1,606	57.7	1
		MAS LANC	4	MASTOGLOIA LANCEOLATA	10,784,000	0.3875	1,606	57.7	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	5,167,000	0.1857	3,213	115.5	1
		NAV RAD PA	4	NAVICULA RADIOSA V PARVA	1,518,000	0.0545	1,606	57.7	1
		NIT GRA	4	NITZSCHIA GRACILIS	1,269,000	0.0456	1,606	57.7	1
		NIT PALE	4	NITZSCHIA PALEACEA	304,000	0.0109	4,819	173.2	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	1,889,000	0.0679	3,213	115.5	1
FSC-3	Apr-02	ANA AFF	1	ANABAENA AFFINIS	4,839,000	0.1110	96,774	2219.3	1
		APH HOL	1	APHANOCAPSA HOLSATICA	258,000	0.0059	64,516	1479.5	1
		APHA SMI	1	APHANOTHECE SMITHII	387,000	0.0089	64,516	1479.5	1
		APHA STA	1	APHANOTHECE STAGNINA	968,000	0.0222	40,323	924.7	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	2,129,000	0.0488	96,774	2219.3	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	1,677,000	0.0385	419,355	9616.9	1
		CHR PRE	1	CHROOCOCCUS PRESCOTTII	10,452,000	0.2397	64,516	1479.5	1
		G GLO	1	GLOEOCAPSA SP	129,000	0.0030	32,258	739.8	1
		G PHO	1	PHORMIDIUM SP	1,008,000	0.0231	40,323	924.7	1
		G SYNE	1	SYNECHOCCOCCUS SP	10,839,000	0.2486	169,355	3883.7	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	1,452,000	0.0333	241,935	5548.2	1
		LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	258,000	0.0059	16,129	369.9	1
		MER DUP	1	MERISMOPEDIA DUPLEX	484,000	0.0111	32,258	739.8	1
		MER GLA	1	MERISMOPEDIA GLAUCA	1,355,000	0.0311	96,774	2219.3	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	81,000	0.0019	80,645	1849.4	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	23,516,000	0.5393	1,306,452	29960.3	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	4,968,000	0.1139	709,677	16274.7	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	9,226,000	0.2116	709,677	16274.7	1
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	3,048,000	0.0699	145,161	3328.9	1
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	290,000	0.0067	24,194	554.8	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	161,000	0.0037	16,129	369.9	1
		AMP LIN	4	AMPHORA LINEOLATA?	43,874,000	1.0061	8,065	185.0	1
		BRA VIT	4	BRACHYSIRA VITREA	7,387,000	0.1694	16,129	369.9	1
		CYC ATO	4	CYCLOTELLA ATOMUS	1,137,000	0.0261	8,065	185.0	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	1,371,000	0.0314	8,065	185.0	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	1,516,000	0.0348	8,065	185.0	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	25,935,000	0.5948	16,129	369.9	1
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	5,984,000	0.1372	8,065	185.0	1
		NIT PALE	4	NITZSCHIA PALEACEA	508,000	0.0116	8,065	185.0	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	14,226,000	0.3262	24,194	554.8	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
FSC-3	Aug-02	APH HOL	1	APHANOCAPSA HOLSATICA	26,000	0.0004	6,426	103.2	1
		APHA STA	1	APHANOTHECE STAGNINA	3,161,000	0.0508	131,727	2115.1	1
		APHN FLO	1	APHANIZOMENON FLOS-AQUAE	512,000	0.0082	23,293	374.0	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	106,000	0.0017	9,639	154.8	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	154,000	0.0025	38,554	619.1	1
		G ANA	1	ANABAENA SP	275,000	0.0044	14,458	232.2	1
		G GLO	1	GLOEOCAPSA SP	6,000	0.0001	1,606	25.8	1
		G SYNE	1	SYNECHOCCOCCUS SP	17,941,000	0.2881	280,321	4501.1	1
		GOM APO	1	GOMPHOSPHAERIA APONINA	1,080,000	0.0173	38,554	619.1	1
		JOH PEL	1	JOHANNESBAPTISTIA PELLUCIDA	360,000	0.0058	6,426	103.2	1
		LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	578,000	0.0093	96,386	1547.7	1
		MER GLA	1	MERISMOPEDIA GLAUCA	90,000	0.0014	6,426	103.2	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	31,000	0.0005	30,522	490.1	1
		PHO WIL	1	PHORMIDIUM WILLEI?	4,183,000	0.0672	199,197	3198.5	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	663,000	0.0106	94,779	1521.9	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	1,316,000	0.0211	101,205	1625.0	1
		PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	1,906,000	0.0306	90,763	1457.4	1
		SCH ARE	1	SCHIZOTHRIX ARENARIA?	627,000	0.0101	48,193	773.8	1
		SNO LAC	1	SNOWELLA LACUSTRIS	964,000	0.0155	38,554	619.1	1
		ANK SPI	3	ANKISTRODESMUS SPIRALIS	19,000	0.0003	1,606	25.8	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	164,000	0.0026	1,606	25.8	1
		TET MIN	3	TETRAEDRON MINIMUM	37,000	0.0006	803	12.9	1
		TET TRI	3	TETRAEDRON TRIGONUM	781,000	0.0125	803	12.9	1
		AMP LIN	4	AMPHORA LINEOLATA?	26,215,000	0.4209	4,819	77.4	1
		BRA VIT	4	BRACHYSIRA VITREA	368,000	0.0059	803	12.9	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	137,000	0.0022	803	12.9	1
		DIP OBL	4	DIPLONEIS OBLONGELLA	270,000	0.0043	803	12.9	1
		DIP PARM	4	DIPLONEIS PARMA	1,665,000	0.0267	803	12.9	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	151,000	0.0024	803	12.9	1
		ENC MIN	4	ENCYONEMA MINUTUM	283,000	0.0045	1,606	25.8	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	2,584,000	0.0415	2,410	38.7	1
		G NIT SM	4	NITZSCHIA SP (SMALL)	85,000	0.0014	803	12.9	1
		GOM PAR	4	GOMPHONEMA PARVULUM	1,434,000	0.0230	803	12.9	1
		MAS SMI	4	MASTOGLOIA SMITHII	5,586,000	0.0897	1,606	25.8	1
		MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	3,875,000	0.0622	2,410	38.7	1
		NIT PAL	4	NITZSCHIA PALEA	5,482,000	0.0880	10,442	167.7	1
		NIT PALE	4	NITZSCHIA PALEACEA	51,000	0.0008	803	12.9	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	4,723,000	0.0758	8,032	129.0	1
FSC-4	Jan-02	APH DEL	1	APHANOCAPSA DELICATISSIMA	8,000	0.0002	7,711	192.3	1
		APH HOL	1	APHANOCAPSA HOLSATICA	33,000	0.0008	8,353	208.3	1
		APHA CLA	1	APHANOTHECE CLATHRATA	28,000	0.0007	9,317	232.3	1
		APHA SMI	1	APHANOTHECE SMITHII	15,000	0.0004	2,570	64.1	1
		APHA STA	1	APHANOTHECE STAGNINA	85,000	0.0021	3,534	88.1	1
		CHR MIN	1	CHROOCOCCUS MINUTUS	4,000	0.0001	321	8.0	1
		CHR MINI	1	CHROOCOCCUS MINIMUS	8,000	0.0002	1,928	48.1	1
		G GLO	1	GLOEOCAPSA SP	4,000	0.0001	964	24.0	1
		G SYNE	1	SYNECHOCCOCCUS SP	103,000	0.0026	1,606	40.0	1
		JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	4,000	0.0001	1,928	48.1	1
		MER GLA	1	MERISMOPEDIA GLAUCA	18,000	0.0004	1,285	32.0	1
		MER TEN	1	MERISMOPEDIA TENUISSIMA	3,000	0.0001	2,570	64.1	1
		PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	315,000	0.0079	17,510	436.6	1
		PSE LIM	1	PSEUDANABAENA LIMNETICA	78,000	0.0019	11,084	276.4	1
		PSE MON	1	PSEUDANABAENA MONILIFORMIS	104,000	0.0026	8,032	200.3	1
		SNO LAC	1	SNOWELLA LACUSTRIS	129,000	0.0032	5,141	128.2	1
		ANK NAN	3	ANKISTRODESMUS NANNOSELENE	1,000	0.0000	161	4.0	1
		OOC SOL	3	OOCYSTIS SOLITARIA	218,000	0.0054	161	4.0	1
		SCE BIJ	3	SCENEDESMUS BIJUGA	6,000	0.0001	643	16.0	1
		SCE QUA	3	SCENEDESMUS QUADRICAUDA	66,000	0.0016	643	16.0	1
		TET TRI	3	TETRAEDRON TRIGONUM	626,000	0.0156	643	16.0	1
		ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	23,000	0.0006	161	4.0	1
		BRA VIT	4	BRACHYSIRA VITREA	809,000	0.0202	1,767	44.1	1
		CYC MEN	4	CYCLOTELLA MENEGHINIANA	174,000	0.0043	161	4.0	1
		CYM MIC	4	CYMBELLA MICROCEPHALA	191,000	0.0048	1,124	28.0	1

EXHIBIT E.1-10

Period-of-Record and Monthly Summaries of Average Algal Biovolumes and Cell Counts for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Organism Code	Division Code	Organism	Biovolumes (μm^3/ml)	Biovolumes (cm^3/m^2)	Cell Counts (# cells/ml)	Cell Counts (# cells/m^2 x 10^6)	No. of Events
		DIP OVA	4	DIPLONEIS OVALIS	129,000	0.0032	321	8.0	1
		ENC EVE	4	ENCYONEMA EVERGLADIANUM	362,000	0.0090	1,928	48.1	1
		FRA SYN	4	FRAGILARIA SYNEGROTESCA	861,000	0.0215	803	20.0	1
		GOM GRA	4	GOMPHONEMA GRACILE	56,000	0.0014	161	4.0	1
		GOM PAR	4	GOMPHONEMA PARVULUM	288,000	0.0072	161	4.0	1
		NAV CRYP	4	NAVICULA CRYPTOTENELLA	119,000	0.0030	161	4.0	1
		NIT FRU	4	NITZSCHIA FRUSTULUM	72,000	0.0018	321	8.0	1
		NIT PALE	4	NITZSCHIA PALEACEA	20,000	0.0005	321	8.0	1
		NIT PALF	4	NITZSCHIA PALEAFORMIS	274,000	0.0068	321	8.0	1
		NIT SEM	4	NITZSCHIA SEMIROBUSTA	1,322,000	0.0330	2,249	56.1	1
		THA BRA	4	THALASSIOSIRA BRAMAPUTRAE	734,000	0.0183	161	4.0	1

EXHIBIT E.1-11

Summary of Macrophyte Biomass Data from the Field Scale Cells, August 2001 - September 2002

		Dry Weight		Wet Weight		Total Solids
Treatment	**Date**	**g**	**g/m^2**	**g**	**g/m^2**	**%**
FSC-1	Sep-01	11.9	97.1	143.2	1164.1	8.3
	Oct-01	32.7	265.9	---	---	11.6
	Nov-01	35.1	285.4	244.2	1985.4	14.7
	Dec-01	24.2	196.7	194.4	1580.6	13.6
	Apr-02	55.2	280.7	345.8	1756.9	15.3
	Aug-02	63.0	320.4	256.7	1304.4	---
FSC-2	Sep-01	4.6	56.6	35.2	429.0	13.2
	Oct-01	5.8	70.3	---	---	11.3
	Nov-01	4.9	59.3	36.0	439.3	13.5
	Dec-01	5.6	68.0	59.5	726.1	9.4
	Apr-02	6.1	47.0	91.0	698.3	9.5
	Aug-02	9.6	65.2	77.7	526.3	---
FSC-3	Aug-01	0.9	14.2	1.9	31.2	45.4
	Sep-01	3.4	27.6	30.3	246.0	11.3
	Oct-01	1.9	15.8	---	---	9.9
	Nov-01	3.3	26.9	22.4	182.1	14.8
	Dec-01	0.9	7.5	10.0	81.5	9.2
	Apr-02	5.0	41.7	29.2	241.1	18.8
	Aug-02	4.5	22.7	43.5	221.0	---
FSC-4	Nov-01	3.9	32.0	30.7	249.3	12.8
	Dec-01	3.8	31.0	33.9	275.4	11.2

EXHIBIT E.1-12

Period-of-Record, Quarterly and Monthly Summaries of Ecosystem Metabolism Data from the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	GPP(day) $g/m^2/d$	CR(24hr) $g/m^2/d$	P/R Ratio	NPP(24hr) $g/m^2/d$	NPP(day) $g/m^2/d$	Avg Night Res $g/m^2/hr$	PAR(24hr) $E/m^2/d$	Efficiency %
Period-of-Record									
FSC-1	POR	2.75	2.75	1.00	0.01	1.22	0.11	23.82	2.54
FSC-2	POR	3.98	4.01	0.99	0.02	1.76	0.17	25.86	3.35
FSC-3	POR	1.64	1.69	0.97	-0.04	0.64	0.07	27.18	1.38
FSC-4	POR	2.48	2.54	0.98	-0.06	1.08	0.11	25.46	2.04
Quarterly									
FSC-1	2001-QTR3	1.89	1.89	1.00	0.00	0.80	0.08	20.02	2.86
	2001-QTR4	2.01	2.00	1.01	0.02	0.94	0.08	20.59	2.17
	2002-QTR1	3.00	3.04	0.99	-0.04	1.39	0.13	22.11	3.02
	2002-QTR2	3.65	3.57	1.02	0.08	1.56	0.15	33.56	2.08
	2002-QTR3	4.21	4.20	1.00	0.02	1.76	0.17	30.93	2.71
FSC-2	2001-QTR3	3.09	2.78	1.11	0.31	1.52	0.12	17.36	4.97
	2001-QTR4	4.05	3.92	1.03	0.12	1.83	0.16	28.11	2.97
	2002-QTR1	3.46	3.47	1.00	-0.01	1.59	0.14	23.58	3.31
	2002-QTR2	4.42	4.41	1.00	0.01	1.85	0.18	31.10	2.90
	2002-QTR3	6.10	6.15	0.99	-0.05	2.52	0.26	29.41	4.18
FSC-3	2001-QTR3	1.21	1.27	0.95	-0.06	0.46	0.05	19.96	2.11
	2002-QTR1	1.09	1.11	0.99	-0.02	0.47	0.05	25.84	0.92
	2002-QTR2	1.54	1.65	0.94	-0.10	0.58	0.07	29.75	1.11
	2002-QTR3	2.24	2.27	0.98	-0.04	0.86	0.09	30.40	1.46
FSC-4	2001-QTR3	0.79	0.82	0.97	-0.02	0.36	0.03	13.42	1.23
	2001-QTR4	2.41	2.48	0.97	-0.07	1.08	0.10	24.35	2.09
	2002-QTR1	2.69	2.77	0.97	-0.08	1.18	0.12	23.97	2.40
	2002-QTR2	2.83	2.87	0.99	-0.03	1.16	0.12	35.23	1.56
Monthly									
FSC-1	Aug-01	2.36	2.47	0.96	-0.11	0.92	0.10	32.49	1.43
	Sep-01	1.72	1.68	1.02	0.04	0.76	0.07	15.62	3.36
	Oct-01	1.95	1.94	1.01	0.01	0.89	0.08	23.60	1.82
	Nov-01	1.69	1.67	1.01	0.02	0.76	0.07	20.57	1.80
	Dec-01	2.54	2.51	1.01	0.03	1.28	0.10	14.98	3.28
	Jan-02	3.13	3.20	0.98	-0.07	1.51	0.13	17.48	3.54
	Feb-02	3.33	3.17	1.05	0.16	1.69	0.13	21.25	3.34
	Mar-02	2.53	2.72	0.93	-0.19	0.96	0.11	28.79	2.05
	Apr-02	3.65	3.57	1.02	0.08	1.56	0.15	33.56	2.08
	May-02	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--
	Jul-02	1.67	1.70	0.98	-0.03	0.61	0.07	37.20	0.86
	Aug-02	3.33	3.23	1.03	0.10	1.42	0.13	30.94	2.14
	Sep-02	6.55	6.72	0.98	-0.17	2.68	0.28	30.22	4.24
FSC-2	Sep-01	3.09	2.78	1.11	0.31	1.52	0.12	17.36	4.97
	Oct-01	3.88	3.77	1.03	0.11	1.73	0.16	29.00	2.74
	Nov-01	5.25	5.01	1.05	0.24	2.53	0.21	21.90	4.59
	Jan-02	3.34	3.25	1.03	0.09	1.72	0.14	18.06	3.66
	Feb-02	3.35	3.32	1.01	0.02	1.59	0.14	20.80	3.91
	Mar-02	3.68	3.81	0.97	-0.13	1.49	0.16	31.11	2.40
	Apr-02	4.42	4.41	1.00	0.01	1.85	0.18	31.10	2.90
	May-02	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--
	Aug-02	--	--	--	--	--	--	--	--
	Sep-02	6.10	6.15	0.99	-0.05	2.52	0.26	29.41	4.18
FSC-3	Aug-01	1.21	1.37	0.88	-0.16	0.41	0.06	32.21	0.71
	Sep-01	1.21	1.24	0.98	-0.02	0.48	0.05	15.25	2.66
	Oct-02	--	--	--	--	--	--	--	--
	Nov-02	--	--	--	--	--	--	--	--
	Dec-02	--	--	--	--	--	--	--	--
	Jan-02	0.82	0.91	0.91	-0.08	0.37	0.04	22.88	0.69
	Feb-02	0.81	0.78	1.04	0.03	0.40	0.03	20.44	1.00
	Mar-02	1.36	1.41	0.96	-0.05	0.54	0.06	30.71	0.87
	Apr-02	1.54	1.65	0.94	-0.10	0.58	0.07	29.75	1.11
	May-02	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--
	Jul-02	1.86	1.87	1.00	-0.01	0.67	0.08	30.73	1.18
	Aug-02	2.08	2.08	1.00	0.00	0.84	0.09	30.37	1.38
	Sep-02	5.32	5.81	0.92	-0.48	1.94	0.24	29.15	3.50
FSC-4	Sep-01	0.79	0.82	0.97	-0.02	0.36	0.03	13.42	1.23
	Oct-01	2.09	2.19	0.95	-0.11	0.88	0.09	26.66	1.58
	Nov-01	0.77	0.80	0.97	-0.03	0.37	0.03	18.04	0.82
	Dec-01	3.85	3.83	1.00	0.02	1.93	0.16	18.44	4.04
	Jan-02	2.26	2.45	0.92	-0.19	1.02	0.10	21.59	2.00
	Feb-02	2.40	2.36	1.02	0.04	1.17	0.10	20.33	2.59
	Mar-02	3.13	3.25	0.96	-0.12	1.25	0.14	28.02	2.42
	Apr-02	2.83	2.87	0.99	-0.03	1.16	0.12	35.23	1.56
	May-02	--	--	--	--	--	--	--	--
	Jun-02	--	--	--	--	--	--	--	--
	Jul-02	--	--	--	--	--	--	--	--
	Aug-02	--	--	--	--	--	--	--	--
	Sep-02	--	--	--	--	--	--	--	--

EXHIBIT E.1-13

Period-of-Record, Quarterly and Monthly Summaries of Groundwater Data for the Field-Scale Cells, August 200

Well	Date	CL (mg/L)	TP (mg/L)
Period-of-Record			
FSC-WELL-1BERM	POR	193	0.015
FSC-WELL-1CTR	POR	147	0.014
FSC-WELL-1IN	POR	145	0.014
FSC-WELL-1OUT	POR	219	0.022
FSC-WELL-2CTR	POR	125	0.015
FSC-WELL-3CTR	POR	86	0.016
FSC-WELL-3IN	POR	77	0.013
FSC-WELL-3OUT	POR	193	0.014
FSC-WELL-4BERM	POR	222	0.020
FSC-WELL-4CTR	POR	167	0.016
Quarterly			
FSC-WELL-1BERM	2001-QTR3	---	0.013
	2001-QTR4	181	0.013
	2002-QTR1	139	0.011
	2002-QTR2	212	0.019
	2002-QTR3	232	0.015
FSC-WELL-1CTR	2001-QTR3	---	0.020
	2001-QTR4	117	0.011
	2002-QTR1	139	0.012
	2002-QTR2	155	0.016
	2002-QTR3	156	0.017
FSC-WELL-1IN	2001-QTR3	---	0.011
	2001-QTR4	104	0.012
	2002-QTR1	114	0.012
	2002-QTR2	164	0.017
	2002-QTR3	183	0.019
FSC-WELL-1OUT	2001-QTR3	---	0.017
	2001-QTR4	195	0.018
	2002-QTR1	187	0.018
	2002-QTR2	231	0.025
	2002-QTR3	247	0.027
FSC-WELL-2CTR	2001-QTR3	---	0.016
	2001-QTR4	112	0.014
	2002-QTR1	101	0.012
	2002-QTR2	145	0.018
	2002-QTR3	140	0.015
FSC-WELL-3CTR	2001-QTR3	---	0.014
	2001-QTR4	41	0.018
	2002-QTR1	56	0.014
	2002-QTR2	122	0.019
	2002-QTR3	96	0.014
FSC-WELL-3IN	2001-QTR3	---	0.013
	2001-QTR4	46	0.012
	2002-QTR1	53	0.013
	2002-QTR2	97	0.015
	2002-QTR3	86	0.013
FSC-WELL-3OUT	2001-QTR3	---	0.010
	2001-QTR4	158	0.013
	2002-QTR1	153	0.016
	2002-QTR2	235	0.013
	2002-QTR3	189	0.017
FSC-WELL-4BERM	2001-QTR3	---	0.023
	2001-QTR4	172	0.020
	2002-QTR1	194	0.017
	2002-QTR2	315	0.021
	2002-QTR3	187	0.022
FSC-WELL-4CTR	2001-QTR3	---	0.011
	2001-QTR4	120	0.012
	2002-QTR1	125	0.013
	2002-QTR2	203	0.016
	2002-QTR3	188	0.025

EXHIBIT E.1-13

Period-of-Record, Quarterly and Monthly Summaries of Groundwater Data for the Field-Scale Cells, August 200

Well	Date	CL (mg/L)	TP (mg/L)
Monthly			
FSC-WELL-1BERM	Sep-01	---	0.013
	Oct-01	---	0.013
	Nov-01	---	0.012
	Dec-01	181	0.013
	Jan-02	172	0.011
	Feb-02	197	0.009
	Mar-02	94	0.012
	Apr-02	149	0.018
	May-02	203	0.022
	Jun-02	292	0.014
	Jul-02	213	0.015
	Aug-02	265	0.017
	Sep-02	236	0.015
FSC-WELL-1CTR	Sep-01	---	0.020
	Oct-01	---	0.012
	Nov-01	---	0.012
	Dec-01	117	0.010
	Jan-02	119	0.010
	Feb-02	114	0.010
	Mar-02	184	0.015
	Apr-02	141	0.013
	May-02	131	0.022
	Jun-02	192	0.014
	Jul-02	100	0.014
	Aug-02	207	0.018
	Sep-02	161	0.018
FSC-WELL-1IN	Sep-01	---	0.011
	Oct-01	---	0.011
	Nov-01	---	0.013
	Dec-01	104	0.012
	Jan-02	112	0.012
	Feb-02	117	0.011
	Mar-02	114	0.013
	Apr-02	108	0.013
	May-02	134	0.019
	Jun-02	250	0.018
	Jul-02	175	0.018
	Aug-02	199	0.026
	Sep-02	174	0.014
FSC-WELL-1OUT	Sep-01	---	0.017
	Oct-01	---	0.014
	Nov-01	---	0.019
	Dec-01	195	0.019
	Jan-02	221	0.020
	Feb-02	215	0.013
	Mar-02	124	0.021
	Apr-02	190	0.026
	May-02	246	0.024
	Jun-02	258	0.025
	Jul-02	442	0.023
	Aug-02	174	0.032
	Sep-02	199	0.020
FSC-WELL-2CTR	Sep-01	---	0.016
	Oct-01	---	0.013
	Nov-01	---	0.016
	Dec-01	112	0.013
	Jan-02	123	0.013
	Feb-02	111	0.011
	Mar-02	60	0.014
	Apr-02	124	0.012
	May-02	127	0.026
	Jun-02	183	0.016
	Jul-02	167	0.017
	Aug-02	91	0.014
	Sep-02	161	0.014

EXHIBIT E.1-13
Period-of-Record, Quarterly and Monthly Summaries of Groundwater Data for the Field-Scale Cells, August 200

Well	Date	CL (mg/L)	TP (mg/L)
FSC-WELL-3CTR	Sep-01	---	0.014
	Oct-01	---	0.017
	Nov-01	---	0.022
	Dec-01	41	0.015
	Jan-02	46	0.014
	Feb-02	59	0.017
	Mar-02	65	0.010
	Apr-02	99	0.020
	May-02	116	0.026
	Jun-02	150	0.012
	Jul-02	67	0.012
	Aug-02	108	0.012
	Sep-02	112	0.017
FSC-WELL-3IN	Sep-01	---	0.013
	Oct-01	---	0.011
	Nov-01	---	0.013
	Dec-01	46	0.013
	Jan-02	42	0.012
	Feb-02	41	0.012
	Mar-02	74	0.014
	Apr-02	190	0.015
	May-02	46	0.012
	Jun-02	75	0.017
	Jul-02	58	0.013
	Aug-02	99	0.013
	Sep-02	99	0.012
FSC-WELL-3OUT	Sep-01	---	0.010
	Oct-01	---	0.010
	Nov-01	---	0.013
	Dec-01	158	0.016
	Jan-02	141	0.016
	Feb-02	158	0.010
	Mar-02	159	0.018
	Apr-02	232	0.017
	May-02	217	0.009
	Jun-02	258	0.011
	Jul-02	192	0.020
	Aug-02	165	0.015
	Sep-02	211	0.016
FSC-WELL-4BERM	Sep-01	---	0.023
	Oct-01	---	0.019
	Nov-01	---	0.022
	Dec-01	172	0.019
	Jan-02	201	0.020
	Feb-02	202	0.015
	Mar-02	179	0.016
	Apr-02	662	0.018
	May-02	91	0.026
	Jun-02	192	0.018
	Jul-02	200	0.025
	Aug-02	199	0.021
	Sep-02	174	0.022
FSC-WELL-4CTR	Sep-01	---	0.011
	Oct-01	---	0.011
	Nov-01	---	0.014
	Dec-01	120	0.012
	Jan-02	158	0.014
	Feb-02	117	0.011
	Mar-02	99	0.013
	Apr-02	165	0.015
	May-02	195	0.016
	Jun-02	250	0.016
	Jul-02	175	0.020
	Aug-02	190	0.035
	Sep-02	199	0.019

EXHIBIT E.1-14

Period-of-Record, Quarterly and Monthly Summaries of PAR Extinction Measurements
for the Field-Scale Cells, August 2001 - September 2002

Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	Z (m)	Ext Coeff (m-1)
Period-of-Record						
FSC-1	POR	0.36	938	560	0.26	2.29
FSC-2	POR	0.26	946	599	0.18	3.09
FSC-3	POR	0.36	1,250	777	0.24	2.09
FSC-4	POR	0.23	1,103	653	0.21	2.04
Quarterly						
FSC-1	2001-QTR3	0.35	781	586	0.23	1.58
	2001-QTR4	0.29	847	481	0.21	3.01
	2002-QTR1	0.41	811	460	0.29	1.97
	2002-QTR2	0.39	1,819	683	0.27	4.25
	2002-QTR3	0.40	916	630	0.28	1.77
FSC-2	2001-QTR3	0.26	1,271	717	0.20	2.97
	2001-QTR4	0.24	536	314	0.19	3.22
	2002-QTR1	0.29	1,110	699	0.17	3.70
	2002-QTR2	0.28	1,611	1,132	0.16	2.17
	2002-QTR3	0.24	615	409	0.18	2.58
FSC-3	2001-QTR3	0.38	1,533	977	0.26	1.62
	2001-QTR4	0.34	845	519	0.22	2.43
	2002-QTR1	0.32	1,160	905	0.20	1.68
	2002-QTR2	0.39	1,984	724	0.27	3.93
	2002-QTR3	0.37	1,146	747	0.24	1.85
FSC-4	2001-QTR3	0.06	---	---	---	---
	2001-QTR4	0.05	---	---	---	---
	2002-QTR1	0.33	1,059	778	0.21	1.31
	2002-QTR2	0.18	2,135			
	2002-QTR3	0.34	974	528	0.22	2.76
Monthly						
FSC-1	Aug-01	0.42	247	128	0.30	2.21
	Sep-01	0.28	1,314	1,045	0.16	0.96
	Oct-01	0.43	820	312	0.31	3.00
	Nov-01	0.16	599	399	0.09	1.94
	Dec-01	0.27	1,039	677	0.15	3.38
	Jan-02	0.43	429	245	0.31	1.82
	Feb-02	--	--	--	--	--
	Mar-02	0.39	1,193	675	0.27	2.12
	Apr-02	0.39	1,819	683	0.27	4.25
	May-02	--	--	--	--	--
	Jun-02	--	--	--	--	--
	Jul-02	0.41	991	557	0.28	1.98
	Aug-02	0.39	1,245	965	0.27	1.00
	Sep-02	0.41	512	368	0.29	2.32

EXHIBIT E.1-14
Period-of-Record, Quarterly and Monthly Summaries of PAR Extinction Measurements
for the Field-Scale Cells, August 2001 - September 2002

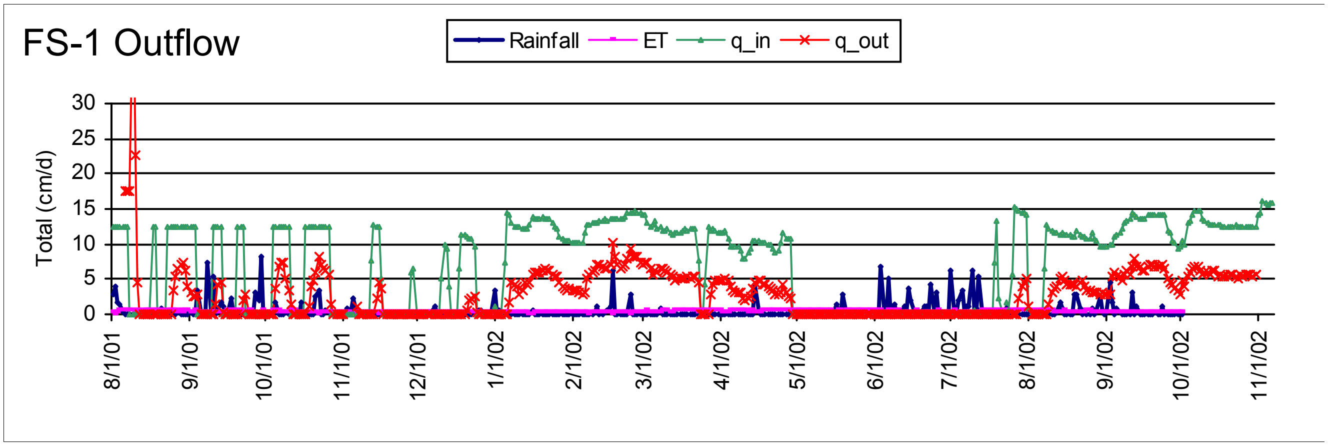
Treatment	Date	Water Depth (m)	PAR ($\mu mol/m^2/s$) Surface	PAR ($\mu mol/m^2/s$) Bottom	Z (m)	Ext Coeff (m-1)
FSC-2	Aug-01	0.15	---	---	---	---
	Sep-01	0.32	1,271	717	0.20	2.97
	Oct-01	0.34	320	148	0.22	3.73
	Nov-01	0.10	---	---	---	---
	Dec-01	0.29	752	480	0.17	2.71
	Jan-02	0.28	1,505	925	0.16	5.02
	Feb-02	0.29	679	419	0.16	3.49
	Mar-02	0.30	1,146	754	0.18	2.58
	Apr-02	0.28	1,611	1,132	0.16	2.17
	May-02	--	--	--	--	--
	Jun-02	--	--	--	--	--
	Jul-02	0.28	796	574	0.16	2.13
	Aug-02	0.14	---	---	---	---
	Sep-02	0.32	434	243	0.20	3.03
FSC-3	Aug-01	0.37	774	678	0.25	1.07
	Sep-01	0.39	2,293	1,276	0.27	2.17
	Oct-01	0.37	492	268	0.25	2.42
	Nov-01	0.31	1,199	769	0.19	2.43
	Dec-01	--	--	--	--	--
	Jan-02	0.29	1,645	1,431	0.17	0.80
	Feb-02	--	--	--	--	--
	Mar-02	0.35	674	379	0.23	2.55
	Apr-02	0.39	1,984	724	0.27	3.93
	May-02	--	--	--	--	--
	Jun-02	--	--	--	--	--
	Jul-02	0.33	1,060	709	0.21	1.91
	Aug-02	0.39	1,571	1,065	0.27	1.46
	Sep-02	0.38	808	468	0.26	2.20
FSC-4	Sep-01	0.06	---	---	---	---
	Oct-02	--	--	--	--	--
	Nov-01	0.05	---	---	---	---
	Dec-01	--	--	--	--	--
	Jan-02	0.35	1,141	813	0.23	1.13
	Feb-02	--	--	--	--	--
	Mar-02	0.31	977	743	0.18	1.49
	Apr-02	0.18	2,135	---	---	---
	May-02	--	--	--	--	--
	Jun-02	--	--	--	--	--
	Jul-02	--	--	--	--	--
	Aug-02	0.37	1,323	706	0.25	2.58
	Sep-02	0.32	626	349	0.20	2.94

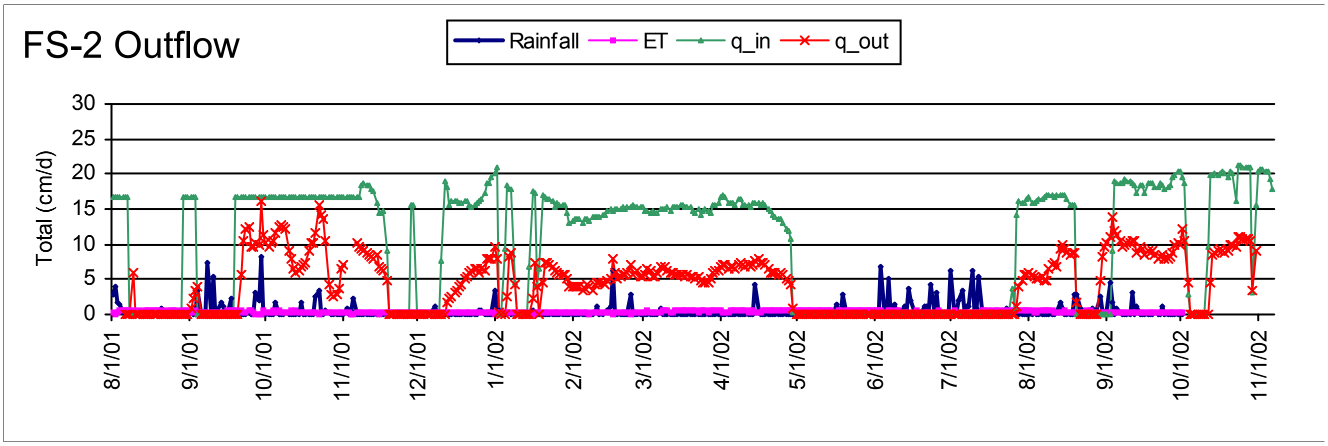
APPENDIX E.2

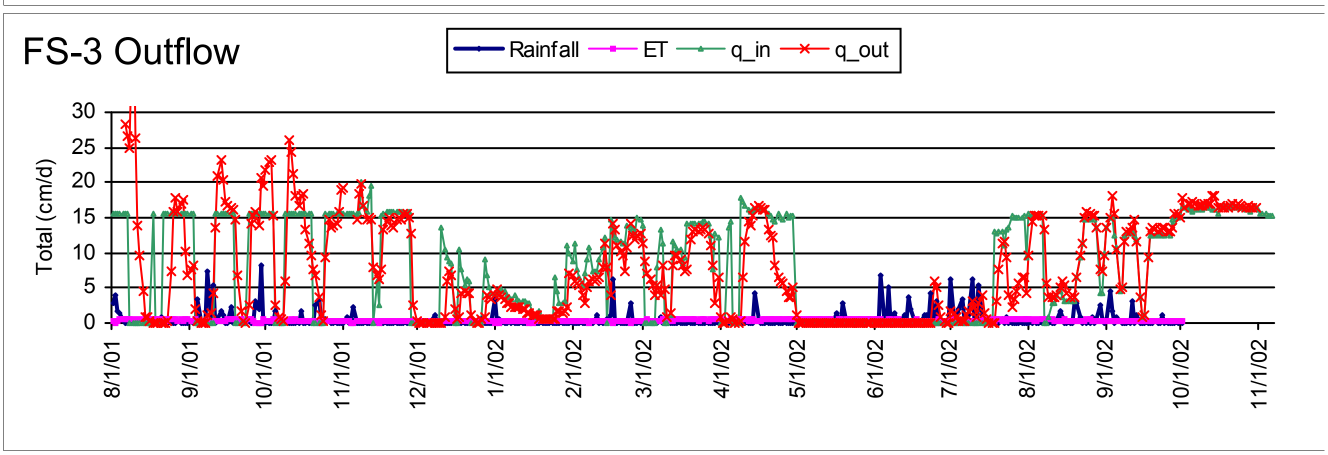
Trend Charts

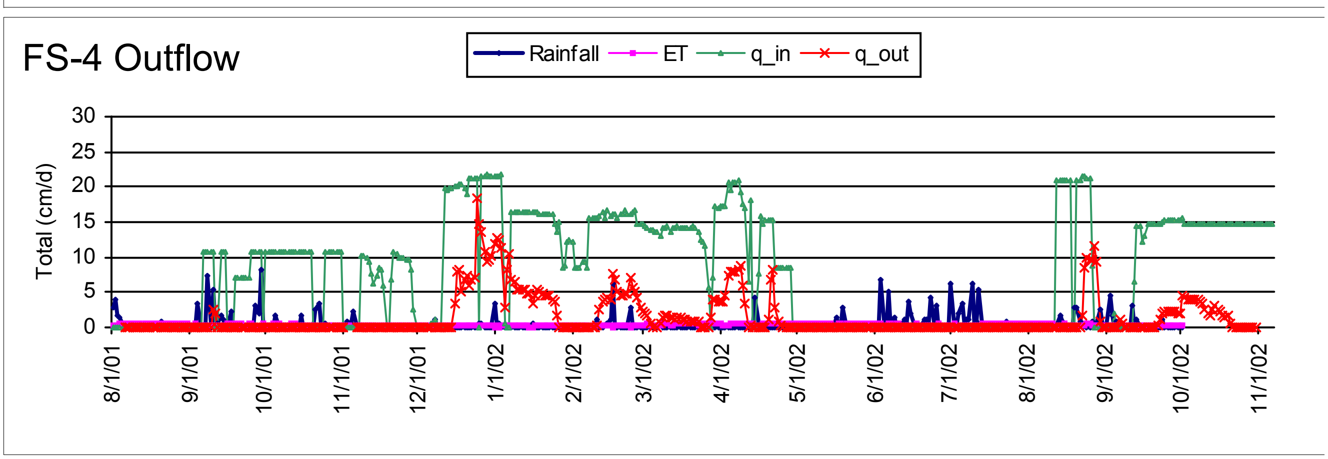
PSTA Field Scale Phase 3

Rainfall, Evapotranspiration, and Hydraulic Loading



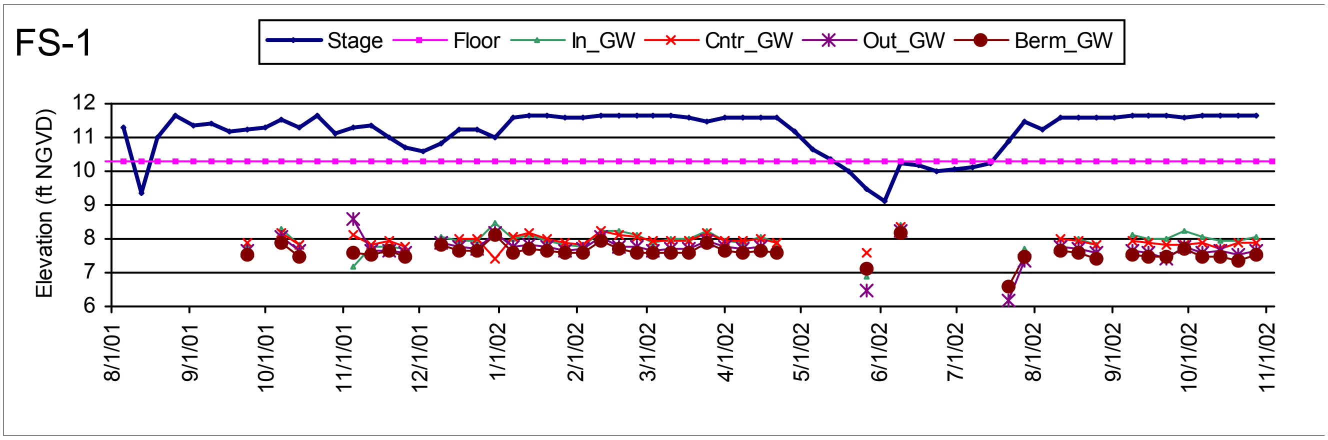


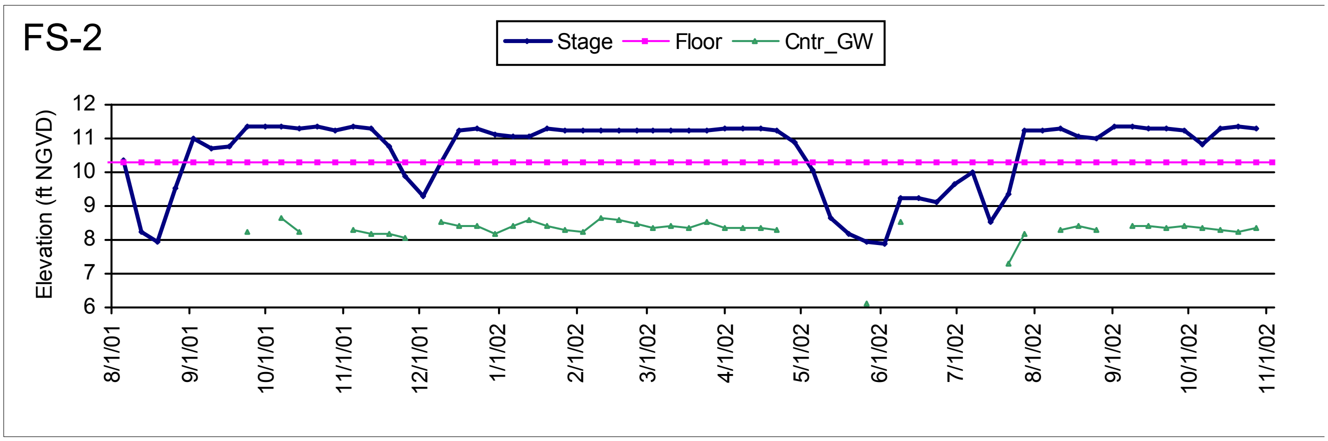


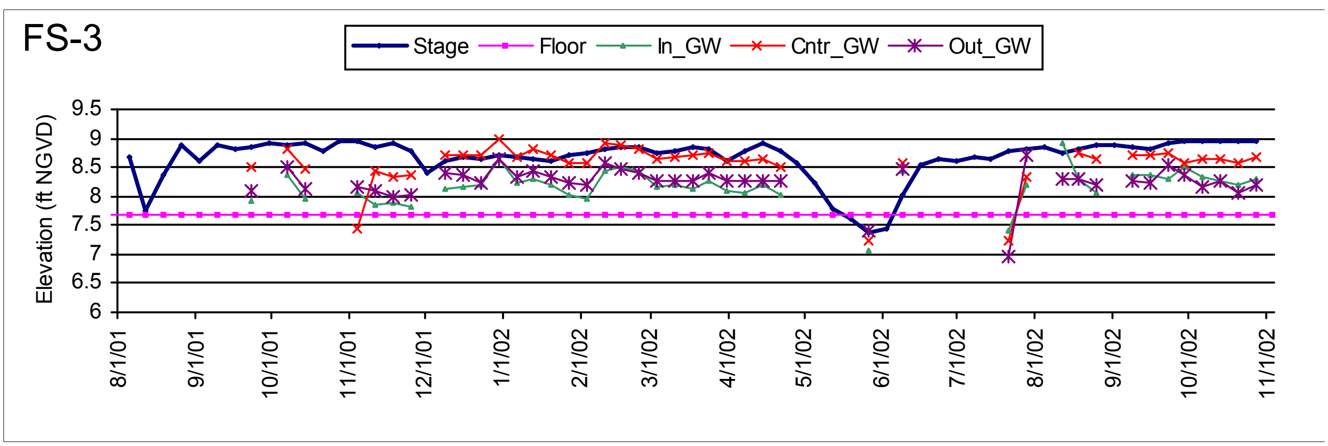


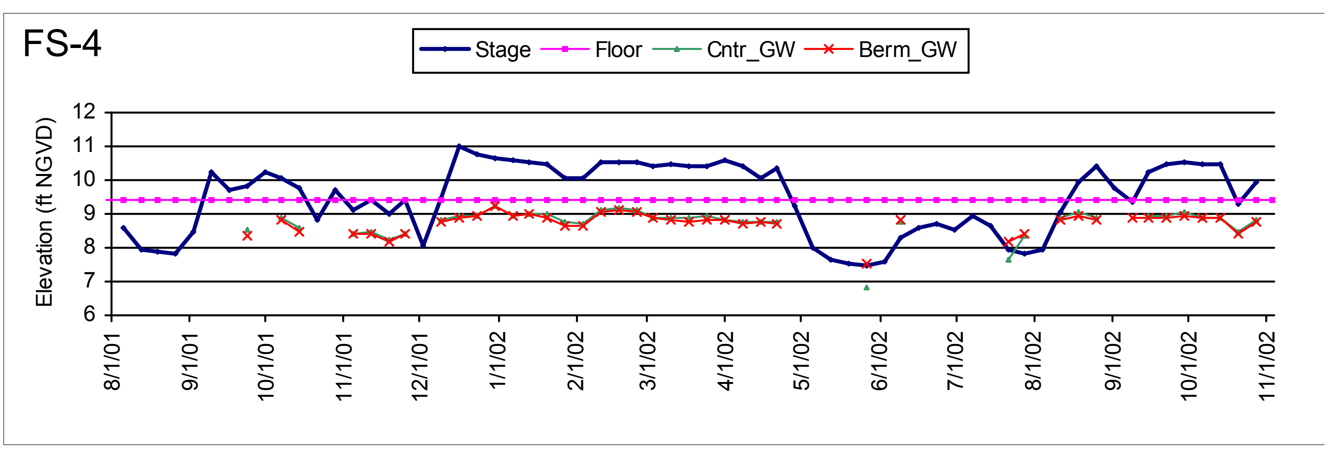
PSTA Field Scale Phase 3

Water Stage and Groundwater Elevations





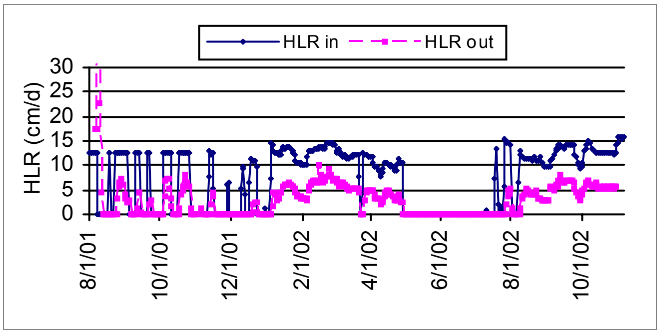


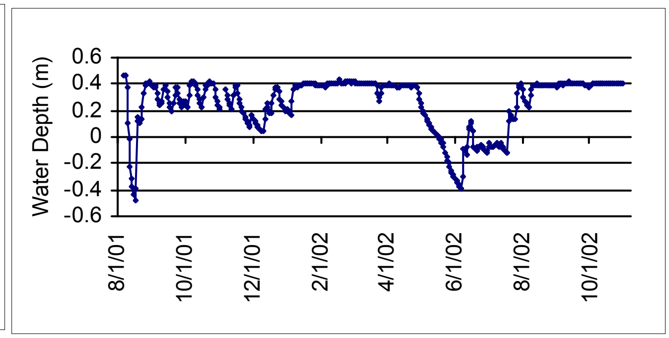


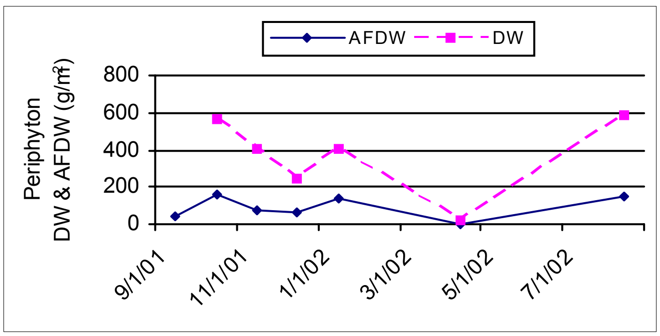
PSTA Research and Demonstration Project Phase 3
Field Scale PSTAs

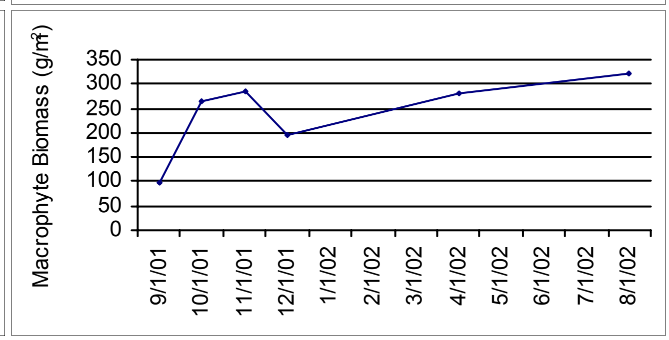
Treatment: FS-1 **Period:** 8/1/2001 - 11/15/2002

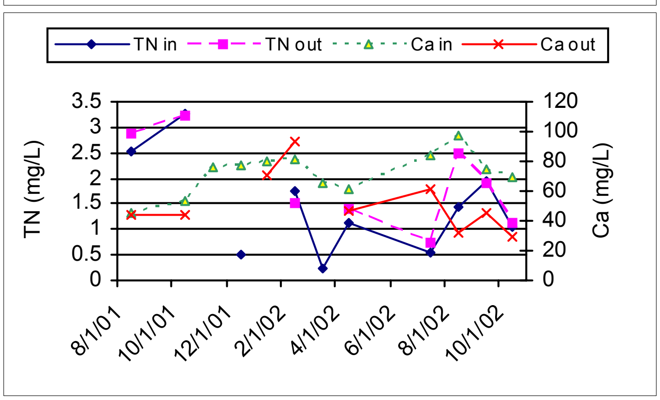
Cell Size: 66 x 315 m (2.08 ha) **Soil:** Limerock fill over peat

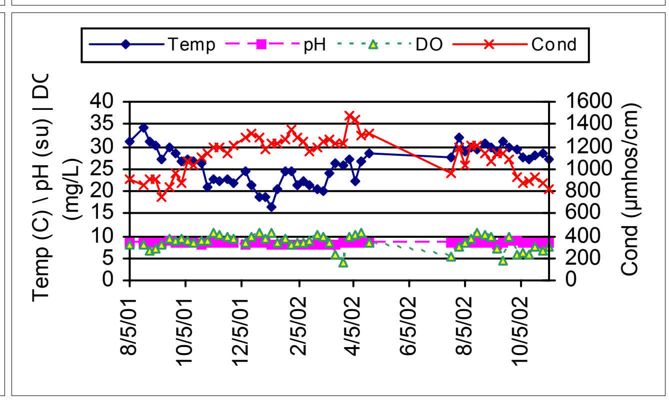


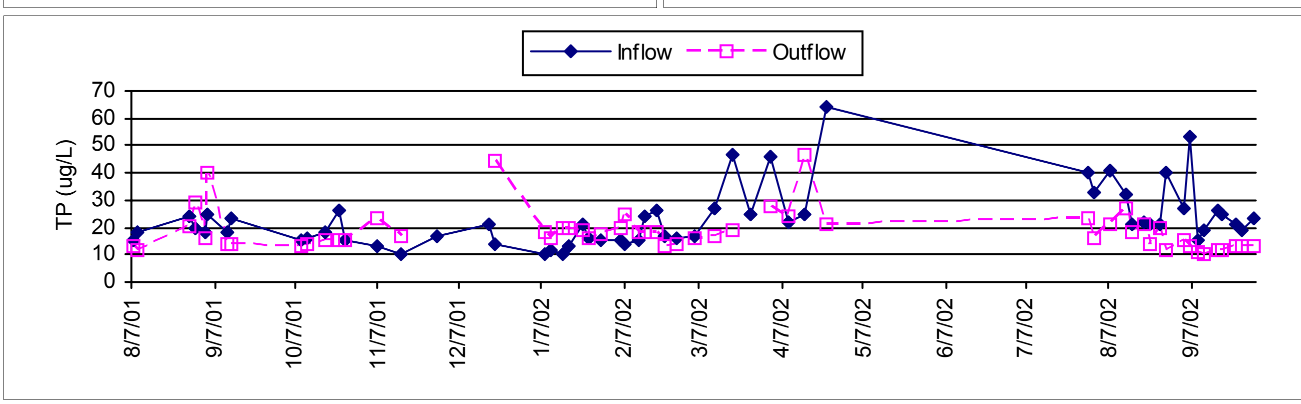










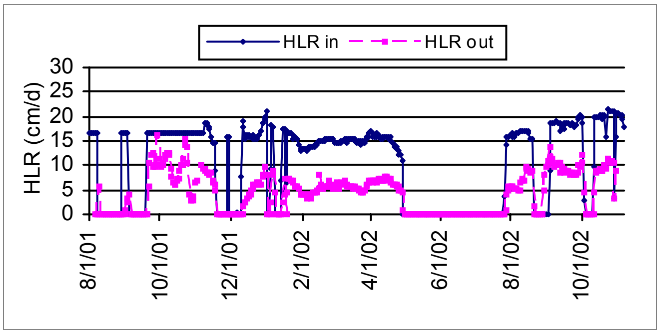


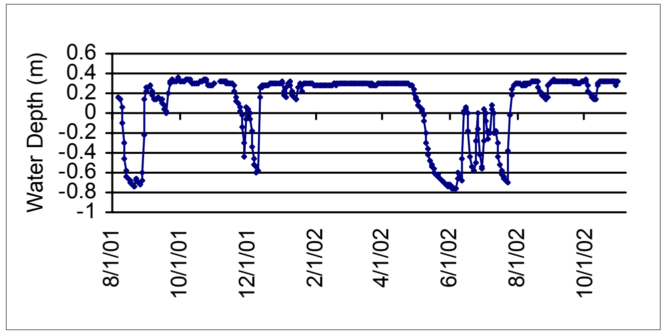
Summary for Period

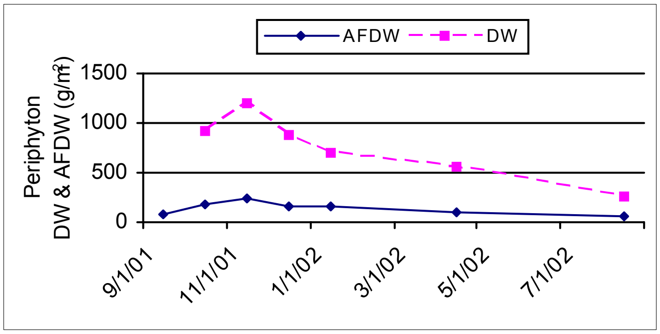
Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k_1 (m/yr)
FS-1	5.03	0.26	23	19	3.7

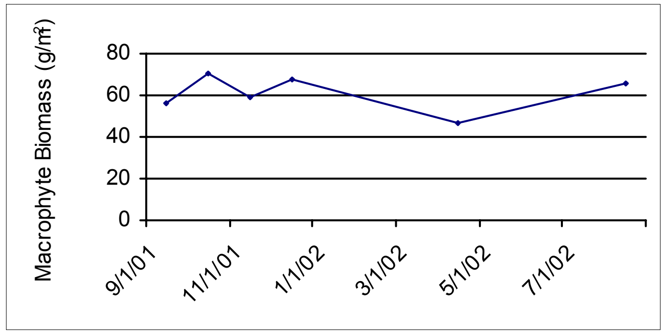
PSTA Research and Demonstration Project Phase 3
Field Scale PSTAs

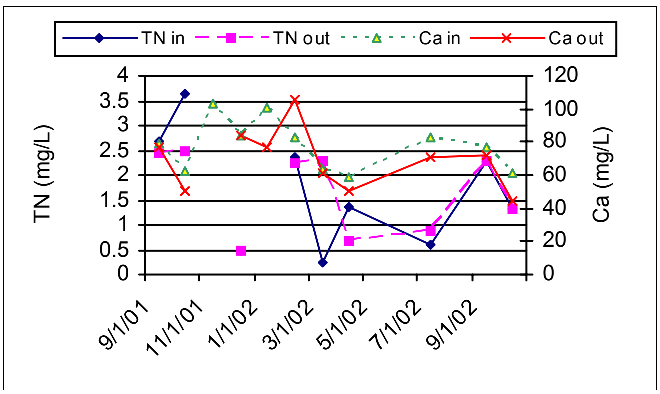
Treatment:	**FS-2**	**Period:**	**8/1/2001 - 11/15/2002**
Cell Size:	**22 x 945 m (2.08 ha)**	**Soil:**	**Limerock fill over peat**

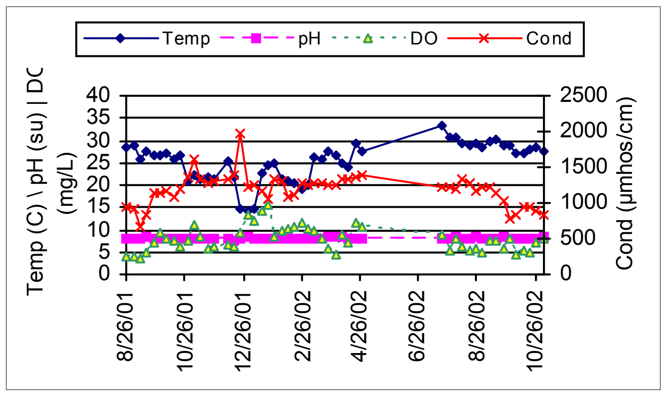


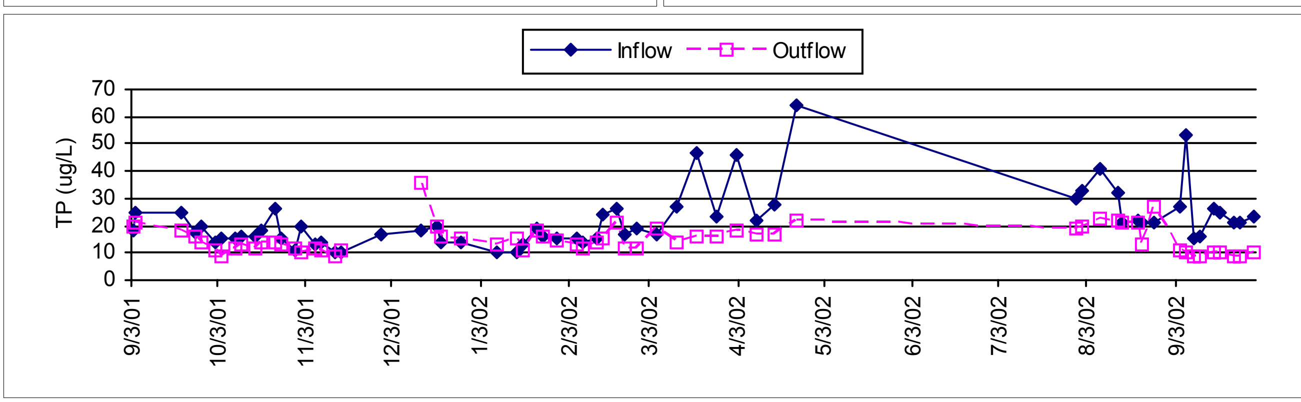












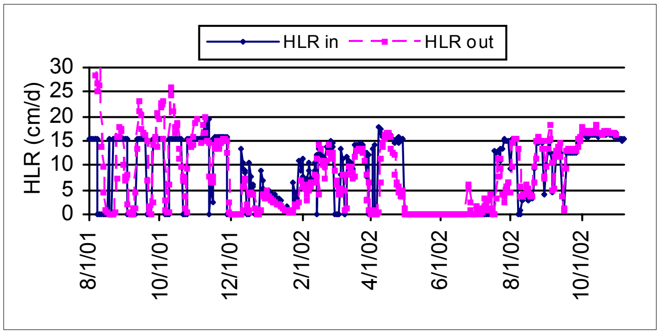
Summary for Period

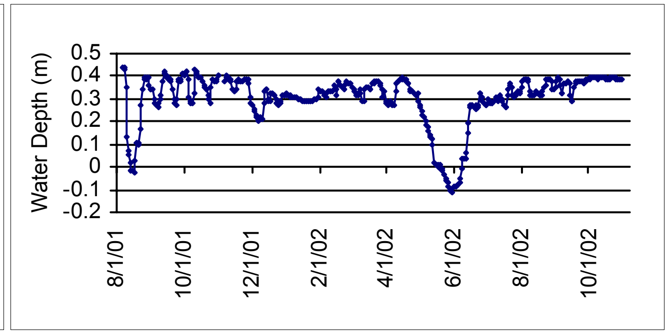
Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k_1 (m/yr)
FS-2	7.23	0.09	22	15	9.5

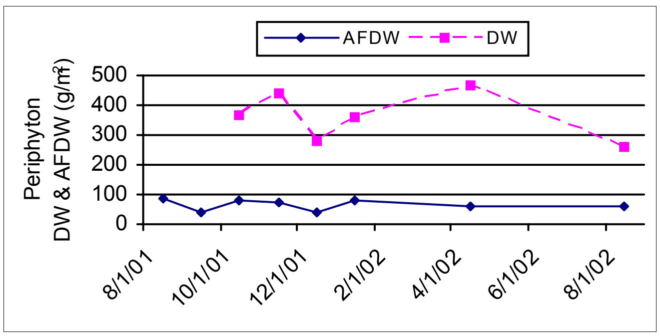
PSTA Research and Demonstration Project Phase 3
Field Scale PSTAs

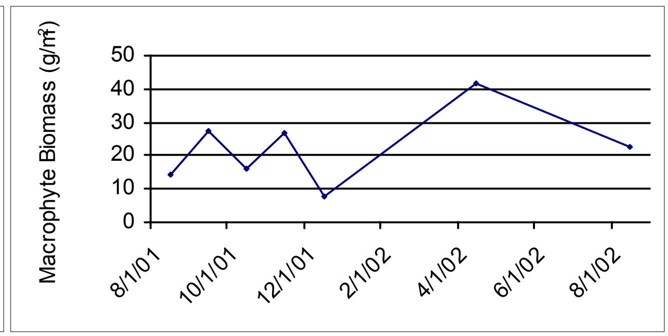
Treatment: FS-3 **Period:** 8/1/2001 - 11/15/2002

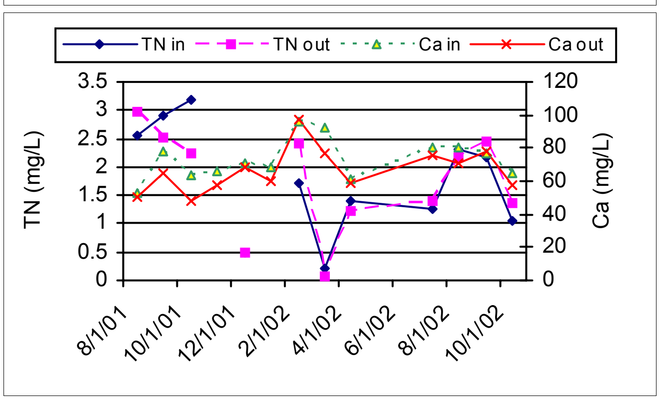
Cell Size: 66 x 315 m (2.08 ha) **Soil:** Limestone caprock

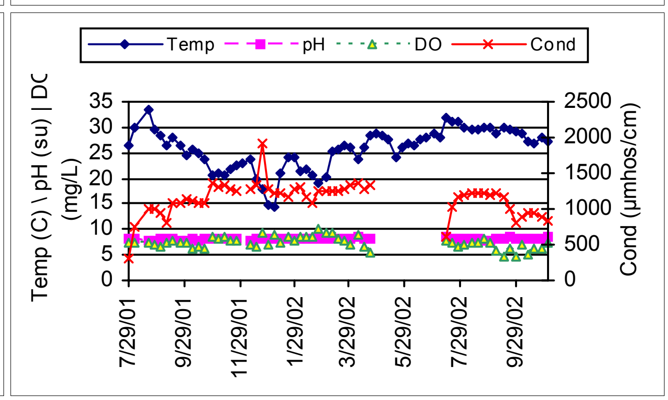


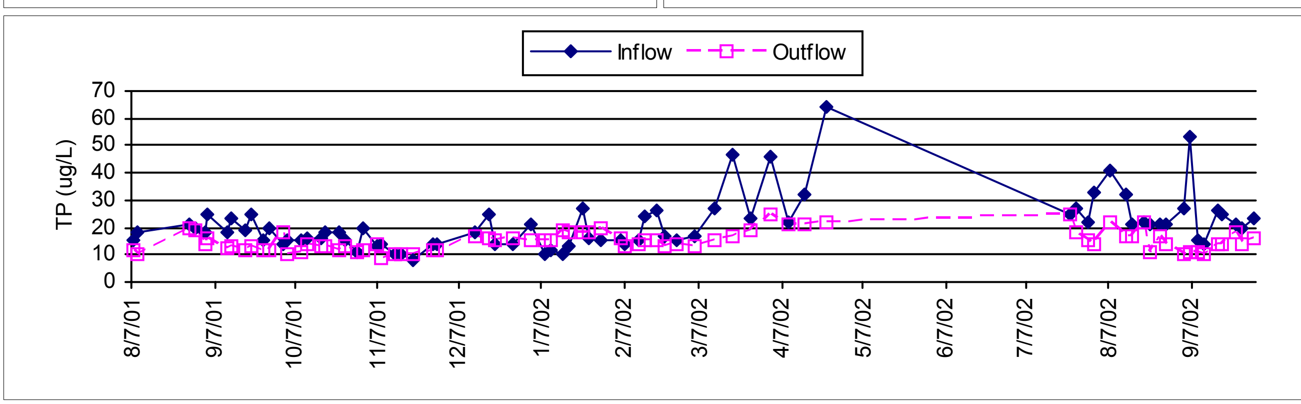










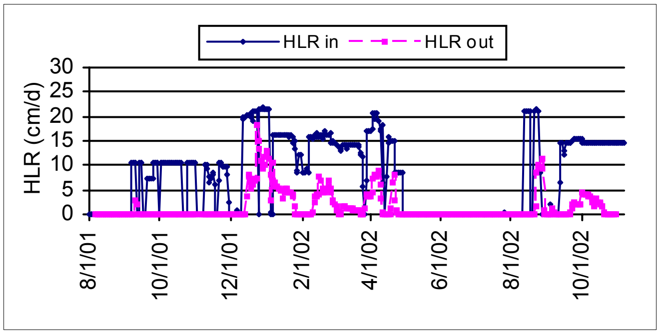


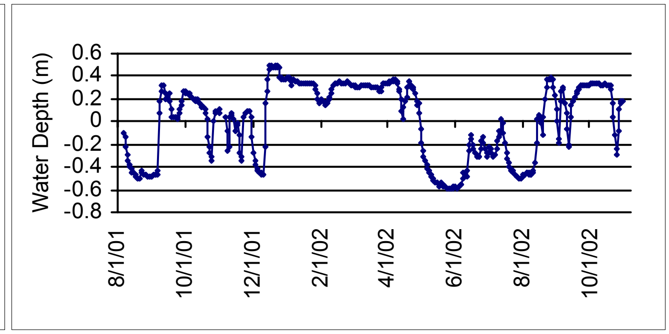
Summary for Period

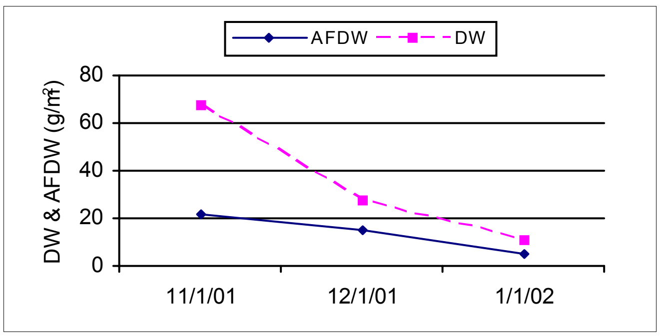
Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k_1 (m/yr)
FS-3	7.99	0.30	21	15	9.8

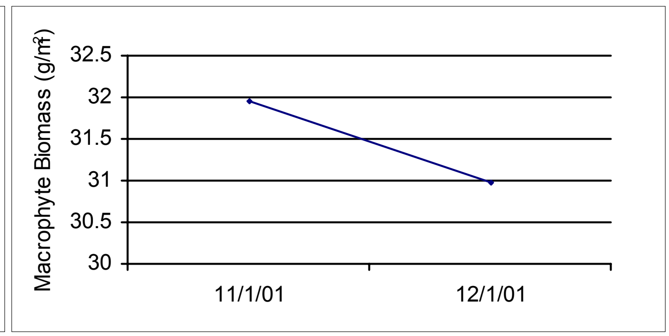
PSTA Research and Demonstration Project Phase 3
Field Scale PSTAs

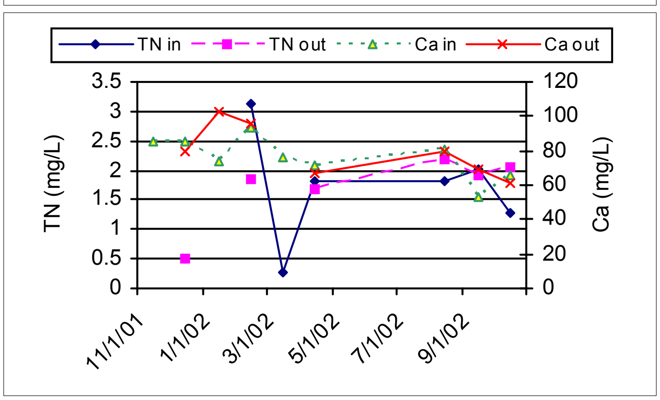
Treatment:	**FS-4**	**Period:**	**8/1/2001 - 11/15/2002**
Cell Size:	**66 x 315 m (2.08 ha)**	**Soil:**	**Peat**

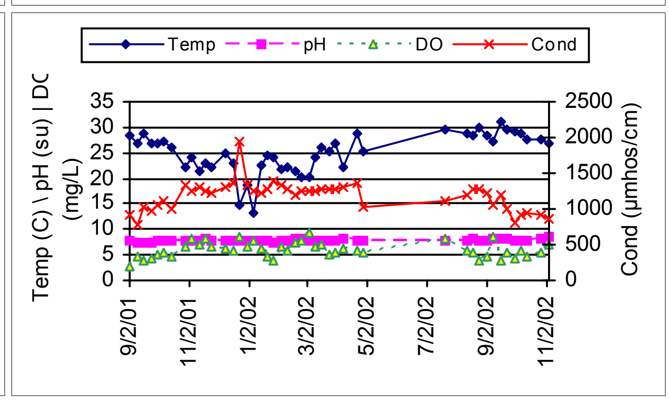


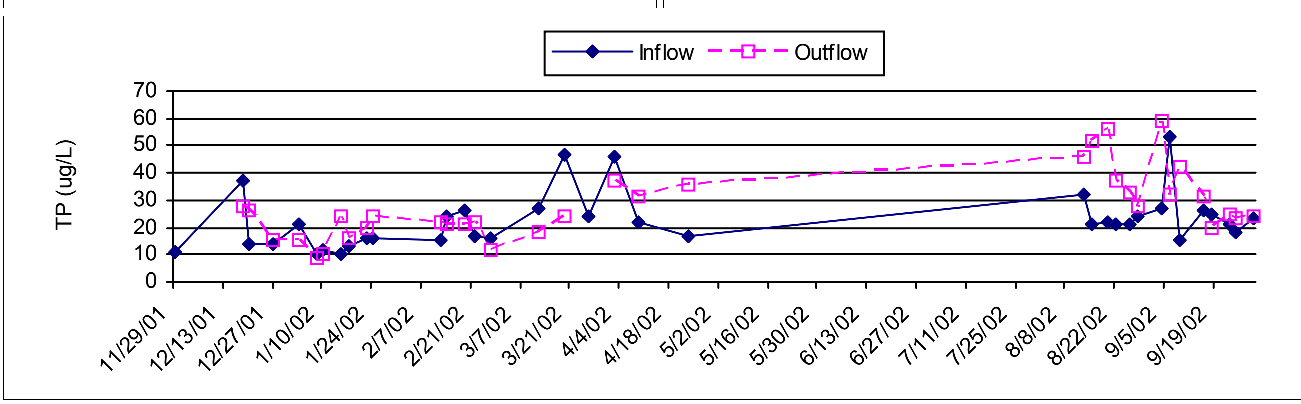






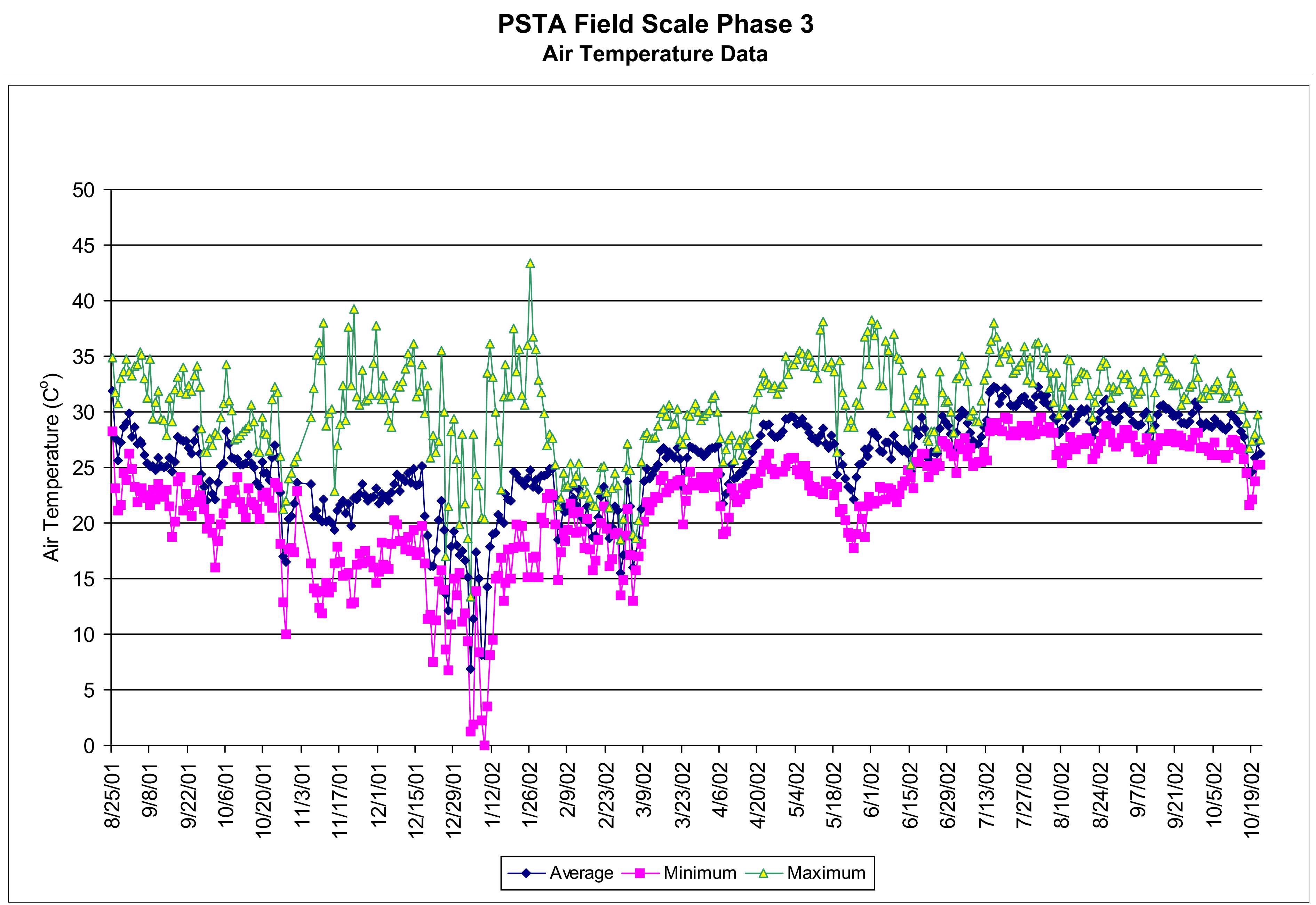






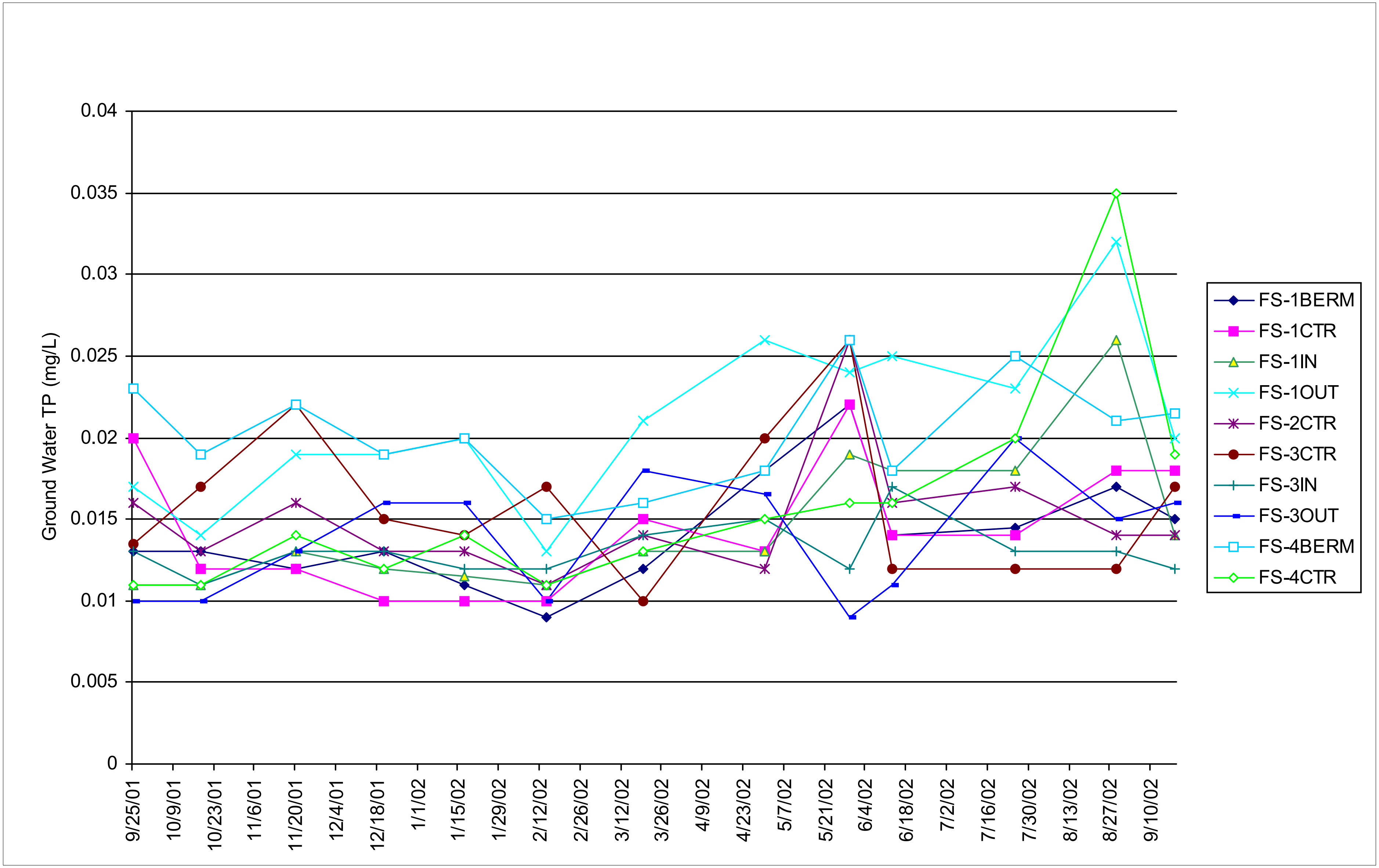
Summary for Period

Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	k_1 (m/yr)
FS-4	4.79	0.01	22	28	-3.7

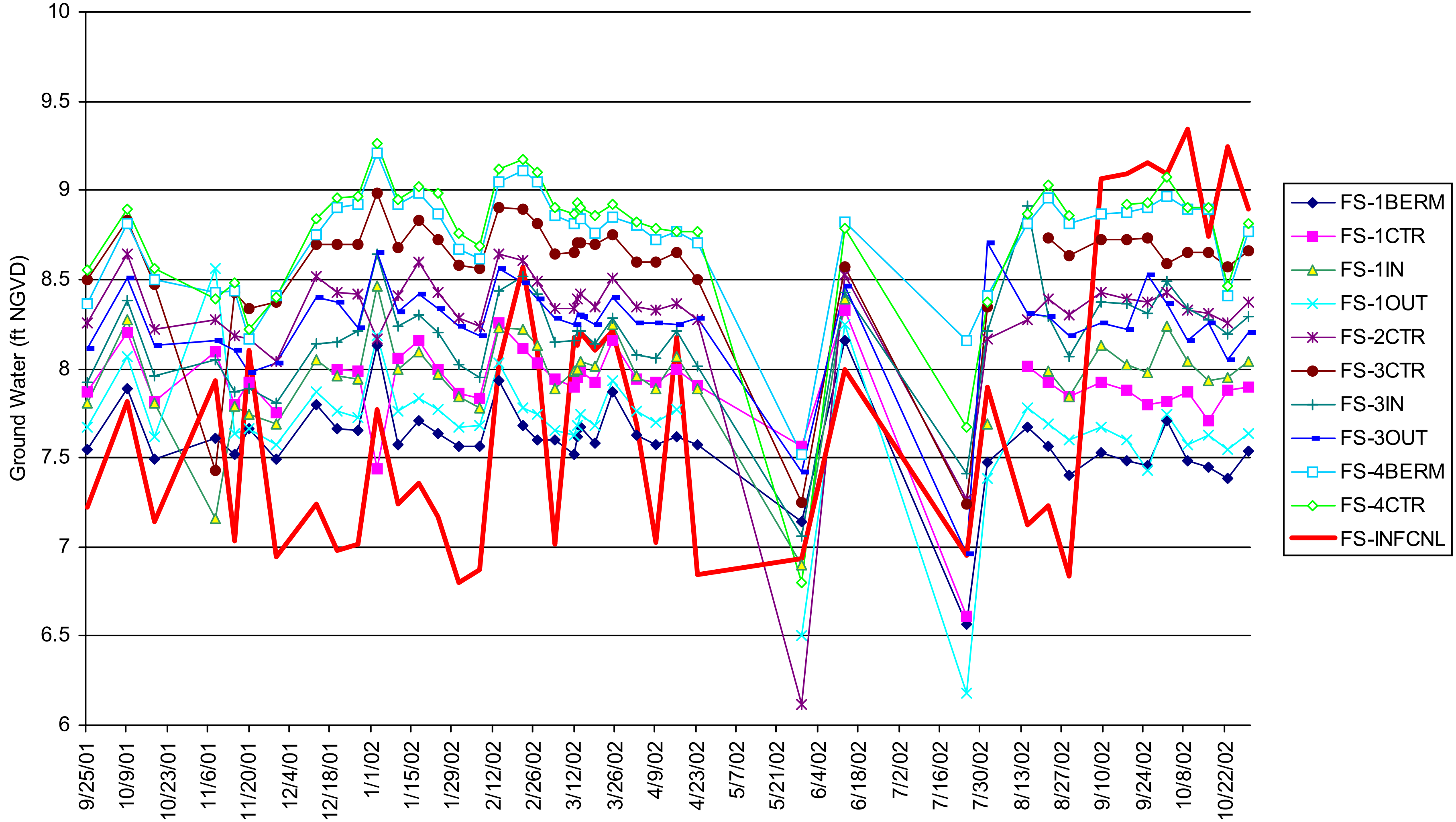

PSTA Field Scale Phase 3
Air Temperature Data
Air Temperature (C°)
0
5
10
15
20
25
30
35
40
45
50
8/25/01
9/8/01
9/22/01
10/6/01
10/20/01
11/3/01
11/17/01
12/1/01
12/15/01
12/29/01
1/12/02
1/26/02
2/9/02
2/23/02
3/9/02
3/23/02
4/6/02
4/20/02
5/4/02
5/18/02
6/1/02
6/15/02
6/29/02
7/13/02
7/27/02
8/10/02
8/24/02
9/7/02
9/21/02
10/5/02
10/19/02
Average
Minimum
Maximum

PSTA Field Scale Phase 3

Ground Water TP Concentrations

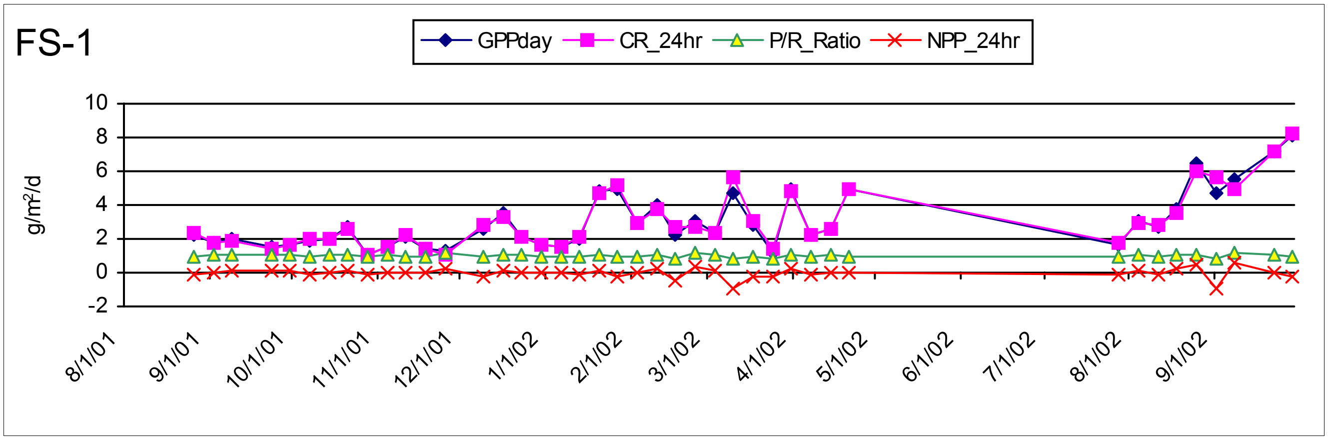


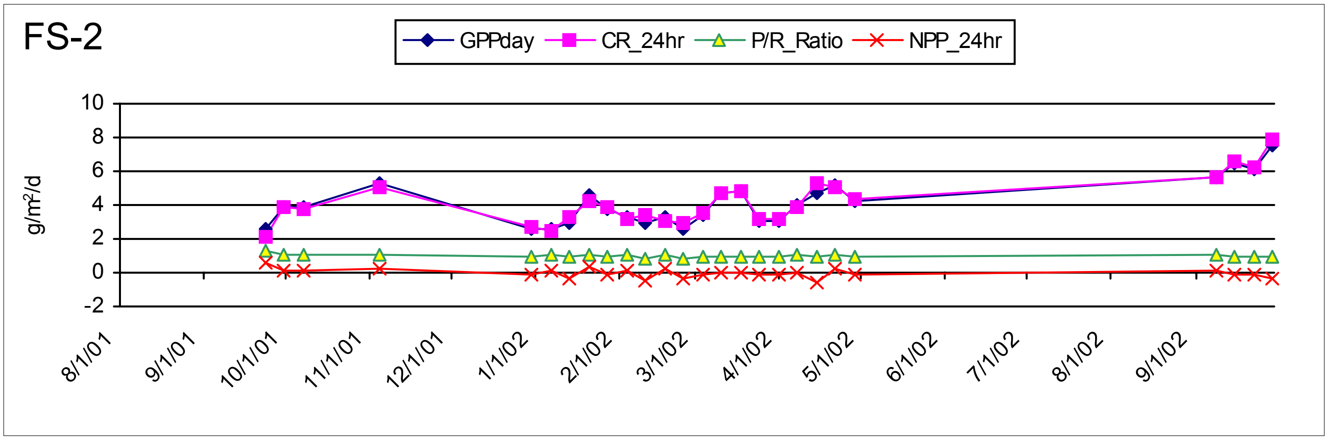
PSTA Field Scale Phase 3
Ground Water Elevations

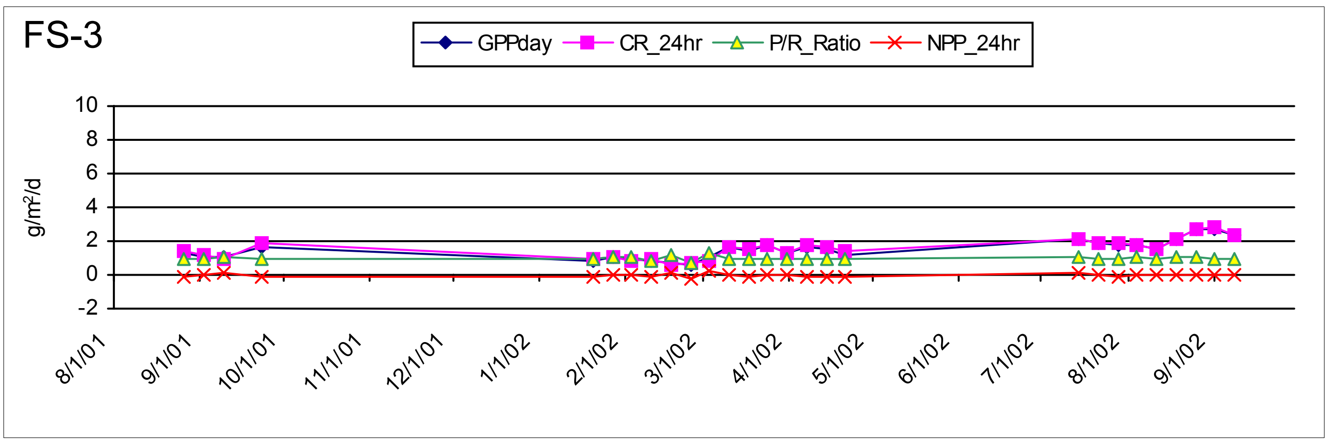


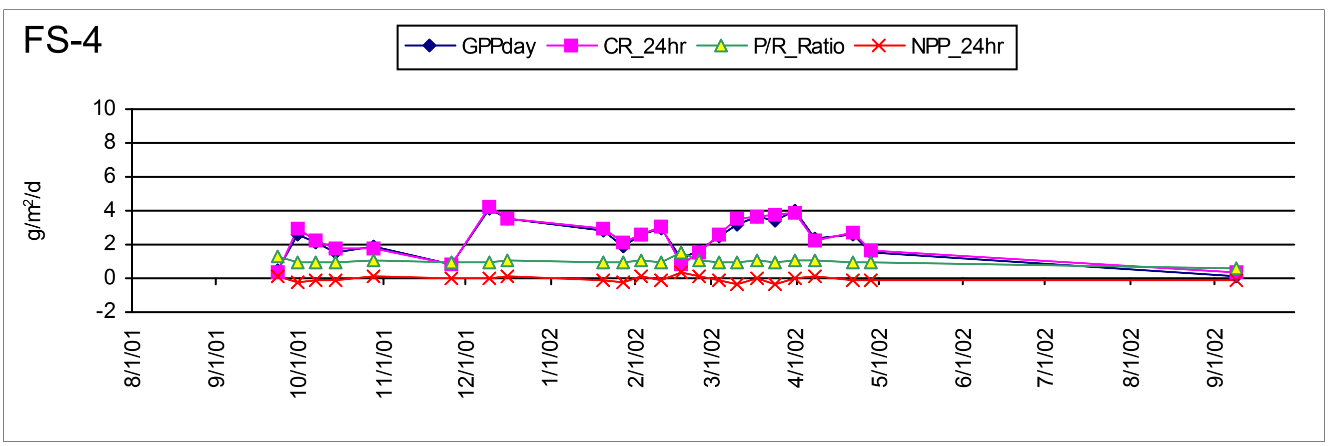
FS-INFCNL = Inflow Canal Stage

PSTA Field Scale Phase 3
Community Metabolism



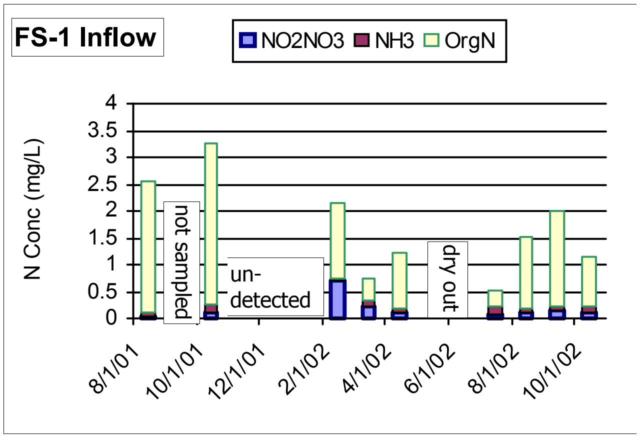


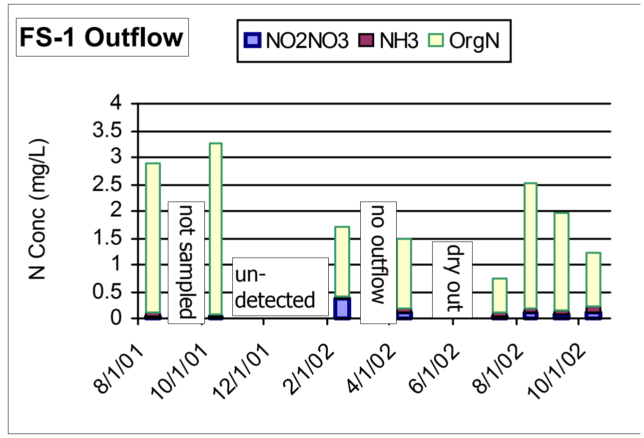


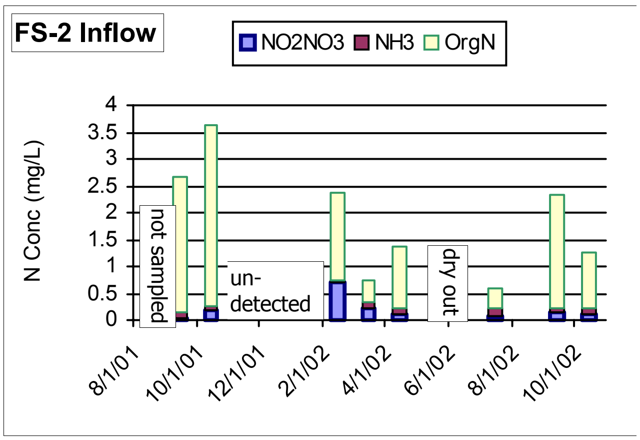


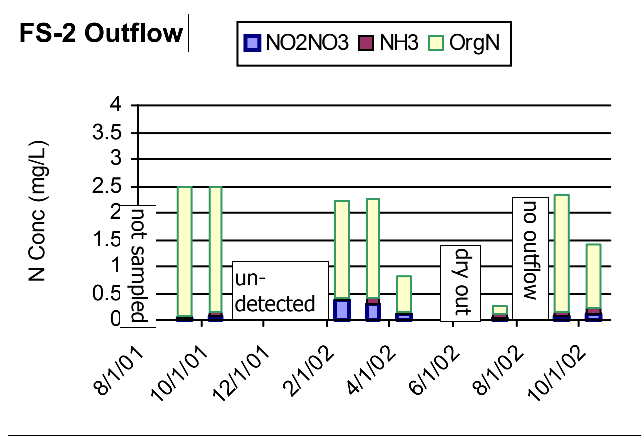
PSTA Field Scale Phase 3

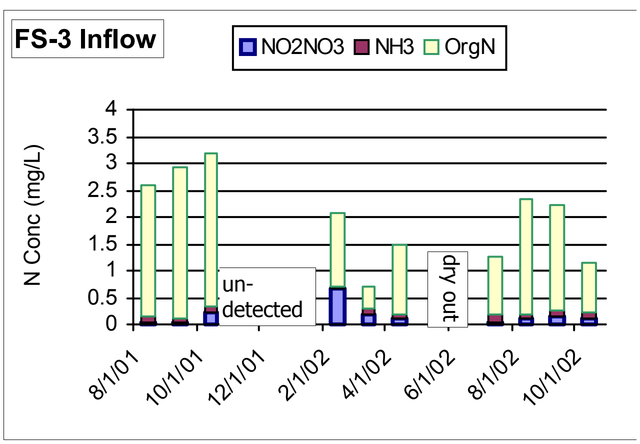
Surface Water Inflow and Outflow Nitrogen

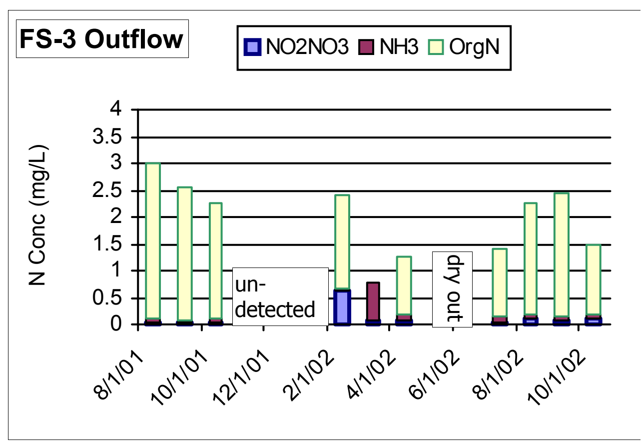


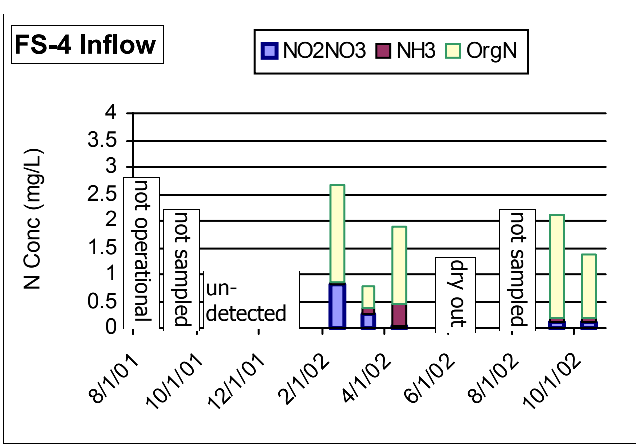


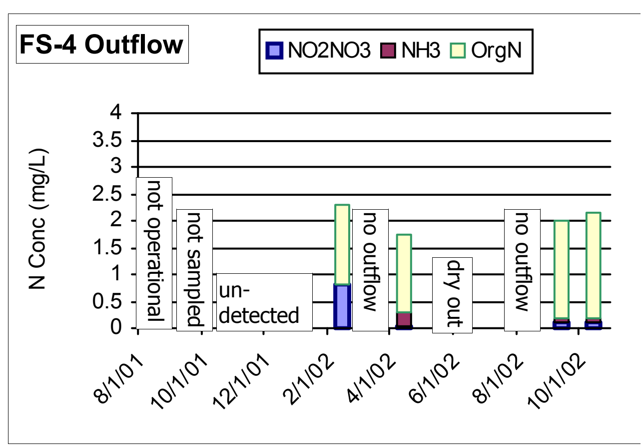




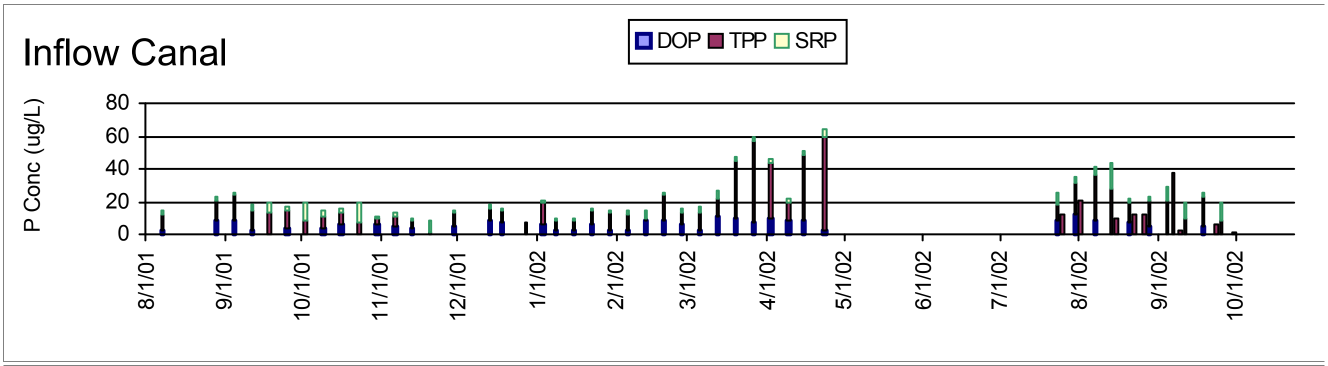


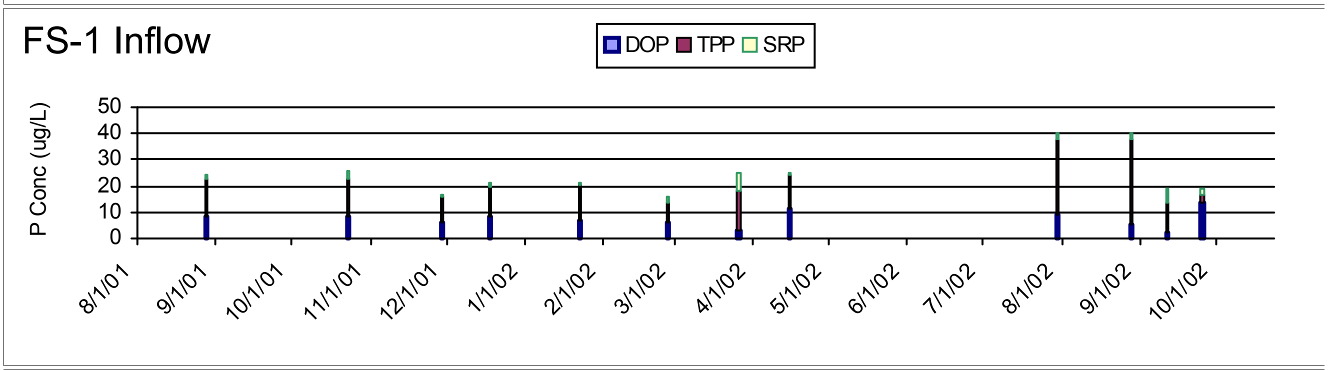


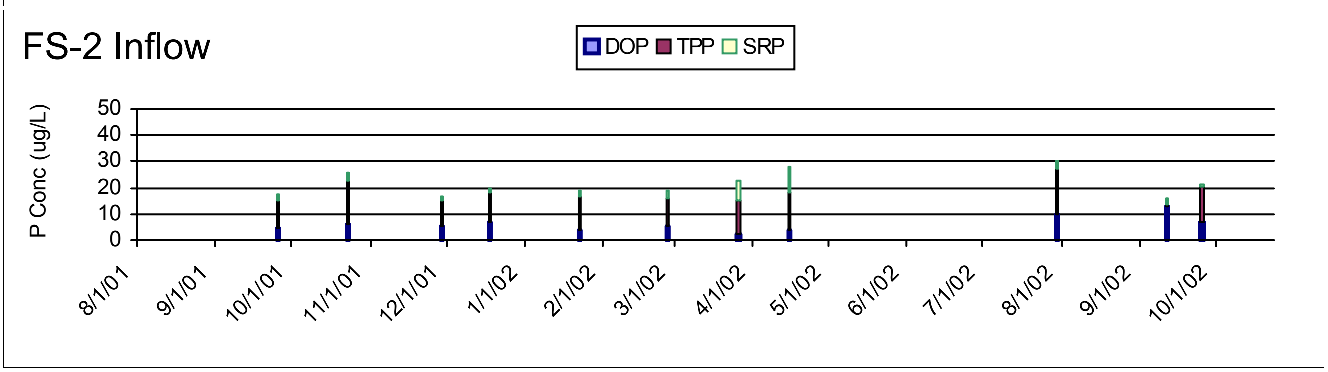


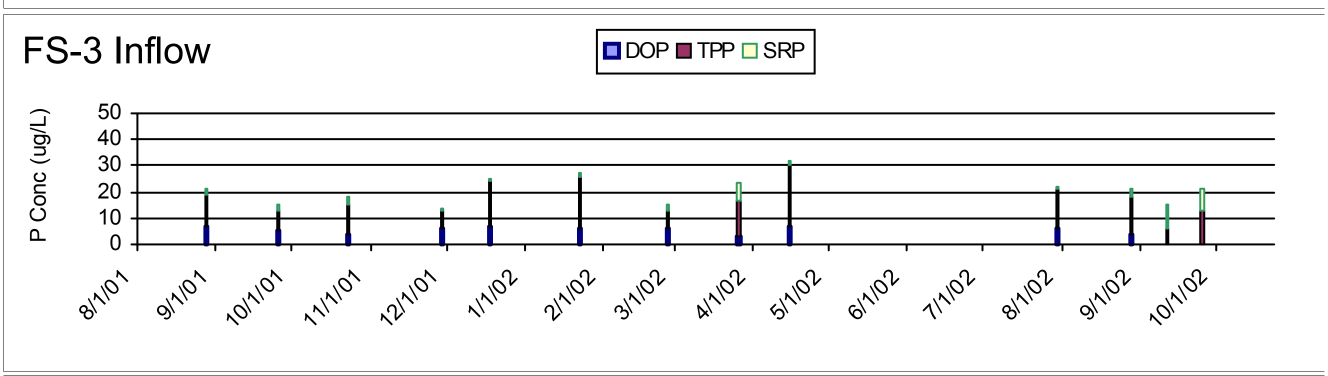


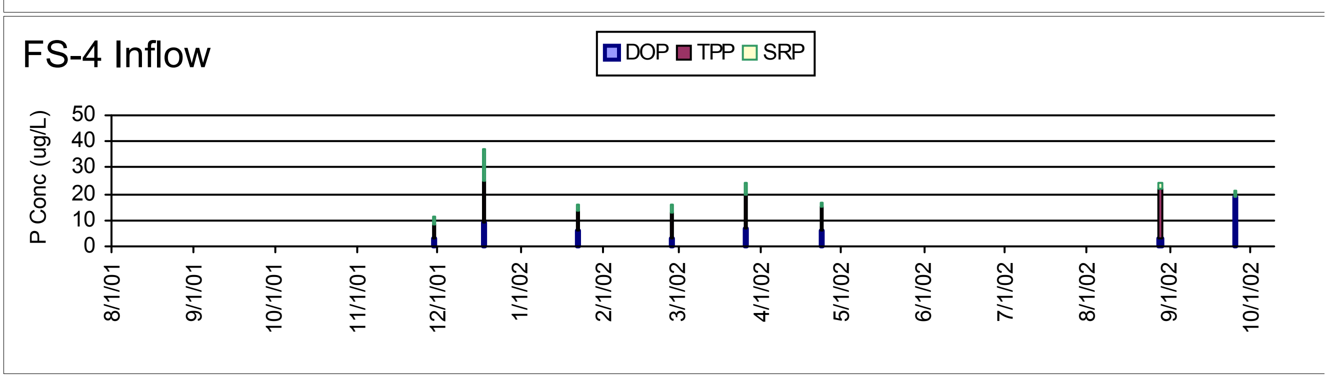
PSTA Field Scale Phase 3
Surface Water Inflow Phosphorus



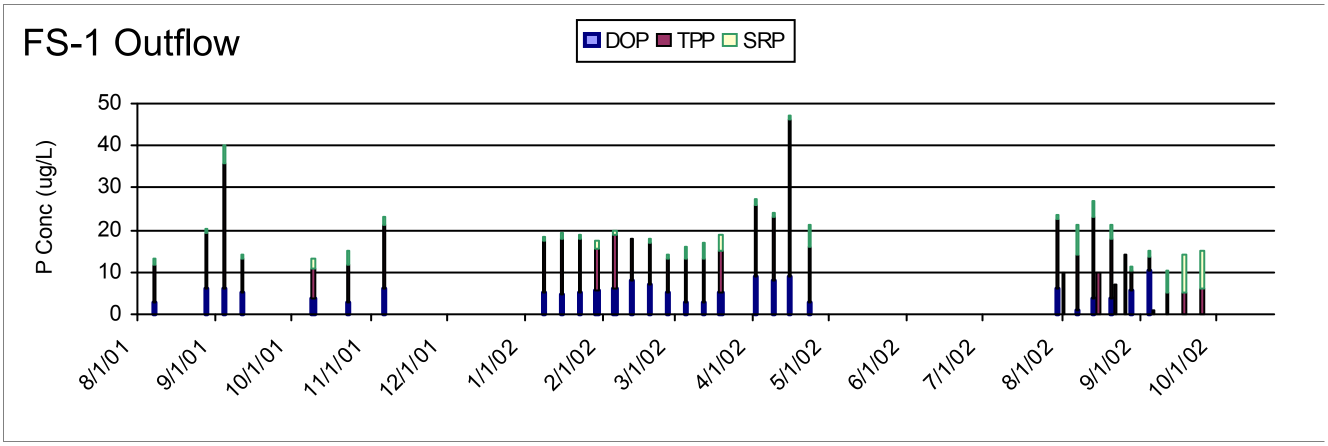


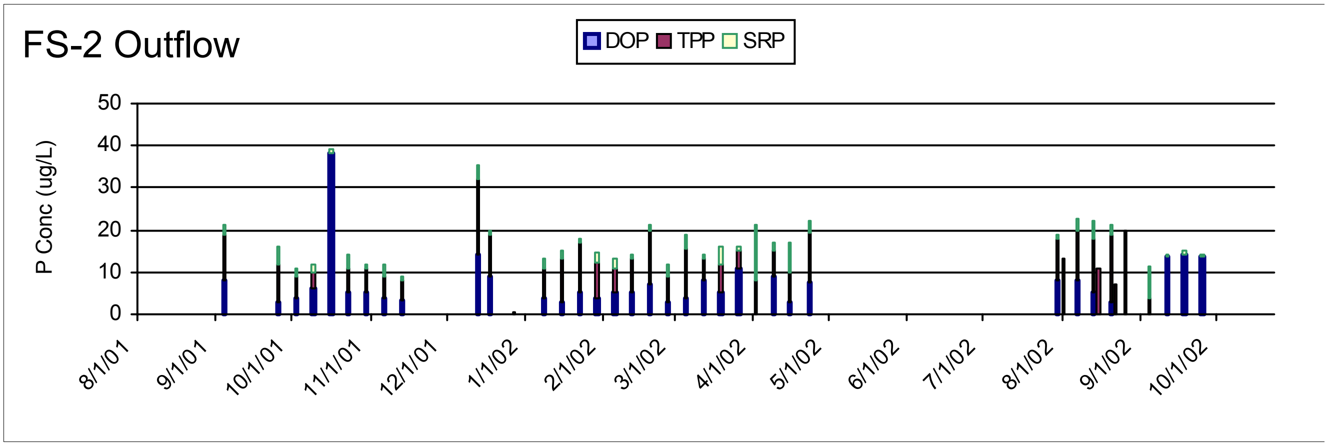


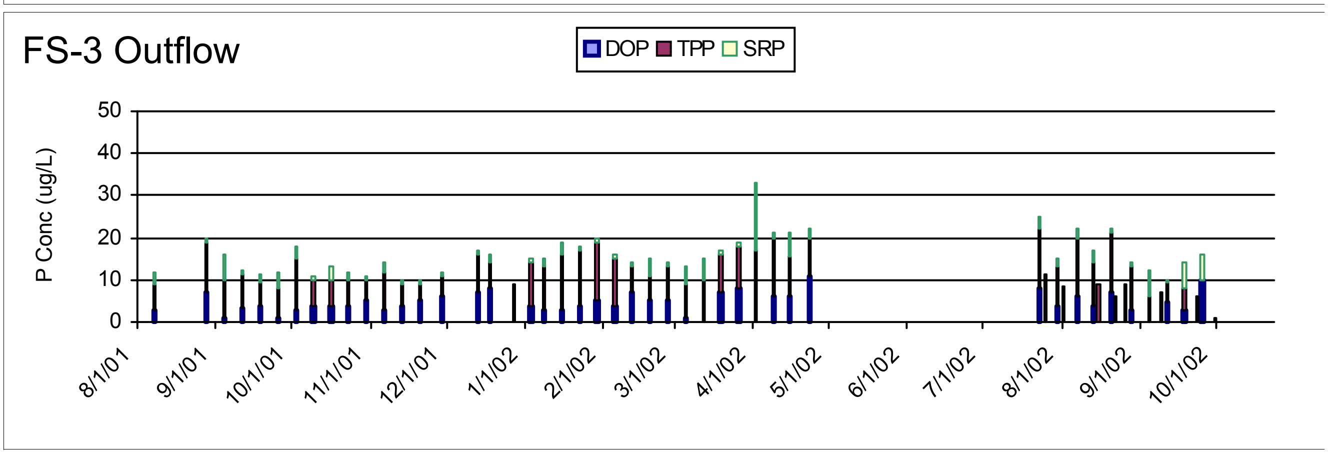


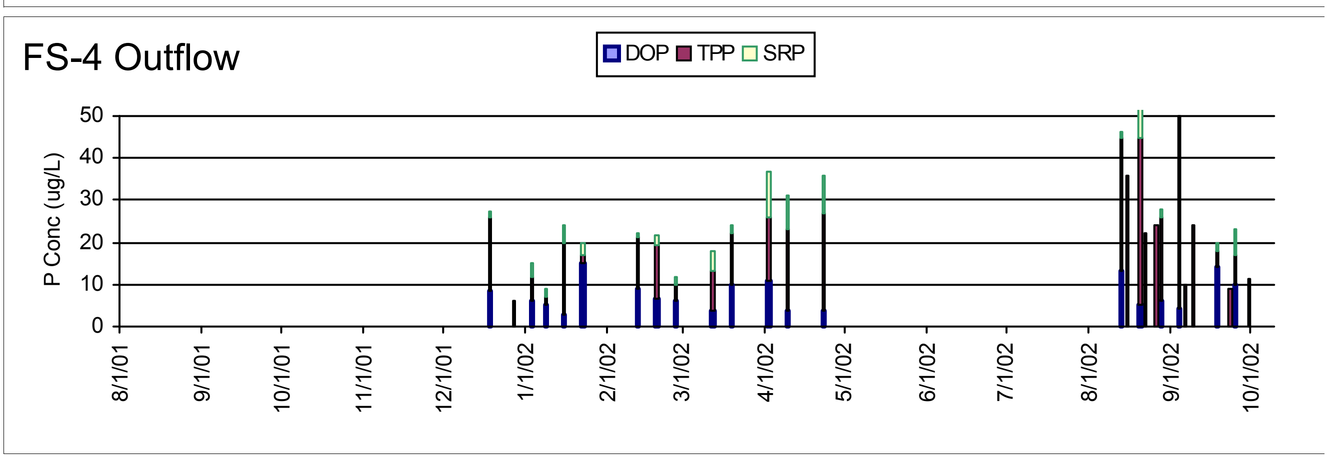


PSTA Field Scale Phase 3
Surface Water Outflow Phosphorus



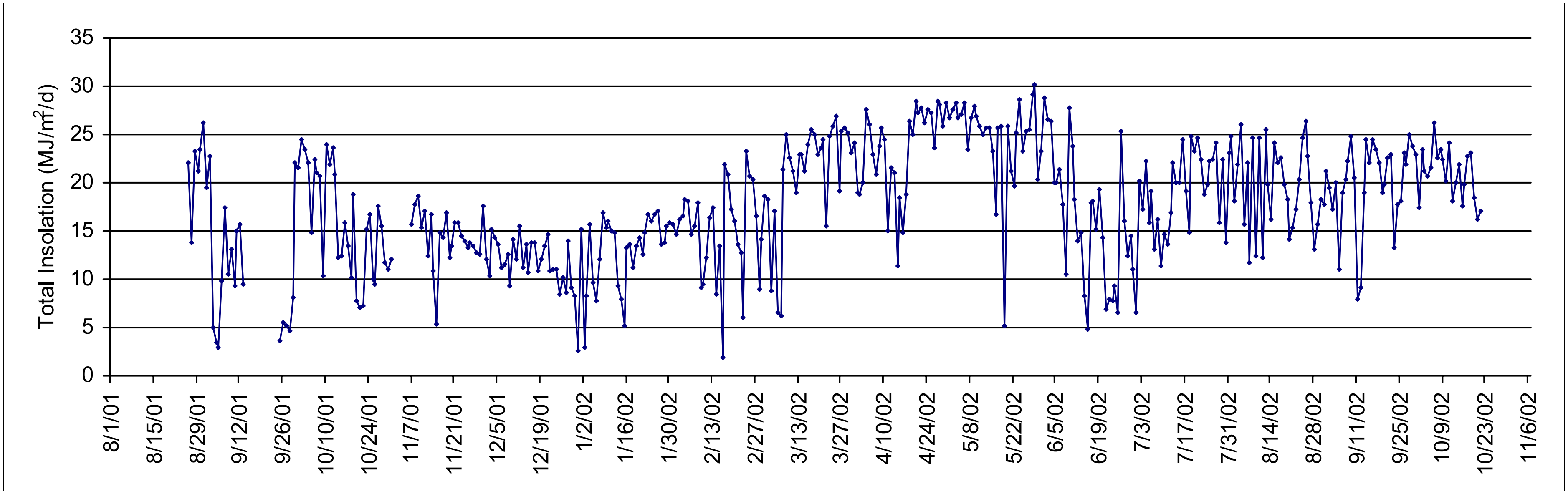


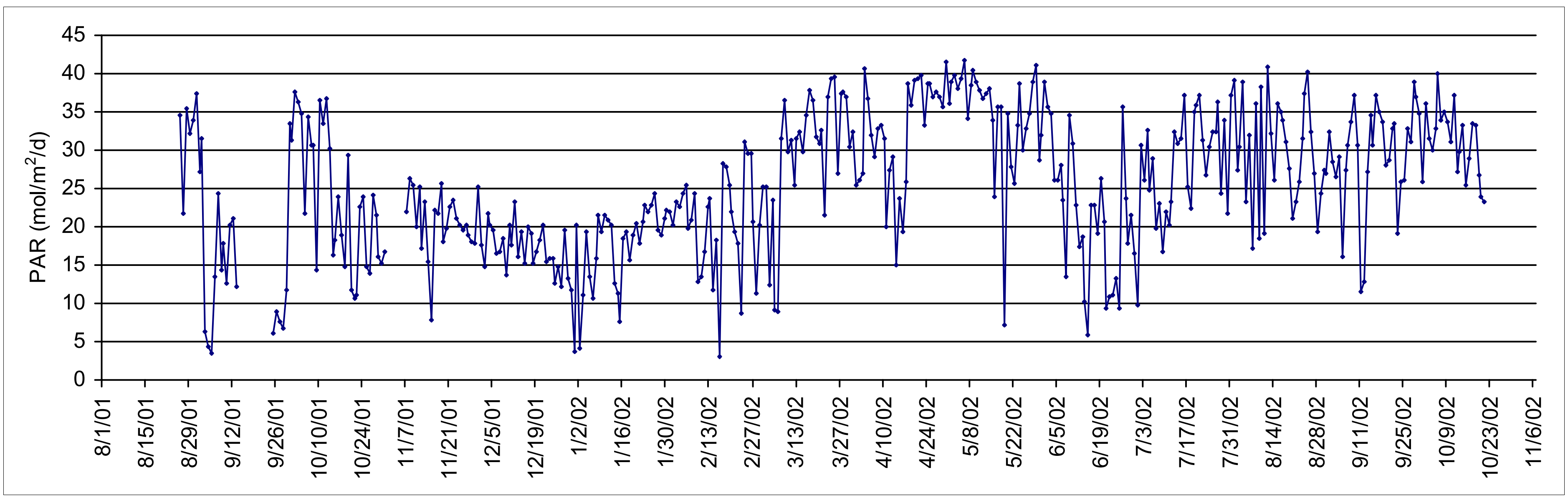




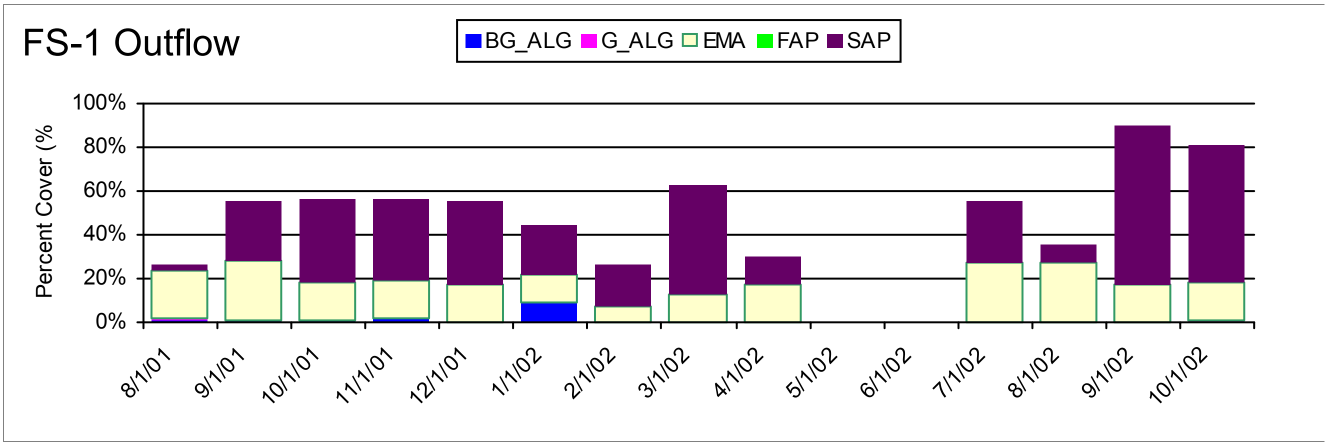
PSTA Field Scale Phase 3

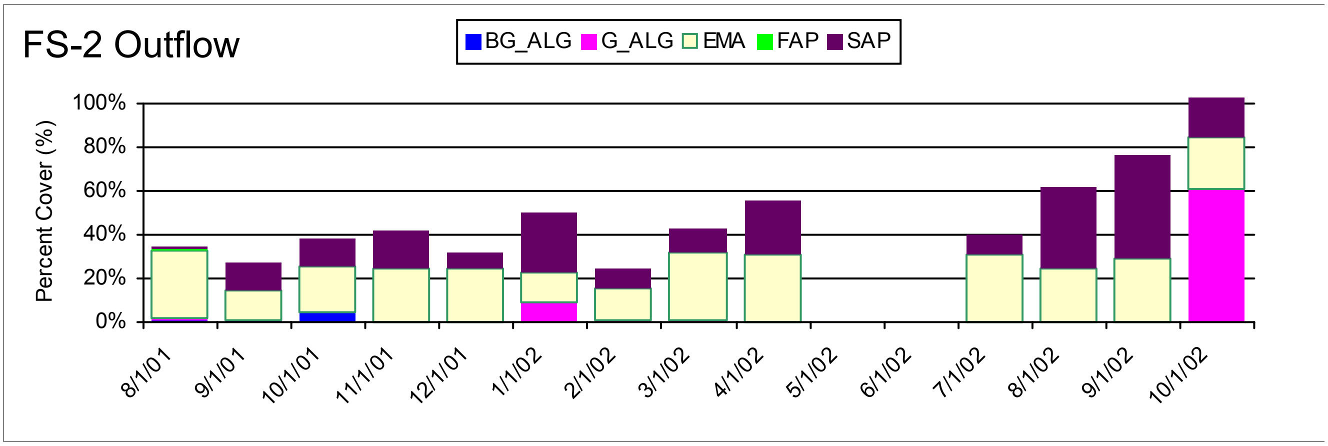
Total Solar Radiation and Photosynthetically Active Radiation

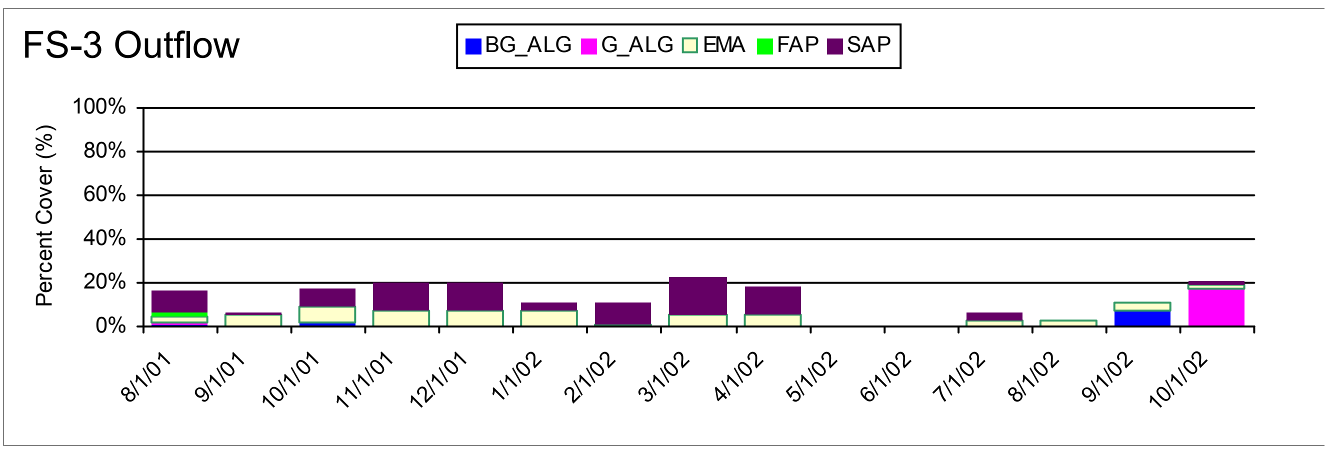


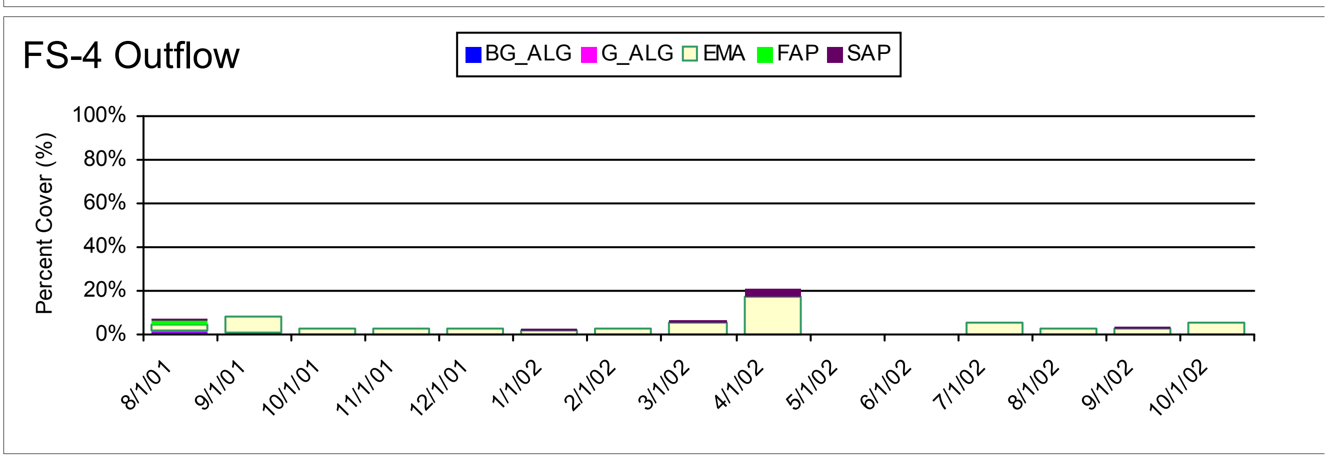


PSTA Field Scale Phase 3
Estimated Percent Cover

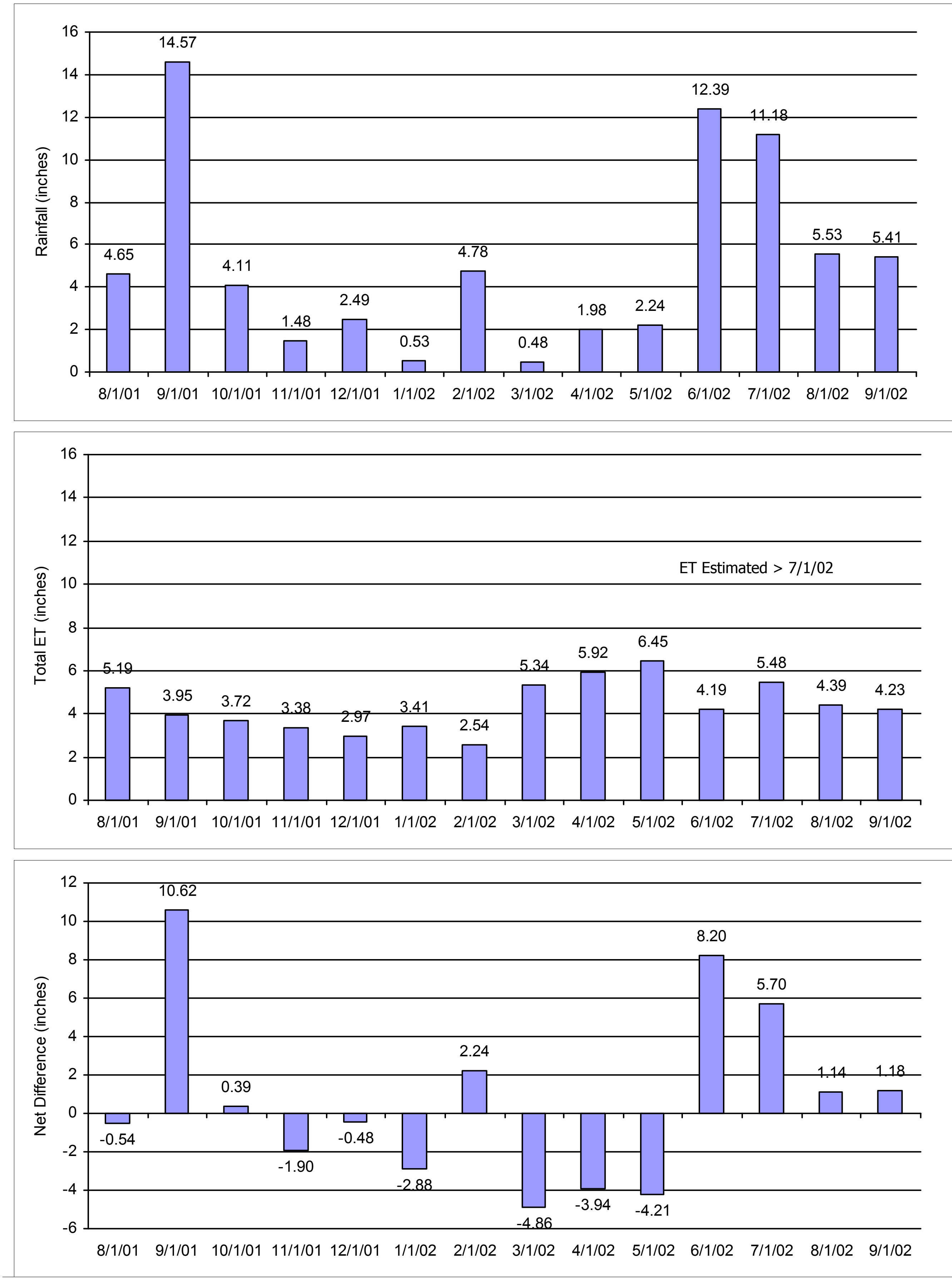






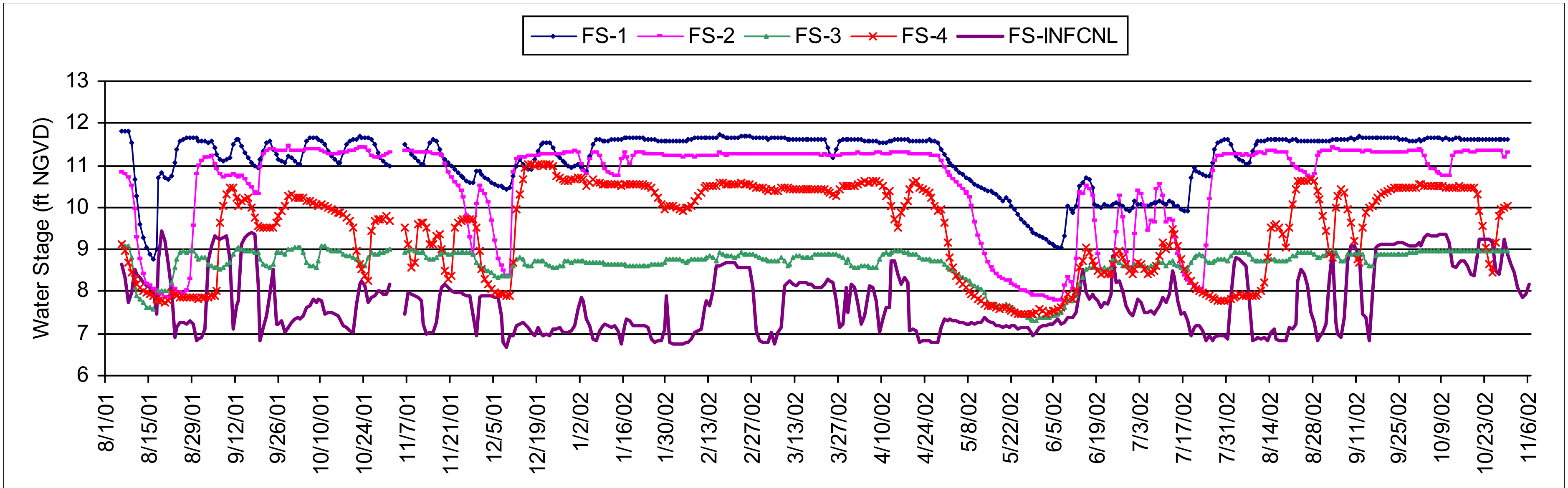


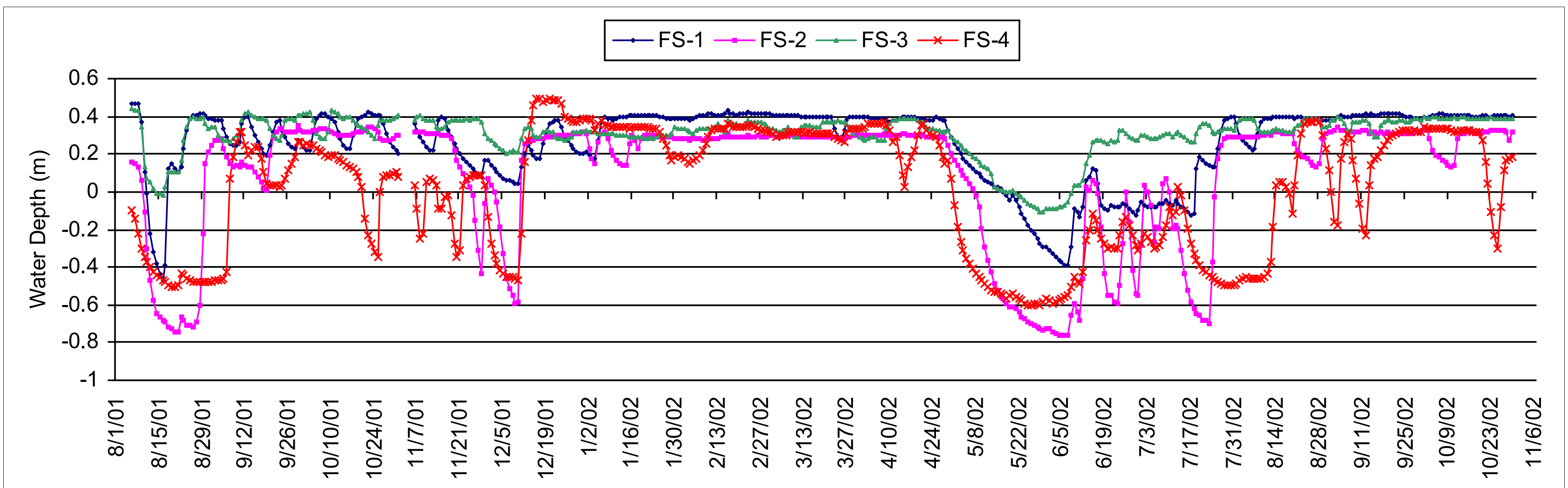
PSTA Field Scale Phase 3
Rainfall and Evapotranspiration



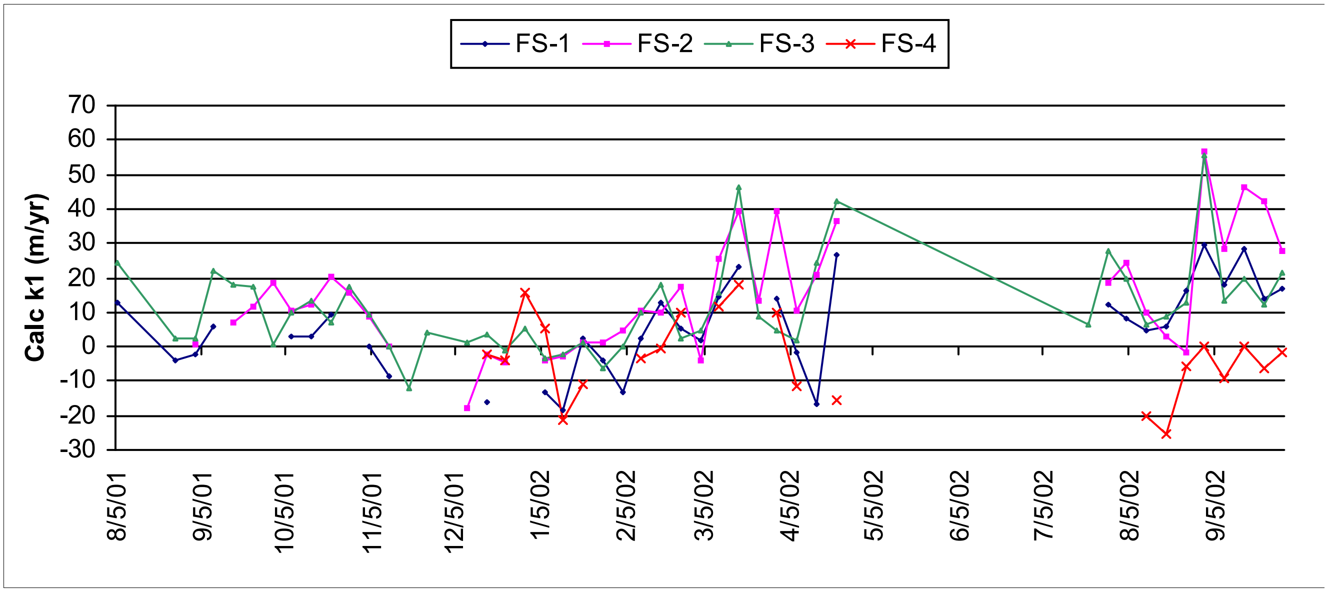
PSTA Field Scale Phase 3

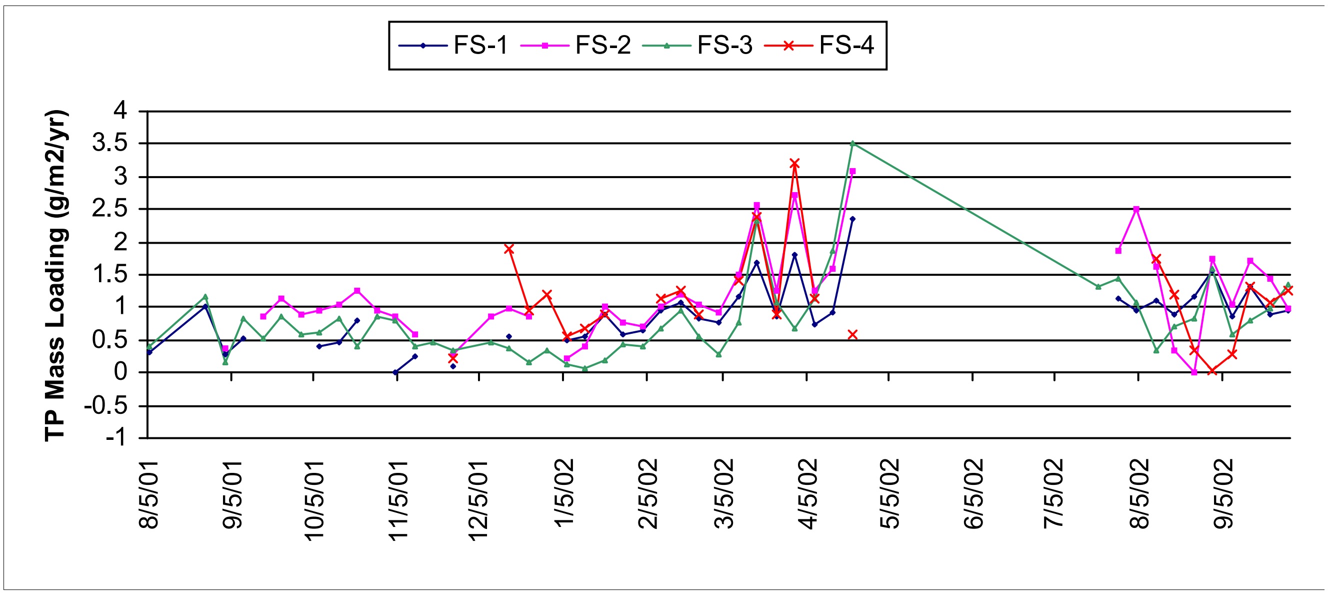
Water Stage and Depths

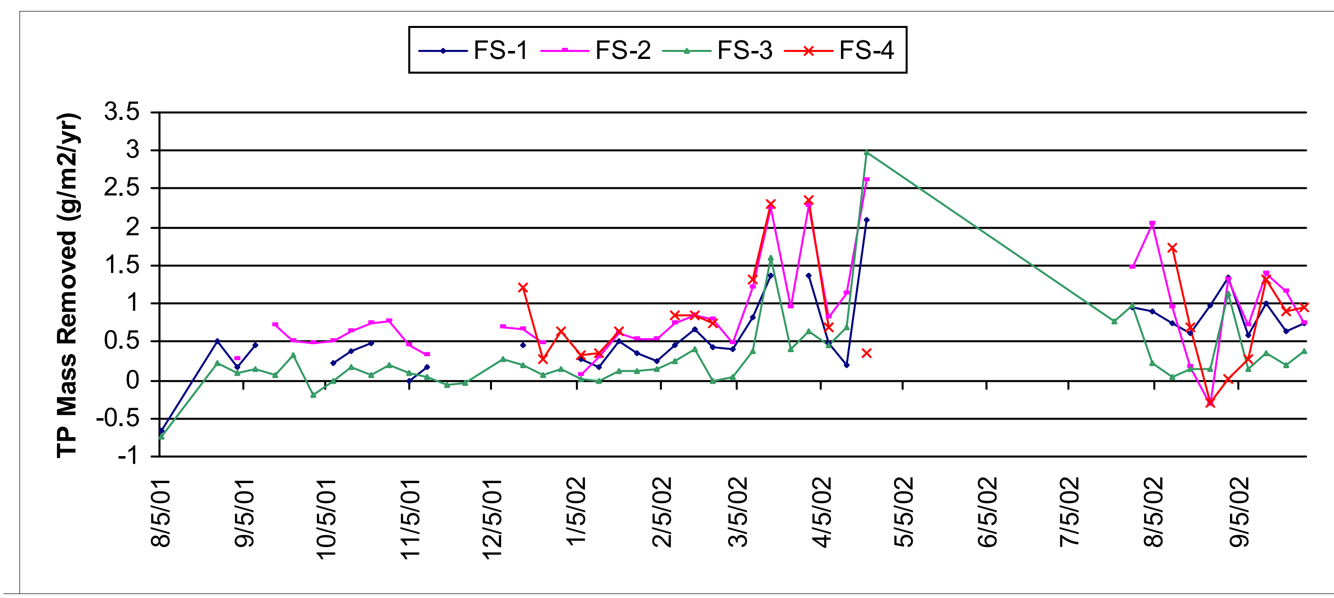




PSTA Field Scale Phase 3
Phosphorus Mass Loading and Removal







APPENDIX F

Periphyton Taxonomic and Abundance Data Analysis

APPENDIX F

Periphyton Taxonomic and Abundance Data Analysis[1]

F.1 Introduction

Periphyton composition in the portable PSTA mesocosms (Porta-PSTAs) and in the PSTA Test Cells was evaluated based on the biovolume of four major taxonomic groups:

- Blue-green algae (Cyanobacteria, Cyanophyta)
- Green algae (Chlorophyta, including Conjugatophyceae)
- Diatoms (Bacillariopyta)
- Other

F.2 Porta-PSTA Periphyton

In general, the periphyton in Porta-PSTAs is similar to that found in Water Conservation Area 2A (WCA-2A). The dominant species are those commonly reported from oligotrophic or slightly eutrophic regions. At the early stages, all treatments, regardless of substrate, were dominated by diatoms, with *Mastogloia smithii* being the most abundant species. Prior experience indicates that when any substrate is submerged in WCA-2A and at other oligotrophic to slightly eutrophic Everglades sites, no matter if it is a natural or artificial substrate and to some extent also independent of phosphorus (P) concentration, these substrates are immediately (within days) colonized by bacteria and small diatoms (in the Everglades, the most conspicuous species is *M. smithii*). Other abundant diatom species in the early stages of periphyton development were: *Rhopalodia gibba*, *Surirella elegans*, *Amphora lineolata*, or *Denticula kuetzingii* (see Exhibit F-1).

The results from Porta-PSTA treatments also show the succession in which diatoms are replaced, predominantly by blue-green algae. This trend is especially clear in treatments that have been in operation for longer time without disturbance (e.g., Porta-PSTA treatments PP-3, PP-4, and especially PP-7). The most dominant blue-green species was *Scytonema* sp. (see Exhibit F-1).

This phenomenon has not often been reported in the periphyton studies in the Everglades because most of those studies use either grab samples of floating mats and/or periphyton growing on natural substrates or periphyton growing on artificial substrates exposed only for a short period of time (i.e., months). The Porta-PSTA results indicate that the time necessary for blue-green algae to replace diatoms in dominance could be as long as 1 year. It is important to note that when blue-green algae are the dominant group in the periphyton, diatoms are still abundant.

[1]Prepared by Jan Vymazal/Ecology and Use of Wetlands

EXHIBIT F-1
Dominant Species (According to Biovolume) in Porta-PSTAs

Porta-PSTA	Apr-99	Jun-99	Aug-99	Nov-99	Jan-00	Mar-00	Porta-PSTA	Apr-00	Jun-00	Oct-00	Aug-00
1	Mastogloia smithii	Surirella elegans	**Oedogonium punctatostriatum**	Nitzschia semirobusta			13	**Oedogonium punct**	Pinnularia viridis	**Oedogonium punct**	**Oedogonium punct**
2	Mastogloia smithii	Rhopalodia gibba	Mastogloia smithii	Mastogloia smithii			14	Mastogloia smithii	Mastogloia smithii	**Oedogonium punct**	*Scytonema* sp.
3	Mastogloia smithii	Amphora lineolata	Nitzschia sigmoidea	**Spirogyra sp.**	*Scytonema* sp.	Pinnularia ruttneri			*Synechococcus* sp.		*Synechococcus* sp.
4	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	*Scytonema* sp.	Mastogloia smithii			*Lyngbya aerugineo-carulea*		*Synechococcus* sp.
5	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	Rhopalodia gibba	15	Mastogloia smithii	**Spirogyra sp.**	**Spirogyra sp.**	*Scytonema* sp.
6	Mastogloia smithii	Mastogloia smithii	*Lyngbya* sp.	Mastogloia smithii	**Oedogonium punct.**	Mastogloia smithii	16	Mastogloia smithii	**Cosmarium botrytis**	*Scytonema sp.*	*Scytonema* sp.
7	Rhopalodia gibba	Mastogloia smithii	Rhopalodia gibba	Mastogloia smithii	Mastogloia smithii	*Oscillatoria limosa*			*Aphanothece stagnina*		*Scytonema* sp.
8	Mastogloia smithii	Rhopalodia gibba	*Oscillatoria limosa*	Mastogloia smithii		*Oscillatoria formosa*	17	Mastogloia smithii	**Oedogonium punct**	**Oedogonium punct**	**Oedogonium punct**
9	Mastogloia smithii	Denticula kuetzingii	Pinnularia viridula v. minor	Pinnularia viridis	Cymbella aspera		18	Mastogloia smithii	**Oedogonium punct**	**Oedogonium punct**	*Lyngbya limnetica*
10	Rhopalodia gibba	Rhopalodia gibba	Nitzschia semirobusta	Mastogloia smithii	**Oedogonium punct.**	**Oedogonium sp.**	19	Mastogloia smithii	**Oedogonium punct**	*Oscillatoria formosa*	*Scytonema* sp.
11	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	Mastogloia smithii	*Scytonema* sp.	Mastogloia smithii			*Scytonema* sp.		*Synechococcus* sp.
12	Mastogloia smithii	Mastogloia smithii	*Johannesbaptistia pellucida*	Nitzschia semirobusta	*Johannesbaptistia p.*	Mastogloia smithii			Diploneis finnica		Pinnularia viridis

Notes:
plain=diatoms
italics =blue-green algae
bold=green algae

Under eutrophic conditions, this replacement is faster and could be seen clearly after approximately 2 months, with the major blue-green algae group being thick filamentous Lyngbya species. This rapid succession to Lyngbya was not observed in the Porta-PSTAs, no doubt because they did not have high enough P concentrations necessary for this replacement (50–100 micrograms per liter [μg/L]). In the case of the Porta-PSTAs, diatoms are replaced by blue-green algae, namely Scytonema. However, this takes a much longer time, up to 1 year under very low P concentrations. The decrease in diatom biovolume (diatoms are still abundant) is not a sign of eutrophication, but it is a result of natural succession (typical examples are PP-7 and PP-6/16).

The analysis of species biovolume in the periphyton observed in the Porta-PSTA treatments reveals the presence of species that have been suggested as indicators of low P (e.g., *Oscillatoria limnetica*, *Amphora lineolata*) as well as high P (*O. princeps*, *Nitzschia palea*, *Rhopalodia gibba*, *Spirogyra* sp.) availability (McCormick and Stevenson 1998). These findings indicate that typical Everglades oligotrophic species (*M. smithii* and *Scytonema* sp.) can grow abundantly in water with P concentrations between 15 and 20 μg/L in Porta-PSTA cells. On the other hand, species that are usually reported from Everglades regions with very high P concentrations (*Spirogyra* sp., *Oedogonium* sp.) can also grow under the same P conditions. These populations of green filamentous algae were typically observed only in the front of the Porta-PSTAs in the region with detectable dissolved reactive P (DRP).

In most previous studies from the Everglades, *Schizothrix calcicola* (indicator of low P availability) and *Microcoleus lyngbyaceus* were mentioned as some of the most frequent blue-green algae. However, in this study these species were not found (*S. calcicola* was recorded once.) The explanation comes from the fact that most of the previous studies used Drouet´s system of identification (Drouet, 1968). Within the order "Oscillatoriales" (i.e., filamentous non-heterocystous species), Drouet created on the basis of herbarium studies only six genera: Spirulina, Schizothrix, Porphyrosiphon, Oscillatoria, Arthrospira, Microcoleus and "Nomina Excludenda". Under *S. calcicola*, he placed more than 500 species belonging to such genera as Arthrospira, Microcoleus, Tolypothrix, Pseudanabaena, Symploca, Plectonema, Synechococcus, Spirulina, Leptothrix(?!), Oscillatoria, Phormidium, Schizothrix, or Inactis. It is easy to realize that these >500 species could not have the same environmental requirements and that this system has nearly zero value for environmental evaluation. In addition, the original *S. calcicola* is a typical aerophytic species growing on calcite and dolomite. From 22 species of Lyngbya and Oscillatoria that were found in PSTA cells, according to the Drouet´s system 13 species would have been classified as S. *calcicola* and 4 species as *Microcoleus lyngbyaceus*.

F.2.1 Influence of Substrate

There was little effect of substrate on the species composition trend between shellrock and peat Porta-PSTAs (compare PP-1 and PP-22 or PP-3 and PP-4). It seems that in sand treatments (PP-7 and PP-8), the proportion of blue-green algae is higher. The results from Phase 2 indicate a higher proportion of green algae, but the decrease in diatom numbers is similar in all treatments.

F.2.2 Influence of Aquashade

It has been found that periphyton in the Porta-PSTAs with Aquashade is less calcified (see Exhibit F-2) as compared to Porta-PSTAs without Aquashade (and in the South Test Cell [STC] PSTAs). This observation can be explained by the very low presence of blue-green algae (see PP-9 and PP-10), which are mostly responsible for calcification. It is also very clear that after Aquashade was removed, blue-green algae colonized very quickly (PP-9/18 and PP-10/19).

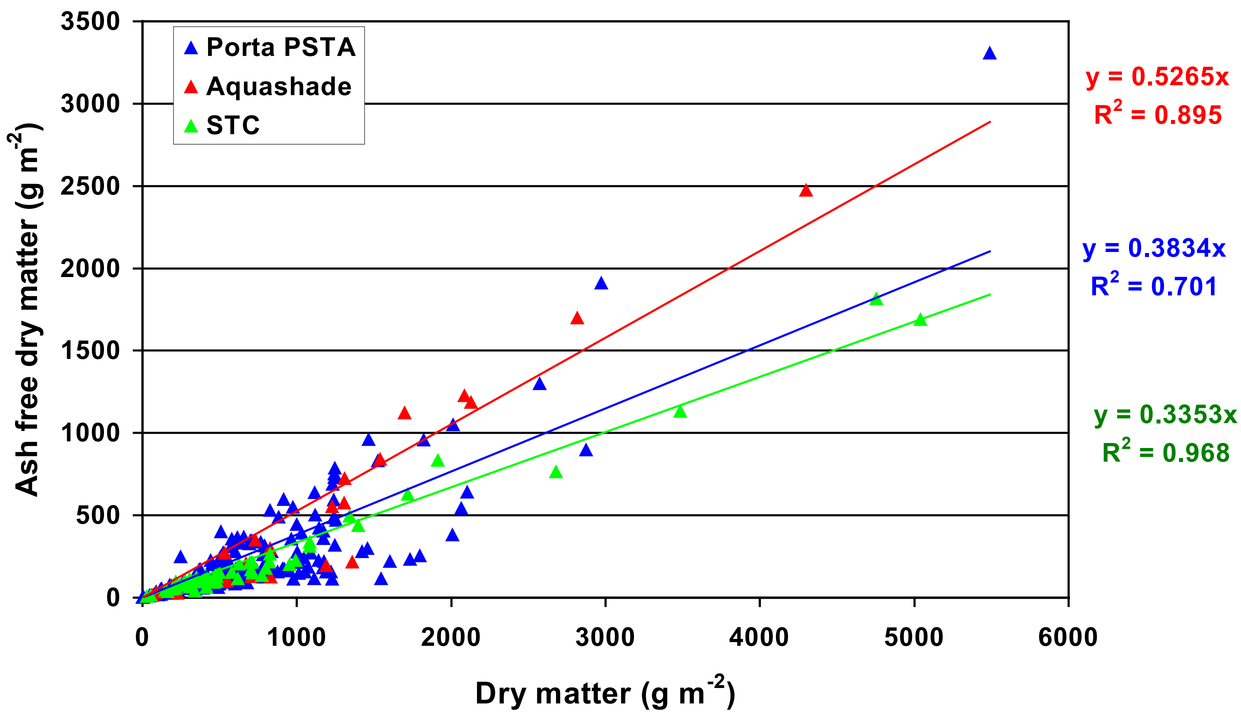


EXHIBIT F-2
Relationship Between Periphyton Dry and Ash-Free Dry Weight in Cells with and without Aquashade

F.2.3 Influence of Depth

In deeper water (60 cm), diatoms decreased their biovolume faster than in shallower cells (30 cm) (compare PP-1 and PP-3, PP-2 and PP-4, and PP-7 and PP-8). There was little effect of water depth fluctuation on species composition (compare PP-5 and PP-6). However, in PP-15 and PP-16, there was much higher proportion of green algae in treatment PP-15 with stable water depth.

F.2.4 Influence of Hydraulic Loading Rate

Results from PP-2 and PP-5 indicate that there is negligible effect of hydraulic loading rate (HLR) on periphyton species composition.

F.3 South Test Cell PSTA Periphyton

Results from STC-1/4 (peat substrate) indicate that if there is a major disturbance, the species composition changes quickly. Within STC-1, the regular process of diatom replacement by blue-green algae occurred. After the change of substrates, this succession started again with a dominance of diatoms which were in turn replaced again. On the other hand, STC-3/6 (shellrock) where there was no substrate replacement shows more or less a steady replacement of diatoms by blue-green algae, with *Scytonema* being the dominant species at the end. *Scytonema* was also dominant in in STC-1, but at the very end it was replaced by *Spirogyra* in STC-4 (see Exhibit F-3). These short "peaks" of green algae dominance were also observed in Porta-PSTAs. The same observation described above about dominance of green filamentous algae in the inlet areas with measurable DRP were made qualitatively in the Test Cells.

F.4 References

Drouet, F. 1968. Revision of the classification of the Oscillatoriales. Monogr. No. 15, The Academy of Natural Sciences of Philadelphia, Fulton Press, Lancaster. PA.

McCormick, P.V. and Stevenson, R.J. 1998. Periphyton as a tool for ecological assessment and management in the Florida Everglades. J. Phycol. 34, 726-733.

EXHIBIT F-3

Dominant Species (According to Biovolume) in STC Cells

STC	Feb-99	May-99	Jun-99	Aug-99	Oct-99	Dec-99	Mar-00	STC	Apr-00	Jun-00	Aug-00	Oct-00
1	N. reversa	*L. birgei*		*Scytonema*	*Scytonema*	*Scytonema*		4	R. gibba	*Scytonema*	**Spirogyra**	
2	**C. acerosum**	Gyrosigma sp.	M. smithii	M. smithii	N. semirobusta	P. viridis	*L. linearis*	5	M. smithii	**O. punct.**		
3	N. constricta	<u>Euglena sp.</u>	M. smithii	M. smithii	R. gibba	P. viridis	**O. punct.**	6	*L. linearis*	*L. linearis*	*Synechococcus*	*Scytonema*

Notes:

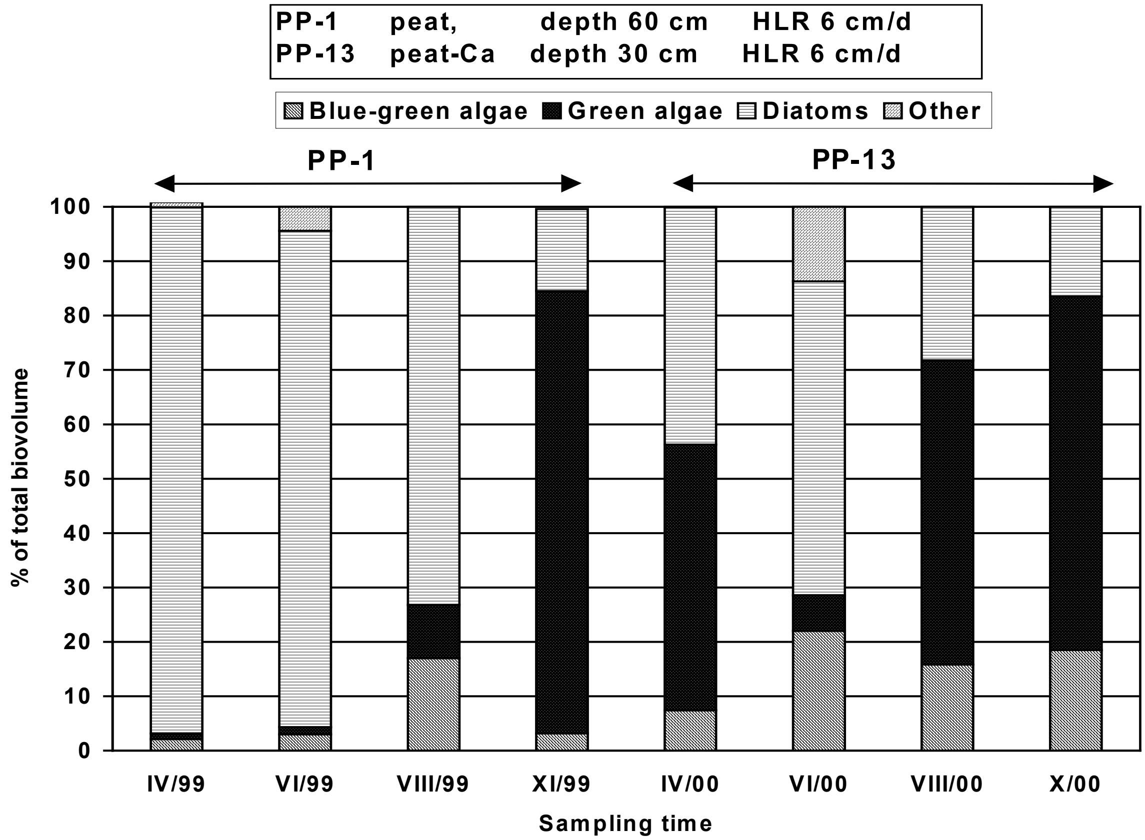
plain=diatoms

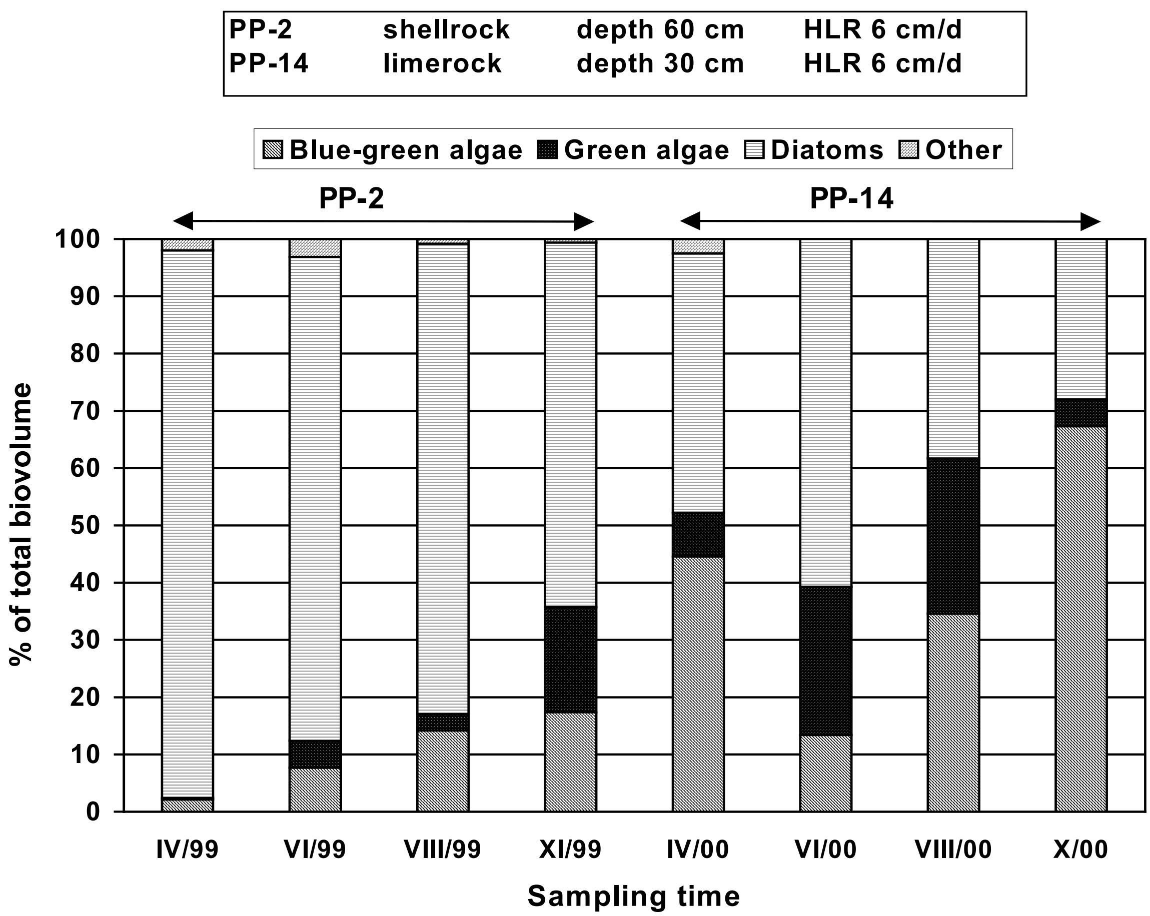
italics =blue-green algae

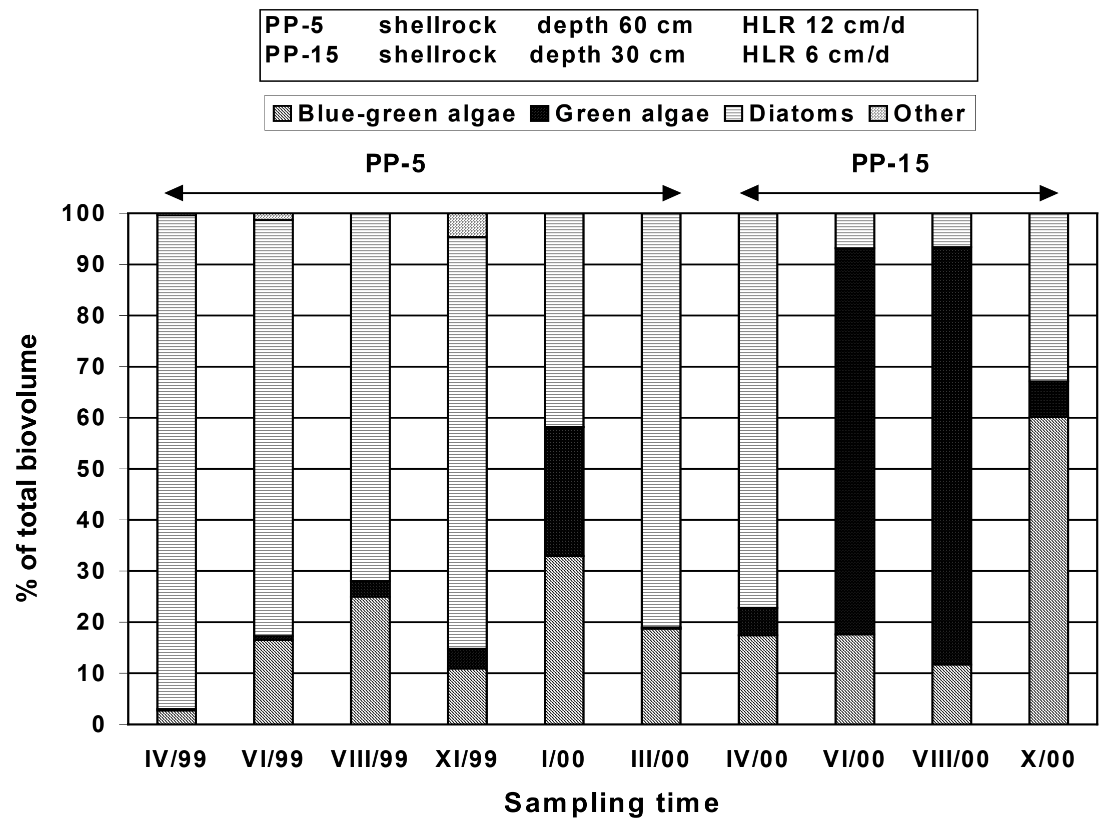
bold=green algae

<u>underline</u>=other

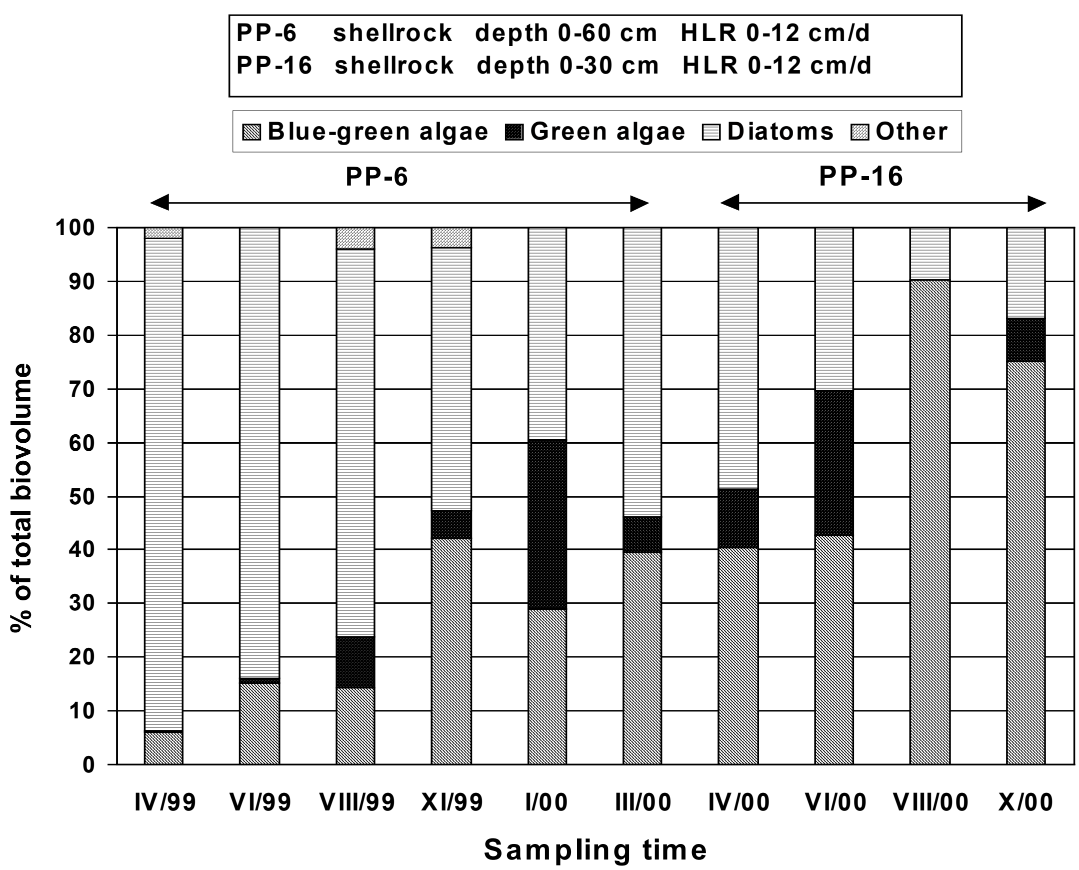
Attachments


PP-1 peat, depth 60 cm HLR 6 cm/d
PP-13 peat-Ca depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
PP-1
PP-13
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
IV/00
VI/00
VIII/00
X/00
Sampling time

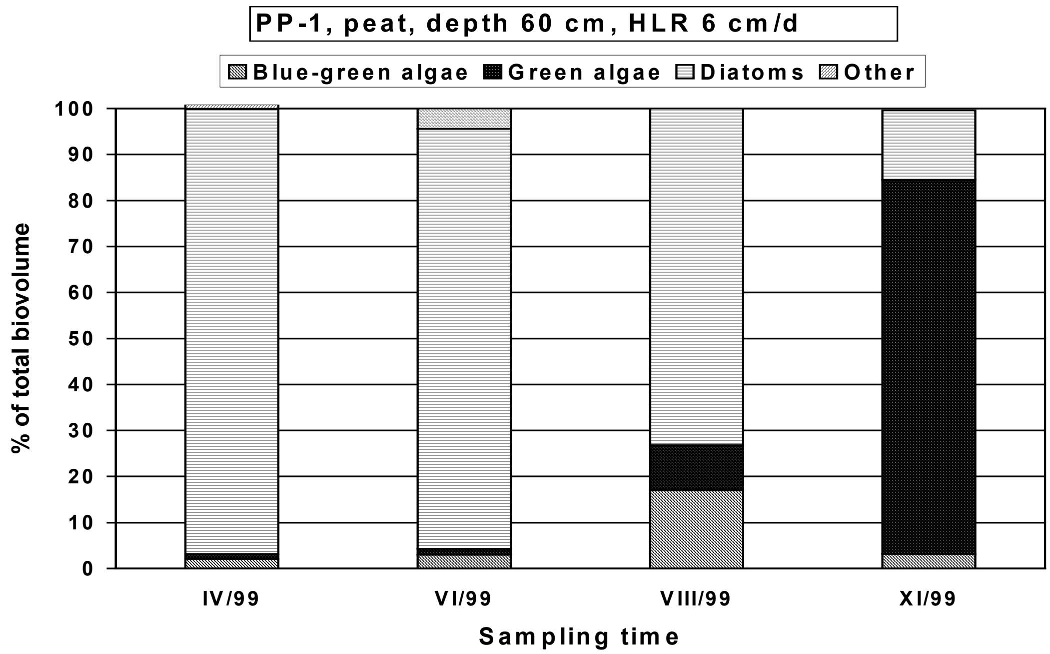

PP-2 shellrock depth 60 cm HLR 6 cm/d
PP-14 limerock depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
PP-2
PP-14
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
IV/00
VI/00
VIII/00
X/00
Sampling time

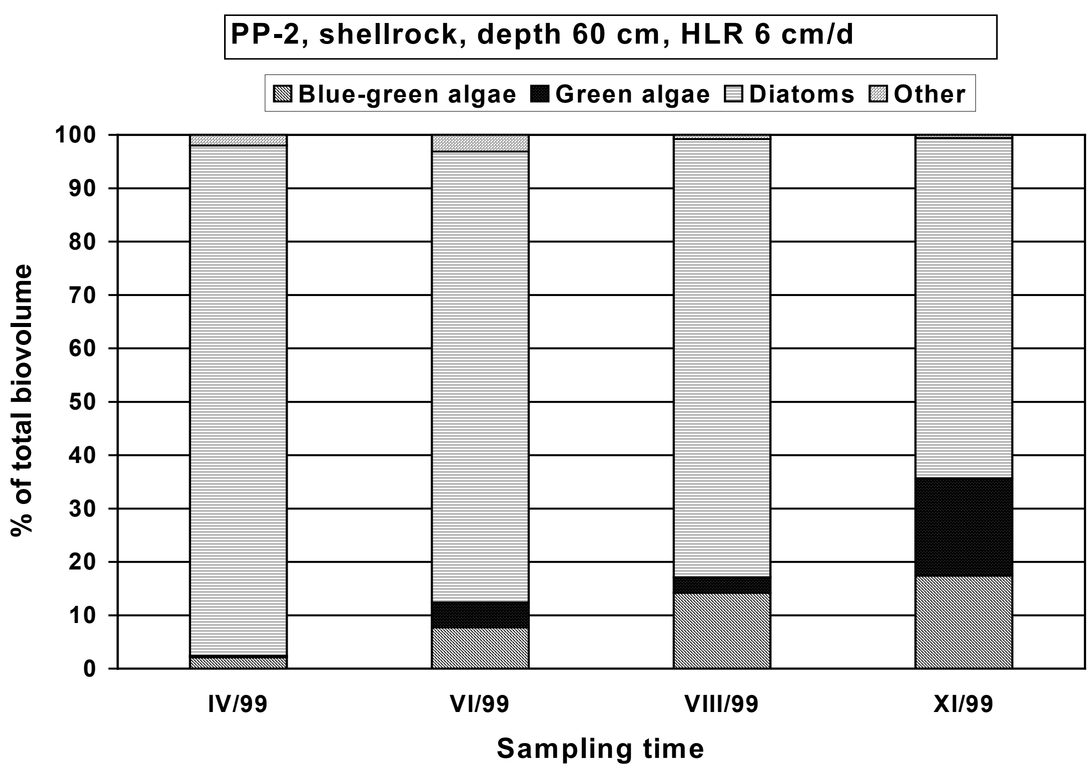


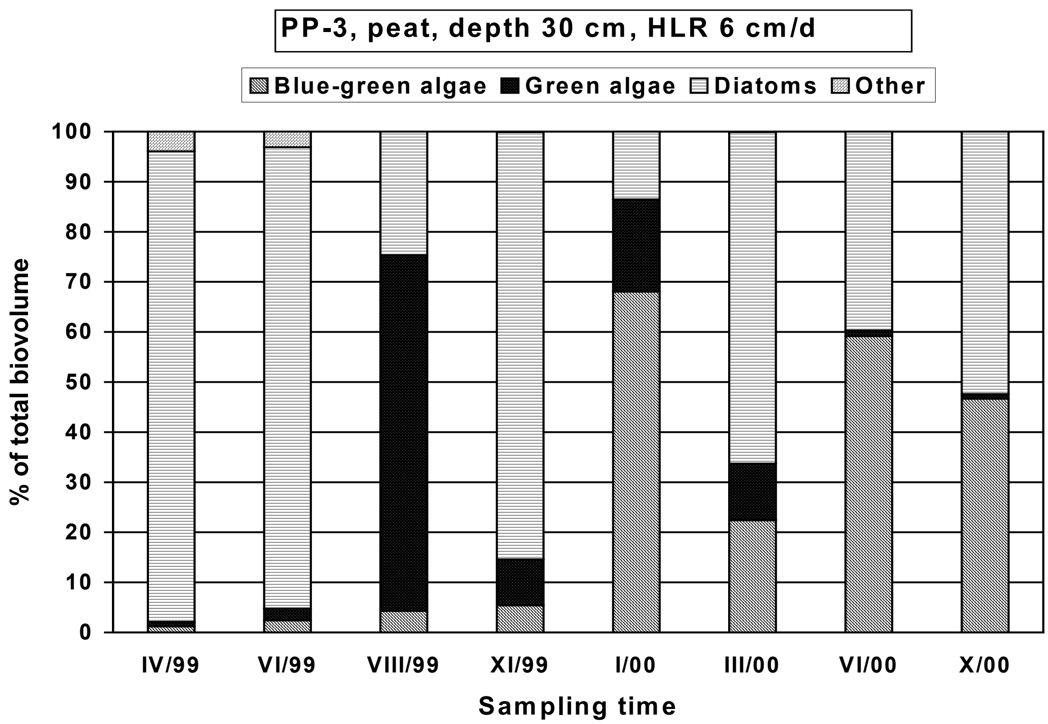
PP-5 shellrock depth 60 cm HLR 12 cm/d
PP-15 shellrock depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
PP-5
PP-15
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
IV/00
VI/00
VIII/00
X/00
Sampling time

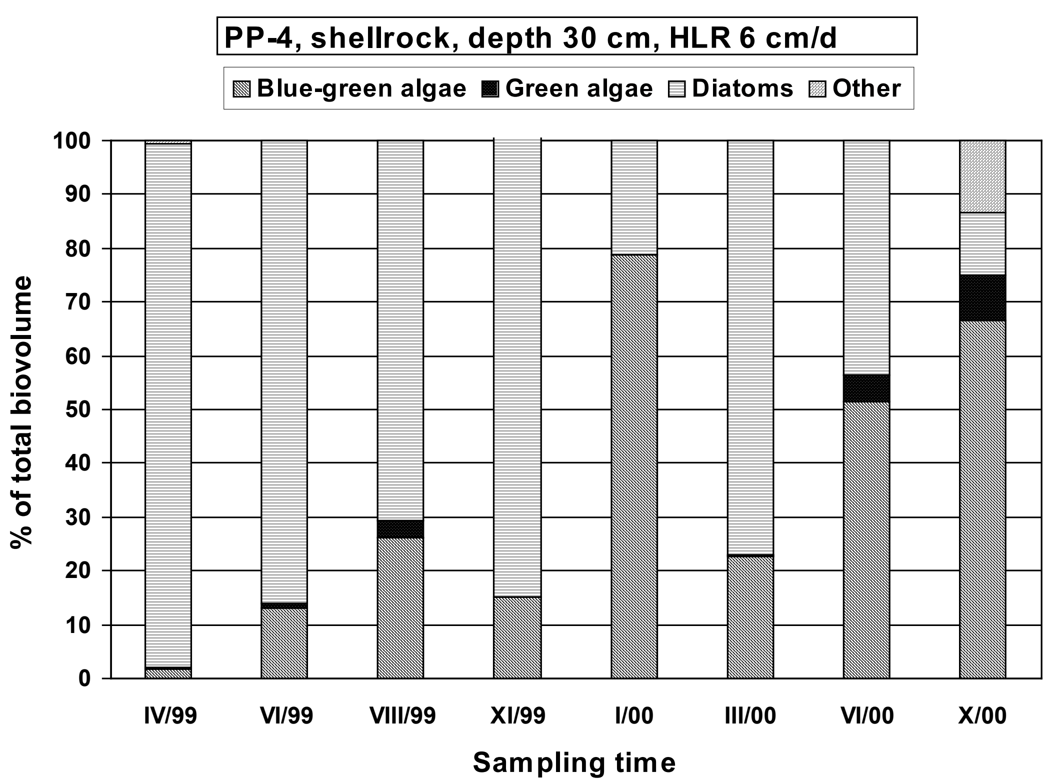


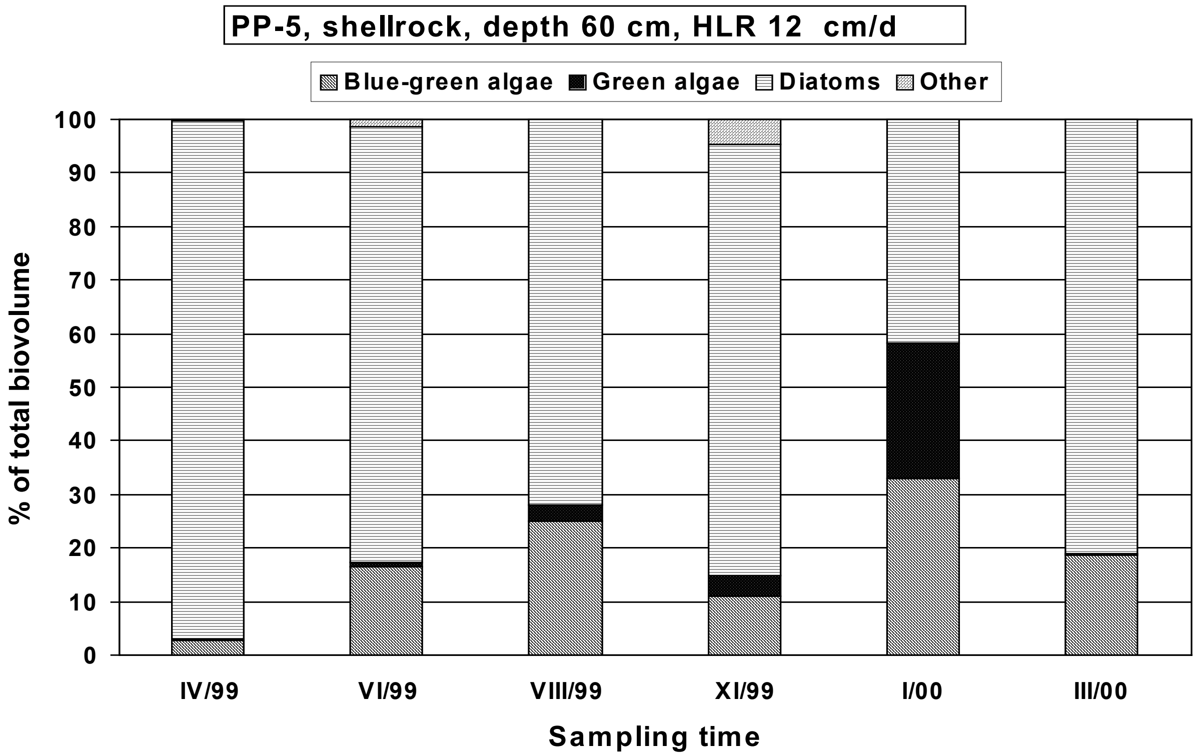
PP-6 shellrock depth 0-60 cm HLR 0-12 cm/d
PP-16 shellrock depth 0-30 cm HLR 0-12 cm/d
Blue-green algae
Green algae
Diatoms
Other
PP-6
PP-16
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
IV/00
VI/00
VIII/00
X/00
Sampling time

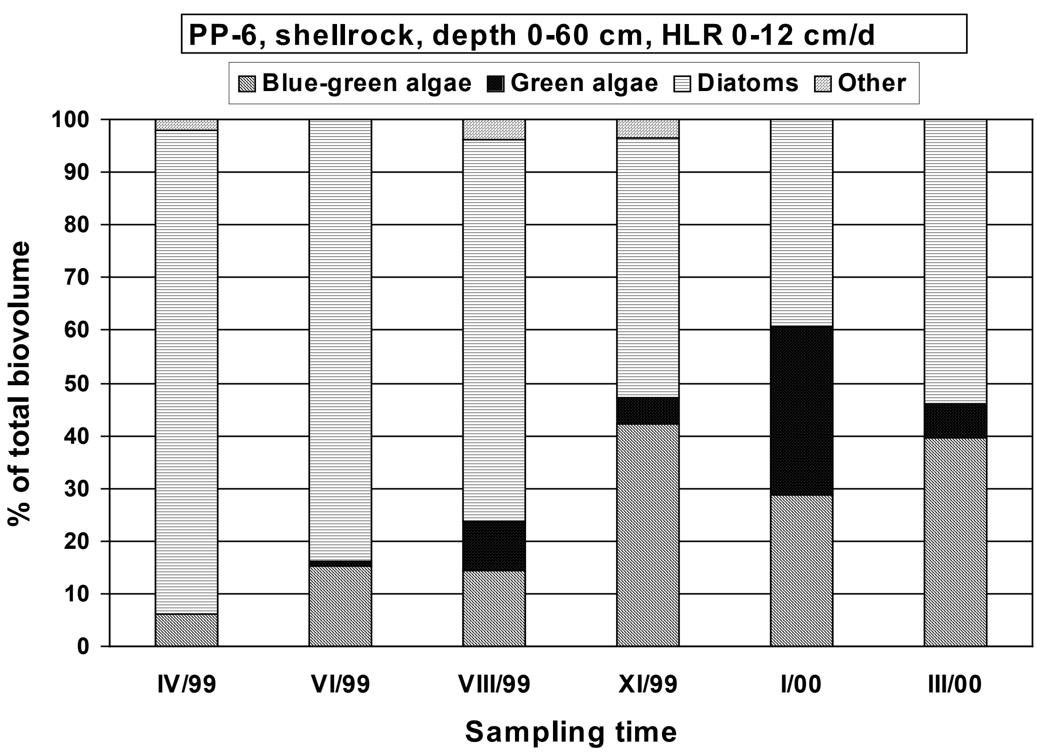

PP-1, peat, depth 60 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
Sampling time

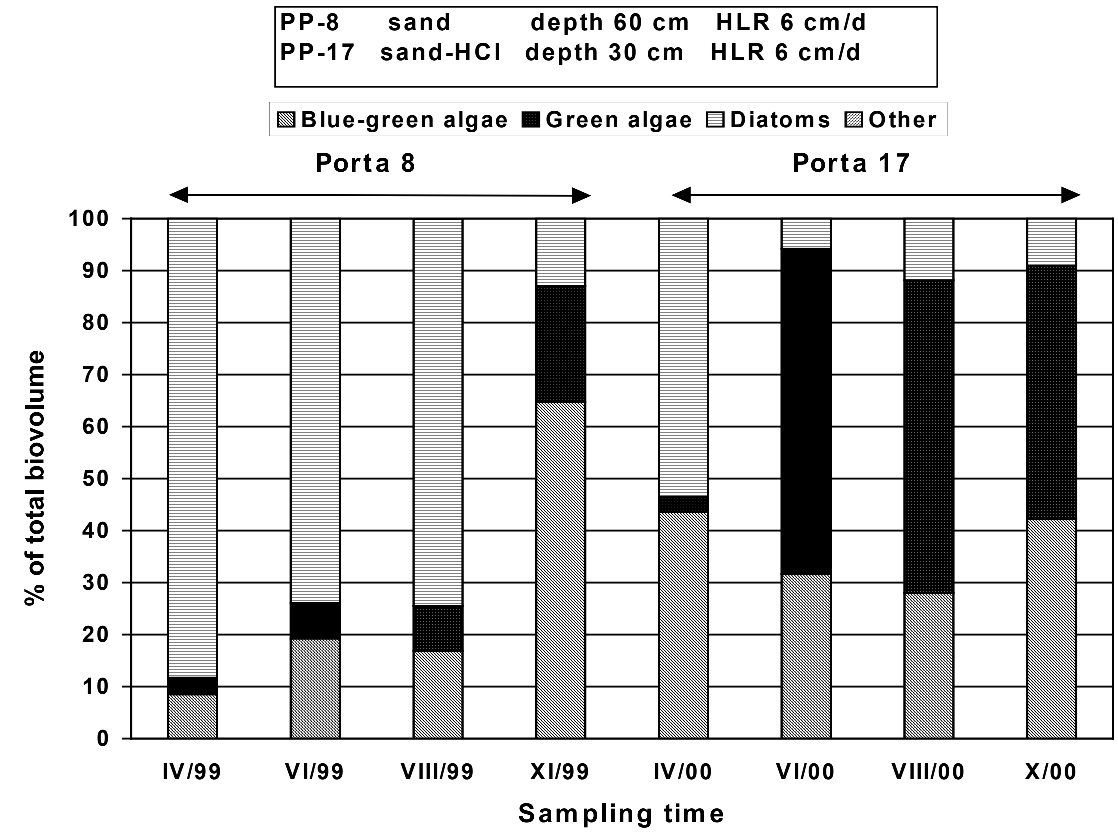

PP-2, shellrock, depth 60 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
Sampling time


PP-3, peat, depth 30 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
100
90
80
70
60
50
40
30
20
10
0
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
VI/00
X/00
Sampling time

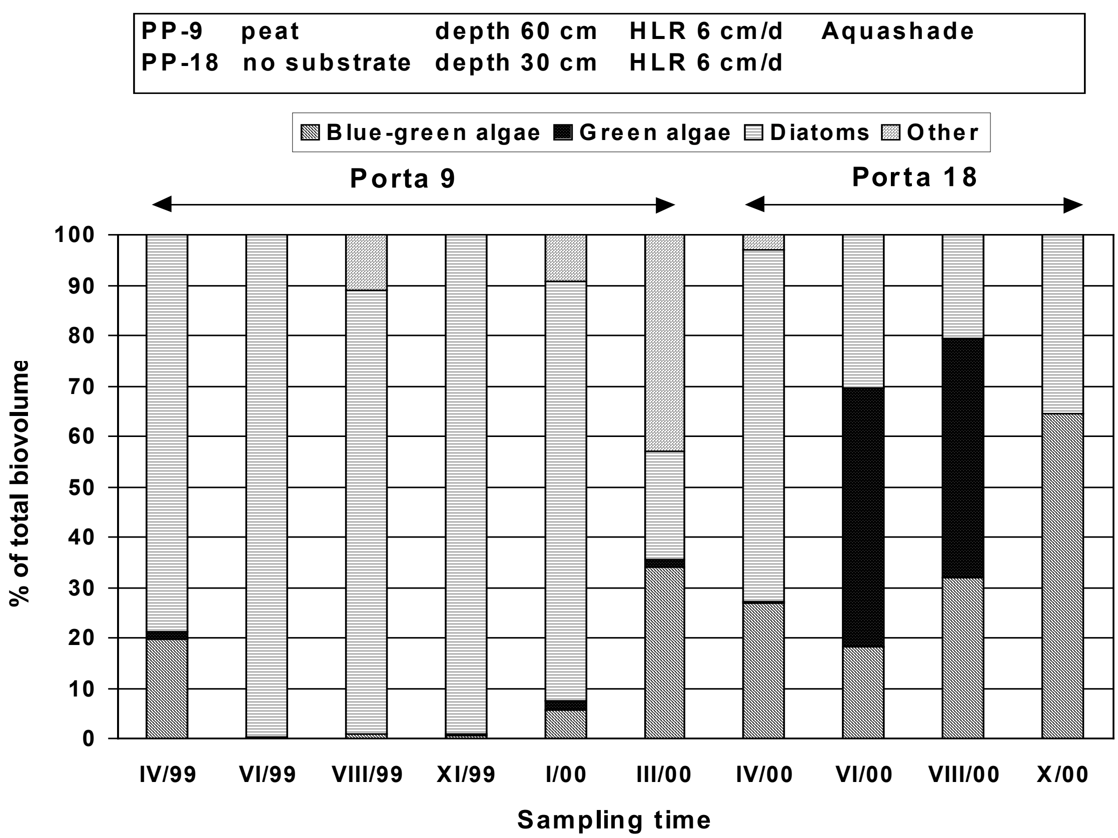

PP-4, shellrock, depth 30 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
100
90
80
70
60
50
40
30
20
10
0
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
VI/00
X/00
Sampling time


PP-5, shellrock, depth 60 cm, HLR 12 cm/d
Blue-green algae
Green algae
Diatoms
Other
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
Sampling time

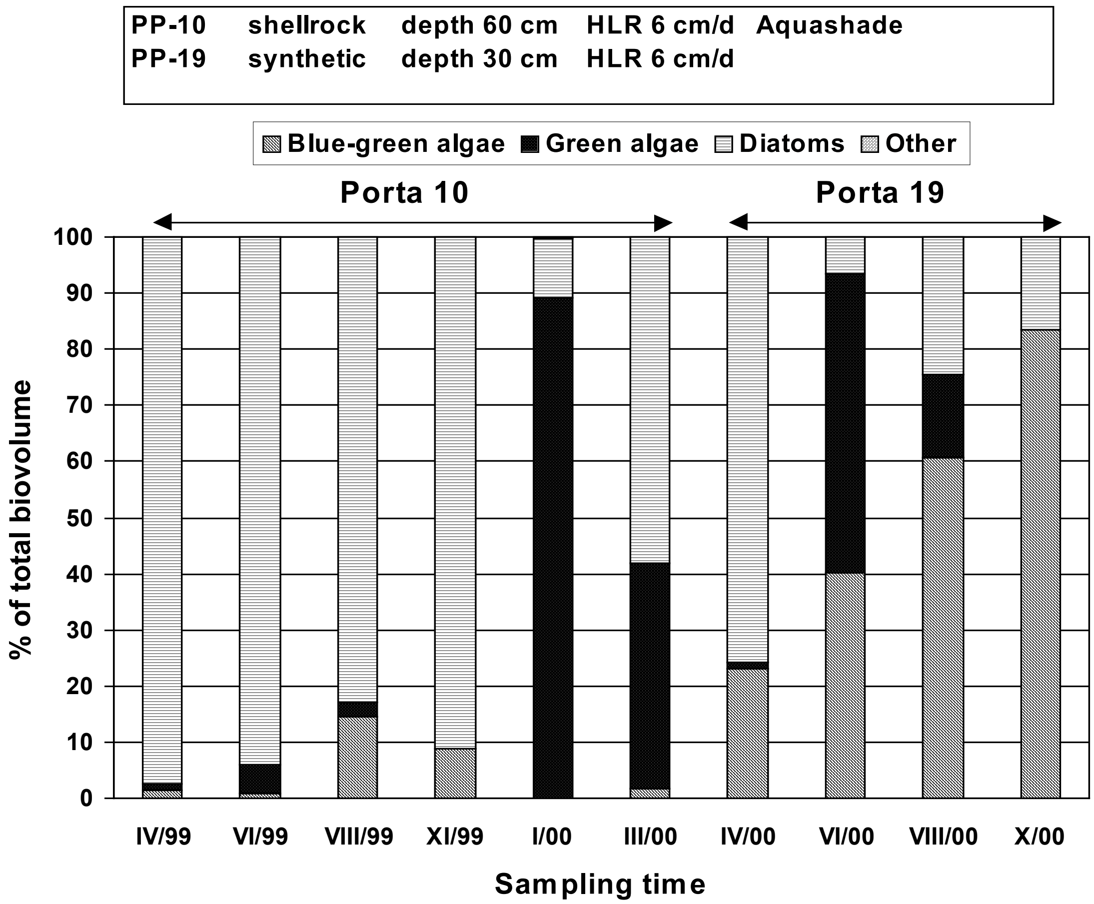

PP-6, shellrock, depth 0-60 cm, HLR 0-12 cm/d
Blue-green algae
Green algae
Diatoms
Other
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
Sampling time

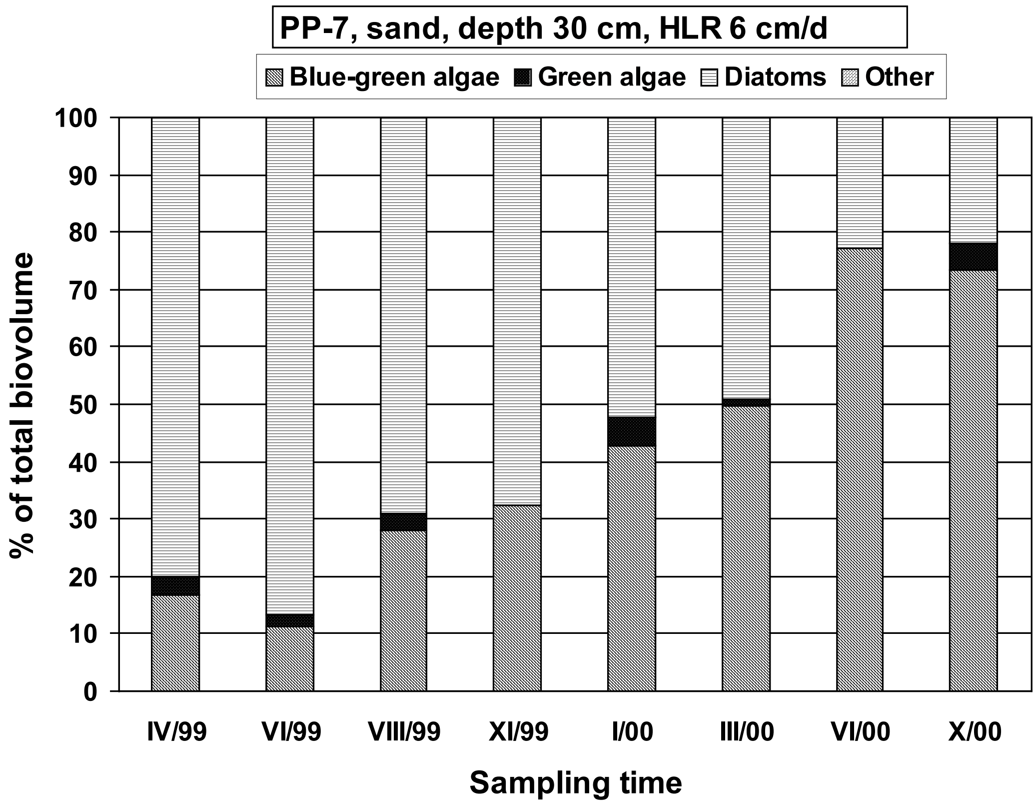


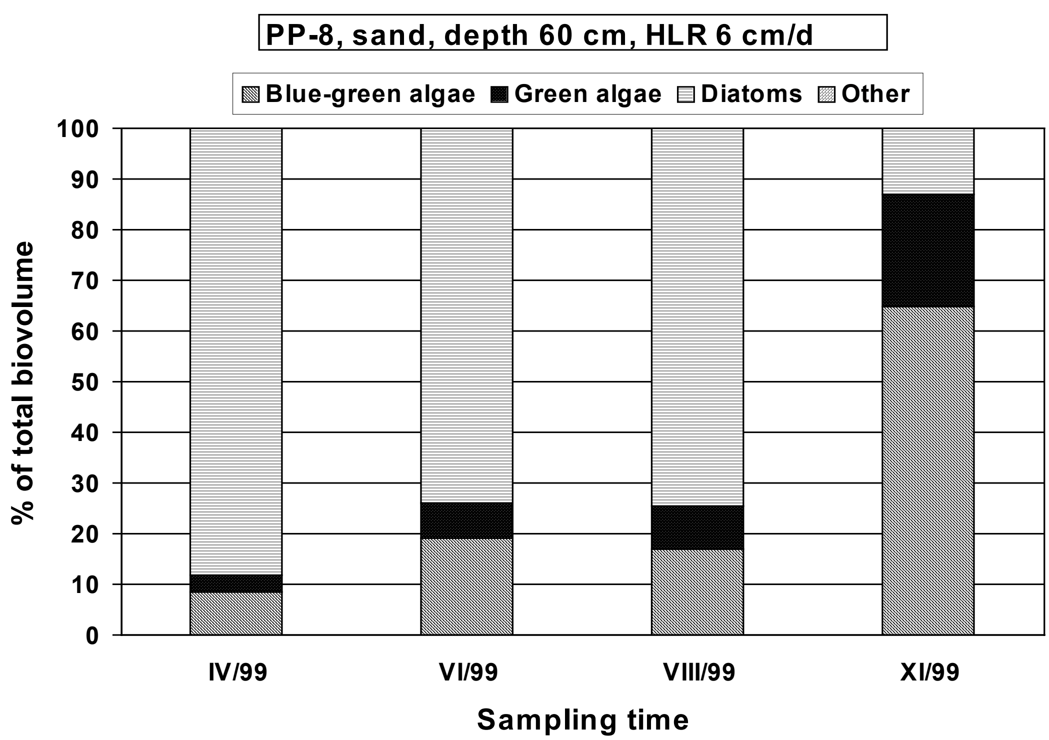
PP-8 sand depth 60 cm HLR 6 cm/d
PP-17 sand-HCl depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
Porta 8
Porta 17
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
IV/00
VI/00
VIII/00
X/00
Sampling time

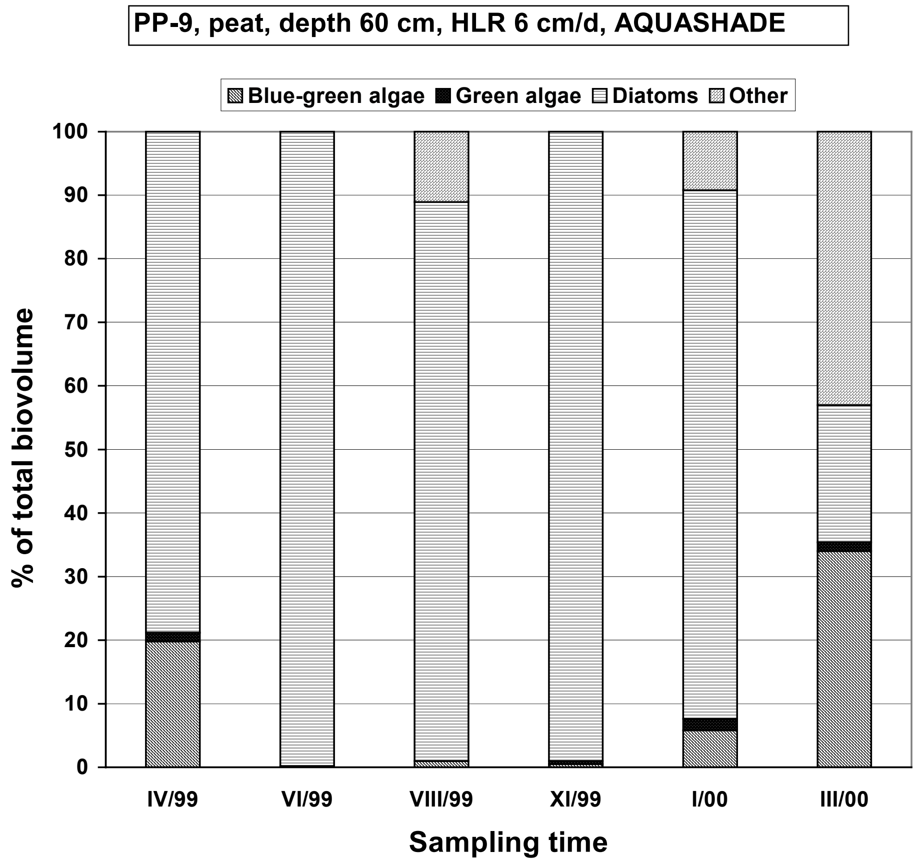


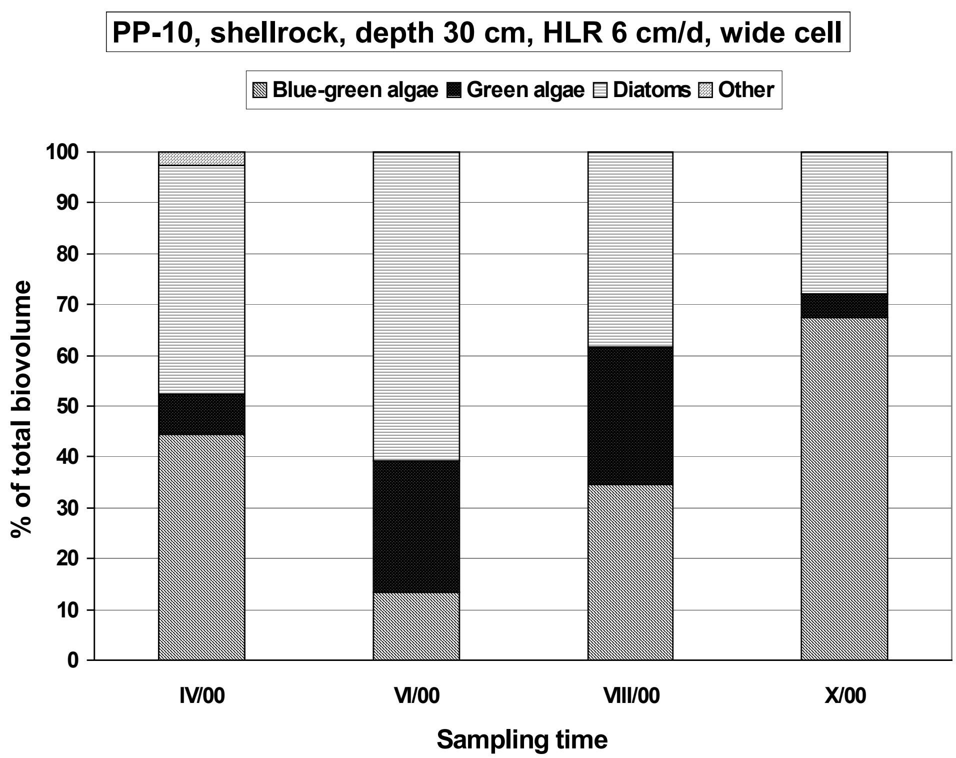
PP-9 peat depth 60 cm HLR 6 cm/d Aquashade
PP-18 no substrate depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
Porta 9
Porta 18
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
IV/00
VI/00
VIII/00
X/00
Sampling time

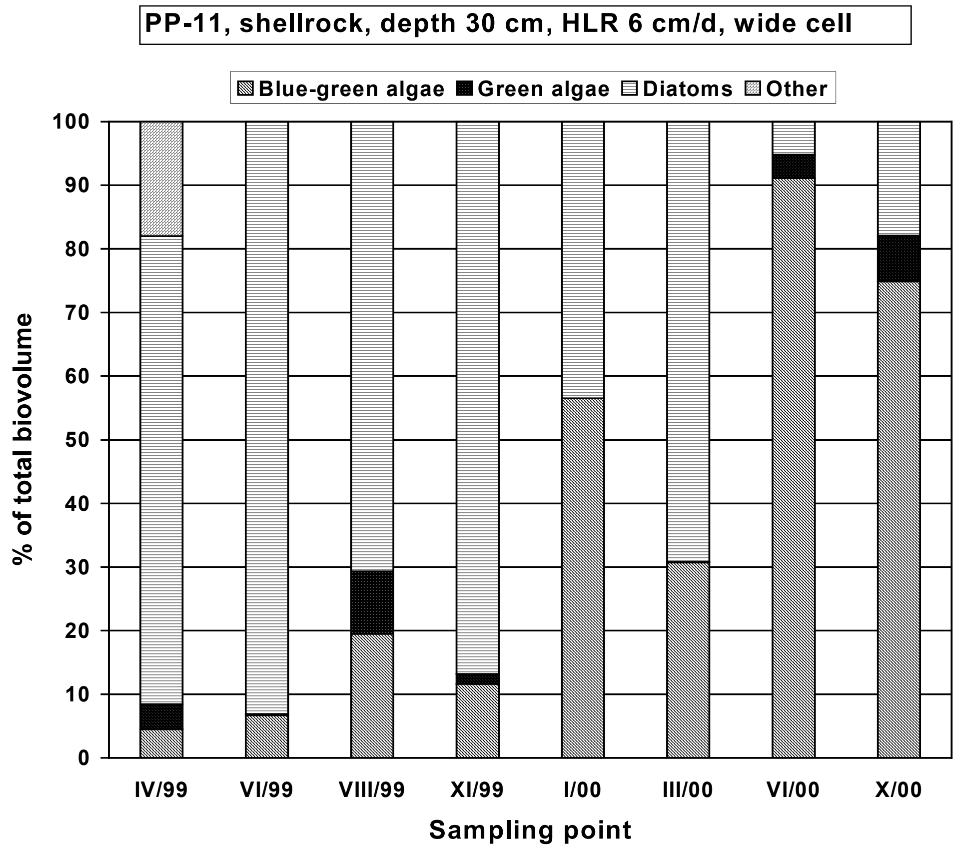

PP-10 shellrock depth 60 cm HLR 6 cm/d Aquashade
PP-19 synthetic depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
Porta 10
Porta 19
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
IV/00
VI/00
VIII/00
X/00
Sampling time

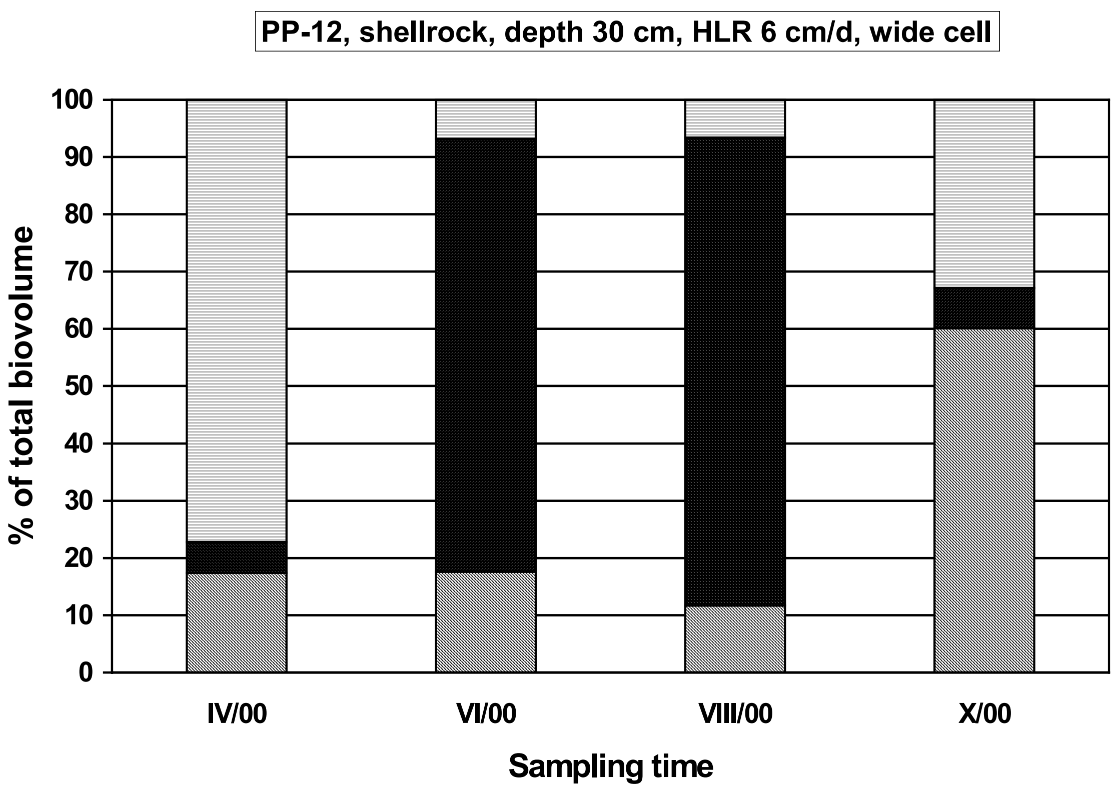

PP-7, sand, depth 30 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
VI/00
X/00
Sampling time

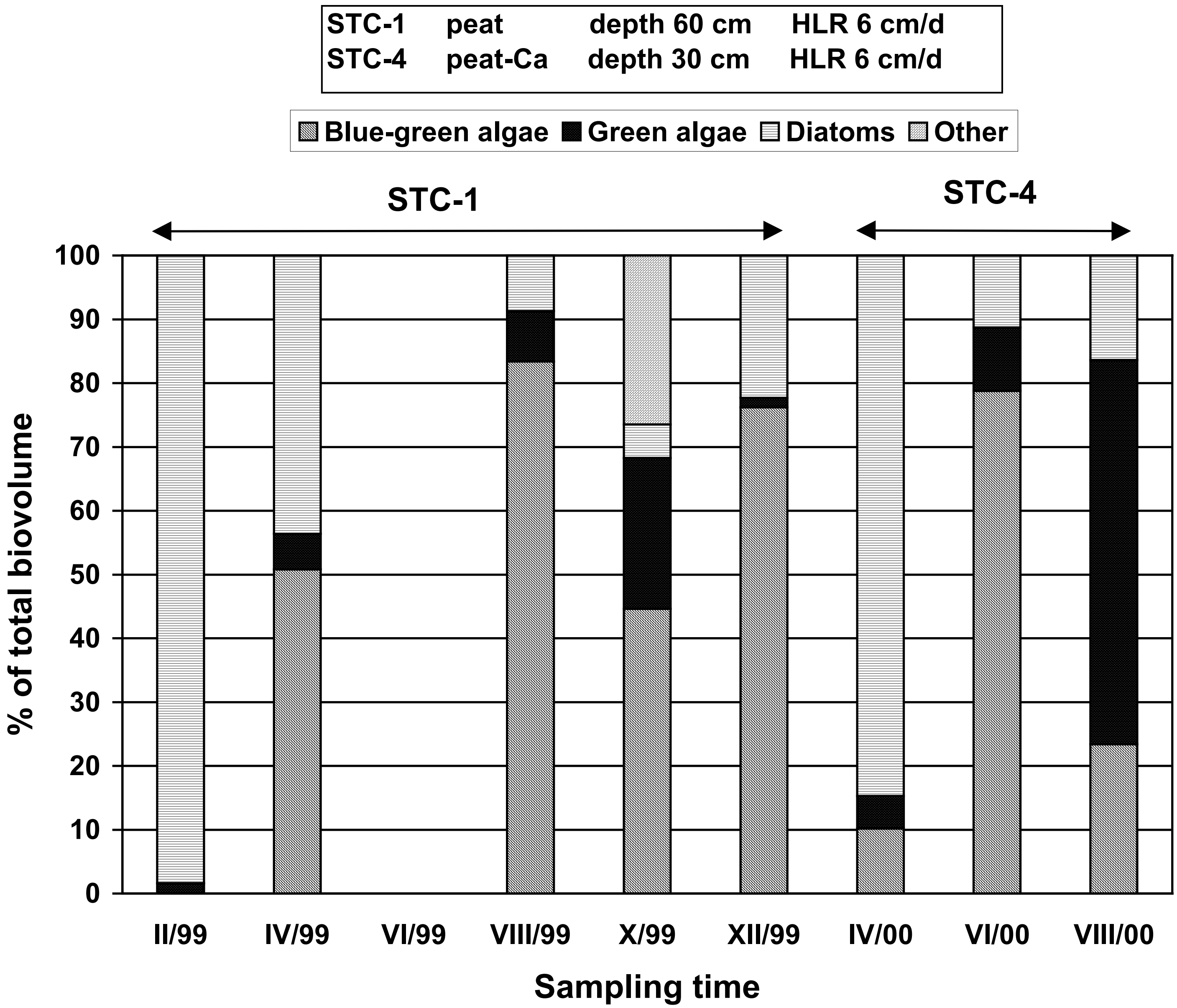

PP-8, sand, depth 60 cm, HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
IV/99
VI/99
VIII/99
XI/99
Sampling time

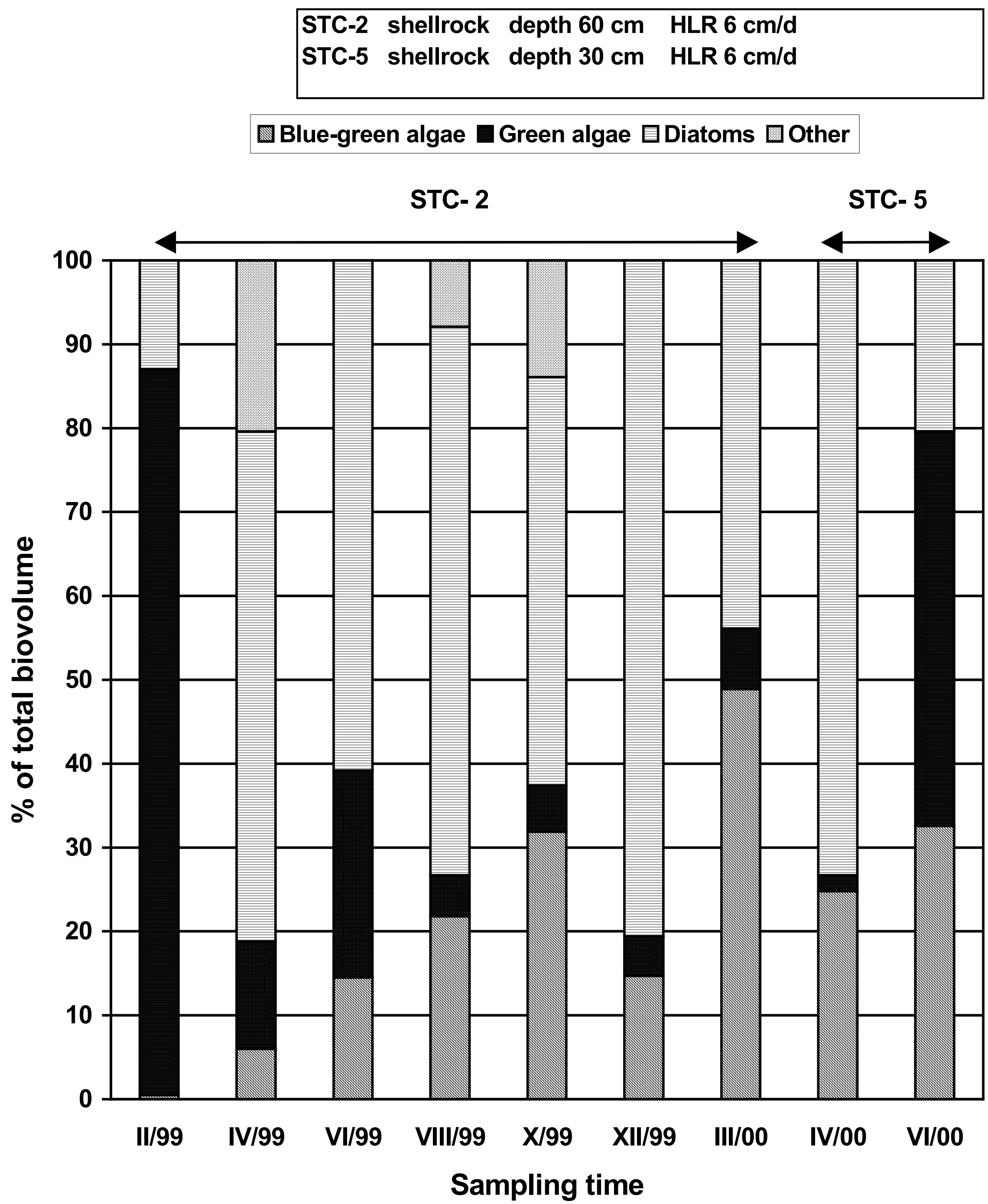

PP-9, peat, depth 60 cm, HLR 6 cm/d, AQUASHADE
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
Sampling time

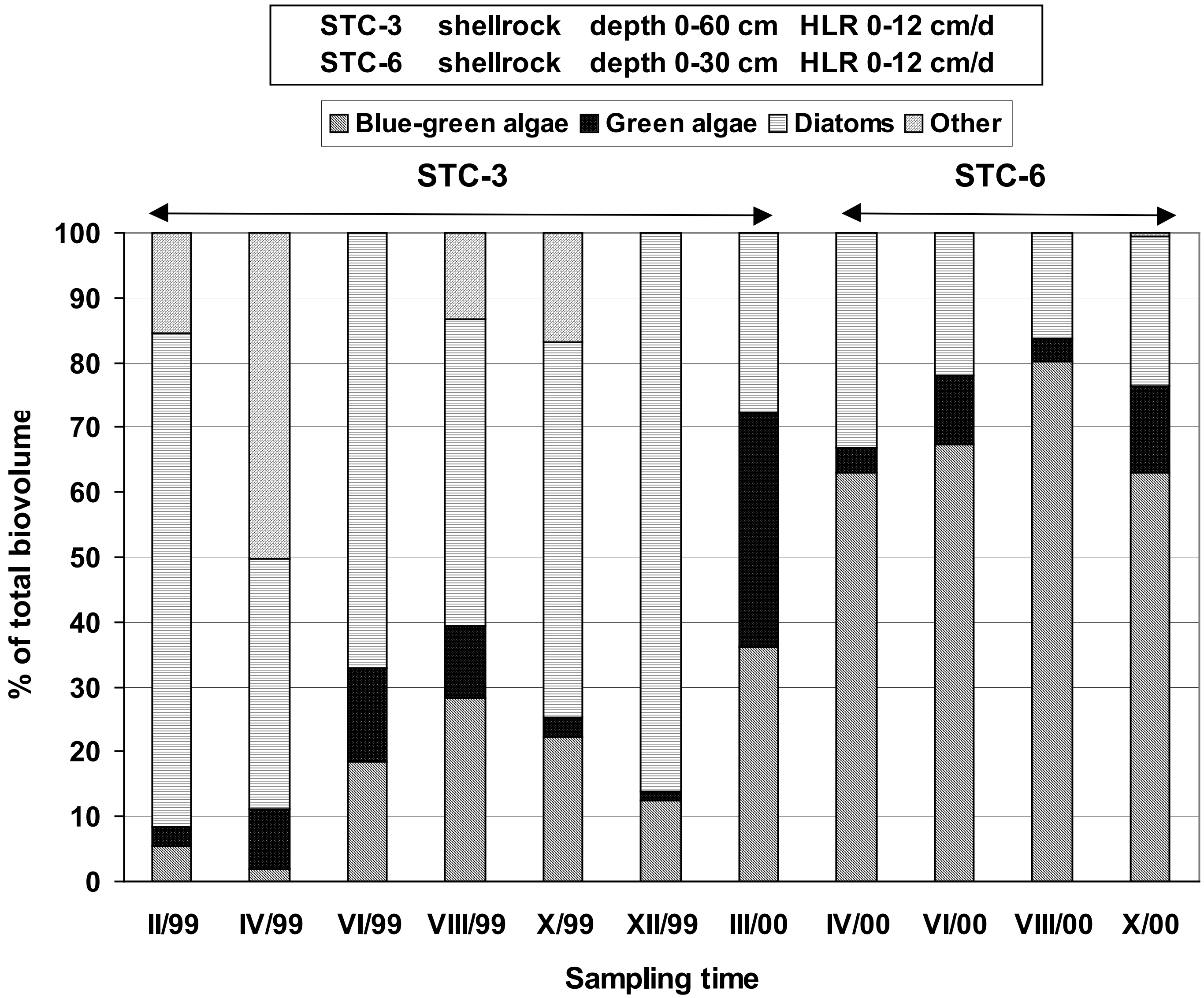

PP-10, shellrock, depth 30 cm, HLR 6 cm/d, wide cell
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/00
VI/00
VIII/00
X/00
Sampling time


PP-11, shellrock, depth 30 cm, HLR 6 cm/d, wide cell
Blue-green algae
Green algae
Diatoms
Other
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/99
VI/99
VIII/99
XI/99
I/00
III/00
VI/00
X/00
Sampling point


PP-12, shellrock, depth 30 cm, HLR 6 cm/d, wide cell
% of total biovolume
0
10
20
30
40
50
60
70
80
90
100
IV/00
VI/00
VIII/00
X/00
Sampling time


STC-1 peat depth 60 cm HLR 6 cm/d
STC-4 peat-Ca depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
STC-1
STC-4
% of total biovolume
100
90
80
70
60
50
40
30
20
10
0
II/99
IV/99
VI/99
VIII/99
X/99
XII/99
IV/00
VI/00
VIII/00
Sampling time


STC-2 shellrock depth 60 cm HLR 6 cm/d
STC-5 shellrock depth 30 cm HLR 6 cm/d
Blue-green algae
Green algae
Diatoms
Other
STC- 2
STC- 5
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
II/99
IV/99
VI/99
VIII/99
X/99
XII/99
III/00
IV/00
VI/00
Sampling time



STC-3 shellrock depth 0-60 cm HLR 0-12 cm/d
STC-6 shellrock depth 0-30 cm HLR 0-12 cm/d
Blue-green algae
Green algae
Diatoms
Other
STC-3
STC-6
100
90
80
70
60
50
40
30
20
10
0
% of total biovolume
II/99
IV/99
VI/99
VIII/99
X/99
XII/99
III/00
IV/00
VI/00
VIII/00
X/00
Sampling time

APPENDIX G

Hydraulic Tracer Test Data

APPENDIX G.1

Phase 1 Tracer Test Data

APPENDIX G.1

Periphyton-Based Stormwater Treatment Area Project: Phase 1 Tracer Study Results

G.1.1 Tracer Studies

Tracer studies provide a method for estimating the mean hydraulic residence time (HRT) and degree of mixing in aquatic treatment systems (Kadlec and Knight, 1996). Because these analyses can offer significant insight into treatment performance, tracer studies were included in these mesocosm studies. An initial tracer experiment was conducted at Tank 7 to evaluate sampling methods, determine sample frequency requirements, and investigate the feasibility of using sodium bromide (NaBr) as a tracer. This preliminary tracer experiment ran from January 29 through February 22, 1999.

A second series of tracer experiments, conducted at Tanks 7, 10, and 23, were performed to compare the results generated by two tracers, NaBr and lithium chloride (LiCl) and to further characterize the hydraulics of the Porta-PSTA mesocosms. These tracer studies were conducted at the Porta-PSTA Mesocosm site during the period from April 19 through June 15, 1999. The three PSTA Test Cells were tracer tested with LiCl during the August to October study period. This section describes the methods employed and the results from Phase 1 tracer testing.

G.1.2 Porta-PSTA Tracer Testing

G.1.2.1 Tank 7 Tracer Study (3rd Quarter)

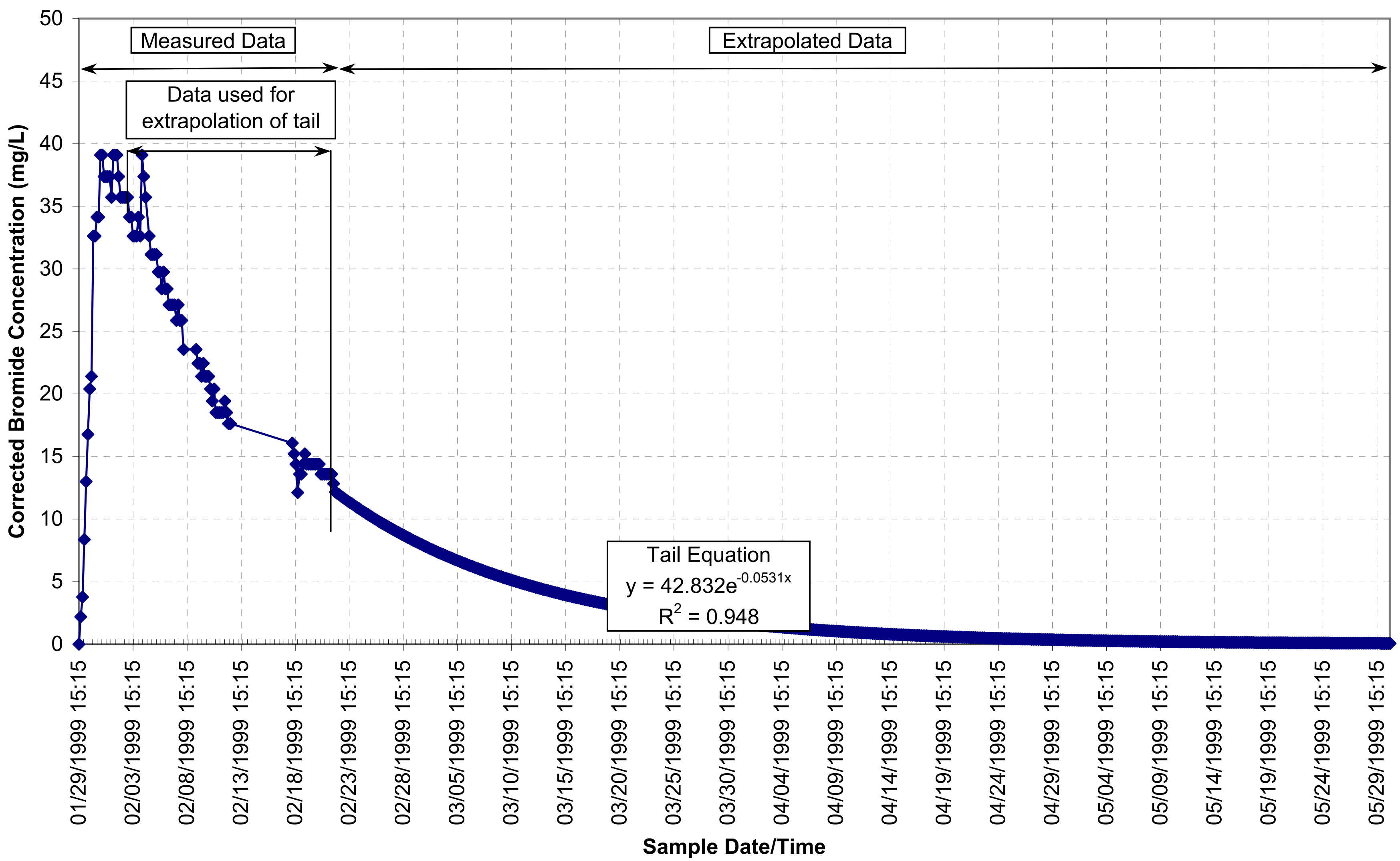
The primary objectives of this tracer study are presented below:

- To evaluate and refine the testing procedures described in the technical memorandum, *Periphyton-based Stormwater Treatment Area (PSTA) Research and Development Project – Tracer Study Plan* (CH2M HILL, 1998). This test was primarily for the purpose of methods development.
- To evaluate the use of sodium bromide as a tracer to be used in conjunction with the lithium chloride solution proposed in the above-referenced document. Because bromide ion (Br^-) concentrations can be determined in the field, the total cost for lithium analyses may be reduced by sending a sub-set of the lithium samples to the laboratory.

Study conditions and results are summarized in Exhibits G.1-1 and G.1-2, respectively.

The tracer study data were interpreted following the methods summarized by Kadlec and Knight (1996). The measured concentration of Sample 1, 3.4 mg/L, was assumed to be the background concentration for the study. As indicated previously, the experiment could not

Exhibit G.1-1: Porta-PSTA Tank 7 Bromide Tracer Study



DFB/Appendix G.1-1 and G.1-2.xls

Exhibit G.1-2
Summary of Tracer Study Results

PortaPSTA Tracer Test - Tank 7

Volume of NaBr Solution Applied:	**0.917**	**L**	**Nominal HRT:**	**10.83**	**d**
Concentration of Br Applied:	**332,030.25**	**mg/L**	**Avg. Flow:**	**0.36**	**m^3/d**
Mass of Br Applied:	**304.588**	**g**	**Avg. HLR:**	**6.0**	**cm/d**
Date/Time of Application:	**01/29/1999 15:15**		**Nominal Volume:**	**3.9**	**m^3**

Background Br Concentration: **3.40 mg/L**

Mass Recovery = 90%

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**19.557**	**M1/M0**
σ^2 (d^2) =	**332.304**	**M2/M0**
Number of Tanks N =	**1.151**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.805**	***$\tau\alpha/\tau\nu$***
Dimensionless Variance =	**0.869**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**2.374**	**Solver**

$\mathscr{D}$
2.374
Dimensionless Variance Guess
Pe = 0.421278903 0.87319974

be completed because the tank required structural repairs. Exhibit G.1-2 presents a summary of the tracer study results. The detailed calculations are provided in the appendix.

A portion of the tail of the curve was extrapolated based upon measured data following the peak of the distribution. The tail was extrapolated for 4-hour time steps from February 22, 1999, at 04:30 to an endpoint at May 30, 1999, at 20:30. The endpoint of the experiment was selected at a point where the change in total mass diminished significantly with each consecutive time step.

An artifact of this extrapolation procedure is that complete mass recovery of the tracer can not be achieved because the manipulated curve becomes asymptotic to the background concentration. This procedure may also artificially lengthen the duration of the tracer study. However, the estimated 90 percent mass recovery is acceptable for the purposes of this initial study.

The calculated HRT for Tank 7 was estimated to be 19.6 days. This value exceeds the nominal HRT of 10.8 days. This experimental artifact could be the result of insufficient flow monitoring during this preliminary study. Lower inflows than desired during a portion of the study could result in the longer observed HRT. Another possible explanation of this artifact is adsorption/desorption of the bromide in the sediments. This possibility was tested by adding bromide to a jar containing shellrock. No bromide was lost from solution, which indicates that variable inflows are the likely explanation for the observed long residence time.

The number of tanks-in-series (1.2) estimated from this data set indicates that the system was relatively well mixed and does not follow plug-flow hydraulics. This condition is expected to change somewhat during the course of the research as wind mixing decreases in response to increasing periphyton and macrophyte cover in the PSTA mesocosms.

G.1.2.2 Tanks 7, 10, and 23 Tracer Study (4th Quarter)

A preliminary tracer study of Tank 7 in March 1999 validated the experimental approach and determined that sodium bromide is an effective tracer in lieu of or in conjunction with lithium chloride (CH2M HILL, 1999b).

An additional tracer study was conducted from April to June 1999 that simultaneously compared the effectiveness of two tracer solutions, NaBr and LiCl. The primary objectives of the study were:

- To characterize the hydraulic properties of Tanks 7, 10, and 23
- To compare the results generated by two different tracer solutions
- To refine the experimental approach in preparation for tracer studies at the ENR Test Cells

Materials and Methods

Tanks 7, 10, and 23 were selected because they represent the full range of depth and volume treatments used for this mesocosm study. Flow data are presented in the appendix. Exhibit G.1-3 presents the design operating conditions for each experiment. Tracer experiment methodology followed that described in a previous technical memorandum (CH2M HILL, 1998).

EXHIBIT G.1-3
Design Operating Conditions in Porta-PSTA Mesocosms Evaluated in the Tracer Study

Parameter	Tank 7	Tank 10	Tank 23
Flow (m^3/d)	0.36	0.36	1.08
Hydraulic Loading Rate (cm/d)	6.0	6.0	6.0
Depth (cm)	60	30	30
Surface Area (m^2)	6	6	18
Nominal Hydraulic Residence Time (d)	10	5	5

Using an aluminum yardstick, average water depths in each tank were measured to be 64.6 cm, 36.3 cm, and 33.5 cm for Tanks 7, 10, and 23, respectively.

Tracer spike solutions were prepared using 40 percent LiCl brine (approximately 83,000 mg/L as Li ion) and 40 percent NaBr brine (approximately 360,000 mg/L as Br ion) to yield average peak concentrations of 0.5 mg/L for lithium (as Li ion) and 200 mg/L for bromide (as Br ion). The sources of the LiCl and NaBr stock solutions were FMC Corporation, Gastonia, North Carolina, and Tetra Technologies, Inc., The Woodlands, Texas, respectively.

The tracer solutions for each tank were combined in 1-gallon containers, stirred, and diluted to a total volume of approximately 1 gallon with de-ionized water to reduce density differences between the tracer solutions and the feed water. The tracer solutions were applied to each tank for a period of approximately 2 minutes by pouring the contents of the 1-gallon containers into each tank at the location of the inlet pipe discharge. Tracer volumes and approximate diluted solution concentrations applied during the study are presented in Exhibit G.1-4.

EXHIBIT G.1-4
Summary of Tracer Volumes and Solution Concentrations Applied During Study

	Tank 7		Tank 10		Tank 23	
Tracer	Volume	Concentration	Volume	Concentration	Volume	Concentration
LiCl	25 mL	550 mg/L as Li	10 mL	220 mg/L as Li	35 mL	770 mg/L as Li
NaBr	1.6 L	152,000 mg/L as Br	0.8 L	76,100 mg/L as Br	2.5 L	238,000 mg/L as Br

Automated ISCO samplers (Model 3700 with 24 1-liter teflon bottles) were deployed at the outlets from each tank and were programmed to collect 750 milliliter (mL) samples at 4-hour intervals, beginning at the time of initial tracer application (1,745 hours on April 19, 1999). The ISCO bottles were rinsed with source water and de-ionized water following each programmed cycle. The sampling frequency was reduced to an 8-hour interval on May 14, 1999. The ISCO samplers were removed on May 27, 1999, and grab samples were collected from the tank outlets for the remainder of the study. Grab samples were also collected at the ENR outflow pump station during the course of the experiment to verify that the discharge from the study tanks would not raise the background concentrations of lithium and/or bromide in discharges from the ENR to Water Catchment Area (WCA) 2.

A subset of 30 samples from each experiment was used to compare the two tracers. Bromide samples were analyzed using an Orion ion-specific probe (Model No. 96-35). Four standard solutions spanning the expected range of sample concentrations were prepared by diluting a 0.1 molar stock bromide solution. The electro-potential (millivolts [mV]) of each standard solution was measured using the ion-specific probe.

The measured electro-potentials of the samples were recorded, and concentrations were calculated using the regression equations. Lithium samples were chilled with ice for shipment to the laboratory. No other preservative was used for the lithium samples.

To assess the potential for the NaBr to be adsorbed to sediments and suspended particles, 1 liter of stock solution (approximately 350 mg/L as Br^-) was mixed with dry shellrock substrate and allowed to settle. The electro-potential was measured before, immediately after, and 6 hours after mixing. No change in electro-potential (-118 mV) was observed, which indicates that Br^- was not adsorbed by the shellrock. A similar study of the adsorption of LiCl to the shellrock will be conducted during the Test Cell tracer studies.

G.1.2.3 Porta-PSTA Results

The tracer study data were interpreted following the methods summarized by Kadlec and Knight (1996). The concentrations of the first samples from each tank were used as the background or starting concentrations. The data collected for each experiment is provided in the appendix. Flows corresponding with each sample were interpolated from the flow records shown in the appendix Plots of tracer concentration versus time are also included in the appendix.

Tracer Response Curves

Exhibits G.1-5 through G.1-7 show the tracer response curves (concentration versus time) for Tanks 7, 10, and 23, respectively. Each figure superimposes the response curves for the two tracers. The curves have been normalized by dividing the concentration of each sample by the maximum observed concentration.

Comparison of Exhibits G.1-5 through G.1-7 indicates that LiCl and NaBr showed nearly identical responses throughout the duration of the study. Tank 23 exhibited relatively lower Li concentrations throughout study.

Hydraulic Characteristics

Exhibits G.1-8 through G.1-10 summarize the hydraulic characteristics of Tanks 7, 10, and 23, as determined through this study.

The experimentally derived HRTs for each tank were longer than the nominal HRTs, which indicates unsteady flow conditions. The inlet valves to the three tanks frequently plugged with organic material, significantly reducing and sometimes completely stopping flow between site visits.

EXHIBIT G.1-5
Tank 7 Normalized Tracer Response Curves

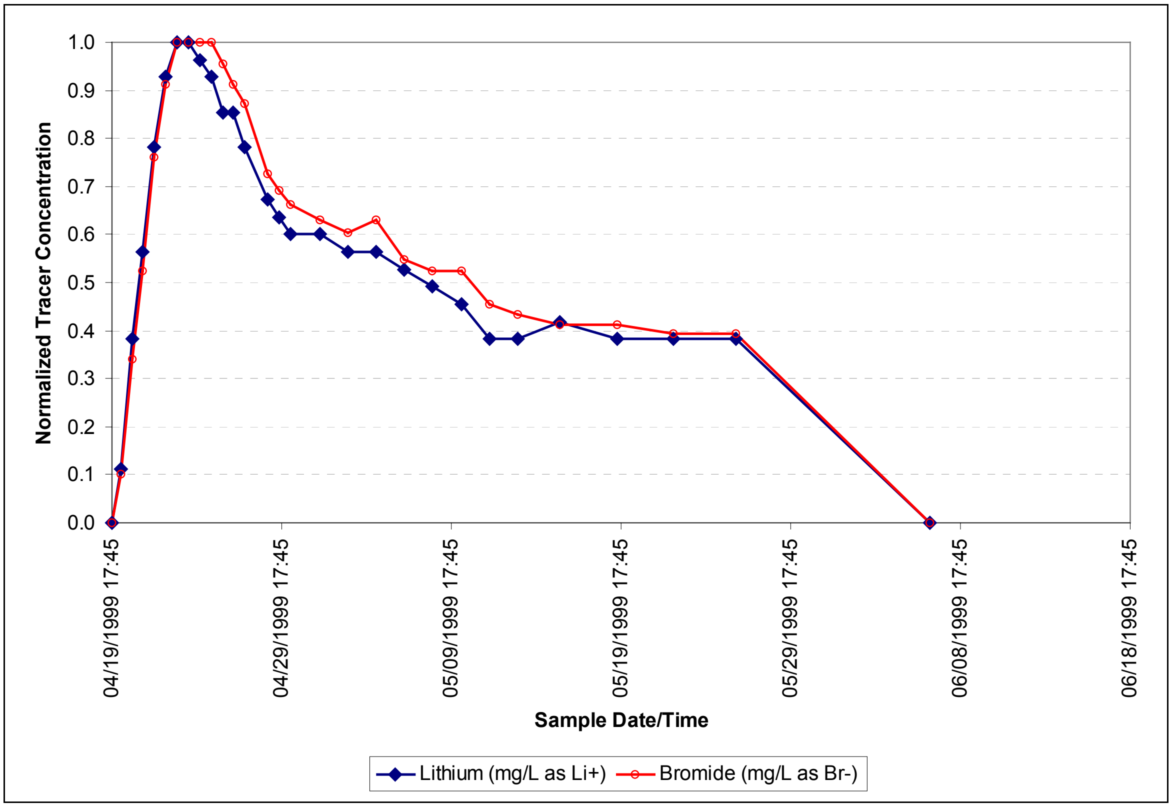


EXHIBIT G.1-6
Tank 10 Normalized Tracer Response Curves

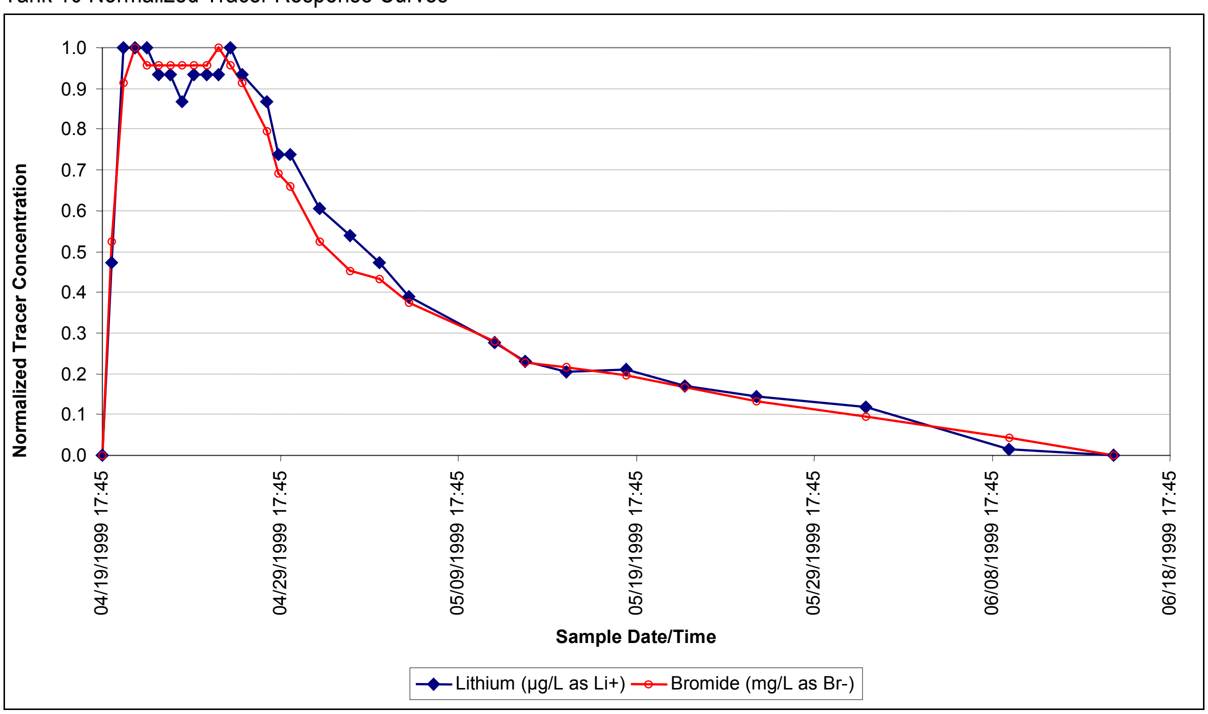


EXHIBIT G.1-7
Tank 23 Normalized Tracer Response Curves

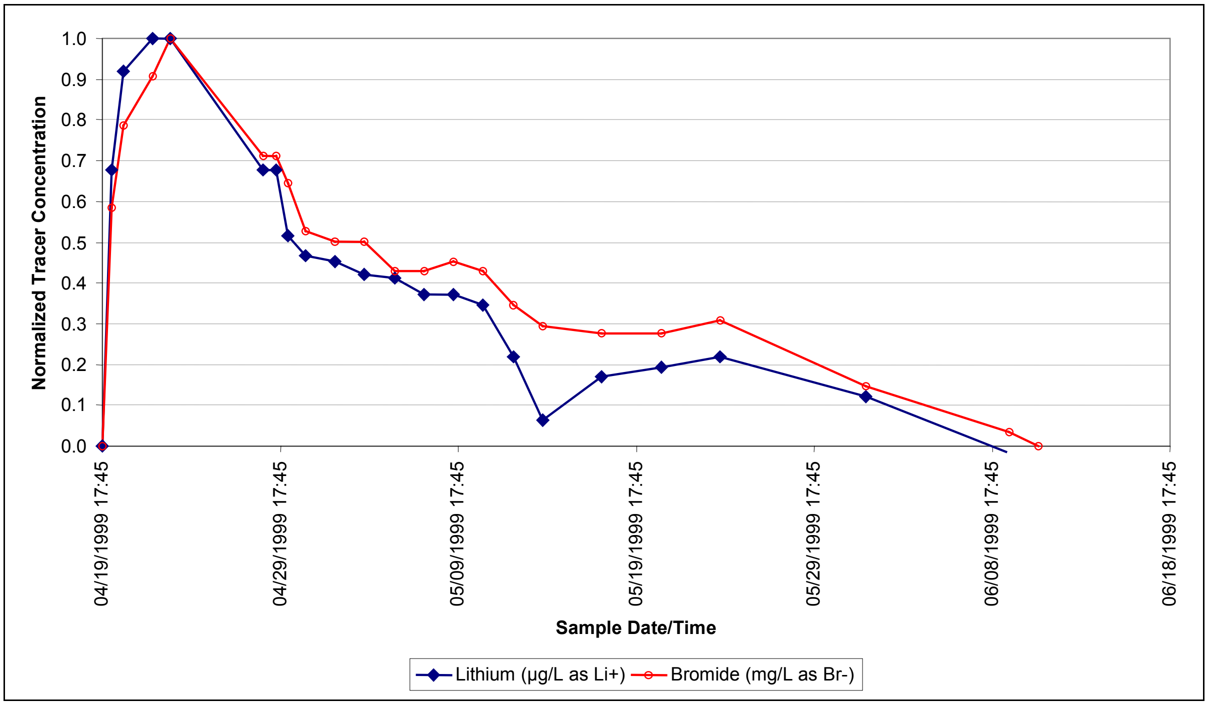


EXHIBIT G.1-8
Tank 7 Combined Tracer Study Results

Parameter	Operating Conditions	LiCl Tracer	NaBr Tracer
Average Depth (m)	0.65	-	-
Average Volume (m^3)	3.88	-	-
Average Flow (m^3/d)	0.28	-	-
Nominal HRT (d)	14.0	-	-
Mean HRT, τ (d)	-	18.5	18.6
Variance, σ^2	-	159.1	155.0
Number of Tanks, N	-	2.15	2.22
Volumetric Efficiency (%)	-	132	132
Dimensionless Variance	-	0.46	0.45
Dispersion Number, $\mathscr{D}$	-	0.34	0.33
Tracer Mass Recovery (percent)	-	83	110

EXHIBIT G.1-9
Tank 10 Combined Tracer Study Results

Parameter	Operating Conditions	LiCl Tracer	NaBr Tracer
Average Depth (m)	0.36	-	-
Average Volume (m^3)	2.18	-	-
Average Flow (m^3/d)	0.27	-	-
Nominal HRT (d)	8.2	-	-
Mean HRT, τ (d)	-	14.6	14.7
Variance, σ^2	-	142.8	151.6
Number of Tanks, N	-	1.49	1.42
Volumetric Efficiency (%)	-	178	179
Dimensionless Variance	-	0.67	0.71
Dispersion Number, $\mathscr{D}$	-	0.75	0.87
Tracer Mass Recovery	-	98	120

EXHIBIT G.1-10
Tank 23 Combined Tracer Study Results

Parameter	Operating Conditions	LiCl Tracer	NaBr Tracer
Average Depth (m)	0.34	-	-
Average Volume (m^3)	6.14	-	-
Average Flow (m^3/d)	0.96	-	-
Nominal HRT (d)	6.4	-	-
Mean HRT, τ (d)	-	14.8	17.1
Variance, σ^2	-	150.7	166.8
Number of Tanks, N	-	1.45	1.75
Volumetric Efficiency (%)	-	228	266
Dimensionless Variance	-	0.69	0.57
Dispersion Number, $\mathscr{D}$	-	0.81	0.50
Tracer Mass Recovery (percent)	-	75	87

The relatively low estimates of the tanks-in-series parameter (N) and high volumetric efficiencies further suggest that the inconsistent inflows retarded the movement of the tracers through the tanks. These parameters also indicate that the tanks are between well mixed and plug flow. The estimated tanks-in-series increased for Tank 7 from approximately 1.2 to 2.2 between the first and second tracer studies.

G.1.2.4 Discussion

The testing procedures used for this study provide sufficient data to determine the hydraulic characteristics of the experimental systems at the PSTA research site. LiCl and

NaBr produce similar results with deviations most likely attributable to analytical error. Continuous or more infrequent inflow and outflow measurements will be conducted during future tracer studies to reduce variation between actual and nominal HRTs.

Elevated bromide concentrations were not detected at the ENR outflow pump station. Lithium samples from the ENR pump station were within the range of background conditions for the ENR.

Bromide adsorption was not observed for the shellrock substrate at the Porta-PSTA site. A lithium adsorption experiment will be conducted during the ENR Test Cell tracer studies.

NaBr can be used for future Porta-PSTA tracer studies. This approach offers distinct advantages over the use of LiCl in these mesocosms, including inexpensive onsite analysis of the samples and rapid data turn-around. Studies at the ENR Test Cells should use LiCl so that tracer spiking volumes can be efficiently managed by field personnel. For example, tracer studies at ENR Test Cell 13 will require only 7 liters of LiCl solution compared to 600 liters of NaBr solution.

Results from the tracer tests in the Porta-PSTA mesocosms indicated that these tanks are between well mixed and plug flow with tanks-in-series (TIS) numbers between 1.2 and 2.2. Very little difference was detected between the results using Li and Br salts. There was no apparent difference in degree of mixing between the smallest tanks (6 m^2) and the larger tanks (18 m^2). Water depth did appear to make a difference in mixing with the deeper tank (0.65 m) acting like 2.2 TIS while the shallower tanks (0.34 to 0.36 m) were best modeled as 1.4 to 1.8 TIS.

G.1.3 Test Cell Tracer Testing

G.1.3.1 Materials and Methods

Tracer spike solutions were prepared using an LiCl brine solution with approximately 78,460 milligrams per liter (mg/L) as Li ion to yield average peak concentrations of approximately 0.5 mg/L for lithium. The tracer solutions for each PSTA Test Cell were combined in clean plastic containers with de-ionized water and stirred to reduce density differences between the tracer solutions and the feed water. The tracer solutions were applied to each Test Cell for approximately 2 minutes by pouring the contents of the plastic containers into the inlet piping assemblies. Tracer volumes were 5.5 L for Test Cells 3 and 13 and 7.0 L for Test Cell 8.

Automated ISCO samplers (Model 3700) were deployed at the outlets from each Test Cell and were programmed to collect approximately 100 milliliter (mL) samples at 4-hour intervals, beginning at the time of initial tracer application (between 14:50 and 15:30 on July 29, 1999). The filled ISCO bottles were capped and replaced with clean bottles after each programmed cycle. The sampling frequency was reduced to an 8-hour interval on August 24, 1999. The ISCO samplers were removed on August 31, 1999, because of the threat of high winds from several hurricanes off the Atlantic coast. Grab samples were collected every few days until September 30, 1999. Grab samples were also collected at the ENR outflow pump station during the course of the experiment to determine if the discharge from the study would raise the background concentrations of lithium in the ENR.

Lithium samples were sent to Savannah Laboratories in Mobile, Alabama, for analysis. Lithium samples were chilled with ice for shipment to the laboratory. No other preservative was used for the lithium samples.

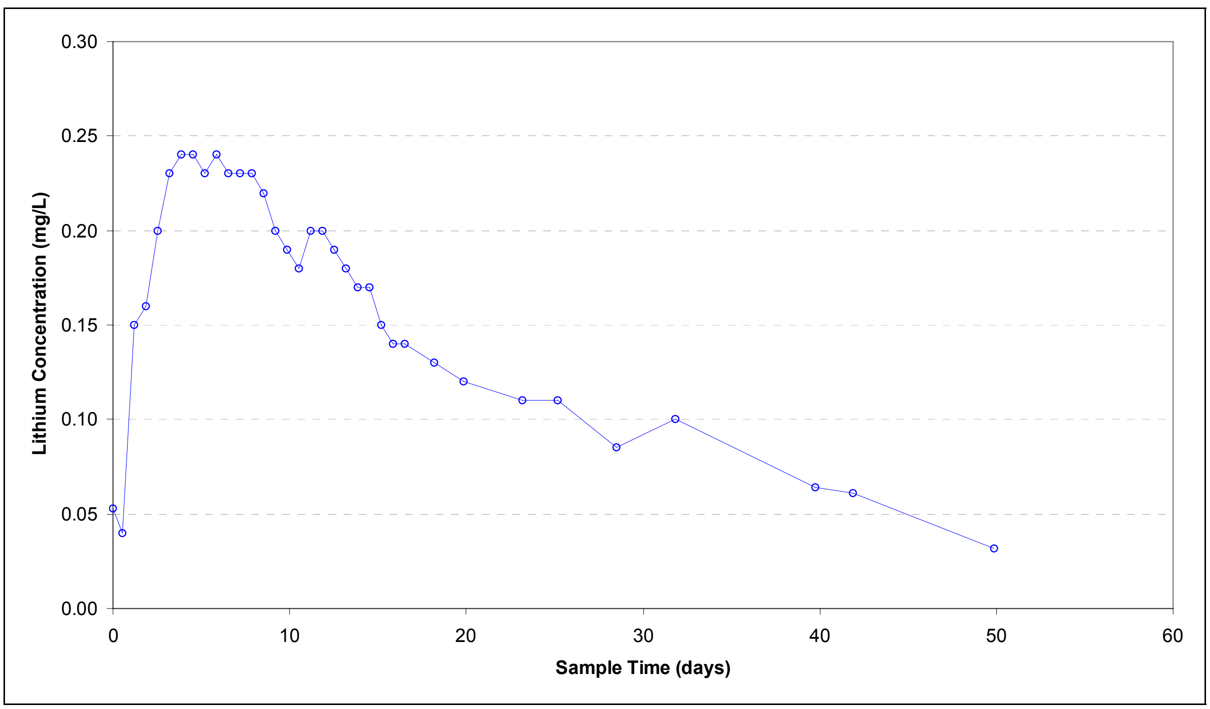
Outflows were calculated based on measurements of the V-notch weir elevations and the water level in the outflow structures just upstream from the weirs. Flows were measured in the same manner twice each week during the course of the experiments.

G.1.3.2 Test Cell Tracer Results

The PSTA Test Cell tracer study data were interpreted following the methods summarized by Kadlec and Knight (1996). The data collected for each experiment are presented in the appendix. Flows corresponding with each sample were interpolated from the flow records described above.

Exhibits G.1-11 through G.1-13 show the tracer response curves (concentration versus time) for Test Cells 3, 8, and 13, respectively.

EXHIBIT G.1-11
Test Cell 3 Tracer Response Curve



The endpoint for the Test Cell 13 experiment was extrapolated based on the measured concentrations of the previous six samples. The regression equation used was:

$$\text{Concentration} = -0.001(\text{time}) + 0.0655,\ R^2 = 0.92$$

Exhibit G.1-14 summarizes the hydraulic characteristics of Test Cells 3, 8, and 13, as determined through this lithium tracer study.

EXHIBIT G.1-12
Test Cell 8 Tracer Response Curve

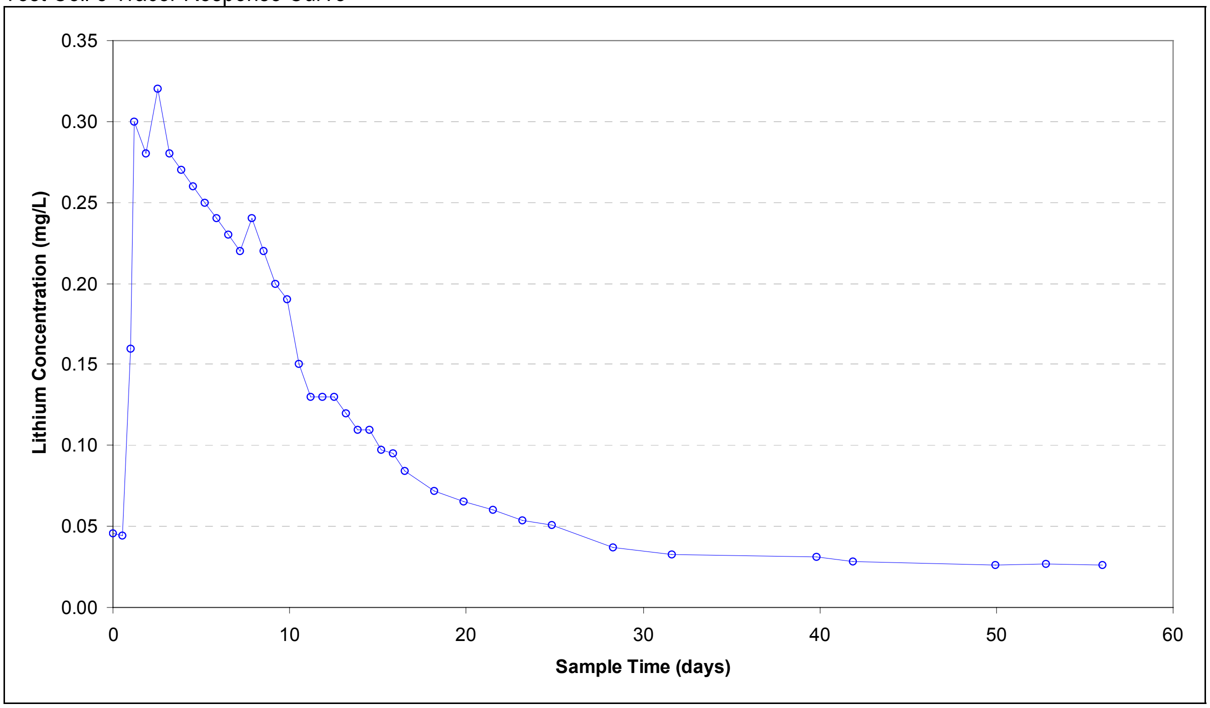


EXHIBIT G.1-13
Test Cell 13 Tracer Response Curve

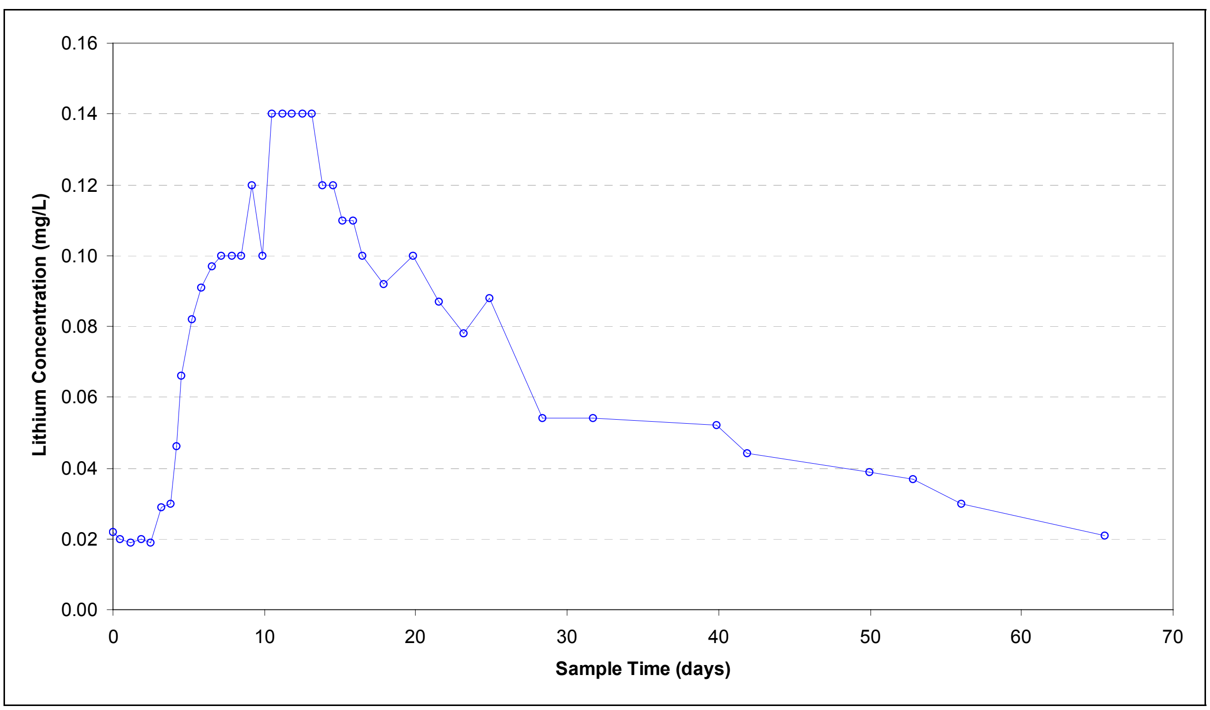


EXHIBIT G.1-14
Summary of South ENR Test Cell Tracer Study Results

Parameter	Test Cell 13	Test Cell 8	Test Cell 3
Average Depth (m)	0.66	0.66	0.77
Average Volume (m^3)	1,612	1,612	1,908
Average Flow (m^3/d)	114	125	127
Nominal HRT (d)	14.2	12.9	15.1
Mean HRT, τ (d)	22.4	10.7	15.5
Variance, σ^2	184.7	95.0	124.0
Number of Tanks, N	2.7	1.2	1.9
Volumetric Efficiency	1.55	0.83	1.03
Dimensionless Variance	0.37	0.83	0.52
Dispersion Number, $\mathscr{D}$	0.24	1.73	0.42
Tracer Mass Recovery (%)	61	75	118

The nominal and mean HRTs for Test Cell 3 were very similar with values of 15.1 days and 15.5 days, respectively. The nominal and mean HRTs for Test Cell 8 were 12.9 days and 10.7 days, respectively. For Test Cell 8, the measured HRT was less than the nominal HRT, and the volumetric efficiency was 0.83, indicating that the estimated effective volume of this cell is less than the design volume. The nominal and mean HRTs for Test Cell 13 were 14.2 days and 22.4 days, respectively. This finding suggests that there is 55 percent more effective volume in this cell than was assumed based on design drawings. The actual volumes of the Test Cells will be estimated by direct measurement during the next operational quarter to clarify the source of these apparent discrepancies. Based on the results of this tracer test, Test Cells 3, 8, and 13 can be modeled as 1.9, 1.2, and 2.7 completely mixed TIS, respectively.

Percent cover data for the 5th quarter indicate that total vegetative cover in Test Cell 13 is more than twice that in either Test Cells 3 or 8. The larger number of TIS estimated for Test Cell 13 may be a result of the higher density of submerged and emergent vegetation.

Grab samples were collected at the ENR outflow pump station canal to detect whether this tracer test in the South Test Cells might result in elevated lithium concentrations in the ENR outflow. Exhibit G.1-15 summarizes the canal grab samples that were analyzed during this tracer study. Samples CG-1 through CG-6 are within the range of background concentrations observed at the South ENR Test Cell site and the Porta-PSTA site. A high lithium concentration reported by the laboratory in a sample collected at the ENR outfall canal on September 23 (0.17 mg/L) was excluded from this presentation as an unexplained outlier.

EXHIBIT G.1-15

Summary of ENR Outflow Pump Station Canal Lithium Samples

Sample ID	Sample Date and Time	Lithium Concentration (mg/L)
CG-1	8/12/1999 16:20	0.037
CG-2	8/19/1999 16:10	0.033
CG-3	8/26/1999 16:35	0.032
CG-4	9/2/1999 14:07	0.034
CG- 5	9/9/1999 13:20	0.031
CG-6	9/16/1999 15:30	0.029

Appendix

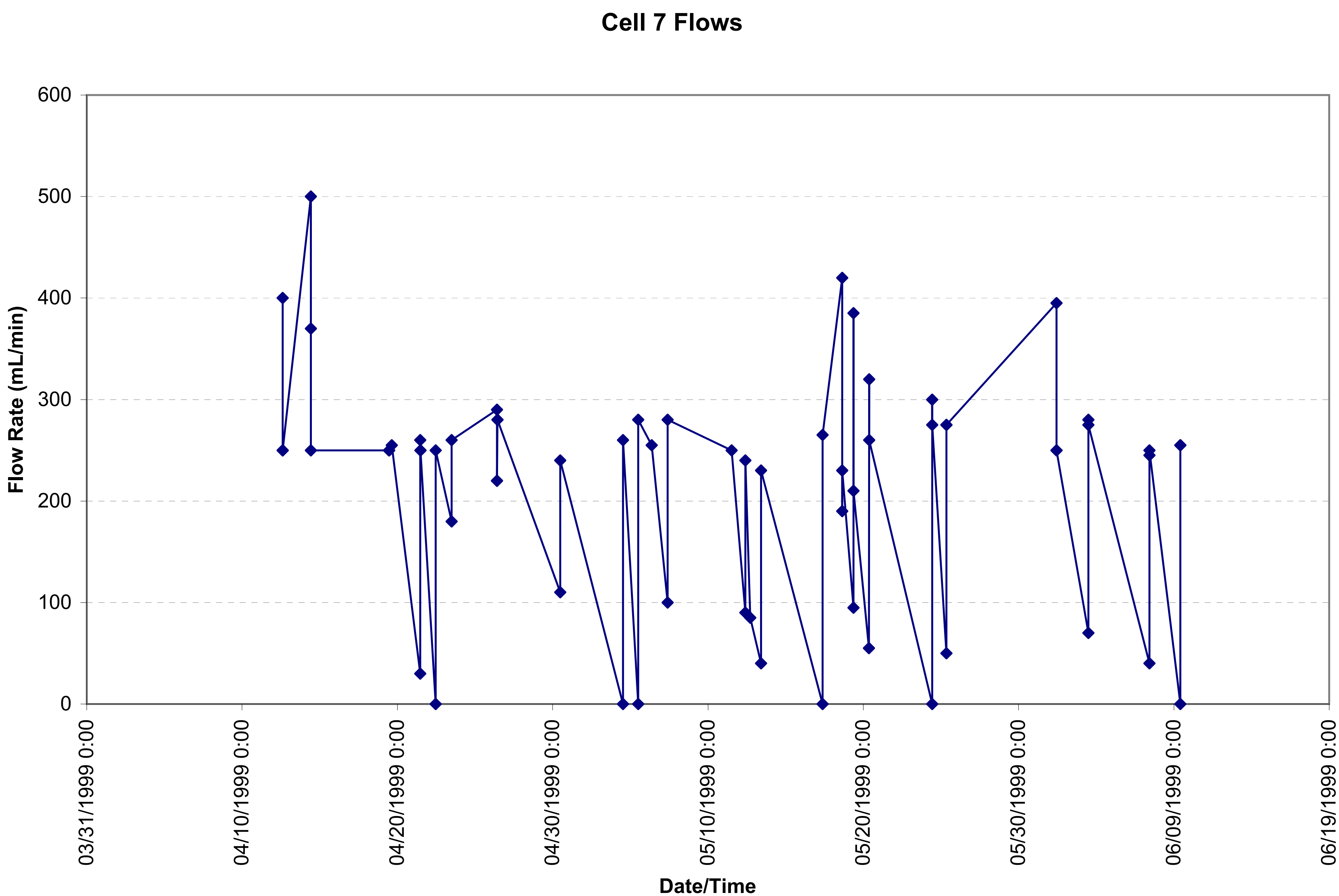
Porta-PSTA Tracer Test Data

REC_NO	SITE	CELL	STATION	DATE	TIME	D/T Formula	Date/Time	FLOW (mL/min)
175	PORTA	7	Inflow	04/12/1999	14:48	04/12/99 14:48	04/12/1999 14:48	400
176	PORTA	7	Inflow	04/12/1999	14:49	04/12/99 14:49	04/12/1999 14:49	250
177	PORTA	7	Inflow	04/12/1999	14:50	04/12/99 14:50	04/12/1999 14:50	250
251	PORTA	7	Inflow	04/14/1999	10:20	04/14/99 10:20	04/14/1999 10:20	500
252	PORTA	7	Inflow	04/14/1999	10:22	04/14/99 10:22	04/14/1999 10:22	370
253	PORTA	7	Inflow	04/14/1999	10:24	04/14/99 10:24	04/14/1999 10:24	250
323	PORTA	7	Inflow	04/19/1999	11:04	04/19/99 11:04	04/19/1999 11:04	250
324	PORTA	7	Inflow	04/19/1999	11:05	04/19/99 11:05	04/19/1999 11:05	250
325	PORTA	7	Inflow	04/19/1999	11:07	04/19/99 11:07	04/19/1999 11:07	250
399	PORTA	7	Inflow	04/19/1999	15:20	04/19/99 15:20	04/19/1999 15:20	255
9	PORTA	7	Inflow	04/21/1999	11:10	04/21/99 11:10	04/21/1999 11:10	30
10	PORTA	7	Inflow	04/21/1999	11:11	04/21/99 11:11	04/21/1999 11:11	260
28	PORTA	7	Inflow	04/21/1999	11:39	04/21/99 11:39	04/21/1999 11:39	250
507	PORTA	7	Inflow	04/21/1999	11:39	04/21/99 11:39	04/21/1999 11:39	250
539	PORTA	7	Inflow	04/22/1999	11:04	04/22/99 11:04	04/22/1999 11:04	0
560	PORTA	7	Inflow	04/22/1999	11:07	04/22/99 11:07	04/22/1999 11:07	250
580	PORTA	7	Inflow	04/23/1999	11:46	04/23/99 11:46	04/23/1999 11:46	180
598	PORTA	7	Inflow	04/23/1999	11:50	04/23/99 11:50	04/23/1999 11:50	260
57	PORTA	7	Inflow	04/26/1999	9:56	04/26/99 09:56	04/26/1999 9:56	290
58	PORTA	7	Inflow	04/26/1999	9:57	04/26/99 09:57	04/26/1999 9:57	220
59	PORTA	7	Inflow	04/26/1999	9:58	04/26/99 09:58	04/26/1999 9:58	220
109	PORTA	7	Inflow	04/26/1999	10:48	04/26/99 10:48	04/26/1999 10:48	280
110	PORTA	7	Inflow	04/26/1999	10:49	04/26/99 10:49	04/26/1999 10:49	280
606	PORTA	7	Inflow	04/30/1999	11:32	04/30/99 11:32	04/30/1999 11:32	110
628	PORTA	7	Inflow	04/30/1999	11:35	04/30/99 11:35	04/30/1999 11:35	240
654	PORTA	7	Inflow	05/04/1999	12:33	05/04/99 12:33	05/04/1999 12:33	0
655	PORTA	7	Inflow	05/04/1999	12:35	05/04/99 12:35	05/04/1999 12:35	260
700	PORTA	7	Inflow	05/05/1999	12:06	05/05/99 12:06	05/05/1999 12:06	0
701	PORTA	7	Inflow	05/05/1999	12:09	05/05/99 12:09	05/05/1999 12:09	280
728	PORTA	7	Inflow	05/06/1999	9:00	05/06/99 09:00	05/06/1999 9:00	255
758	PORTA	7	Inflow	05/07/1999	9:43	05/07/99 09:43	05/07/1999 9:43	100
759	PORTA	7	Inflow	05/07/1999	9:44	05/07/99 09:44	05/07/1999 9:44	280
819	PORTA	7	Inflow	05/11/1999	12:28	05/11/99 12:28	05/11/1999 12:28	250
860	PORTA	7	Inflow	05/12/1999	9:52	05/12/99 09:52	05/12/1999 9:52	90
884	PORTA	7	Inflow	05/12/1999	9:57	05/12/99 09:57	05/12/1999 9:57	240
906	PORTA	7	Inflow	05/12/1999	17:12	05/12/99 17:12	05/12/1999 17:12	85
926	PORTA	7	Inflow	05/13/1999	10:05	05/13/99 10:05	05/13/1999 10:05	40
942	PORTA	7	Inflow	05/13/1999	10:06	05/13/99 10:06	05/13/1999 10:06	230
965	PORTA	7	Inflow	05/17/1999	9:05:00 AM	05/17/99 09:05	05/17/1999 9:05	0
966	PORTA	7	Inflow	05/17/1999	9:06:00 AM	05/17/99 09:06	05/17/1999 9:06	265
1015	PORTA	7	Inflow	05/18/1999	3:21:00 PM	05/18/99 15:21	05/18/1999 15:21	420
1016	PORTA	7	Inflow	05/18/1999	3:22:00 PM	05/18/99 15:22	05/18/1999 15:22	190
1017	PORTA	7	Inflow	05/18/1999	3:23:00 PM	05/18/99 15:23	05/18/1999 15:23	230
1079	PORTA	7	Inflow	05/19/1999	8:55:00 AM	05/19/99 08:55	05/19/1999 8:55	95
1080	PORTA	7	Inflow	05/19/1999	8:56:00 AM	05/19/99 08:56	05/19/1999 8:56	385
1081	PORTA	7	Inflow	05/19/1999	8:57:00 AM	05/19/99 08:57	05/19/1999 8:57	210
1111	PORTA	7	Inflow	05/20/1999	8:57:00 AM	05/20/99 08:57	05/20/1999 8:57	55
1112	PORTA	7	Inflow	05/20/1999	8:58:00 AM	05/20/99 08:58	05/20/1999 8:58	320
1113	PORTA	7	Inflow	05/20/1999	8:59:00 AM	05/20/99 08:59	05/20/1999 8:59	260
1162	PORTA	7	Inflow	05/24/1999	10:22:00 AM	05/24/99 10:22	05/24/1999 10:22	0
1163	PORTA	7	Inflow	05/24/1999	10:23:00 AM	05/24/99 10:23	05/24/1999 10:23	300
1164	PORTA	7	Inflow	05/24/1999	10:24:00 AM	05/24/99 10:24	05/24/1999 10:24	275
1278	PORTA	7	Inflow	05/25/1999	8:34:00 AM	05/25/99 08:34	05/25/1999 8:34	50
1279	PORTA	7	Inflow	05/25/1999	8:35:00 AM	05/25/99 08:35	05/25/1999 8:35	275
1280	PORTA	7	Inflow	05/25/1999	8:36:00 AM	05/25/99 08:36	05/25/1999 8:36	275
1362	PORTA	7	Inflow	06/01/1999	10:46:00 AM	06/01/99 10:46	06/01/1999 10:46	395
1363	PORTA	7	Inflow	06/01/1999	10:47:00 AM	06/01/99 10:47	06/01/1999 10:47	250
1364	PORTA	7	Inflow	06/01/1999	10:48:00 AM	06/01/99 10:48	06/01/1999 10:48	250
1442	PORTA	7	Inflow	06/03/1999	11:46:00 AM	06/03/99 11:46	06/03/1999 11:46	70
1443	PORTA	7	Inflow	06/03/1999	11:47:00 AM	06/03/99 11:47	06/03/1999 11:47	280
1444	PORTA	7	Inflow	06/03/1999	11:48:00 AM	06/03/99 11:48	06/03/1999 11:48	275
1531	PORTA	7	Inflow	06/07/1999	10:16:00 AM	06/07/99 10:16	06/07/1999 10:16	40
1532	PORTA	7	Inflow	06/07/1999	10:17:00 AM	06/07/99 10:17	06/07/1999 10:17	245
1533	PORTA	7	Inflow	06/07/1999	10:18:00 AM	06/07/99 10:18	06/07/1999 10:18	250
1603	PORTA	7	Inflow	06/09/1999	9:55:00 AM	06/09/99 09:55	06/09/1999 9:55	0
1604	PORTA	7	Inflow	06/09/1999	9:57:00 AM	06/09/99 09:57	06/09/1999 9:57	255

Porta-PSTA Tracer Test Data

REC_NO	SITE	CELL	STATION	DATE	TIME	D/T Formula	Date/Time	FLOW (mL/min)
1605	PORTA	7	Inflow	06/09/1999	9:58:00 AM	06/09/99 09:58	06/09/1999 9:58	255
184	PORTA	10	Inflow	04/12/1999	14:58	04/12/99 14:58	04/12/1999 14:58	490
185	PORTA	10	Inflow	04/12/1999	15:00	04/12/99 15:00	04/12/1999 15:00	250
186	PORTA	10	Inflow	04/12/1999	15:02	04/12/99 15:02	04/12/1999 15:02	250
260	PORTA	10	Inflow	04/14/1999	10:42	04/14/99 10:42	04/14/1999 10:42	200
261	PORTA	10	Inflow	04/14/1999	10:44	04/14/99 10:44	04/14/1999 10:44	300
262	PORTA	10	Inflow	04/14/1999	10:46	04/14/99 10:46	04/14/1999 10:46	260
332	PORTA	10	Inflow	04/19/1999	11:27	04/19/99 11:27	04/19/1999 11:27	235
333	PORTA	10	Inflow	04/19/1999	11:29	04/19/99 11:29	04/19/1999 11:29	235
334	PORTA	10	Inflow	04/19/1999	11:31	04/19/99 11:31	04/19/1999 11:31	235
381	PORTA	10	Inflow	04/19/1999	12:27	04/19/99 12:27	04/19/1999 12:27	255
402	PORTA	10	Inflow	04/19/1999	15:23	04/19/99 15:23	04/19/1999 15:23	300
11	PORTA	10	Inflow	04/21/1999	11:15	04/21/99 11:15	04/21/1999 11:15	250
24	PORTA	10	Inflow	04/21/1999	11:43	04/21/99 11:43	04/21/1999 11:43	250
504	PORTA	10	Inflow	04/21/1999	11:43	04/21/99 11:43	04/21/1999 11:43	250
536	PORTA	10	Inflow	04/22/1999	11:35	04/22/99 11:35	04/22/1999 11:35	255
577	PORTA	10	Inflow	04/23/1999	11:43	04/23/99 11:43	04/23/1999 11:43	0
596	PORTA	10	Inflow	04/23/1999	11:45	04/23/99 11:45	04/23/1999 11:45	270
84	PORTA	10	Inflow	04/26/1999	9:56	04/26/99 09:56	04/26/1999 9:56	0
85	PORTA	10	Inflow	04/26/1999	9:58	04/26/99 09:58	04/26/1999 9:58	270
105	PORTA	10	Inflow	04/26/1999	11:04	04/26/99 11:04	04/26/1999 11:04	245
609	PORTA	10	Inflow	04/30/1999	11:45	04/30/99 11:45	04/30/1999 11:45	235
661	PORTA	10	Inflow	05/04/1999	12:38	05/04/99 12:38	05/04/1999 12:38	0
662	PORTA	10	Inflow	05/04/1999	12:40	05/04/99 12:40	05/04/1999 12:40	255
705	PORTA	10	Inflow	05/05/1999	12:14	05/05/99 12:14	05/05/1999 12:14	245
726	PORTA	10	Inflow	05/06/1999	8:57	05/06/99 08:57	05/06/1999 8:57	40
727	PORTA	10	Inflow	05/06/1999	8:59	05/06/99 08:59	05/06/1999 8:59	120
729	PORTA	10	Inflow	05/06/1999	9:01	05/06/99 09:01	05/06/1999 9:01	210
763	PORTA	10	Inflow	05/07/1999	9:49	05/07/99 09:49	05/07/1999 9:49	50
764	PORTA	10	Inflow	05/07/1999	9:50	05/07/99 09:50	05/07/1999 9:50	300
822	PORTA	10	Inflow	05/11/1999	12:34	05/11/99 12:34	05/11/1999 12:34	260
863	PORTA	10	Inflow	05/12/1999	10:05	05/12/99 10:05	05/12/1999 10:05	30
887	PORTA	10	Inflow	05/12/1999	10:06	05/12/99 10:06	05/12/1999 10:06	255
909	PORTA	10	Inflow	05/12/1999	17:18	05/12/99 17:18	05/12/1999 17:18	110
928	PORTA	10	Inflow	05/13/1999	10:12	05/13/99 10:12	05/13/1999 10:12	40
944	PORTA	10	Inflow	05/13/1999	10:13	05/13/99 10:13	05/13/1999 10:13	260
971	PORTA	10	Inflow	05/17/1999	9:12:00 AM	05/17/99 09:12	05/17/1999 9:12	110
972	PORTA	10	Inflow	05/17/1999	9:13:00 AM	05/17/99 09:13	05/17/1999 9:13	255
1021	PORTA	10	Inflow	05/18/1999	3:31:00 PM	05/18/99 15:31	05/18/1999 15:31	40
1022	PORTA	10	Inflow	05/18/1999	3:32:00 PM	05/18/99 15:32	05/18/1999 15:32	260
1086	PORTA	10	Inflow	05/19/1999	9:01:00 AM	05/19/99 09:01	05/19/1999 9:01	180
1118	PORTA	10	Inflow	05/20/1999	9:22:00 AM	05/20/99 09:22	05/20/1999 9:22	90
1119	PORTA	10	Inflow	05/20/1999	9:23:00 AM	05/20/99 09:23	05/20/1999 9:23	240
1171	PORTA	10	Inflow	05/24/1999	10:38:00 AM	05/24/99 10:38	05/24/1999 10:38	0
1172	PORTA	10	Inflow	05/24/1999	10:39:00 AM	05/24/99 10:39	05/24/1999 10:39	280
1173	PORTA	10	Inflow	05/24/1999	10:40:00 AM	05/24/99 10:40	05/24/1999 10:40	245
1287	PORTA	10	Inflow	05/25/1999	8:50:00 AM	05/25/99 08:50	05/25/1999 8:50	125
1288	PORTA	10	Inflow	05/25/1999	8:51:00 AM	05/25/99 08:51	05/25/1999 8:51	265
1289	PORTA	10	Inflow	05/25/1999	8:52:00 AM	05/25/99 08:52	05/25/1999 8:52	260
1329	PORTA	10	Inflow	05/28/1999	12:55:00 PM	05/28/99 12:55	05/28/1999 12:55	255
1330	PORTA	10	Inflow	05/28/1999	12:56:00 PM	05/28/99 12:56	05/28/1999 12:56	255
1331	PORTA	10	Inflow	05/28/1999	12:57:00 PM	05/28/99 12:57	05/28/1999 12:57	255
1371	PORTA	10	Inflow	06/01/1999	10:49:00 AM	06/01/99 10:49	06/01/1999 10:49	245
1372	PORTA	10	Inflow	06/01/1999	10:50:00 AM	06/01/99 10:50	06/01/1999 10:50	245
1373	PORTA	10	Inflow	06/01/1999	10:51:00 AM	06/01/99 10:51	06/01/1999 10:51	245
1451	PORTA	10	Inflow	06/03/1999	11:58:00 AM	06/03/99 11:58	06/03/1999 11:58	15
1452	PORTA	10	Inflow	06/03/1999	11:59:00 AM	06/03/99 11:59	06/03/1999 11:59	250
1453	PORTA	10	Inflow	06/03/1999	12:00:00 PM	06/03/99 12:00	06/03/1999 12:00	250
1540	PORTA	10	Inflow	06/07/1999	10:34:00 AM	06/07/99 10:34	06/07/1999 10:34	0
1541	PORTA	10	Inflow	06/07/1999	10:35:00 AM	06/07/99 10:35	06/07/1999 10:35	280
1542	PORTA	10	Inflow	06/07/1999	10:36:00 AM	06/07/99 10:36	06/07/1999 10:36	280
1612	PORTA	10	Inflow	06/09/1999	10:08:00 AM	06/09/99 10:08	06/09/1999 10:08	0
1613	PORTA	10	Inflow	06/09/1999	10:10:00 AM	06/09/99 10:10	06/09/1999 10:10	250
1614	PORTA	10	Inflow	06/09/1999	10:11:00 AM	06/09/99 10:11	06/09/1999 10:11	250
221	PORTA	23	Inflow	04/12/1999	16:41	04/12/99 16:41	04/12/1999 16:41	850
222	PORTA	23	Inflow	04/12/1999	16:44	04/12/99 16:44	04/12/1999 16:44	730

REC_NO	SITE	CELL	STATION	DATE	TIME	D/T Formula	Date/Time	FLOW (mL/min)
223	PORTA	23	Inflow	04/12/1999	16:45	04/12/99 16:45	04/12/1999 16:45	750
299	PORTA	23	Inflow	04/14/1999	12:02	04/14/99 12:02	04/14/1999 12:02	700
300	PORTA	23	Inflow	04/14/1999	12:04	04/14/99 12:04	04/14/1999 12:04	790
301	PORTA	23	Inflow	04/14/1999	12:06	04/14/99 12:06	04/14/1999 12:06	735
371	PORTA	23	Inflow	04/19/1999	14:12	04/19/99 14:12	04/19/1999 14:12	765
372	PORTA	23	Inflow	04/19/1999	14:14	04/19/99 14:14	04/19/1999 14:14	760
373	PORTA	23	Inflow	04/19/1999	14:19	04/19/99 14:19	04/19/1999 14:19	750
415	PORTA	23	Inflow	04/19/1999	15:37	04/19/99 15:37	04/19/1999 15:37	750
3	PORTA	23	Inflow	04/21/1999	10:55	04/21/99 10:55	04/21/1999 10:55	740
489	PORTA	23	Inflow	04/21/1999	10:55	04/21/99 10:55	04/21/1999 10:55	740
523	PORTA	23	Inflow	04/22/1999	10:49	04/22/99 10:49	04/22/1999 10:49	0
546	PORTA	23	Inflow	04/22/1999	10:51	04/22/99 10:51	04/22/1999 10:51	760
564	PORTA	23	Inflow	04/23/1999	11:40	04/23/99 11:40	04/23/1999 11:40	0
588	PORTA	23	Inflow	04/23/1999	11:43	04/23/99 11:43	04/23/1999 11:43	720
66	PORTA	23	Inflow	04/26/1999	10:08	04/26/99 10:08	04/26/1999 10:08	380
67	PORTA	23	Inflow	04/26/1999	10:09	04/26/99 10:09	04/26/1999 10:09	1000
68	PORTA	23	Inflow	04/26/1999	10:11	04/26/99 10:11	04/26/1999 10:11	720
119	PORTA	23	Inflow	04/26/1999	10:29	04/26/99 10:29	04/26/1999 10:29	480
120	PORTA	23	Inflow	04/26/1999	10:30	04/26/99 10:30	04/26/1999 10:30	450
121	PORTA	23	Inflow	04/26/1999	10:31	04/26/99 10:31	04/26/1999 10:31	450
154	PORTA	23	Inflow	04/29/1999	9:09	04/29/99 09:09	04/29/1999 9:09	700
622	PORTA	23	Inflow	04/30/1999	12:39	04/30/99 12:39	04/30/1999 12:39	490
640	PORTA	23	Inflow	04/30/1999	12:42	04/30/99 12:42	04/30/1999 12:42	740
690	PORTA	23	Inflow	05/04/1999	13:05	05/04/99 13:05	05/04/1999 13:05	750
720	PORTA	23	Inflow	05/05/1999	12:40	05/05/99 12:40	05/05/1999 12:40	755
730	PORTA	23	Inflow	05/06/1999	9:02	05/06/99 09:02	05/06/1999 9:02	260
731	PORTA	23	Inflow	05/06/1999	9:04	05/06/99 09:04	05/06/1999 9:04	740
781	PORTA	23	Inflow	05/10/1999	9:54	05/10/99 09:54	05/10/1999 9:54	100
782	PORTA	23	Inflow	05/10/1999	9:56	05/10/99 09:56	05/10/1999 9:56	780
835	PORTA	23	Inflow	05/11/1999	13:49	05/11/99 13:49	05/11/1999 13:49	550
852	PORTA	23	Inflow	05/11/1999	13:53	05/11/99 13:53	05/11/1999 13:53	755
876	PORTA	23	Inflow	05/12/1999	10:49	05/12/99 10:49	05/12/1999 10:49	765
922	PORTA	23	Inflow	05/12/1999	17:31	05/12/99 17:31	05/12/1999 17:31	600
933	PORTA	23	Inflow	05/13/1999	10:29	05/13/99 10:29	05/13/1999 10:29	760
997	PORTA	23	Inflow	05/17/1999	9:52:00 AM	05/17/99 09:52	05/17/1999 9:52	550
998	PORTA	23	Inflow	05/17/1999	9:53:00 AM	05/17/99 09:53	05/17/1999 9:53	760
1047	PORTA	23	Inflow	05/18/1999	4:07:00 PM	05/18/99 16:07	05/18/1999 16:07	750
1099	PORTA	23	Inflow	05/19/1999	9:29:00 AM	05/19/99 09:29	05/19/1999 9:29	760
1142	PORTA	23	Inflow	05/20/1999	10:04:00 AM	05/20/99 10:04	05/20/1999 10:04	670
1207	PORTA	23	Inflow	05/24/1999	10:43:00 AM	05/24/99 10:43	05/24/1999 10:43	380
1208	PORTA	23	Inflow	05/24/1999	10:44:00 AM	05/24/99 10:44	05/24/1999 10:44	800
1209	PORTA	23	Inflow	05/24/1999	10:45:00 AM	05/24/99 10:45	05/24/1999 10:45	800
1323	PORTA	23	Inflow	05/25/1999	8:49:00 AM	05/25/99 08:49	05/25/1999 8:49	555
1324	PORTA	23	Inflow	05/25/1999	8:50:00 AM	05/25/99 08:50	05/25/1999 8:50	710
1325	PORTA	23	Inflow	05/25/1999	8:51:00 AM	05/25/99 08:51	05/25/1999 8:51	710
1338	PORTA	23	Inflow	05/28/1999	1:12:00 PM	05/28/99 13:12	05/28/1999 13:12	770
1339	PORTA	23	Inflow	05/28/1999	1:13:00 PM	05/28/99 13:13	05/28/1999 13:13	770
1340	PORTA	23	Inflow	05/28/1999	1:14:00 PM	05/28/99 13:14	05/28/1999 13:14	770
1408	PORTA	23	Inflow	06/01/1999	11:05:00 AM	06/01/99 11:05	06/01/1999 11:05	800
1409	PORTA	23	Inflow	06/01/1999	11:06:00 AM	06/01/99 11:06	06/01/1999 11:06	800
1410	PORTA	23	Inflow	06/01/1999	11:07:00 AM	06/01/99 11:07	06/01/1999 11:07	780
1487	PORTA	23	Inflow	06/03/1999	3:13:00 PM	06/03/99 15:13	06/03/1999 15:13	190
1488	PORTA	23	Inflow	06/03/1999	3:14:00 PM	06/03/99 15:14	06/03/1999 15:14	780
1489	PORTA	23	Inflow	06/03/1999	3:15:00 PM	06/03/99 15:15	06/03/1999 15:15	800
1579	PORTA	23	Inflow	06/07/1999	10:16:00 AM	06/07/99 10:16	06/07/1999 10:16	550
1580	PORTA	23	Inflow	06/07/1999	10:17:00 AM	06/07/99 10:17	06/07/1999 10:17	765
1581	PORTA	23	Inflow	06/07/1999	10:18:00 AM	06/07/99 10:18	06/07/1999 10:18	765
1651	PORTA	23	Inflow	06/09/1999	11:05:00 AM	06/09/99 11:05	06/09/1999 11:05	780
1652	PORTA	23	Inflow	06/09/1999	11:06:00 AM	06/09/99 11:06	06/09/1999 11:06	775
1653	PORTA	23	Inflow	06/09/1999	11:07:00 AM	06/09/99 11:07	06/09/1999 11:07	775



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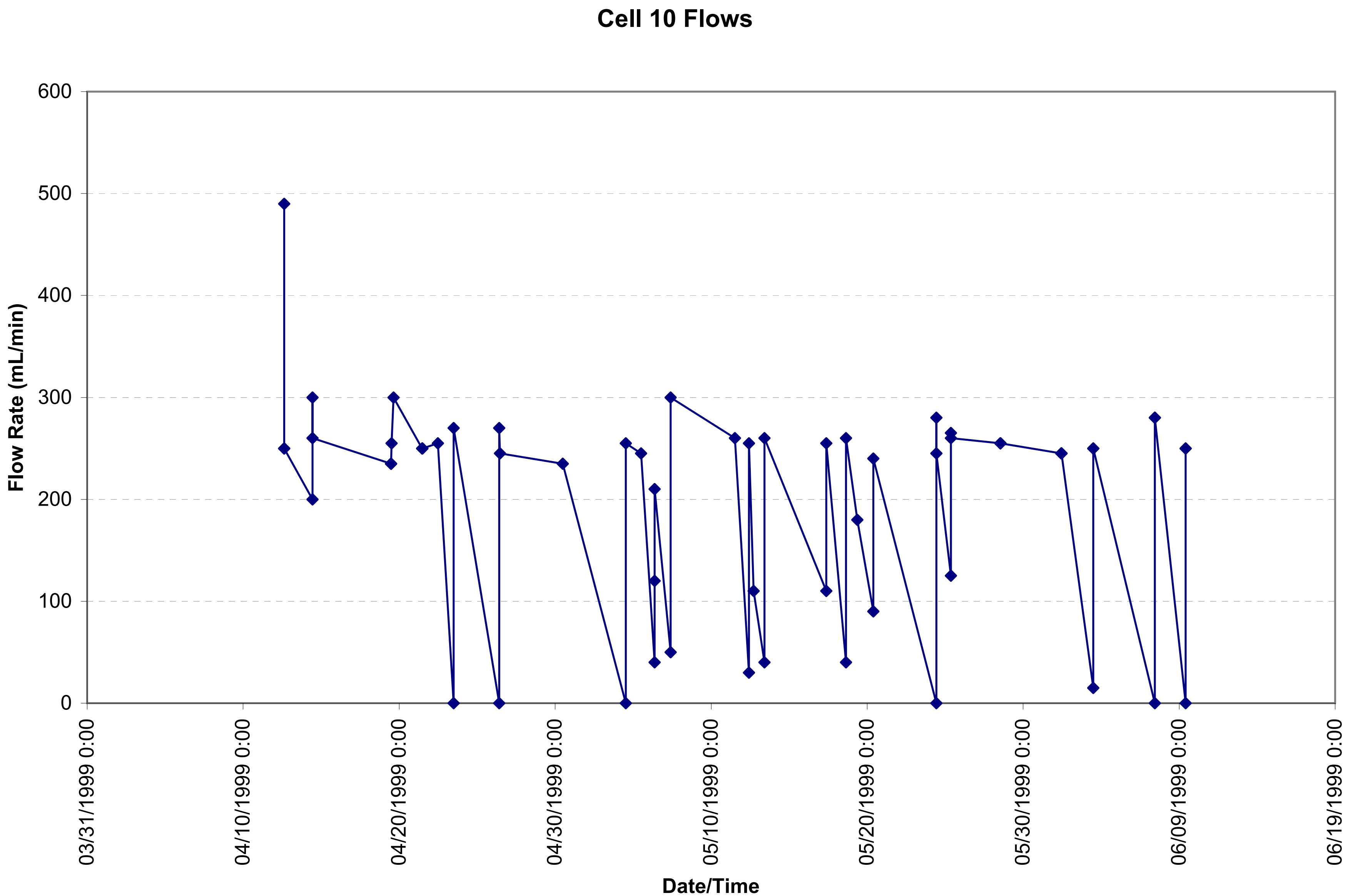

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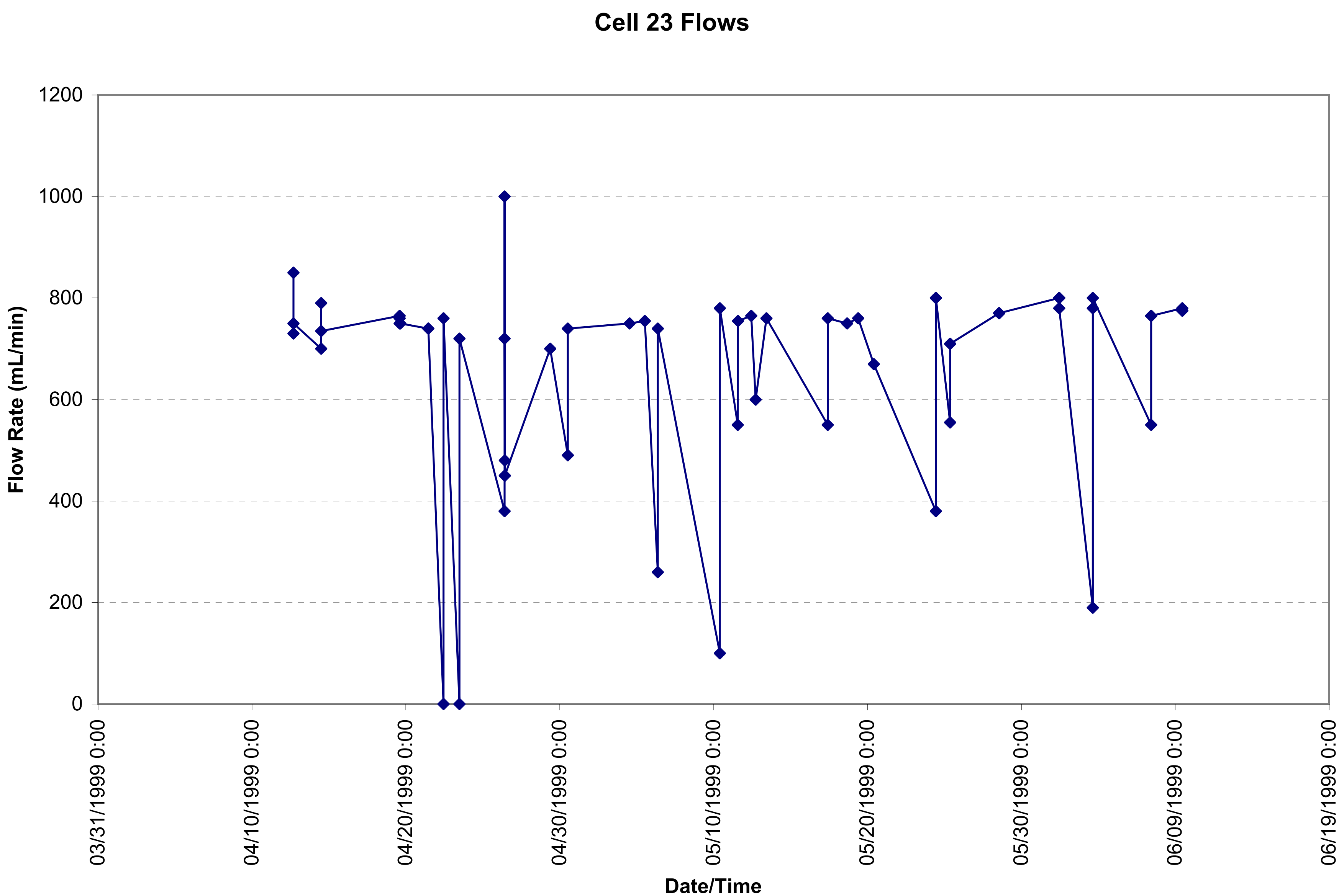
Cell 23 Flows
Flow Rate (mL/min)
1200
1000
800
600
400
200
0
03/31/1999 0:00
04/10/1999 0:00
04/20/1999 0:00
04/30/1999 0:00
05/10/1999 0:00
05/20/1999 0:00
05/30/1999 0:00
06/09/1999 0:00
06/19/1999 0:00
Date/Time

Porta-PSTA Tracer Test Data - Cell 7

Volume of NaBr Solution Applied:	**1.60 L**	**Nominal HRT:**	**14.01 d**
Concentration of Br^- Applied:	**438,439 mg/L**	**Avg. Flow:**	**0.28 m^3/d**
Mass of Br^- Applied:	**702 g**	**Avg. HLR:**	**4.6 cm/d**
Date/Time of Application:	**04/19/1999 17:45**	**Nominal Volume:**	**3.876 m^3**

Porta PSTA #7

Sample ID	Date/Time Sampled	Time (days)	Meas mV	Meas Temp	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
7-1	04/19/1999 17:45	0.00	-66	24.9	4.3	0.0	0.35	0.00	0.00	0.00	0.00	0.00	0.00
7-4	04/20/1999 5:45	0.50	-97	24.9	16.8	12.5	0.26	0.00	3.13	0.00	0.95	0.00	0.37
7-8	04/20/1999 21:45	1.17	-120	24.9	46.3	42.0	0.14	0.01	18.17	0.01	3.66	0.01	2.02
7-12	04/21/1999 13:45	1.83	-129	24.9	68.8	64.5	0.33	0.02	35.49	0.01	8.34	0.02	3.66
7-16	04/22/1999 5:45	2.50	-137	25.0	97.8	93.5	0.08	0.03	52.67	0.02	10.78	0.04	5.01
7-20	04/22/1999 21:45	3.17	-141	24.9	116.7	112.4	0.32	0.04	68.63	0.02	13.67	0.07	6.01
7-24	04/23/1999 13:45	3.83	-143	24.9	127.4	123.1	0.38	0.04	78.49	0.03	27.16	0.10	6.30
7-28	04/24/1999 5:58	4.51	-143	25.0	127.4	123.1	0.39	0.04	83.18	0.03	31.66	0.12	6.10
7-32	04/24/1999 21:58	5.18	-143	25.0	127.4	123.1	0.40	0.04	82.07	0.03	32.05	0.14	5.47
7-36	04/25/1999 13:58	5.84	-143	24.9	127.4	123.1	0.41	0.04	82.07	0.03	32.86	0.16	4.95
7-40	04/26/1999 5:58	6.51	-142	24.9	121.9	117.6	0.42	0.04	80.24	0.03	32.92	0.18	4.36
7-44	04/26/1999 21:58	7.18	-141	24.9	116.7	112.4	0.37	0.04	76.66	0.03	30.29	0.19	3.72
7-48	04/27/1999 13:58	7.84	-140	24.9	111.6	107.3	0.33	0.04	73.24	0.03	25.98	0.19	3.16
7-52	04/28/1999 22:45	9.21	-136	24.9	93.6	89.3	0.25	0.03	134.32	0.05	39.35	0.41	4.78
7-56	04/29/1999 14:45	9.87	-135	24.9	89.6	85.3	0.21	0.03	58.20	0.02	13.46	0.20	1.67
7-60	04/30/1999 6:45	10.54	-134	24.9	85.7	81.4	0.17	0.03	55.57	0.02	10.60	0.20	1.37
7-70	05/01/1999 23:30	12.24	-133	25.1	82.0	77.7	0.22	0.03	135.13	0.05	26.22	0.55	2.46
7-80	05/03/1999 15:30	13.91	-132	25.1	78.5	74.2	0.08	0.03	126.62	0.04	18.52	0.59	1.35
7-90	05/05/1999 7:30	15.57	-133	25.1	82.0	77.7	0.07	0.03	126.62	0.04	9.39	0.66	0.65
7-100	05/06/1999 23:30	17.24	-130	25.0	71.9	67.6	0.24	0.03	121.10	0.04	18.74	0.70	0.20
7-110	05/08/1999 15:30	18.91	-129	24.9	68.8	64.5	0.39	0.02	110.07	0.04	34.47	0.70	0.01
7-120	05/10/1999 7:30	20.57	-129	24.9	68.8	64.5	0.37	0.02	107.49	0.04	41.00	0.75	0.05
7-130	05/11/1999 23:30	22.24	-126	24.9	60.3	56.0	0.24	0.02	100.39	0.04	30.82	0.76	0.29
7-140	05/13/1999 15:30	23.91	-125	24.9	57.7	53.4	0.31	0.02	91.14	0.03	25.23	0.75	0.66
7-150	05/16/1999 3:30	26.41	-124	25.0	55.2	50.9	0.10	0.02	130.36	0.05	27.08	1.16	2.01
7-160	05/19/1999 11:30	29.74	-124	25.0	55.2	50.9	0.28	0.02	169.67	0.06	32.39	1.69	5.45
7-170	05/22/1999 19:30	33.07	-123	25.0	52.8	48.5	0.15	0.02	165.71	0.06	35.47	1.84	9.70
7-181	05/26/1999 11:30	36.74	-123	25.1	52.8	48.5	0.42	0.02	177.92	0.06	50.95	2.20	16.86
Extrap.	06/06/1999 22:33	48.20	-66	--	4.3	0.0	0.35	0.01	278.05	0.10	107.51	4.18	56.35
								0.76	**2822.41**	**1.00**	**771.53**	**18.55**	**154.99**
										M_0		**M_1**	**M_2**

Mass Recovery **110%**

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**18.55**	**M_1/M_0**
σ^2 (d^2) =	**154.99**	**M_2/M_0**
Number of Tanks N =	**2.22**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.32**	**τ_a/τ_v**
Dimensionless Variance =	**0.4503**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.3271**	**Solver**

Dimensionless Variance Guess

Pe = 3.05687772 0.45029948

$\mathscr{D}$

0.3271

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

Porta-PSTA Tracer Test Data - Cell 7

Volume of LiCl Solution Applied:	0.025 L	Nominal HRT:	14.01 d
Concentration of Li^+ Applied:	78,457 mg/L	Avg. Flow:	0.28 m^3/d
Mass of Li^+ Applied:	1.96 g	Avg. HLR:	4.6 cm/d
Date/Time of Application:	04/19/1999 17:45	Nominal Volume:	3.876 m^3

Porta PSTA #7

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
7-1	04/19/1999 17:45	0.00	0.025	0.000	0.35	0.00	0.00	0.00	0.00	0.00	0.00
7-4	04/20/1999 5:45	0.50	0.056	0.031	0.26	0.00	0.01	0.00	0.00	0.00	0.43
7-8	04/20/1999 21:45	1.17	0.130	0.105	0.14	0.01	0.05	0.01	0.01	0.01	2.38
7-12	04/21/1999 13:45	1.83	0.180	0.155	0.33	0.02	0.09	0.01	0.02	0.02	4.21
7-16	04/22/1999 5:45	2.50	0.240	0.215	0.08	0.03	0.12	0.02	0.03	0.04	5.52
7-20	04/22/1999 21:45	3.17	0.280	0.255	0.32	0.04	0.16	0.03	0.03	0.07	6.46
7-24	04/23/1999 13:45	3.83	0.300	0.275	0.38	0.04	0.18	0.03	0.06	0.10	6.67
7-28	04/24/1999 5:58	4.51	0.300	0.275	0.39	0.05	0.19	0.03	0.07	0.13	6.41
7-32	04/24/1999 21:58	5.18	0.290	0.265	0.40	0.05	0.18	0.03	0.07	0.15	5.64
7-36	04/25/1999 13:58	5.84	0.280	0.255	0.41	0.04	0.17	0.03	0.07	0.16	4.91
7-40	04/26/1999 5:58	6.51	0.260	0.235	0.42	0.04	0.16	0.03	0.07	0.17	4.17
7-44	04/26/1999 21:58	7.18	0.260	0.235	0.37	0.04	0.16	0.03	0.06	0.18	3.58
7-48	04/27/1999 13:58	7.84	0.240	0.215	0.33	0.04	0.15	0.03	0.05	0.19	3.04
7-52	04/28/1999 22:45	9.21	0.210	0.185	0.25	0.03	0.27	0.05	0.08	0.39	4.57
7-56	04/29/1999 14:45	9.87	0.200	0.175	0.21	0.03	0.12	0.02	0.03	0.19	1.62
7-60	04/30/1999 6:45	10.54	0.190	0.165	0.17	0.03	0.11	0.02	0.02	0.19	1.31
7-70	05/01/1999 23:30	12.24	0.190	0.165	0.22	0.03	0.28	0.05	0.05	0.54	2.38
7-80	05/03/1999 15:30	13.91	0.180	0.155	0.08	0.03	0.27	0.04	0.04	0.58	1.32
7-90	05/05/1999 7:30	15.57	0.180	0.155	0.07	0.03	0.26	0.04	0.02	0.64	0.62
7-100	05/06/1999 23:30	17.24	0.170	0.145	0.24	0.03	0.25	0.04	0.04	0.69	0.19
7-110	05/08/1999 15:30	18.91	0.160	0.135	0.39	0.02	0.23	0.04	0.07	0.71	0.01
7-120	05/10/1999 7:30	20.57	0.150	0.125	0.37	0.02	0.22	0.04	0.08	0.72	0.06
7-130	05/11/1999 23:30	22.24	0.130	0.105	0.24	0.02	0.19	0.03	0.06	0.69	0.27
7-140	05/13/1999 15:30	23.91	0.130	0.105	0.31	0.02	0.17	0.03	0.05	0.68	0.61
7-150	05/16/1999 3:30	26.41	0.140	0.115	0.10	0.02	0.28	0.05	0.06	1.16	2.04
7-160	05/19/1999 11:30	29.74	0.130	0.105	0.28	0.02	0.37	0.06	0.07	1.73	5.63
7-170	05/22/1999 19:30	33.07	0.130	0.105	0.15	0.02	0.35	0.06	0.07	1.84	9.76
7-181	05/26/1999 11:30	36.74	0.130	0.105	0.42	0.02	0.39	0.06	0.11	2.25	17.36
Extrap.	06/06/1999 22:33	48.20	0.025	0.000	0.35	0.01	0.60	0.10	0.23	4.29	57.94
						0.76	**5.96**	**1.00**	**1.63**	**18.51**	**159.09**
								M_0		M_1	M_2
								Mass Recovery	83%		

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	18.51	M_1/M_0
σ^2 (d^2) =	159.09	M_2/M_0
Number of Tanks N =	2.15	τ_a^2/σ^2
Volumetric Efficiency =	1.32	τ_a/τ_v
Dimensionless Variance =	0.4644	1/N
Wetland Dispersion Number $\mathscr{D}$ =	0.3442	Solver

Dimensionless Variance Guess

Pe = 2.905521401 0.464399188

$\mathscr{D}$

0.3442

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

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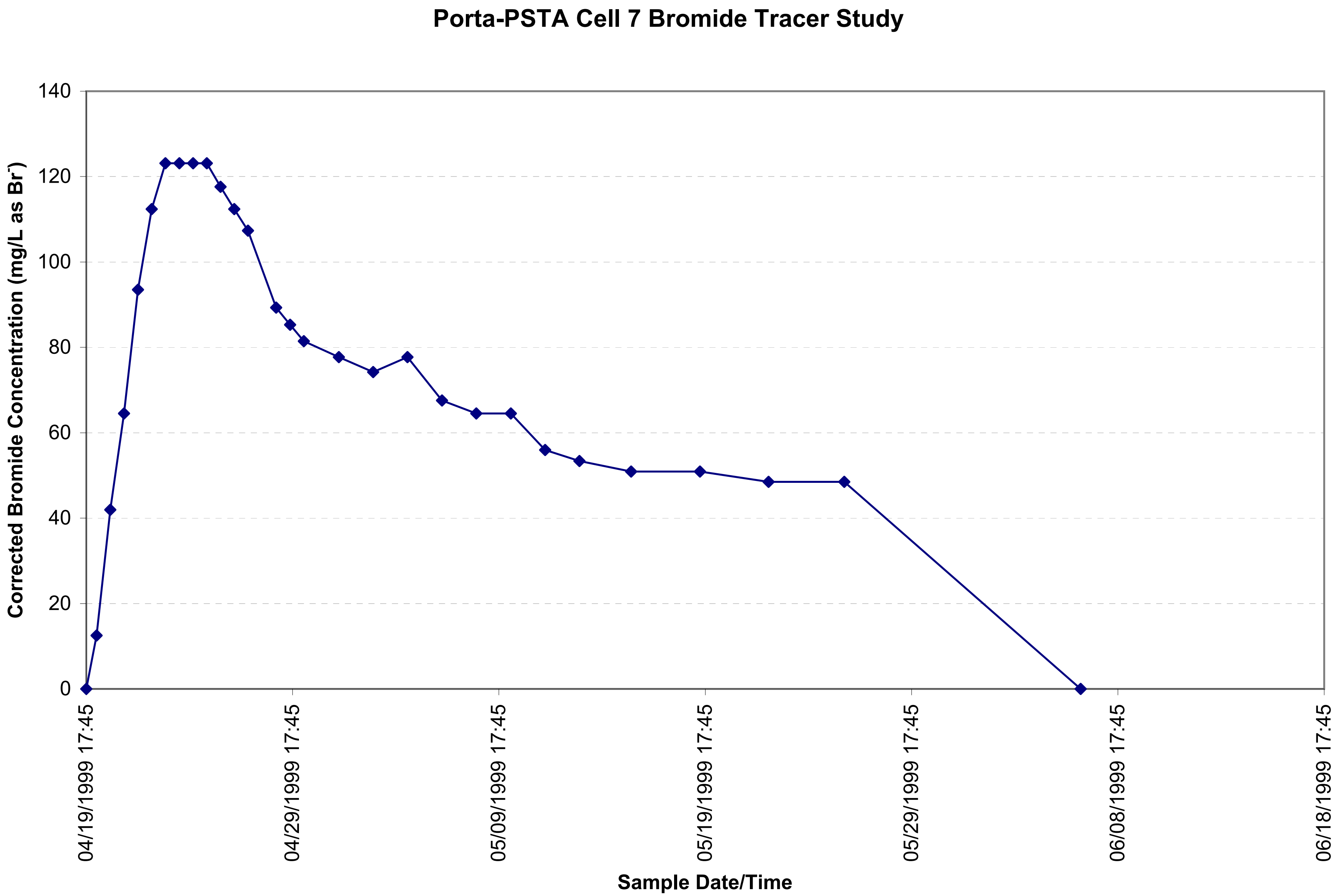

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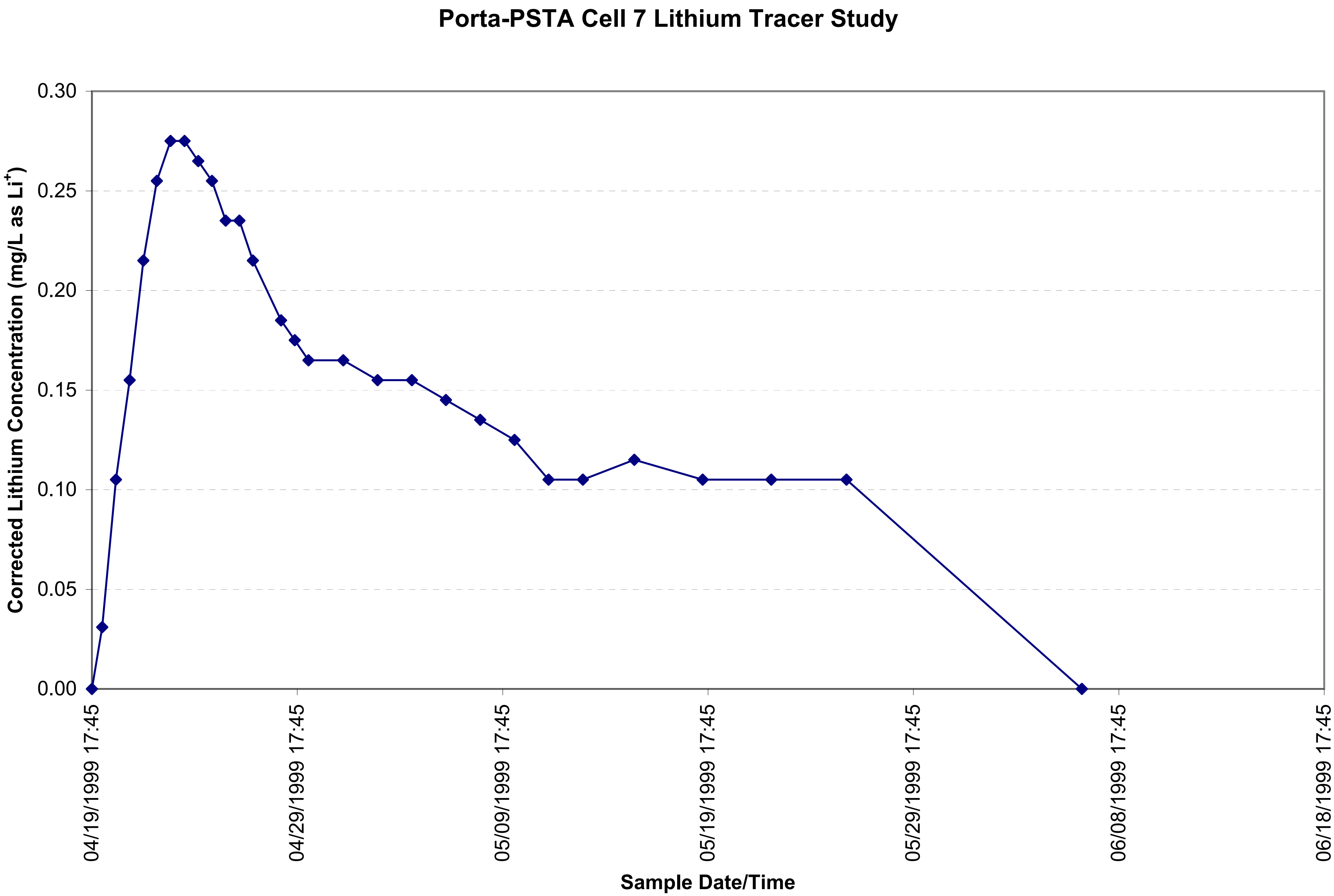

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Porta-PSTA Tracer Test - Cell 10

Volume of NaBr Solution Applied:	**0.80 L**	**Nominal HRT:**	**8.17 d**
Concentration of Br^- Applied:	**438,439 mg/L**	**Avg. Flow:**	**0.27 m^3/d**
Mass of Br^- Applied:	**351 g**	**Avg. HLR:**	**4.4 cm/d**
Date/Time of Application:	**04/19/1999 17:45**	**Nominal Volume:**	**2.178 m^3**

Porta PSTA #10

Sample ID	Date/Time Sampled	Time (days)	Meas mV	Meas Temp	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
10-1	04/19/1999 17:45	0.00	-59	25.0	3.2	0.0	0.43	0.00	0.00	0.00	0.00	0.00	0.00
10-4	04/20/1999 5:45	0.50	-121	25.0	48.4	45.2	0.41	0.01	11.30	0.01	4.73	0.00	1.49
10-8	04/20/1999 21:45	1.17	-133	25.0	82.0	78.9	0.38	0.04	41.36	0.03	16.35	0.02	5.03
10-12	04/21/1999 13:45	1.83	-135	25.0	89.6	86.4	0.36	0.05	55.10	0.04	20.46	0.05	6.06
10-16	04/22/1999 5:45	2.50	-134	25.0	85.7	82.6	0.37	0.05	56.33	0.04	20.45	0.08	5.59
10-20	04/22/1999 21:45	3.17	-134	24.9	85.7	82.6	0.21	0.05	55.05	0.04	15.91	0.10	4.89
10-24	04/23/1999 13:45	3.83	-134	24.9	85.7	82.6	0.38	0.05	55.05	0.04	16.24	0.12	4.36
10-28	04/24/1999 5:58	4.51	-134	24.9	85.7	82.6	0.29	0.05	55.79	0.04	18.57	0.15	3.90
10-32	04/24/1999 21:58	5.18	-134	24.9	85.7	82.6	0.20	0.05	55.05	0.04	13.41	0.17	3.37
10-36	04/25/1999 13:58	5.84	-134	24.9	85.7	82.6	0.11	0.05	55.05	0.04	8.53	0.19	2.93
10-40	04/26/1999 5:58	6.51	-135	24.9	89.6	86.4	0.02	0.05	56.33	0.04	3.73	0.22	2.57
10-44	04/26/1999 21:58	7.18	-134	24.9	85.7	82.6	0.35	0.05	56.33	0.04	10.51	0.25	2.19
10-48	04/27/1999 13:58	7.84	-133	24.9	82.0	78.9	0.35	0.05	53.81	0.03	18.83	0.26	1.75
10-52	04/28/1999 23:25	9.24	-130	25.0	71.9	68.7	0.34	0.05	102.86	0.07	35.62	0.56	2.44
10-56	04/29/1999 15:25	9.90	-127	25.1	63.0	59.8	0.34	0.04	42.85	0.03	14.68	0.26	0.70
10-60	04/30/1999 7:25	10.57	-126	24.9	60.3	57.1	0.34	0.04	38.98	0.02	13.26	0.25	0.48
10-70	05/01/1999 23:30	12.24	-121	25.1	48.4	45.2	0.21	0.03	85.45	0.05	23.61	0.62	0.57
10-80	05/03/1999 15:30	13.91	-118	25.1	42.4	39.2	0.07	0.03	70.36	0.04	10.11	0.59	0.11
10-90	05/05/1999 7:30	15.57	-117	25.1	40.6	37.4	0.36	0.02	63.86	0.04	13.71	0.60	0.00
10-100	05/06/1999 23:30	17.24	-114	25.2	35.5	32.4	0.17	0.02	58.15	0.04	15.22	0.61	0.11
10-110	05/11/1999 19:30	22.07	-108	25.2	27.3	24.1	0.27	0.02	136.58	0.09	29.74	1.71	2.18
10-120	05/13/1999 11:30	23.74	-104	25.2	22.9	19.7	0.37	0.01	36.55	0.02	11.68	0.53	1.59
10-130	05/15/1999 19:30	26.07	-103	25.2	21.9	18.7	0.24	0.01	44.88	0.03	13.81	0.71	3.01
10-140	05/19/1999 3:30	29.41	-101	25.2	20.1	16.9	0.30	0.01	59.39	0.04	16.03	1.05	6.48
10-150	05/22/1999 11:30	32.74	-98	25.2	17.6	14.4	0.17	0.01	52.18	0.03	12.08	1.03	8.96
10-162	05/26/1999 11:30	36.74	-94	25.2	14.7	11.6	0.37	0.01	51.98	0.03	14.02	1.15	13.36
10-163	06/01/1999 15:35	42.91	-88	25.6	11.3	8.2	0.32	0.01	60.88	0.04	21.09	1.54	24.57
10-164	06/09/1999 16:45	50.96	-77	25.5	7.0	3.8	0.00	0.00	48.18	0.03	7.73	1.44	31.97
Extrap.	06/15/1999 13:25	56.82	-59	--	3.2	0.0	0.00	0.00	11.18	0.01	0.00	0.38	10.96
								0.90	**1570.88**	**1.00**	**420.13**	**14.65**	**151.61**
										M_0		**M_1**	**M_2**

Mass Recovery 120%

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**14.65**	**M_1/M_0**
σ^2 (d^2) =	**151.61**	**M_2/M_0**
Number of Tanks N =	**1.42**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.79**	**τ_α/τ_v**
Dimensionless Variance =	**0.7066**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.8731**	**Solver**

Dimensionless Variance Guess

Pe = 1.14530772 0.70659939

$\mathscr{D}$

0.8731

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

Porta-PSTA Tracer Test - Cell 10

Volume of LiCl Solution Applied:	0.010 L	Nominal HRT:	8.17 d
Concentration of Li^+ Applied:	78,457 mg/L	Avg. Flow:	0.27 m^3/d
Mass of Li^+ Applied:	0.78 g	Avg. HLR:	4.4 cm/d
Date/Time of Application:	04/19/1999 17:45	Nominal Volume:	2.178 m^3

Porta PSTA #10

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
10-1	04/19/1999 17:45	0.00	0.028	0.000	0.43	0.00	0.00	0.00	0.00	0.00	0.00
10-4	04/20/1999 5:45	0.50	0.100	0.072	0.41	0.01	0.02	0.01	0.01	0.00	1.30
10-8	04/20/1999 21:45	1.17	0.180	0.152	0.38	0.04	0.07	0.03	0.03	0.02	4.95
10-12	04/21/1999 13:45	1.83	0.180	0.152	0.36	0.05	0.10	0.04	0.04	0.05	6.08
10-16	04/22/1999 5:45	2.50	0.180	0.152	0.37	0.05	0.10	0.04	0.04	0.08	5.47
10-20	04/22/1999 21:45	3.17	0.170	0.142	0.21	0.05	0.10	0.03	0.03	0.10	4.74
10-24	04/23/1999 13:45	3.83	0.170	0.142	0.38	0.05	0.09	0.03	0.03	0.12	4.07
10-28	04/24/1999 5:58	4.51	0.160	0.132	0.29	0.05	0.09	0.03	0.03	0.14	3.51
10-32	04/24/1999 21:58	5.18	0.170	0.142	0.20	0.05	0.09	0.03	0.02	0.16	3.03
10-36	04/25/1999 13:58	5.84	0.170	0.142	0.11	0.05	0.09	0.03	0.01	0.18	2.73
10-40	04/26/1999 5:58	6.51	0.170	0.142	0.02	0.05	0.09	0.03	0.01	0.21	2.34
10-44	04/26/1999 21:58	7.18	0.180	0.152	0.35	0.05	0.10	0.03	0.02	0.24	2.05
10-48	04/27/1999 13:58	7.84	0.170	0.142	0.35	0.05	0.10	0.03	0.03	0.26	1.72
10-52	04/28/1999 23:25	9.24	0.160	0.132	0.34	0.05	0.19	0.07	0.07	0.57	2.44
10-56	04/29/1999 15:25	9.90	0.140	0.112	0.34	0.04	0.08	0.03	0.03	0.27	0.71
10-60	04/30/1999 7:25	10.57	0.140	0.112	0.34	0.04	0.07	0.03	0.03	0.27	0.49
10-70	05/01/1999 23:30	12.24	0.120	0.092	0.21	0.04	0.17	0.06	0.05	0.68	0.60
10-80	05/03/1999 15:30	13.91	0.110	0.082	0.07	0.03	0.14	0.05	0.02	0.67	0.11
10-90	05/05/1999 7:30	15.57	0.100	0.072	0.36	0.03	0.13	0.05	0.03	0.66	0.00
10-100	05/06/1999 23:30	17.24	0.087	0.059	0.17	0.02	0.11	0.04	0.03	0.63	0.13
10-110	05/11/1999 19:30	22.07	0.070	0.042	0.27	0.02	0.24	0.09	0.05	1.68	2.21
10-120	05/13/1999 11:30	23.74	0.063	0.035	0.37	0.01	0.06	0.02	0.02	0.52	1.56
10-130	05/15/1999 19:30	26.07	0.059	0.031	0.24	0.01	0.08	0.03	0.02	0.67	2.89
10-140	05/19/1999 3:30	29.41	0.060	0.032	0.30	0.01	0.11	0.04	0.03	1.02	6.39
10-150	05/22/1999 11:30	32.74	0.054	0.026	0.17	0.01	0.10	0.03	0.02	1.05	9.24
10-162	05/26/1999 11:30	36.74	0.050	0.022	0.37	0.01	0.10	0.03	0.03	1.17	13.70
10-163	06/01/1999 15:35	42.91	0.046	0.018	0.32	0.01	0.12	0.04	0.04	1.72	27.61
10-164	06/09/1999 16:45	50.96	0.030	0.002	0.00	0.00	0.08	0.03	0.01	1.33	29.58
Extrap.	06/15/1999 13:25	56.82	0.028	0.000	0.00	0.00	0.01	0.00	0.00	0.11	3.18
						0.89	**2.85**	**1.00**	**0.77**	**14.57**	**142.84**
								M_0		**M_1**	**M_2**

Mass Recovery **98%**

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**14.57**	**M_1/M_0**
σ^2 (d^2) =	**142.84**	**M_2/M_0**
Number of Tanks N =	**1.49**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.78**	**τ_α/τ_v**
Dimensionless Variance =	**0.6727**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.7536**	**Solver**

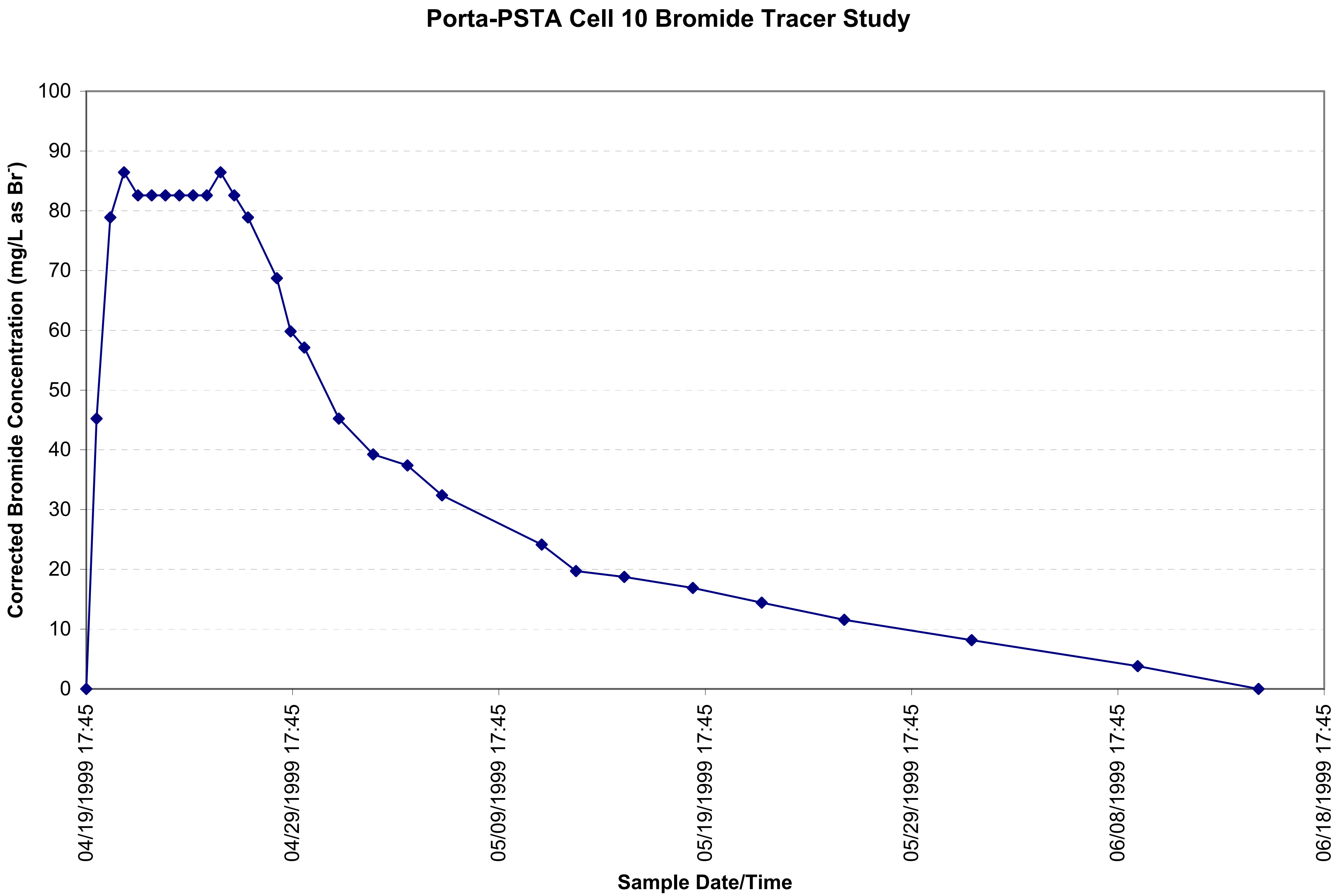
Dimensionless Variance Guess

Pe = 1.326896802 0.672699674

$\mathscr{D}$

0.7536

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))



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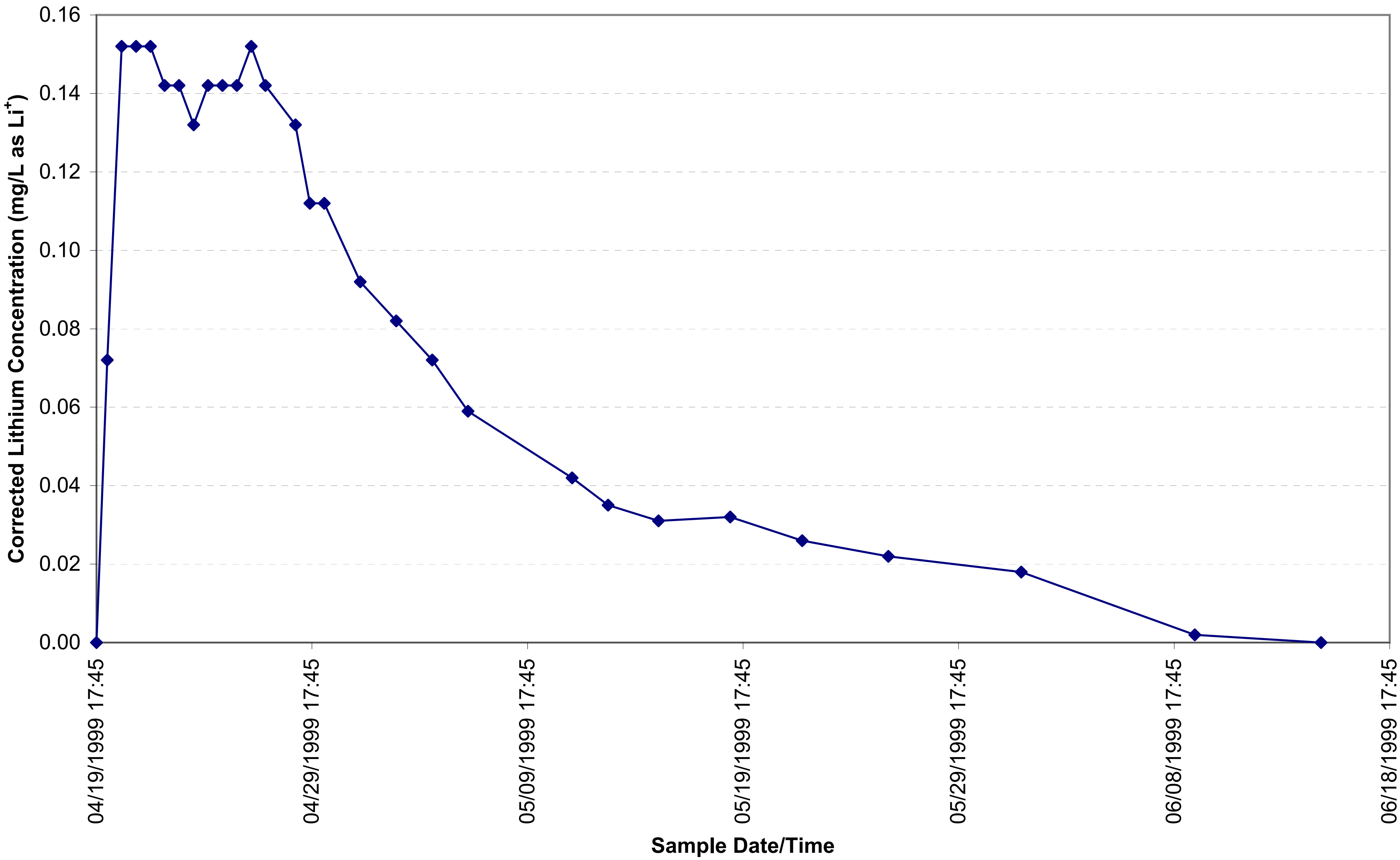
Porta-PSTA Cell 10 Lithium Tracer Study



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Porta-PSTA Tracer Test - Cell 23

Volume of NaBr Solution Applied:	**2.50 L**	**Nominal HRT:**	**6.42 d**
Concentration of Br$^-$ Applied:	**438,439 mg/L**	**Avg. Flow:**	**0.96 m^3/d**
Mass of Br$^-$ Applied:	**1096 g**	**Avg. HLR:**	**5.3 cm/d**
Date/Time of Application:	**04/19/1999 17:45**	**Nominal Volume:**	**6.138 m^3**

Porta PSTA #23

Sample ID	Date/Time Sampled	Time (days)	Meas mV	Meas Temp	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	f(t)dt(t-τ)^2
23-1	04/19/1999 17:45	0.00	-65	25.1	4.1	0.0	1.08	0.00	0.00	0.00	0.00	0.00	0.00
23-4	04/20/1999 5:45	0.50	-112	25.1	32.5	28.4	1.08	0.01	7.11	0.01	7.66	0.00	2.04
23-8	04/20/1999 21:45	1.17	-118	25.1	42.4	38.3	1.07	0.03	22.24	0.02	23.85	0.02	5.96
23-10	04/22/1999 13:48	2.84	-121	25.1	48.4	44.3	0.96	0.04	68.86	0.07	70.04	0.14	15.90
23-12	04/23/1999 13:10	3.81	-123	25.2	52.8	48.7	1.03	0.05	45.26	0.05	45.05	0.15	8.70
23-16	04/28/1999 19:30	9.07	-116	25.2	38.8	34.7	0.94	0.04	219.53	0.22	215.70	1.43	25.27
23-20	04/29/1999 11:30	9.74	-116	25.2	38.8	34.7	0.98	0.04	23.13	0.02	22.21	0.22	1.39
23-24	04/30/1999 3:30	10.41	-114	25.2	35.5	31.4	0.81	0.03	22.04	0.02	19.71	0.22	1.10
23-30	05/01/1999 3:30	11.41	-110	25.1	29.8	25.7	1.07	0.03	28.56	0.03	26.76	0.32	1.11
23-40	05/02/1999 19:30	13.07	-109	25.1	28.5	24.4	1.07	0.03	41.75	0.04	44.70	0.52	1.00
23-50	05/04/1999 11:30	14.74	-109	25.1	28.5	24.4	1.08	0.02	40.68	0.04	43.80	0.57	0.42
23-60	05/06/1999 3:30	16.41	-106	25.1	25.0	20.9	0.57	0.02	37.74	0.04	31.09	0.60	0.09
23-70	05/07/1999 19:30	18.07	-106	25.1	25.0	20.9	0.74	0.02	34.80	0.04	22.72	0.61	0.00
23-80	05/09/1999 11:30	19.74	-107	25.1	26.1	22.0	0.36	0.02	35.74	0.04	19.57	0.68	0.12
23-90	05/11/1999 3:30	21.41	-106	25.1	25.0	20.9	0.91	0.02	35.74	0.04	22.72	0.74	0.44
23-100	05/12/1999 19:30	23.07	-102	25.2	21.0	16.8	0.89	0.02	31.44	0.03	28.38	0.71	0.84
23-110	05/14/1999 11:30	24.74	-99	25.2	18.4	14.3	1.02	0.02	25.91	0.03	24.70	0.63	1.21
23-120	05/17/1999 19:30	28.07	-98	25.2	17.6	13.5	1.09	0.01	46.19	0.05	48.61	1.24	4.05
23-130	05/21/1999 3:30	31.41	-98	25.2	17.6	13.5	0.89	0.01	44.87	0.05	44.40	1.35	7.26
23-140	05/24/1999 11:30	34.74	-100	25.3	19.2	15.1	1.14	0.01	47.56	0.05	48.26	1.59	12.29
23-149	06/01/1999 15:30	42.91	-88	25.4	11.3	7.2	1.05	0.01	90.98	0.09	99.70	3.58	43.47
23-150	06/09/1999 16:40	50.95	-73	25.4	5.8	1.7	1.08	0.00	35.97	0.04	38.34	1.71	32.41
Extrap.	06/11/1999 7:54	52.59	-65	--	4.1	0.0	1.08	0.00	1.42	0.00	1.53	0.07	1.73
								0.51	**987.49**	**1.00**	**949.52**	**17.10**	**166.79**
										M_0		**M_1**	**M_2**

Mass Recovery 87%

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**17.10**	**M_1/M_0**
σ^2 (d^2) =	**166.79**	**M_2/M_0**
Number of Tanks N =	**1.75**	**τ_a^2/σ^2**
Volumetric Efficiency =	**2.66**	**τ_α/τ_v**
Dimensionless Variance =	**0.5703**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.5049**	**Solver**

Dimensionless Variance Guess

Pe = 1.98062977 0.57029938

$\mathscr{D}$

0.5049

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

Porta-PSTA Tracer Test - Cell 23

Volume of LiCl Solution Applied:	**0.035 L**	**Nominal HRT:**	**6.46 d**
Concentration of Li^+ Applied:	**78,457 mg/L**	**Avg. Flow:**	**0.95 m^3/d**
Mass of Li^+ Applied:	**2.75 g**	**Avg. HLR:**	**5.3 cm/d**
Date/Time of Application:	**04/19/1999 17:45**	**Nominal Volume:**	**6.138 m^3**

Porta PSTA #23

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
23-1	04/19/1999 17:45	0.00	0.036	0.000	1.08	0.00	0.00	0.00	0.00	0.00	0.00
23-4	04/20/1999 5:45	0.50	0.120	0.084	1.08	0.02	0.02	0.01	0.02	0.00	2.06
23-8	04/20/1999 21:45	1.17	0.150	0.114	1.07	0.05	0.07	0.03	0.07	0.03	5.98
23-10	04/22/1999 13:48	2.84	0.160	0.124	0.96	0.06	0.20	0.09	0.20	0.19	15.09
23-12	04/23/1999 13:10	3.81	0.160	0.124	1.03	0.06	0.12	0.06	0.12	0.19	7.37
23-16	04/28/1999 19:30	9.07	0.120	0.084	0.94	0.05	0.55	0.26	0.54	1.65	17.69
23-20	04/29/1999 11:30	9.74	0.120	0.084	0.98	0.04	0.06	0.03	0.05	0.25	0.75
23-24	04/30/1999 3:30	10.41	0.100	0.064	0.81	0.03	0.05	0.02	0.04	0.23	0.51
23-30	05/01/1999 3:30	11.41	0.094	0.058	1.07	0.03	0.06	0.03	0.06	0.31	0.42
23-40	05/02/1999 19:30	13.07	0.092	0.056	1.07	0.03	0.09	0.04	0.10	0.54	0.28
23-50	05/04/1999 11:30	14.74	0.088	0.052	1.08	0.03	0.09	0.04	0.10	0.58	0.03
23-60	05/06/1999 3:30	16.41	0.087	0.051	0.57	0.02	0.09	0.04	0.07	0.62	0.03
23-70	05/07/1999 19:30	18.07	0.082	0.046	0.74	0.02	0.08	0.04	0.05	0.65	0.23
23-80	05/09/1999 11:30	19.74	0.082	0.046	0.36	0.02	0.08	0.04	0.04	0.68	0.62
23-90	05/11/1999 3:30	21.41	0.079	0.043	0.91	0.02	0.07	0.03	0.05	0.71	1.17
23-100	05/12/1999 19:30	23.07	0.063	0.027	0.89	0.02	0.06	0.03	0.05	0.61	1.52
23-110	05/14/1999 11:30	24.74	0.044	0.008	1.02	0.01	0.03	0.01	0.03	0.33	1.14
23-120	05/17/1999 19:30	28.07	0.057	0.021	1.09	0.01	0.05	0.02	0.05	0.60	3.06
23-130	05/21/1999 3:30	31.41	0.060	0.024	0.89	0.01	0.08	0.04	0.07	1.04	7.86
23-140	05/24/1999 11:30	34.74	0.063	0.027	1.14	0.01	0.09	0.04	0.09	1.31	13.31
23-149	06/01/1999 15:30	42.91	0.051	0.015	1.05	0.01	0.17	0.08	0.19	3.11	46.35
23-150	06/09/1999 16:40	50.95	0.034	-0.002	1.08	0.00	0.05	0.02	0.06	1.15	25.27
						0.54	**2.14**	**1.00**	**2.06**	**14.76**	**150.74**
								M_0		**M_1**	**M_2**
							Mass Recovery		**75%**		

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**14.76**	**M_1/M_0**
σ^2 (d^2) =	**150.74**	**M_2/M_0**
Number of Tanks N =	**1.45**	**τ_a^2/σ^2**
Volumetric Efficiency =	**2.28**	**τ_a/τ_v**
Dimensionless Variance =	**0.6919**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.8181**	**Solver**

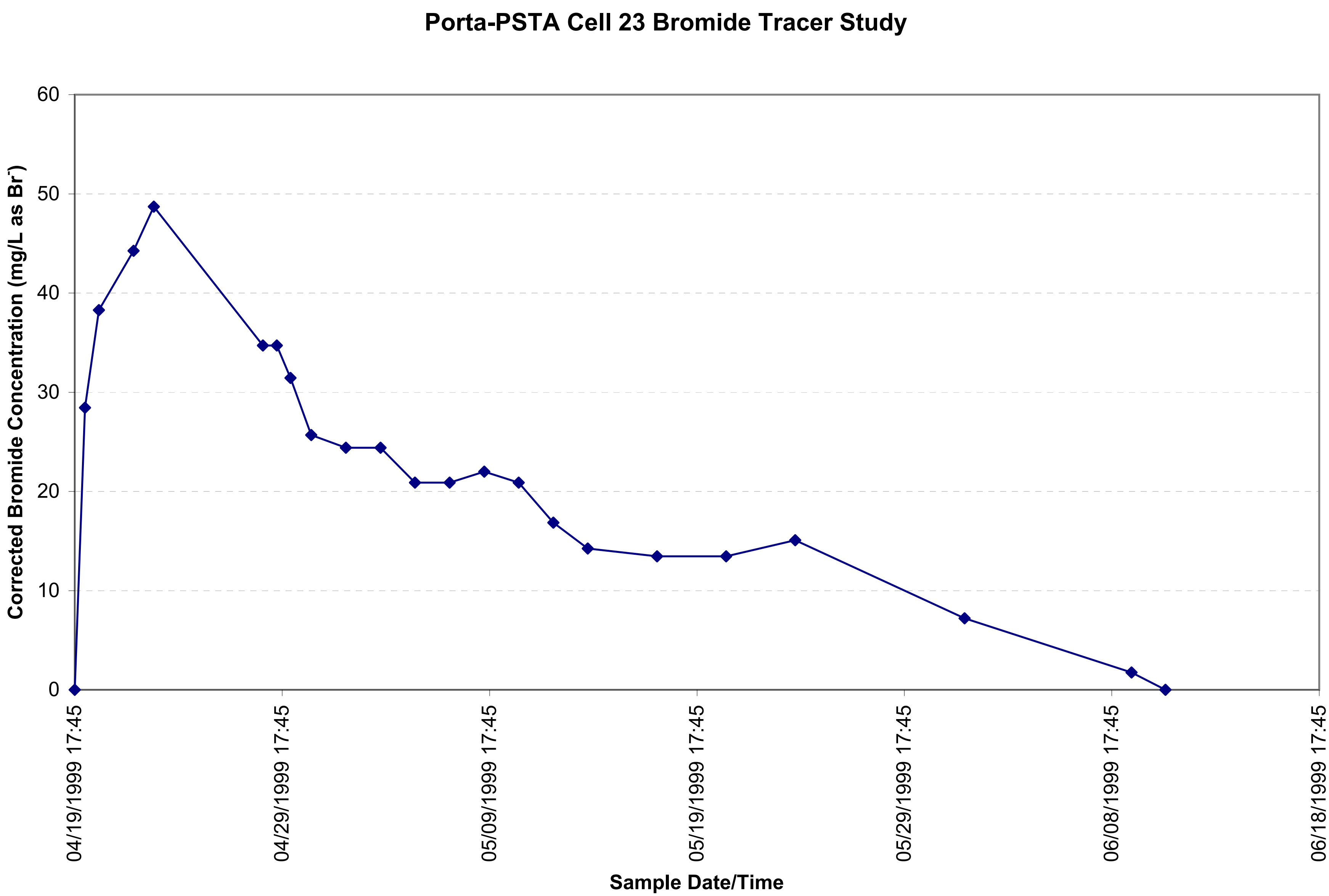
Dimensionless Variance Guess

Pe = 1.22227824 0.691899582

$\mathscr{D}$

0.8181

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))



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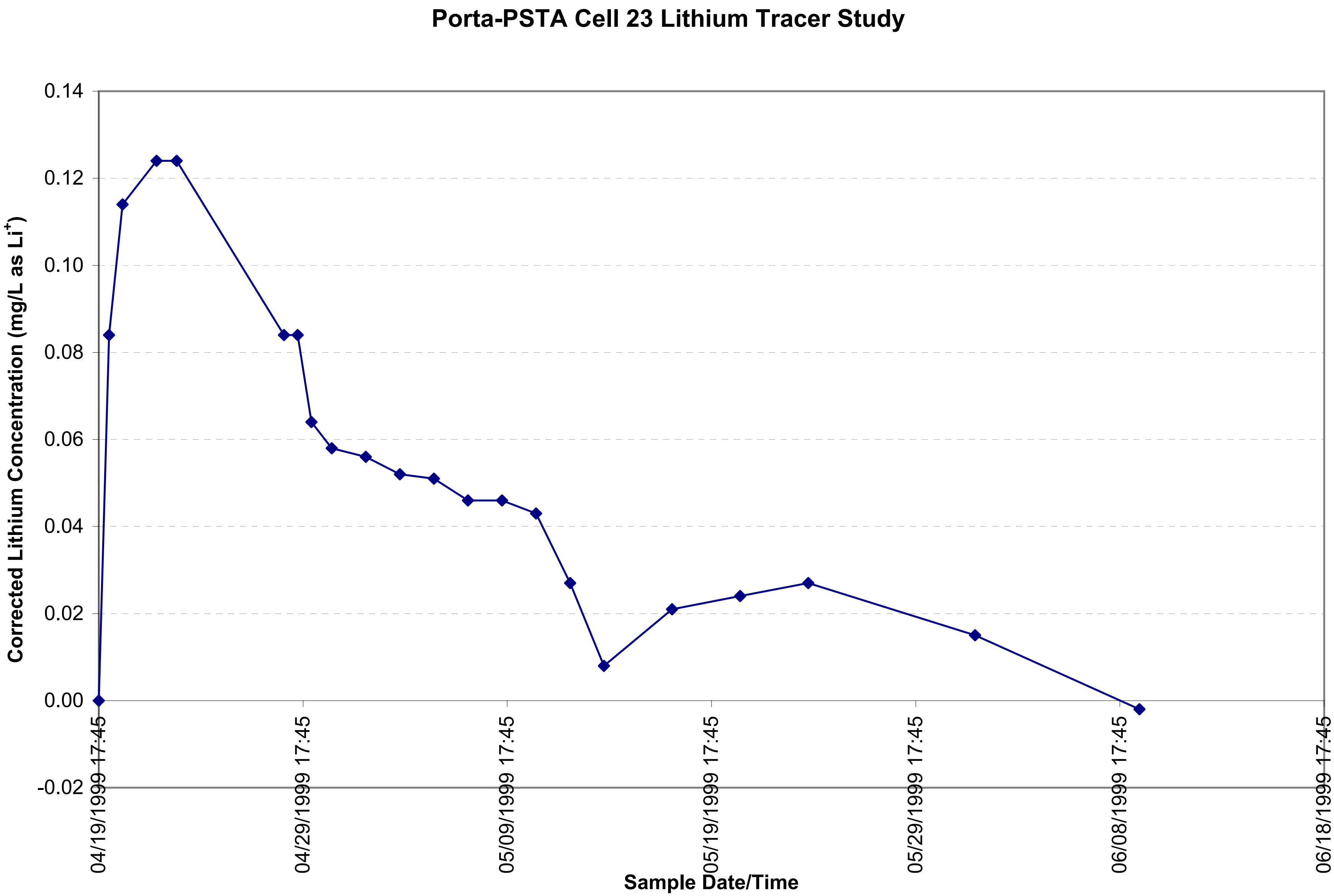

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South Test Cells - Cell 3

Volume of LiCl Solution Applied:	**5.5 L**	**Nominal HRT:**	**15.1 d**
Concentration of Li^+ Applied:	**78,457 mg/L**	**Avg. Flow:**	**127 m^3/d**
Mass of Li^+ Applied:	**431.52 g**	**Avg. HLR:**	**4.7 cm/d**
Date/Time of Application:	**7/29/1999 15:29**	**Avg. Depth:**	**77 cm**
Average Background Concentration:	**0.042 mg/L**	**Nominal Volume:**	**1908 m^3**

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m^3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
3-1	7/29/1999 15:29	0.00	0.053	0.011	129.58	0.00	0.00	0.00	0.00	0.00	0.00
3-4	7/30/1999 3:29	0.50	0.040	0.000	129.58	0.00	0.00	0.00	0.36	0.00	0.16
3-8	7/30/1999 19:29	1.17	0.150	0.108	129.58	0.01	0.04	0.01	4.66	0.01	1.98
3-12	7/31/1999 11:29	1.83	0.160	0.118	129.58	0.03	0.08	0.02	9.76	0.03	3.78
3-16	8/1/1999 3:29	2.50	0.200	0.158	129.58	0.04	0.09	0.02	11.92	0.05	4.19
3-20	8/1/1999 19:29	3.17	0.230	0.188	129.58	0.04	0.12	0.03	14.94	0.08	4.74
3-24	8/2/1999 11:29	3.83	0.240	0.198	129.72	0.05	0.13	0.03	16.68	0.12	4.75
3-28	8/3/1999 3:29	4.50	0.240	0.198	133.20	0.05	0.13	0.03	17.35	0.14	4.34
3-32	8/3/1999 19:29	5.17	0.230	0.188	136.69	0.05	0.13	0.03	17.36	0.16	3.75
3-36	8/4/1999 11:29	5.83	0.240	0.198	140.17	0.05	0.13	0.03	17.81	0.18	3.30
3-40	8/5/1999 3:29	6.50	0.230	0.188	143.66	0.05	0.13	0.03	18.26	0.20	2.87
3-44	8/5/1999 19:29	7.17	0.230	0.188	142.52	0.05	0.13	0.03	17.93	0.22	2.41
3-48	8/6/1999 11:29	7.83	0.230	0.188	137.48	0.05	0.13	0.03	17.55	0.24	2.05
3-52	8/7/1999 3:29	8.50	0.220	0.178	132.45	0.05	0.12	0.03	16.47	0.26	1.68
3-56	8/7/1999 19:29	9.17	0.200	0.158	127.41	0.04	0.11	0.03	14.55	0.25	1.28
3-60	8/8/1999 11:29	9.83	0.190	0.148	122.39	0.04	0.10	0.03	12.74	0.25	0.94
3-64	8/9/1999 3:29	10.50	0.180	0.138	117.35	0.04	0.10	0.02	11.43	0.25	0.69
3-68	8/9/1999 19:29	11.17	0.200	0.158	101.66	0.04	0.10	0.03	10.80	0.27	0.55
3-72	8/10/1999 11:29	11.83	0.200	0.158	76.35	0.04	0.11	0.03	9.38	0.31	0.43
3-76	8/11/1999 3:29	12.50	0.190	0.148	51.05	0.04	0.10	0.03	6.50	0.32	0.29
3-80	8/11/1999 19:29	13.17	0.180	0.138	25.75	0.04	0.10	0.02	3.66	0.31	0.17
3-84	8/12/1999 11:29	13.83	0.170	0.128	0.45	0.03	0.09	0.02	1.16	0.31	0.09
3-88	8/13/1999 3:29	14.50	0.170	0.128	26.75	0.03	0.09	0.02	1.16	0.31	0.04
3-92	8/13/1999 19:29	15.17	0.150	0.108	53.97	0.03	0.08	0.02	3.18	0.30	0.01
3-96	8/14/1999 11:29	15.83	0.140	0.098	81.20	0.03	0.07	0.02	4.64	0.27	0.00
3-100	8/15/1999 3:29	16.50	0.140	0.098	108.43	0.03	0.07	0.02	6.19	0.27	0.01
3-110	8/16/1999 19:29	18.17	0.130	0.088	156.66	0.02	0.15	0.04	20.54	0.69	0.13
3-120	8/18/1999 11:29	19.83	0.120	0.078	153.18	0.02	0.14	0.04	21.43	0.67	0.44
3-140	8/21/1999 19:29	23.17	0.110	0.068	162.01	0.02	0.24	0.06	38.35	1.34	2.25
3-150	8/23/1999 19:29	25.17	0.110	0.068	173.94	0.02	0.14	0.03	22.84	0.84	2.62
3-160	8/27/1999 3:29	28.50	0.085	0.043	283.44	0.01	0.19	0.05	42.31	1.27	6.09
3-170	8/30/1999 11:29	31.83	0.100	0.058	117.88	0.01	0.17	0.04	33.78	1.30	9.29
3-174	9/7/1999 10:16	39.78	0.064	0.022	129.91	0.01	0.32	0.08	39.40	2.92	33.62
3-175	9/9/1999 12:11	41.86	0.061	0.019	179.74	0.01	0.04	0.01	6.60	0.45	7.01
3-176	9/17/1999 13:03	49.90	0.032	0.000	311.66	0.00	0.08	0.02	18.76	0.90	18.07
						1.06	**3.90**	**1.00**	**510.46**	**15.50**	**124.04**
								M_0		**M_1**	**M_2**
								Mass Recovery	**118%**		

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/𝒟)

Mean Residence Time τ_a (d) =	**15.50**	**M_1/M_0**
σ^2 (d^2) =	**124.04**	**M_2/M_0**
Number of Tanks N =	**1.94**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.03**	**τ_a/τ_v**
Dimensionless Variance =	**0.5165**	**1/N**
Wetland Dispersion Number 𝒟 =	**0.4150**	**Solver**

Dimensionless Variance Guess

Pe = 2.40962785 0.516499295

𝒟

0.4150

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

South Test Cells - Cell 8

Volume of LiCl Solution Applied:	**7.0 L**	**Nominal HRT:**	**12.9 d**
Concentration of Li^+ Applied:	**78,457 mg/L**	**Avg. Flow:**	**125 m^3/d**
Mass of Li^+ Applied:	**549.20 g**	**Avg. HLR:**	**4.7 cm/d**
Date/Time of Application:	**7/29/1999 15:05**	**Avg. Depth:**	**66 cm**
Average Background Concentration:	**0.022 mg/L**	**Nominal Volume:**	**1612 m^3**

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m^3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
8-1	7/29/1999 15:05	0.00	0.046	0.024	142.03	0.00	0.00	0.00	0.00	0.00	0.00
8-4	7/30/1999 3:05	0.50	0.044	0.022	132.68	0.01	0.01	0.00	1.58	0.00	0.37
8-7	7/30/1999 15:05	1.00	0.160	0.138	127.56	0.02	0.04	0.01	5.20	0.01	1.18
8-8	7/30/1999 19:05	1.17	0.300	0.278	128.42	0.06	0.03	0.01	4.44	0.01	0.95
8-12	7/31/1999 11:05	1.83	0.280	0.258	131.85	0.08	0.18	0.05	23.25	0.08	4.49
8-16	8/1/1999 3:05	2.50	0.320	0.298	135.29	0.08	0.19	0.06	24.76	0.12	4.01
8-20	8/1/1999 19:05	3.17	0.280	0.258	138.72	0.08	0.19	0.06	25.39	0.16	3.40
36396	8/2/1999 11:05	3.83	0.270	0.248	142.03	0.08	0.17	0.05	23.68	0.18	2.59
36400	8/3/1999 3:00	4.50	0.260	0.238	142.03	0.07	0.16	0.05	22.89	0.20	2.04
30164	8/3/1999 19:00	5.16	0.250	0.228	142.03	0.07	0.16	0.05	22.06	0.22	1.59
31625	8/4/1999 11:00	5.83	0.240	0.218	142.03	0.07	0.15	0.04	21.12	0.24	1.19
14824	8/5/1999 3:00	6.50	0.230	0.208	142.03	0.06	0.14	0.04	20.17	0.26	0.86
16285	8/5/1999 19:00	7.16	0.220	0.198	138.01	0.06	0.14	0.04	18.95	0.28	0.60
17746	8/6/1999 11:00	7.83	0.240	0.218	128.72	0.06	0.14	0.04	18.49	0.31	0.42
19207	8/7/1999 3:00	8.50	0.220	0.198	119.43	0.06	0.14	0.04	17.21	0.34	0.26
20668	8/7/1999 19:00	9.16	0.200	0.178	110.14	0.06	0.13	0.04	14.39	0.33	0.13
22129	8/8/1999 11:00	9.83	0.190	0.168	100.29	0.05	0.12	0.03	12.13	0.33	0.05
23590	8/9/1999 3:00	10.50	0.150	0.128	91.00	0.04	0.10	0.03	9.44	0.30	0.01
25051	8/9/1999 19:00	11.16	0.130	0.108	87.81	0.04	0.08	0.02	7.03	0.25	0.00
26512	8/10/1999 11:00	11.83	0.130	0.108	90.51	0.03	0.07	0.02	6.42	0.25	0.01
27973	8/11/1999 3:00	12.50	0.130	0.108	93.21	0.03	0.07	0.02	6.61	0.26	0.05
29434	8/11/1999 19:00	13.16	0.120	0.098	95.91	0.03	0.07	0.02	6.49	0.26	0.09
30895	8/12/1999 11:00	13.83	0.110	0.088	98.62	0.03	0.06	0.02	6.03	0.25	0.15
32356	8/13/1999 3:00	14.50	0.110	0.088	108.19	0.03	0.06	0.02	6.07	0.25	0.21
33817	8/13/1999 19:00	15.16	0.097	0.075	118.27	0.02	0.05	0.02	6.15	0.24	0.28
35278	8/14/1999 11:00	15.83	0.095	0.073	128.34	0.02	0.05	0.01	6.08	0.23	0.34
8-100	8/15/1999 3:00	16.50	0.084	0.062	138.42	0.02	0.04	0.01	6.00	0.22	0.40
8-110	8/16/1999 19:00	18.16	0.072	0.050	133.97	0.02	0.09	0.03	12.71	0.48	1.23
8-120	8/18/1999 11:00	19.83	0.065	0.043	75.04	0.01	0.08	0.02	8.10	0.44	1.60
8-180	8/20/1999 3:00	21.50	0.060	0.038	78.72	0.01	0.07	0.02	5.19	0.42	2.00
8-140	8/21/1999 19:00	23.16	0.054	0.032	88.26	0.01	0.06	0.02	4.87	0.39	2.36
8-150	8/23/1999 11:00	24.83	0.051	0.029	97.80	0.01	0.05	0.02	4.73	0.36	2.68
8-160	8/26/1999 23:00	28.33	0.037	0.015	110.85	0.01	0.08	0.02	8.03	0.61	5.80
8-170	8/30/1999 7:00	31.66	0.033	0.011	99.26	0.00	0.04	0.01	4.55	0.39	4.82
8-175	9/7/1999 10:45	39.82	0.031	0.009	141.92	0.00	0.08	0.02	9.84	0.87	15.26
8-176	9/9/1999 11:43	41.86	0.028	0.006	194.23	0.00	0.02	0.00	2.57	0.19	4.15
8-177	9/17/1999 13:10	49.92	0.026	0.004	158.57	0.00	0.04	0.01	7.11	0.55	14.88
8-178	9/20/1999 10:15	52.80	0.027	0.005	158.57	0.00	0.01	0.00	2.05	0.20	6.39
8-179	9/23/1999 14:40	55.98	0.026	0.004	176.03	0.00	0.01	0.00	2.40	0.23	8.16
8-180	9/30/1999 13:25	62.93	0.026	0.004	175.94	0.00	0.03	0.01	4.89	0.49	19.70
						1.35	**3.36**	**1.00**	**414.18**	**10.68**	**94.99**
								M_0		M_1	M_2

Mass Recovery 75%

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/𝒟)

Mean Residence Time τ_a (d) =	**10.68**	**M_1/M_0**
σ^2 (d^2) =	**94.99**	**M_2/M_0**
Number of Tanks N =	**1.20**	**τ_a^2/σ^2**
Volumetric Efficiency =	**0.83**	**τ_α/τ_v**
Dimensionless Variance =	**0.8321**	**1/N**
Wetland Dispersion Number 𝒟 =	**1.7284**	**Solver**

Dimensionless Variance Guess

Pe = 0.57856356 0.832099631

𝒟

1.7284

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

South Test Cells - Cell 13

Volume of LiCl Solution Applied:	**5.5 L**	**Nominal HRT:**	**14.5 d**
Concentration of Li^+ Applied:	**78,457 mg/L**	**Avg. Flow:**	**111 m^3/d**
Mass of Li^+ Applied:	**431.52 g**	**Avg. HLR:**	**4.2 cm/d**
Date/Time of Application:	**7/29/1999 14:50**	**Avg. Depth:**	**66 cm**
Average Background Concentration:	**0.021 mg/L**	**Nominal Volume:**	**1612 m^3**

Sample ID	Date/Time Sampled	Time (days)	Calc Conc (mg/L)	Corr Conc (mg/L)	Flow Rate (m^3/d)	f(t)	C(t)dt	f(t)dt	QC(t)dt	tf(t)dt	$f(t)dt(t-\tau)^2$
13-1	7/29/1999 14:50	0.00	0.022	0.001	160.28	0.00	0.00	0.00	0.00	0.00	0.00
13-4	7/30/1999 2:50	0.50	0.020	0.000	160.28	0.00	0.00	0.00	0.04	0.00	0.05
13-8	7/30/1999 18:50	1.17	0.019	0.000	158.53	0.00	0.00	0.00	0.00	0.00	0.00
13-12	7/31/1999 10:50	1.83	0.020	0.000	154.84	0.00	0.00	0.00	0.00	0.00	0.00
13-16	8/1/1999 2:50	2.50	0.019	0.000	151.14	0.00	0.00	0.00	0.00	0.00	0.00
13-20	8/1/1999 18:50	3.17	0.029	0.008	147.44	0.00	0.00	0.00	0.40	0.00	0.39
13-24	8/2/1999 10:50	3.83	0.030	0.009	143.74	0.00	0.01	0.00	0.83	0.01	0.78
13-26	8/2/1999 18:50	4.17	0.046	0.025	143.64	0.01	0.01	0.00	0.81	0.01	0.74
13-28	8/3/1999 2:50	4.50	0.066	0.045	143.64	0.01	0.01	0.00	1.68	0.02	1.47
13-32	8/3/1999 18:50	5.17	0.082	0.061	143.64	0.02	0.04	0.01	5.08	0.07	4.20
13-36	8/4/1999 10:50	5.83	0.091	0.070	143.64	0.03	0.04	0.02	6.27	0.09	4.80
13-40	8/5/1999 2:50	6.50	0.097	0.076	143.64	0.03	0.05	0.02	6.99	0.12	4.94
13-44	8/5/1999 18:50	7.17	0.100	0.079	134.94	0.03	0.05	0.02	7.20	0.14	4.82
13-48	8/6/1999 10:50	7.83	0.100	0.079	113.57	0.03	0.05	0.02	6.54	0.15	4.50
13-52	8/7/1999 2:50	8.50	0.100	0.079	92.21	0.03	0.05	0.02	5.42	0.17	4.11
13-56	8/7/1999 18:50	9.17	0.120	0.099	70.84	0.03	0.06	0.02	4.84	0.20	4.21
13-60	8/8/1999 10:50	9.83	0.100	0.079	49.49	0.03	0.06	0.02	3.57	0.22	3.80
13-64	8/9/1999 2:50	10.50	0.140	0.119	28.13	0.04	0.07	0.03	2.56	0.26	3.81
13-68	8/9/1999 18:50	11.17	0.140	0.119	25.29	0.05	0.08	0.03	2.12	0.33	4.09
13-72	8/10/1999 10:50	11.83	0.140	0.119	46.17	0.05	0.08	0.03	2.83	0.35	3.63
13-76	8/11/1999 2:50	12.50	0.140	0.119	67.04	0.05	0.08	0.03	4.49	0.37	3.20
13-80	8/11/1999 18:50	13.17	0.140	0.119	87.92	0.05	0.08	0.03	6.15	0.39	2.80
13-84	8/12/1999 10:50	13.83	0.120	0.099	108.80	0.04	0.07	0.03	7.15	0.38	2.22
13-88	8/13/1999 2:50	14.50	0.120	0.099	122.05	0.04	0.07	0.03	7.62	0.36	1.73
13-92	8/13/1999 18:50	15.17	0.110	0.089	133.04	0.04	0.06	0.02	7.99	0.36	1.39
13-96	8/14/1999 10:50	15.83	0.110	0.089	144.03	0.03	0.06	0.02	8.22	0.35	1.09
13-100	8/15/1999 2:50	16.50	0.100	0.079	155.02	0.03	0.06	0.02	8.37	0.35	0.84
13-110	8/16/1999 10:50	17.83	0.092	0.071	177.01	0.03	0.10	0.04	16.60	0.66	1.06
13-120	8/18/1999 10:50	19.83	0.100	0.079	113.56	0.03	0.15	0.06	21.79	1.08	0.74
13-130	8/20/1999 2:50	21.50	0.087	0.066	111.74	0.03	0.12	0.05	13.61	0.96	0.14
13-140	8/21/1999 18:50	23.17	0.078	0.057	106.28	0.02	0.10	0.04	11.17	0.88	0.00
13-150	8/23/1999 10:50	24.83	0.088	0.067	100.83	0.02	0.10	0.04	10.70	0.95	0.10
13-160	8/26/1999 23:50	28.38	0.054	0.033	98.87	0.02	0.18	0.07	17.68	1.81	1.19
13-170	8/30/1999 7:50	31.71	0.054	0.033	88.06	0.01	0.11	0.04	10.28	1.27	2.45
13-175	9/7/1999 11:10	39.85	0.052	0.031	76.14	0.01	0.26	0.10	21.38	3.58	17.84
13-176	9/9/1999 11:01	41.84	0.044	0.023	113.56	0.01	0.05	0.02	5.11	0.84	7.01
13-177	9/17/1999 13:15	49.93	0.039	0.018	79.25	0.01	0.17	0.06	15.99	2.92	35.08
13-178	9/20/1999 10:25	52.82	0.037	0.016	87.56	0.01	0.05	0.02	4.09	0.97	15.77
13-179	9/23/1999 14:21	55.98	0.030	0.009	127.92	0.00	0.04	0.02	4.26	0.83	15.53
Extrapolated	10/3/1999 2:50	65.50	0.021	0.000	0.00	0.00	0.04	0.02	2.74	1.00	24.15
						0.87	**2.60**	**1.00**	**262.58**	**22.42**	**184.66**
								M_0		**M_1**	**M_2**
								Mass Recovery	**61%**		

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Mean Residence Time τ_a (d) =	**22.42**	**M_1/M_0**
σ^2 (d^2) =	**184.66**	**M_2/M_0**
Number of Tanks N =	**2.72**	**τ_a^2/σ^2**
Volumetric Efficiency =	**1.55**	**τ_α/τ_ν**
Dimensionless Variance =	**0.3673**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.2407**	**Solver**

Dimensionless Variance Guess

Pe = 4.155274 0.367299899

$\mathscr{D}$

0.2407

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

APPENDIX G.2

Phase 2 Tracer Test Data

APPENDIX G.2

Periphyton-Based Stormwater Treatment Area Project: Phase 2 Tracer Study Results

Hydraulic tracer studies were conducted at the three Periphyton-Based Stormwater Treatment Area (PSTA) South Test Cells (STC) (3, 8, and 13) and Porta-PSTA Tank 16 (PP-16) between January 30, 2001, and February 27, 2001. The objective of the tracer study was to document the hydraulic residence time (HRT) for these PSTA systems during Phase 2. This appendix summarizes the results of these analyses.

G.2.1 Operational Conditions

The Phase 2 studies in the Test Cells were conducted at a shallower operational depth than during Phase 1. STC-3 was operated at seasonally varied depths, including dry-out. During the period of this tracer test, STC-3, STC-8, and STC-13 operated at approximately 30 centimeters (cm).

During Phase 1, PP-16 was operated at 60 cm, and with a hydraulic loading rate (HLR) resulting in velocities of approximately 1.4 meters per day (m/d). During Phase 2, depths were reduced to 30 cm, and a recirculation pump was installed to increase water velocity without changing the HLR. Recirculation flow rates averaged approximately 38 m^3/d, approximately 165 times greater than the mean flow-through rate of 0.23 m^3/d. This recirculation resulted in a linear velocity of approximately 126 m/d.

The goal of the Phase 2 tracer tests was to evaluate flows in the more mature systems and also to provide a comparison with Phase 1 conditions.

G.2.2 Materials and Methods

Tracer experimental procedures were described previously (CH2M HILL, 1998). Tracer spike solutions were prepared using a lithium (Li) chloride brine solution with approximately 78,460 milligrams per liter (mg/L) as Li ion to yield average, well-mixed concentrations of approximately 0.35 mg/L as lithium. The tracer solutions for each cell were measured into clean plastic containers and diluted with de-ionized water. The tracer solutions were applied to each cell for approximately 2 minutes by pouring the contents of the plastic containers into the inlet piping assemblies. Tracer volumes (LiCl solution) were 2.1 L for STC-3, 2.5 L each for STC-8 and STC-13, and 0.01 L for PP-16.

Automated ISCO samplers (Model 3700) were deployed at the outlets from each cell and were programmed to collect 125 mL samples at 3-hour intervals, beginning at the time of initial tracer application (between 13:00 and 15:00 on January 30, 2001). The filled ISCO bottles were capped and replaced with clean bottles following each programmed cycle. The sampling frequency was reduced to a 4-hour interval on February 2, a 6-hour interval on February 9, and a 12-hour interval on February 15. The ISCO samplers were removed on February 27, 2001. Grab samples were also collected at the Everglades Nutrient Removal

(ENR) outflow pump station during the course of the experiment to verify that the discharge from the study would not raise the background concentrations of lithium in the ENR.

Lithium samples were sent to PPB Laboratories in Gainesville, Florida, for analysis. Lithium samples were chilled with ice for shipment to the laboratory. No other preservative was used for the lithium samples.

Daily STC outflow rates were calculated as the net result of measured inflow rates, rainfall, and evapotranspiration (ET). The South Florida Water Management District (District) provided data for these calculations. The District measured inflow and outflow rates weekly at PP-16. Mass recovery calculations were based on averaged inflow and outflow rates for PP-16, with missing daily flow rates estimated by a linear interpolation procedure.

G.2.3 Results and Discussion

The tracer study data were interpreted following the gamma distribution method summarized by Kadlec (2001). The Attachment presents the data collected for each mesocosm.

Exhibits G.2-1 through G.2-4 show the tracer response curves (concentration versus time) for STC-3, STC-8, and STC-13, and PP-16, respectively. The endpoint for the STC-3 experiment was extrapolated based upon the measured concentrations of the previous five samples. Using this approach, the estimated endpoint of the experiment occurred at t = 34.16 days. The regression equation used was:

$$\text{Lithium Concentration} = -3.80(\text{time}) + 129.81,\ r^2 = 0.99$$

Exhibit G.2-5 summarizes the hydraulic characteristics for each cell, as determined via this study.

The results indicate that the Test Cells have very similar hydraulic properties with the number of tanks, N, ranging from 3.8 to 4.1. These systems also have similar amounts of dispersion, with $0.14 < D < 0.16$. Exhibit G.2-6 shows the residence time distributions (RTDs), as approximated by the gamma distribution procedure (Kadlec, 2001), for the three Test Cells. The curves have been plotted in a dimensionless form to allow the direct visual comparison of the RTDs. Exhibit G.2-6 illustrates that these Test Cells are virtually identical.

Discrepancies between nominal HRTs and actual HRTs can be attributed to cumulative errors in flow measurement and wetland volume estimates.

The results for the Test Cells suggest that hydraulic properties have improved with time, perhaps from increased vegetative cover and a reduction in water depths from approximately 60 cm (Phase 1) to 30 cm (Phase 2). Tracer studies conducted at the beginning of Phase 1 showed lower nitrogen (N) values, although these tests were performed under different operating conditions and a different analytical approach was used for data reduction (CH2M HILL, 2000).

EXHIBIT G.2-1
STC-3 Tracer Response Curve

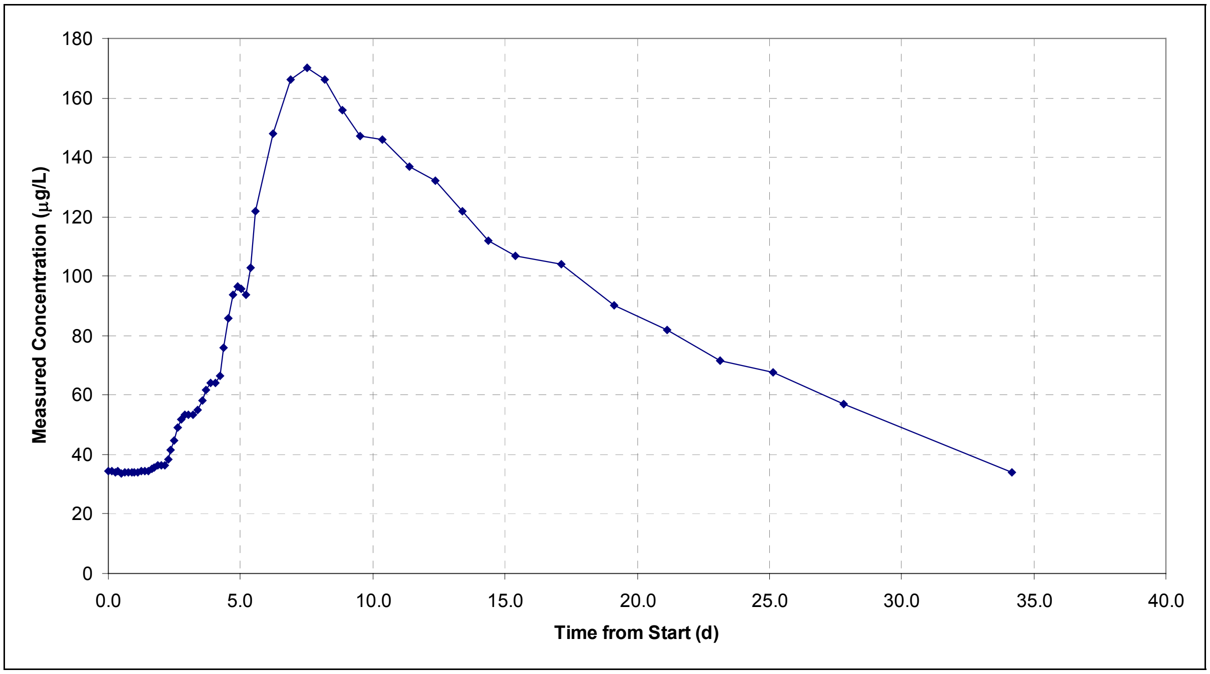


EXHIBIT G.2-2
STC-8 Tracer Response Curve

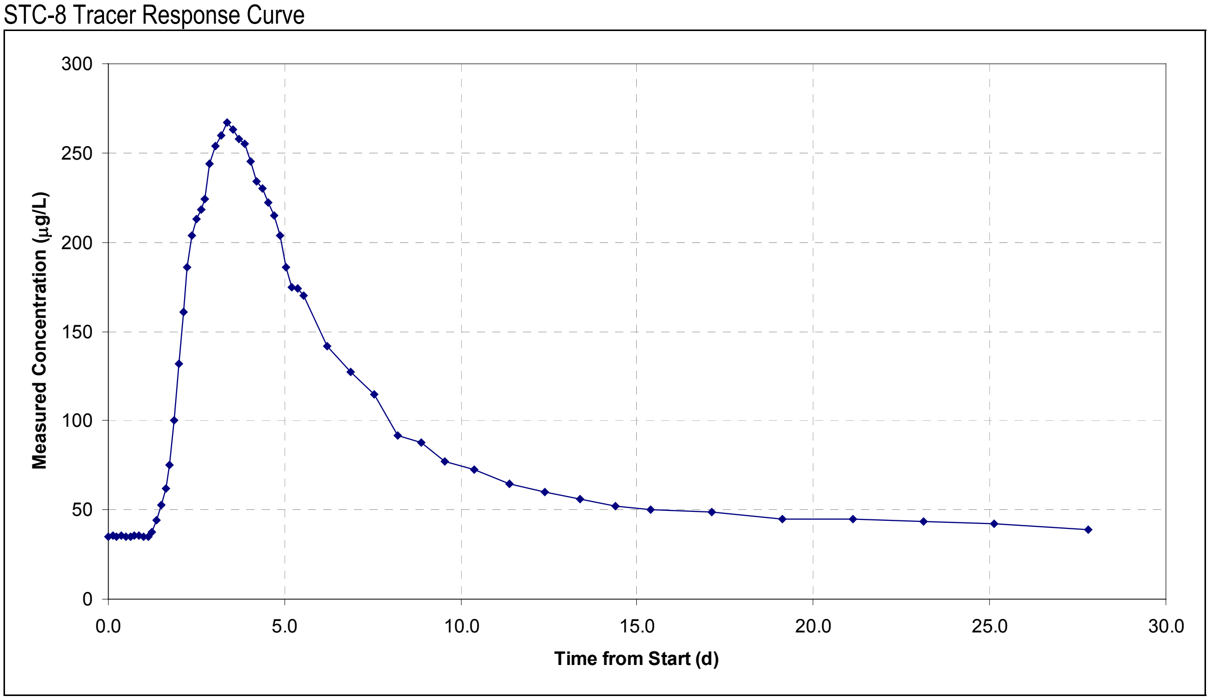


EXHIBIT G.2-3
STC-13 Tracer Response Curve

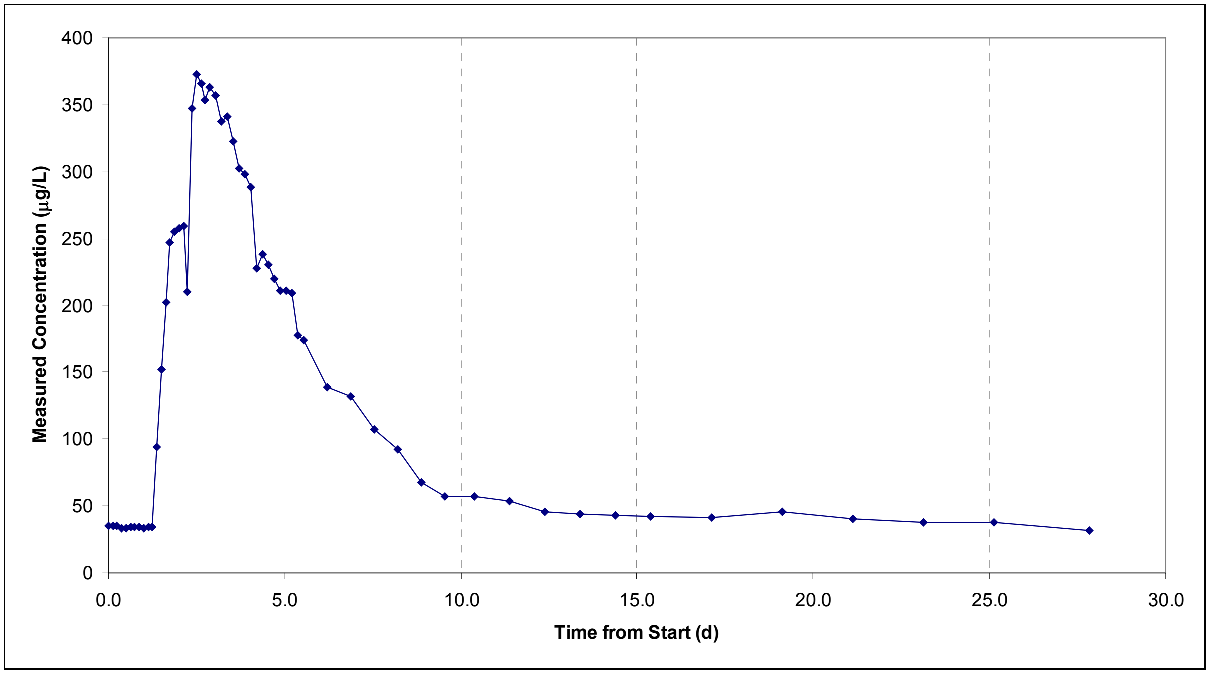


EXHIBIT G.2-4
PP-16 Tracer Response Curve

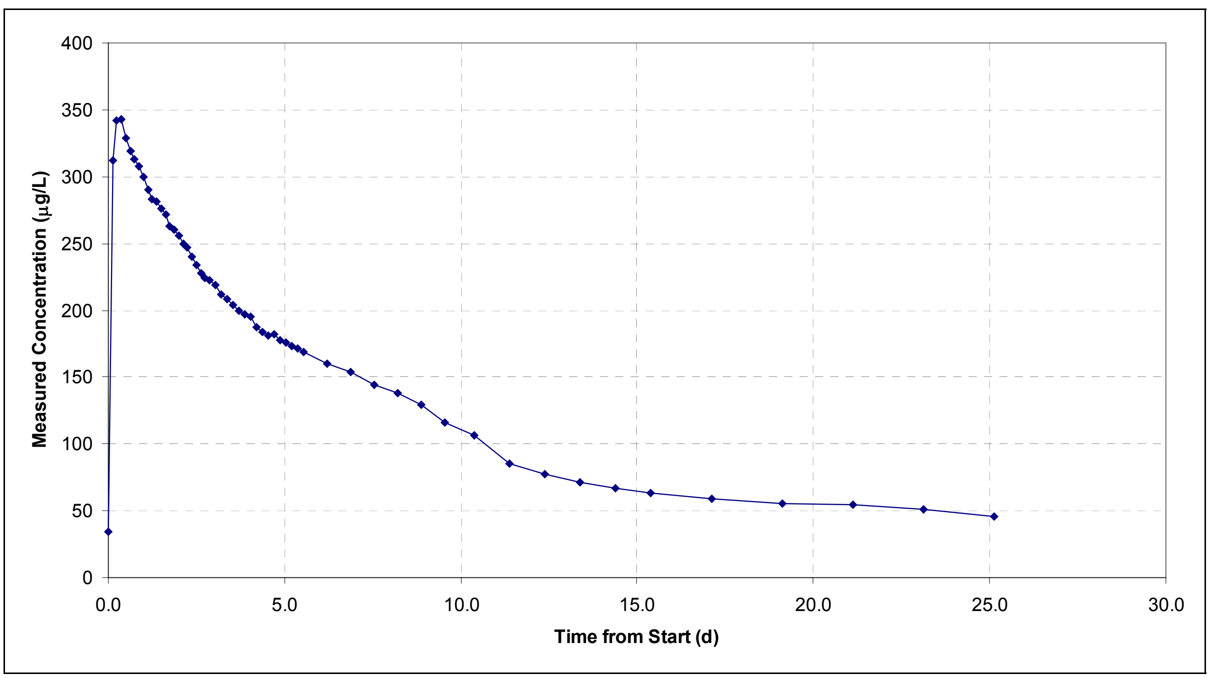


EXHIBIT G.2-5
Tracer Study Hydraulic Characteristics

Parameter	STC-3	STC-8	STC-13	PP-16
Average Volume (m^3)	698	716	729	1.8
Average Flow (m^3/d)	60	116	115	0.23
Nominal HRT (d)	11.7	6.2	6.4	7.8
Mean HRT, τ (d)	14.1	5.6	4.7	6.7
Number of Tanks, N	4.1	4.0	3.8	1.1
Volumetric Efficiency, %	120	91	73	86
Dimensionless Variance	0.25	0.25	0.26	0.94
Dispersion Number, D	0.14	0.15	0.16	4.91
Mass Recovery (%)	70	81	95	62

EXHIBIT G.2-6
Comparison of Modeled Residence Time Distributions for the South Test Cells

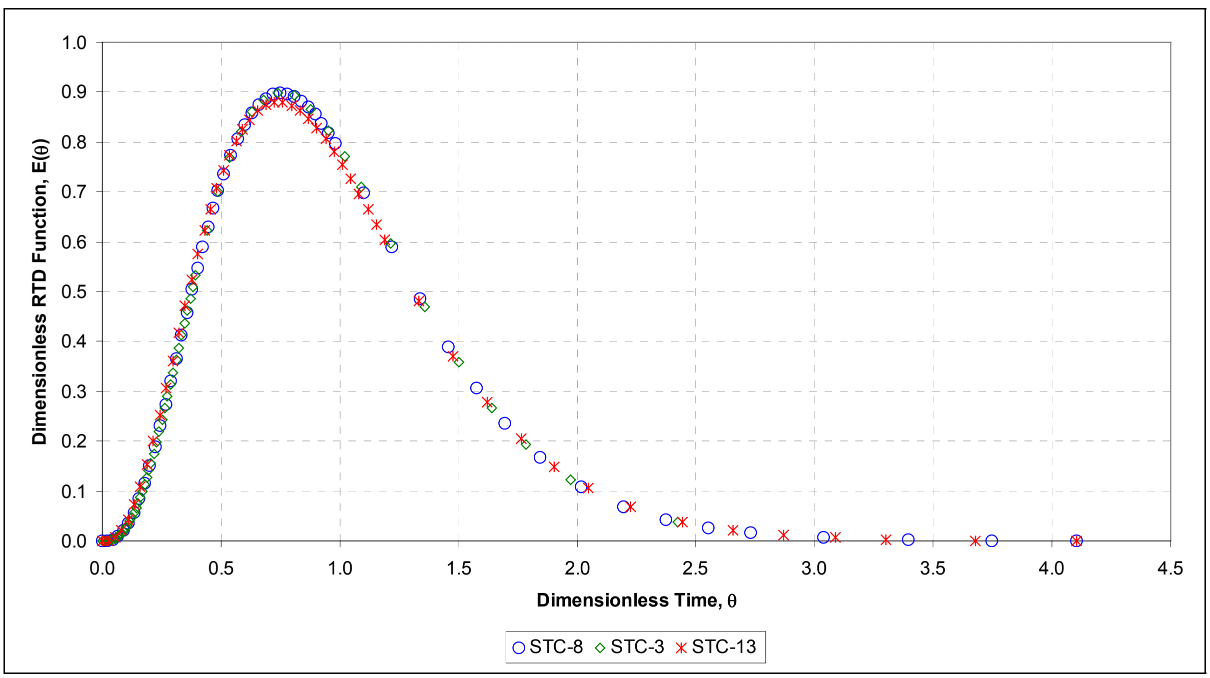


Exhibit G.2-7 compares the Phase 1 results with the more recent results. Kadlec's (2001) recalculation of the Phase 1 data using the gamma distribution technique is also included.

A recirculation pump was added to PP-16 to increase the horizontal velocity through the system to test the hypothesis that higher velocities increase periphyton growth and nutrient uptake rates. The PP-16 water quality data do not show an improvement in net phosphorus (P) removal during the period when the recirculation pump was running (CH2M HILL, 2001). Tracer results for PP-16 show that use of the recirculation pump forced the system to behave like a completely stirred tank reactor (CSTR, N=1) with an estimated N value of 1.1. This agrees well with the theoretical case, recirculation with throughflow, reported by Levenspiel (1972). Previous tracer studies at the Porta-PSTAs (STC-7, STC-10, and STC-23) reported 1.4 < N < 2.2 (CH2M HILL, 1999; Kadlec, 2001). These recent results suggest that any benefit that might have been attributable to an increase in velocity was negated by a reduction in hydraulic effectiveness.

EXHIBIT G.2-7
Comparison of Tracer Study Results with Time at the South Test Cells

STC	Phase 1 (8/99)	Phase 1 (Kadlec Rev.)	Phase 2 (2/01)
3	1.9	1.8	4.1
8	1.2	1.8	4.0
13	2.7	3.1	3.8

Weekly grab samples were collected at the ENR outflow pump station canal to ensure that elevated lithium concentrations were not discharged downstream to the Everglades. Lithium concentrations in the outflow canal ranged from 28.4 to 30.6 micrograms per liter (μg/L) and averaged 29.8 μg/L. These concentrations are representative of background samples collected at each of the Test Cells prior to beginning these experiments. Background samples ranged from 25.6 to 37.5 μg/L.

G.2.4 Conclusions and Recommendations

The following conclusions and recommendations can be offered based upon the tracer studies conducted during Phase 2 of the PSTA Research and Demonstration Project:

- Test Cell hydraulic properties (i.e., N values) may have improved with time, perhaps in part from increased vegetation density. However, direct comparison between the Phase 1 and Phase 2 results must also consider that some of the difference could be caused by changes in operating conditions (decreased depth).
- The N values (approximately 4.0) resulting from the Phase 2 studies are near the middle of the range (2 < N < 8) reported in the literature (Kadlec and Knight, 1996) for similar constructed wetlands.
- The PP-16 experiment demonstrated that the addition of a recirculation pump to increase horizontal velocity resulted in completely stirred tank hydraulics, as indicated by the low N value (1.1).
- Plug-flow models for comparison of P removal performance between experimental treatments do not accurately account for observed hydraulics in PSTA mesocosms and Test Cells. The tanks-in-series model provides a more realistic projection of performance.

G.2.5 References

CH2M HILL, 2001. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Development Project – Phase 2 Interim Report (April 2000 – October 2000)*. Prepared for the South Florida Water Management District.

CH2M HILL, 2000. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Development Project – 5th Quarterly Report (August – October 1999)*. Prepared for the South Florida Water Management District.

CH2M HILL, 1999. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Development Project – 4th Quarterly Report (May - July 1999)*. Prepared for the South Florida Water Management District.

CH2M HILL, 1998. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Development Project – Tracer Study Plan*. Prepared for the South Florida Water Management District.

Kadlec, R.H., 2001. *Tracer Testing of Green Technologies*. Memorandum, February 4, 2001.

Kadlec, R.H. and R.L. Knight. 1996. *Treatment Wetlands*, CRC Lewis, Boca Raton, Florida, 893 pp.

Levenspiel, O. 1972. *Chemical Reaction Engineering, Second Edition*. John Wiley & Sons, New York, 578 pp.

ATTACHMENT

Tracer Test Data

PSTA PHASE II **STC-3**

Volume of LiCl Solution Applied:	**2.10 L**	**Average Flo**	**60 m^3/d**
Concentration of Li Applied:	**78,457 mg/L**	**Cell Volum**	**698 m^3**
Mass of Li Applied:	**0.165 kg**	**Nominal HF**	**11.72 d**
Date/Time of Application:	**1/30/2001 14:48**	**Average HL**	**2.5 cm/d**

Background Li Concentration: **32.4 μg/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (μg/L)	Corrected Lithium Concentration (μg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
TC-3OUT-W-1	1/30/2001 14:48	0.00	62.94	34	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TC-3OUT-W-2	1/30/2001 17:48	0.13	62.94	34	2	0.001	0.250	0.000	0.000	0.000	0.000	0.009	0.014	0.000
TC-3OUT-W-3	1/30/2001 20:48	0.25	62.94	34	2	0.001	0.231	0.000	0.000	0.000	0.000	0.018	0.013	0.000
TC-3OUT-W-4	1/30/2001 23:48	0.38	62.94	34	2	0.001	0.231	0.000	0.000	0.000	0.000	0.027	0.013	0.001
TC-3OUT-W-5	1/31/2001 2:48	0.50	58.24	34	1	0.001	0.213	0.000	0.000	0.000	0.000	0.035	0.012	0.001
TC-3OUT-W-6	1/31/2001 5:48	0.63	58.24	34	2	0.001	0.188	0.000	0.000	0.000	0.000	0.044	0.011	0.003
TC-3OUT-W-7	1/31/2001 8:48	0.75	58.24	34	2	0.001	0.219	0.000	0.000	0.000	0.000	0.053	0.013	0.005
TC-3OUT-W-8	1/31/2001 11:48	0.88	58.24	34	2	0.001	0.213	0.000	0.001	0.000	0.000	0.062	0.012	0.007
TC-3OUT-W-9	1/31/2001 14:48	1.00	58.24	34	2	0.001	0.206	0.000	0.001	0.000	0.000	0.071	0.012	0.011
TC-3OUT-W-10	1/31/2001 17:48	1.13	58.24	34	2	0.001	0.225	0.000	0.001	0.000	0.000	0.080	0.013	0.015
TC-3OUT-W-11	1/31/2001 20:48	1.25	58.24	35	2	0.001	0.256	0.000	0.001	0.000	0.000	0.089	0.015	0.020
TC-3OUT-W-12	1/31/2001 23:48	1.38	58.24	34	2	0.001	0.269	0.000	0.002	0.000	0.000	0.098	0.015	0.025
TC-3OUT-W-13	2/1/2001 2:48	1.50	59.27	35	2	0.001	0.269	0.000	0.002	0.000	0.000	0.106	0.015	0.032
TC-3OUT-W-14	2/1/2001 5:48	1.63	59.27	35	3	0.001	0.325	0.000	0.003	0.000	0.000	0.115	0.019	0.039
TC-3OUT-W-15	2/1/2001 8:48	1.75	59.27	36	3	0.002	0.400	0.000	0.003	0.000	0.000	0.124	0.023	0.047
TC-3OUT-W-16	2/1/2001 11:48	1.88	59.27	36	4	0.002	0.469	0.000	0.004	0.000	0.000	0.133	0.027	0.056
TC-3OUT-W-17	2/1/2001 14:48	2.00	59.27	37	4	0.002	0.513	0.000	0.005	0.001	0.000	0.142	0.029	0.066
TC-3OUT-W-18	2/1/2001 17:48	2.13	59.27	36	4	0.002	0.500	0.000	0.005	0.001	0.000	0.151	0.029	0.077
TC-3OUT-W-19	2/1/2001 20:48	2.25	59.27	38	6	0.003	0.619	0.000	0.006	0.001	0.000	0.160	0.035	0.088
TC-3OUT-W-20	2/1/2001 23:48	2.38	59.27	42	9	0.004	0.956	0.000	0.007	0.001	0.000	0.169	0.055	0.100
TC-3OUT-W-21	2/2/2001 2:48	2.50	59.79	45	12	0.006	1.356	0.000	0.008	0.001	0.000	0.177	0.078	0.113
TC-3OUT-W-22	2/2/2001 5:48	2.63	59.79	49	17	0.007	1.819	0.000	0.009	0.001	0.000	0.186	0.104	0.126
TC-3OUT-W-23	2/2/2001 8:48	2.75	59.79	52	20	0.009	2.269	0.000	0.010	0.001	0.000	0.195	0.130	0.140
TC-3OUT-W-24	2/2/2001 11:48	2.88	59.79	54	21	0.010	2.556	0.000	0.011	0.001	0.000	0.204	0.147	0.155
TC-3OUT-W-25	2/2/2001 15:48	3.04	59.79	53	21	0.011	3.525	0.000	0.012	0.002	0.000	0.216	0.152	0.176
TC-3OUT-W-26	2/2/2001 19:48	3.21	59.79	53	21	0.011	3.508	0.000	0.014	0.002	0.000	0.228	0.151	0.197
TC-3OUT-W-27	2/2/2001 23:48	3.37	59.79	55	23	0.011	3.633	0.000	0.016	0.002	0.000	0.240	0.156	0.219
TC-3OUT-W-28	2/3/2001 3:48	3.54	60.90	58	26	0.012	4.017	0.000	0.017	0.003	0.000	0.251	0.173	0.242
TC-3OUT-W-29	2/3/2001 7:48	3.71	60.90	62	29	0.014	4.575	0.000	0.019	0.003	0.000	0.263	0.197	0.265
TC-3OUT-W-30	2/3/2001 11:48	3.87	60.90	64	32	0.016	5.092	0.000	0.021	0.003	0.000	0.275	0.219	0.289
TC-3OUT-W-31	2/3/2001 15:48	4.04	60.90	64	32	0.016	5.308	0.000	0.022	0.004	0.000	0.287	0.228	0.313
TC-3OUT-W-32	2/3/2001 19:48	4.21	60.90	66	34	0.017	5.483	0.000	0.024	0.004	0.000	0.299	0.236	0.338
TC-3OUT-W-33	2/3/2001 23:48	4.37	60.90	76	44	0.020	6.458	0.000	0.026	0.004	0.000	0.311	0.278	0.363
TC-3OUT-W-34	2/4/2001 3:48	4.54	60.01	86	54	0.025	8.092	0.000	0.027	0.004	0.000	0.322	0.348	0.387
TC-3OUT-W-35	2/4/2001 7:48	4.71	60.01	94	61	0.029	9.567	0.001	0.029	0.005	0.000	0.334	0.412	0.412
TC-3OUT-W-36	2/4/2001 11:48	4.87	60.01	97	64	0.032	10.450	0.001	0.031	0.005	0.000	0.346	0.450	0.437
TC-3OUT-W-37	2/4/2001 15:48	5.04	60.01	96	63	0.032	10.633	0.001	0.033	0.005	0.000	0.358	0.457	0.461
TC-3OUT-W-38	2/4/2001 19:48	5.21	60.01	94	62	0.032	10.417	0.001	0.034	0.006	0.000	0.370	0.448	0.486
TC-3OUT-W-39	2/4/2001 23:48	5.37	60.01	103	71	0.034	11.017	0.001	0.036	0.006	0.000	0.381	0.474	0.510
TC-3OUT-W-40	2/5/2001 3:48	5.54	61.93	122	90	0.041	13.358	0.001	0.038	0.006	0.000	0.393	0.575	0.533
TC-3OUT-W-44	2/5/2001 19:48	6.21	61.93	148	116	0.052	68.433	0.004	0.044	0.027	0.000	0.441	0.736	0.622
TC-3OUT-W-48	2/6/2001 11:48	6.87	57.85	166	134	0.063	83.100	0.005	0.050	0.031	0.000	0.488	0.894	0.701
TC-3OUT-W-52	2/7/2001 3:48	7.54	58.30	170	138	0.069	90.433	0.005	0.055	0.035	0.000	0.535	0.973	0.768
TC-3OUT-W-56	2/7/2001 19:48	8.21	58.30	166	134	0.069	90.433	0.005	0.058	0.038	0.000	0.583	0.973	0.821
TC-3OUT-W-60	2/8/2001 11:48	8.87	57.94	156	124	0.065	85.767	0.005	0.061	0.040	0.000	0.630	0.922	0.860
TC-3OUT-W-64	2/9/2001 3:48	9.54	59.71	147	115	0.061	79.433	0.005	0.063	0.041	0.000	0.677	0.854	0.885
TC-3OUT-W-68	2/9/2001 23:48	10.37	59.71	146	114	0.058	95.125	0.006	0.064	0.053	0.000	0.736	0.818	0.900
TC-3OUT-W-72	2/10/2001 23:48	11.37	58.78	137	105	0.056	109.150	0.006	0.063	0.064	0.000	0.807	0.783	0.893
TC-3OUT-W-76	2/11/2001 23:48	12.37	62.04	132	100	0.052	102.150	0.006	0.062	0.062	0.000	0.878	0.732	0.867
TC-3OUT-W-80	2/12/2001 23:48	13.37	57.66	122	90	0.048	94.650	0.006	0.058	0.060	0.000	0.949	0.679	0.824
TC-3OUT-W-84	2/13/2001 23:48	14.37	58.50	112	80	0.043	84.650	0.005	0.055	0.057	0.000	1.020	0.607	0.770
TC-3OUT-W-88	2/14/2001 23:48	15.37	57.84	107	75	0.039	77.150	0.004	0.050	0.053	0.000	1.091	0.553	0.709
TC-3OUT-W-92	2/16/2001 17:48	17.12	58.58	104	72	0.037	128.013	0.007	0.042	0.081	0.000	1.215	0.525	0.596
TC-3OUT-W-96	2/18/2001 17:48	19.12	59.17	90	58	0.033	129.600	0.008	0.033	0.076	0.000	1.357	0.465	0.470
TC-3OUT-W-100	2/20/2001 17:48	21.12	59.57	82	50	0.027	107.600	0.006	0.025	0.059	0.000	1.499	0.386	0.358
TC-3OUT-W-104	2/22/2001 17:48	23.12	58.64	72	39	0.023	89.100	0.005	0.019	0.044	0.000	1.641	0.319	0.266
TC-3OUT-W-108	2/24/2001 17:48	25.12	58.13	68	35	0.019	74.600	0.004	0.014	0.033	0.000	1.783	0.267	0.192
TC-3OUT-W-END	2/27/2001 9:50	27.79	57.79	57	25	0.015	79.641	0.005	0.009	0.030	0.000	1.973	0.214	0.122
EXTRAP	3/5/2001 18:38	34.16	57.19	34	2	0.009	166.244	0.010	0.003	0.036	0.000	2.425	0.132	0.037
					Σ =	**1.251**	**1964.956**	**0.116**	**1.307**		**0.002**			

Mean residence time τ_a (d) =	**14.09**	**N^*t_i**
Mean detention time in one tank, t_i (d) =	**3.48**	**Solver**
Number of tanks N =	**4.05**	**Solver**
Dimensionless Variance =	**0.2470**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.1443**	**Solver**
Mass Recovery =	**70**	**%**
Volumetric Efficiency =	**1.20**	**τ_a/τ_n**

m -3.8035

b 129.813

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Dimensionless Variance Guess

Pe = 6.929864 0.247

$\mathscr{D}$

0.1443

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

PSTA PHASE II **STC-8**

Volume of LiCl Solution Applied:	**2.50 L**	**Average Flo**	**116 m^3/d**
Concentration of Li Applied:	**78,457 mg/L**	**Cell Volum**	**716 m^3**
Mass of Li Applied:	**0.196 kg**	**Nominal HF**	**6.17 d**
Date/Time of Application:	**1/30/2001 14:52**	**Average HL**	**4.8 cm/d**

Background Li Concentration: **31.9 µg/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (µg/L)	Corrected Lithium Concentration (µg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
TC-8OUT-W-1	1/30/2001 14:52	0.00	119.51	35	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TC-8OUT-W-2	1/30/2001 17:52	0.13	119.51	36	4	0.003	0.431	0.000	0.000	0.000	0.000	0.022	0.014	0.000
TC-8OUT-W-3	1/30/2001 20:52	0.25	119.51	35	3	0.003	0.431	0.000	0.001	0.000	0.000	0.044	0.014	0.003
TC-8OUT-W-4	1/30/2001 23:52	0.38	119.51	35	4	0.002	0.419	0.000	0.002	0.000	0.000	0.067	0.014	0.009
TC-8OUT-W-5	1/31/2001 2:52	0.50	114.42	35	3	0.002	0.406	0.000	0.004	0.000	0.000	0.089	0.013	0.020
TC-8OUT-W-6	1/31/2001 5:52	0.63	114.42	35	3	0.002	0.394	0.000	0.006	0.001	0.000	0.111	0.013	0.036
TC-8OUT-W-7	1/31/2001 8:52	0.75	114.42	36	4	0.003	0.438	0.000	0.010	0.001	0.000	0.133	0.014	0.058
TC-8OUT-W-8	1/31/2001 11:52	0.88	114.42	35	3	0.003	0.444	0.000	0.015	0.002	0.000	0.155	0.015	0.084
TC-8OUT-W-9	1/31/2001 14:52	1.00	114.42	35	3	0.002	0.425	0.000	0.020	0.002	0.000	0.177	0.014	0.115
TC-8OUT-W-1	1/31/2001 17:52	1.13	114.42	35	3	0.002	0.419	0.000	0.027	0.003	0.001	0.200	0.014	0.150
TC-8OUT-W-1	1/31/2001 20:52	1.25	114.42	38	6	0.003	0.569	0.000	0.034	0.004	0.001	0.222	0.019	0.189
TC-8OUT-W-1	1/31/2001 23:52	1.38	114.42	44	12	0.007	1.119	0.000	0.041	0.005	0.001	0.244	0.037	0.231
TC-8OUT-W-1	2/1/2001 2:52	1.50	115.81	53	21	0.012	2.056	0.000	0.049	0.006	0.001	0.266	0.068	0.275
TC-8OUT-W-1	2/1/2001 5:52	1.63	115.81	62	30	0.019	3.163	0.000	0.057	0.007	0.001	0.288	0.105	0.320
TC-8OUT-W-1	2/1/2001 8:52	1.75	115.81	75	43	0.027	4.556	0.001	0.065	0.008	0.001	0.311	0.151	0.366
TC-8OUT-W-1	2/1/2001 11:52	1.88	115.81	100	68	0.041	6.950	0.001	0.073	0.009	0.001	0.333	0.230	0.412
TC-8OUT-W-1	2/1/2001 14:52	2.00	115.81	132	100	0.062	10.519	0.001	0.081	0.010	0.000	0.355	0.348	0.458
TC-8OUT-W-1	2/1/2001 17:52	2.13	115.81	161	129	0.084	14.331	0.002	0.089	0.011	0.000	0.377	0.475	0.504
TC-8OUT-W-1	2/1/2001 20:52	2.25	115.81	186	154	0.104	17.706	0.002	0.097	0.012	0.000	0.399	0.586	0.548
TC-8OUT-W-2	2/1/2001 23:52	2.38	115.81	204	172	0.120	20.394	0.002	0.105	0.013	0.000	0.421	0.675	0.590
TC-8OUT-W-2	2/2/2001 2:52	2.50	116.19	213	181	0.130	22.081	0.003	0.112	0.014	0.000	0.444	0.731	0.630
TC-8OUT-W-2	2/2/2001 5:52	2.63	116.19	218	186	0.135	22.956	0.003	0.118	0.014	0.000	0.466	0.760	0.668
TC-8OUT-W-2	2/2/2001 8:52	2.75	116.19	224	192	0.139	23.644	0.003	0.125	0.015	0.000	0.488	0.783	0.703
TC-8OUT-W-2	2/2/2001 11:52	2.88	116.19	244	212	0.149	25.269	0.003	0.130	0.016	0.000	0.510	0.837	0.735
TC-8OUT-W-2	2/2/2001 15:52	3.04	116.19	254	222	0.160	36.192	0.004	0.137	0.022	0.000	0.540	0.899	0.774
TC-8OUT-W-2	2/2/2001 19:52	3.21	116.19	260	228	0.165	37.525	0.004	0.143	0.023	0.000	0.569	0.932	0.807
TC-8OUT-W-2	2/2/2001 23:52	3.37	116.19	267	235	0.170	38.608	0.004	0.148	0.024	0.000	0.599	0.959	0.836
TC-8OUT-W-2	2/3/2001 3:52	3.54	117.20	263	231	0.171	38.858	0.005	0.152	0.025	0.000	0.629	0.965	0.858
TC-8OUT-W-2	2/3/2001 7:52	3.71	117.20	258	226	0.168	38.108	0.004	0.155	0.026	0.000	0.658	0.947	0.876
TC-8OUT-W-3	2/3/2001 11:52	3.87	117.20	255	223	0.165	37.442	0.004	0.158	0.026	0.000	0.688	0.930	0.888
TC-8OUT-W-3	2/3/2001 15:52	4.04	117.20	245	213	0.160	36.358	0.004	0.159	0.026	0.000	0.717	0.903	0.895
TC-8OUT-W-3	2/3/2001 19:52	4.21	117.20	234	202	0.153	34.608	0.004	0.159	0.027	0.000	0.747	0.860	0.898
TC-8OUT-W-3	2/3/2001 23:52	4.37	117.20	230	198	0.147	33.358	0.004	0.159	0.027	0.000	0.776	0.829	0.897
TC-8OUT-W-3	2/4/2001 3:52	4.54	116.25	222	190	0.143	32.358	0.004	0.158	0.026	0.000	0.806	0.804	0.891
TC-8OUT-W-3	2/4/2001 7:52	4.71	116.25	215	183	0.137	31.108	0.004	0.157	0.026	0.000	0.836	0.773	0.882
TC-8OUT-W-3	2/4/2001 11:52	4.87	116.25	204	172	0.131	29.608	0.003	0.154	0.026	0.001	0.865	0.735	0.870
TC-8OUT-W-3	2/4/2001 15:52	5.04	116.25	186	154	0.120	27.192	0.003	0.152	0.026	0.001	0.895	0.675	0.855
TC-8OUT-W-3	2/4/2001 19:52	5.21	116.25	175	143	0.109	24.775	0.003	0.149	0.025	0.002	0.924	0.615	0.838
TC-8OUT-W-3	2/4/2001 23:52	5.37	116.25	174	142	0.105	23.775	0.003	0.145	0.024	0.002	0.954	0.591	0.818
TC-8OUT-W-4	2/5/2001 3:52	5.54	118.36	170	138	0.103	23.358	0.003	0.141	0.024	0.001	0.983	0.580	0.797
TC-8OUT-W-4	2/5/2001 19:52	6.21	118.36	142	110	0.091	82.767	0.010	0.124	0.088	0.001	1.102	0.514	0.698
TC-8OUT-W-4	2/6/2001 11:52	6.87	114.05	127	95	0.075	68.433	0.008	0.105	0.076	0.001	1.220	0.425	0.590
TC-8OUT-W-5	2/7/2001 3:52	7.54	114.53	115	83	0.065	59.433	0.007	0.086	0.064	0.000	1.338	0.369	0.485
TC-8OUT-W-5	2/7/2001 19:52	8.21	114.53	92	60	0.053	47.667	0.005	0.069	0.052	0.000	1.457	0.296	0.389
TC-8OUT-W-6	2/8/2001 11:52	8.87	114.22	88	56	0.043	38.600	0.004	0.054	0.041	0.000	1.575	0.240	0.306
TC-8OUT-W-6	2/9/2001 3:52	9.54	116.05	77	45	0.037	33.700	0.004	0.042	0.032	0.000	1.693	0.209	0.237
TC-8OUT-W-6	2/9/2001 23:52	10.37	116.05	73	41	0.032	35.750	0.004	0.030	0.030	0.000	1.841	0.178	0.168
TC-8OUT-W-7	2/10/2001 23:52	11.37	115.04	65	33	0.027	36.700	0.004	0.019	0.025	0.000	2.019	0.152	0.109
TC-8OUT-W-7	2/11/2001 23:52	12.37	118.44	60	28	0.022	30.500	0.004	0.012	0.016	0.000	2.196	0.126	0.069
TC-8OUT-W-8	2/12/2001 23:52	13.37	113.71	56	24	0.019	26.150	0.003	0.008	0.010	0.000	2.374	0.108	0.043
TC-8OUT-W-8	2/13/2001 23:52	14.37	114.55	52	21	0.016	22.300	0.003	0.005	0.006	0.000	2.551	0.092	0.026
TC-8OUT-W-8	2/14/2001 23:52	15.37	113.71	50	19	0.014	19.550	0.002	0.003	0.004	0.000	2.728	0.081	0.016
TC-8OUT-W-9	2/16/2001 17:52	17.12	114.69	49	17	0.013	31.063	0.004	0.001	0.003	0.000	3.039	0.073	0.006
TC-8OUT-W-9	2/18/2001 17:52	19.12	115.09	45	13	0.011	29.900	0.003	0.000	0.001	0.000	3.394	0.062	0.002
TC-8OUT-W-1	2/20/2001 17:52	21.12	115.48	45	13	0.010	25.900	0.003	0.000	0.000	0.000	3.749	0.054	0.001
TC-8OUT-W-1	2/22/2001 17:52	23.12	115.12	44	12	0.009	24.900	0.003	0.000	0.000	0.000	4.104	0.052	0.000
TC-8OUT-W-1	2/24/2001 17:52	25.12	114.86	42	10	0.008	22.400	0.003	0.000	0.000	0.000	4.459	0.046	0.000
TC-8OUT-W-E	2/27/2001 10:10	27.80	114.26	39	7	0.006	23.041	0.003	0.000	0.000	0.000	4.934	0.036	0.000
					Σ =	**3.912**	**1361.105**	**0.158**			**0.023**			

Mean residence time τ_a (d) =	**5.64**	**N^*t_i**
Mean detention time in one tank, t_i (d) =	**1.40**	**Solver**
Number of tanks N =	**4.02**	**Solver**
Dimensionless Variance =	**0.2486**	**1/N**
Wetland Dispersion Number $\mathcal{D}$ =	**0.1454**	**Solver**
Mass Recovery =	**81**	**%**
Volumetric Efficiency =	**0.91**	**τ_a/τ_n**

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathcal{D}$)

Dimensionless Variance Gues

Pe = 6.876292 0.2486

$\mathcal{D}$

0.1454

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

PSTA PHASE II **STC-13**

Volume of LiCl Solution Applied:	**2.50 L**	**Average Flo**	**115**	**m^3/d**
Concentration of Li Applied:	**78,457 mg/L**	**Cell Volume**	**729**	**m^3**
Mass of Li Applied:	**0.196 kg**	**Nominal HF**	**6.35**	**d**
Date/Time of Application:	**1/30/2001 14:38**	**Average HL**	**4.8**	**cm/d**

Background Li Concentration: **27.2 μg/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (μg/L)	Corrected Lithium Concentration (μg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
TC-13OUT-W-	1/30/2001 14:38	0.00	118.25	35	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TC-13OUT-W-	1/30/2001 17:38	0.13	118.25	35	8	0.005	0.956	0.000	0.000	0.000	0.000	0.027	0.022	0.001
TC-13OUT-W-	1/30/2001 20:38	0.25	118.25	35	8	0.005	0.956	0.000	0.002	0.000	0.000	0.054	0.022	0.007
TC-13OUT-W-	1/30/2001 23:38	0.38	118.25	33	6	0.004	0.850	0.000	0.005	0.000	0.000	0.081	0.020	0.021
TC-13OUT-W-	1/31/2001 2:38	0.50	113.15	34	6	0.004	0.769	0.000	0.009	0.001	0.000	0.107	0.018	0.043
TC-13OUT-W-	1/31/2001 5:38	0.63	113.15	34	7	0.004	0.831	0.000	0.016	0.002	0.000	0.134	0.019	0.073
TC-13OUT-W-	1/31/2001 8:38	0.75	113.15	34	7	0.004	0.881	0.000	0.023	0.002	0.000	0.161	0.020	0.109
TC-13OUT-W-	1/31/2001 11:38	0.88	113.15	34	7	0.004	0.881	0.000	0.033	0.004	0.001	0.188	0.020	0.152
TC-13OUT-W-	1/31/2001 14:38	1.00	113.15	34	7	0.004	0.844	0.000	0.043	0.005	0.002	0.215	0.019	0.200
TC-13OUT-W-	1/31/2001 17:38	1.13	113.15	34	7	0.004	0.831	0.000	0.054	0.006	0.003	0.242	0.019	0.252
TC-13OUT-W-	1/31/2001 20:38	1.25	113.15	34	7	0.004	0.862	0.000	0.066	0.007	0.004	0.268	0.020	0.306
TC-13OUT-W-	1/31/2001 23:38	1.38	113.15	94	67	0.023	4.606	0.001	0.078	0.009	0.003	0.295	0.106	0.361
TC-13OUT-W-	2/1/2001 2:38	1.50	114.55	152	125	0.059	11.963	0.001	0.090	0.010	0.001	0.322	0.275	0.417
TC-13OUT-W-	2/1/2001 5:38	1.63	114.55	202	175	0.092	18.725	0.002	0.101	0.012	0.000	0.349	0.431	0.471
TC-13OUT-W-	2/1/2001 8:38	1.75	114.55	247	220	0.122	24.663	0.003	0.113	0.013	0.000	0.376	0.567	0.524
TC-13OUT-W-	2/1/2001 11:38	1.88	114.55	255	228	0.138	27.975	0.003	0.123	0.015	0.000	0.403	0.644	0.575
TC-13OUT-W-	2/1/2001 14:38	2.00	114.55	258	231	0.142	28.663	0.003	0.134	0.016	0.000	0.429	0.659	0.622
TC-13OUT-W-	2/1/2001 17:38	2.13	114.55	259	232	0.143	28.913	0.003	0.143	0.017	0.000	0.456	0.665	0.666
TC-13OUT-W-	2/1/2001 20:38	2.25	114.55	210	183	0.128	25.913	0.003	0.152	0.018	0.001	0.483	0.596	0.706
TC-13OUT-W-	2/1/2001 23:38	2.38	114.55	347	320	0.155	31.413	0.004	0.159	0.019	0.000	0.510	0.723	0.743
TC-13OUT-W-	2/2/2001 2:38	2.50	114.93	373	346	0.205	41.600	0.005	0.166	0.020	0.002	0.537	0.957	0.774
TC-13OUT-W-	2/2/2001 5:38	2.63	114.93	366	339	0.211	42.788	0.005	0.172	0.021	0.002	0.564	0.984	0.802
TC-13OUT-W-	2/2/2001 8:38	2.75	114.93	353	326	0.205	41.538	0.005	0.177	0.022	0.001	0.590	0.956	0.825
TC-13OUT-W-	2/2/2001 11:38	2.88	114.93	363	336	0.204	41.350	0.005	0.181	0.022	0.001	0.617	0.951	0.844
TC-13OUT-W-	2/2/2001 15:38	3.04	114.93	357	330	0.205	55.467	0.006	0.185	0.031	0.000	0.653	0.957	0.863
TC-13OUT-W-	2/2/2001 19:38	3.21	114.93	338	311	0.198	53.383	0.006	0.188	0.031	0.000	0.689	0.921	0.875
TC-13OUT-W-	2/2/2001 23:38	3.37	114.93	341	314	0.193	52.050	0.006	0.189	0.031	0.000	0.725	0.898	0.880
TC-13OUT-W-	2/3/2001 3:38	3.54	115.93	323	296	0.188	50.800	0.006	0.189	0.031	0.000	0.760	0.876	0.880
TC-13OUT-W-	2/3/2001 7:38	3.71	115.93	302	275	0.176	47.550	0.006	0.188	0.031	0.000	0.796	0.820	0.874
TC-13OUT-W-	2/3/2001 11:38	3.87	115.93	298	271	0.168	45.467	0.005	0.185	0.031	0.000	0.832	0.784	0.863
TC-13OUT-W-	2/3/2001 15:38	4.04	115.93	288	261	0.164	44.300	0.005	0.182	0.031	0.000	0.868	0.764	0.847
TC-13OUT-W-	2/3/2001 19:38	4.21	115.93	228	201	0.142	38.467	0.004	0.178	0.030	0.001	0.903	0.664	0.828
TC-13OUT-W-	2/3/2001 23:38	4.37	115.93	238	211	0.127	34.300	0.004	0.173	0.029	0.002	0.939	0.592	0.806
TC-13OUT-W-	2/4/2001 3:38	4.54	114.99	230	203	0.128	34.467	0.004	0.168	0.028	0.002	0.975	0.595	0.781
TC-13OUT-W-	2/4/2001 7:38	4.71	114.99	220	193	0.122	32.967	0.004	0.162	0.027	0.002	1.011	0.569	0.754
TC-13OUT-W-	2/4/2001 11:38	4.87	114.99	211	184	0.116	31.383	0.004	0.156	0.026	0.002	1.047	0.541	0.726
TC-13OUT-W-	2/4/2001 15:38	5.04	114.99	211	184	0.113	30.633	0.004	0.149	0.025	0.001	1.082	0.529	0.696
TC-13OUT-W-	2/4/2001 19:38	5.21	114.99	209	182	0.113	30.467	0.004	0.143	0.024	0.001	1.118	0.526	0.665
TC-13OUT-W-	2/4/2001 23:38	5.37	114.99	178	151	0.103	27.717	0.003	0.136	0.023	0.001	1.154	0.478	0.634
TC-13OUT-W-	2/5/2001 3:38	5.54	117.10	174	147	0.092	24.800	0.003	0.129	0.022	0.001	1.190	0.428	0.603
TC-13OUT-W-	2/5/2001 19:38	6.21	117.10	139	112	0.080	86.200	0.010	0.103	0.078	0.001	1.333	0.372	0.481
TC-13OUT-W-	2/6/2001 11:38	6.87	112.78	132	105	0.067	72.200	0.008	0.080	0.061	0.000	1.476	0.311	0.371
TC-13OUT-W-	2/7/2001 3:38	7.54	113.27	107	80	0.057	61.533	0.007	0.060	0.047	0.000	1.619	0.265	0.279
TC-13OUT-W-	2/7/2001 19:38	8.21	113.27	92	65	0.045	48.167	0.005	0.044	0.035	0.000	1.762	0.208	0.205
TC-13OUT-W-	2/8/2001 11:38	8.87	112.95	68	40	0.032	35.033	0.004	0.032	0.025	0.000	1.905	0.151	0.148
TC-13OUT-W-	2/9/2001 3:38	9.54	114.79	57	30	0.022	23.533	0.003	0.023	0.018	0.000	2.048	0.102	0.105
TC-13OUT-W-	2/9/2001 23:38	10.37	114.79	57	30	0.019	25.000	0.003	0.014	0.015	0.000	2.227	0.086	0.067
TC-13OUT-W-	2/10/2001 23:38	11.37	113.77	54	26	0.017	28.100	0.003	0.008	0.011	0.000	2.442	0.081	0.038
TC-13OUT-W-	2/11/2001 23:38	12.37	117.18	46	19	0.014	22.600	0.003	0.005	0.006	0.000	2.657	0.065	0.021
TC-13OUT-W-	2/12/2001 23:38	13.37	112.44	44	16	0.011	17.600	0.002	0.003	0.004	0.000	2.871	0.051	0.012
TC-13OUT-W-	2/13/2001 23:38	14.37	113.28	43	16	0.010	16.100	0.002	0.001	0.002	0.000	3.086	0.046	0.006
TC-13OUT-W-	2/14/2001 23:38	15.37	112.44	42	15	0.009	15.300	0.002	0.001	0.001	0.000	3.301	0.044	0.003
TC-13OUT-W-	2/16/2001 17:38	17.12	113.42	41	14	0.009	25.113	0.003	0.000	0.001	0.000	3.676	0.041	0.001
TC-13OUT-W-	2/18/2001 17:38	19.12	113.82	46	19	0.010	32.400	0.004	0.000	0.000	0.000	4.106	0.047	0.000
TC-13OUT-W-	2/20/2001 17:38	21.12	114.20	41	13	0.010	31.900	0.004	0.000	0.000	0.000	4.535	0.046	0.000
TC-13OUT-W-	2/22/2001 17:38	23.12	113.86	38	11	0.008	24.400	0.003	0.000	0.000	0.000	4.965	0.035	0.000
TC-13OUT-W-	2/24/2001 17:38	25.12	113.61	38	10	0.007	21.300	0.002	0.000	0.000	0.000	5.394	0.031	0.000
TC-13OUT-W-	2/27/2001 10:35	27.83	113.00	32	5	0.005	20.432	0.002	0.000	0.000	0.000	5.975	0.022	0.000
					Σ =	**4.650**	**1619.897**	**0.186**			**0.034**			

Mean residence time τ_a (d) =	**4.66**	**$N*t_i$**
Mean detention time in one tank, t_i (d) =	**1.22**	**Solver**
Number of tanks N =	**3.82**	**Solver**
Dimensionless Variance =	**0.2620**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**0.1550**	**Solver**
Mass Recovery =	**95**	**%**
Volumetric Efficiency =	**0.73**	**τ_a/τ_n**

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Dimensionless Variance Guess

Pe = 6.452418 0.261999

$\mathscr{D}$

0.1550

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

PSTA PHASE II **PP-16**

Volume of LiCl Solution Applied:	**0.01 L**	**Average Flo**	**0.23**	**m^3/d**
Concentration of Li Applied:	**78,457 mg/L**	**Cell Volume**	**1.80**	**m^3**
Mass of Li Applied:	**0.001 kg**	**Nominal HR**	**7.82**	**d**
Date/Time of Application:	**1/30/2001 13:00**	**Average HL**	**3.8**	**cm/d**

Background Li Concentration: **33.3 μg/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (μg/L)	Corrected Lithium Concentration (μg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
PP-16-OUT-1	1/30/2001 13:00	0.00	0.43	34	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PP-16-OUT-2	1/30/2001 16:00	0.13	0.43	312	279	0.068	17.488	0.000	0.124	0.008	0.003	0.019	0.456	0.829
PP-16-OUT-3	1/30/2001 19:00	0.25	0.43	342	309	0.143	36.713	0.000	0.127	0.016	0.000	0.037	0.957	0.853
PP-16-OUT-4	1/30/2001 22:00	0.38	0.43	343	310	0.151	38.650	0.000	0.128	0.016	0.000	0.056	1.008	0.859
PP-16-OUT-5	1/31/2001 1:00	0.50	0.29	329	296	0.147	37.838	0.000	0.128	0.016	0.000	0.075	0.987	0.859
PP-16-OUT-6	1/31/2001 4:00	0.63	0.29	319	286	0.142	36.338	0.000	0.128	0.016	0.000	0.093	0.948	0.855
PP-16-OUT-7	1/31/2001 7:00	0.75	0.29	313	280	0.138	35.338	0.000	0.127	0.016	0.000	0.112	0.921	0.849
PP-16-OUT-8	1/31/2001 10:00	0.88	0.29	308	275	0.135	34.650	0.000	0.126	0.016	0.000	0.131	0.904	0.841
PP-16-OUT-9	1/31/2001 13:00	1.00	0.29	300	267	0.132	33.838	0.000	0.124	0.016	0.000	0.149	0.882	0.832
PP-16-OUT-10	1/31/2001 16:00	1.13	0.29	290	257	0.128	32.713	0.000	0.123	0.015	0.000	0.168	0.853	0.822
PP-16-OUT-11	1/31/2001 19:00	1.25	0.29	283	250	0.123	31.650	0.000	0.121	0.015	0.000	0.187	0.825	0.812
PP-16-OUT-12	1/31/2001 22:00	1.38	0.29	281	248	0.121	31.088	0.000	0.120	0.015	0.000	0.206	0.811	0.801
PP-16-OUT-13	2/1/2001 1:00	1.50	0.15	276	243	0.119	30.650	0.000	0.118	0.015	0.000	0.224	0.799	0.790
PP-16-OUT-14	2/1/2001 4:00	1.63	0.15	272	239	0.117	30.088	0.000	0.116	0.015	0.000	0.243	0.785	0.779
PP-16-OUT-15	2/1/2001 7:00	1.75	0.15	263	230	0.114	29.275	0.000	0.115	0.014	0.000	0.262	0.763	0.767
PP-16-OUT-16	2/1/2001 10:00	1.88	0.15	260	227	0.111	28.525	0.000	0.113	0.014	0.000	0.280	0.744	0.756
PP-16-OUT-17	2/1/2001 13:00	2.00	0.15	256	223	0.109	28.088	0.000	0.111	0.014	0.000	0.299	0.732	0.744
PP-16-OUT-18	2/1/2001 16:00	2.13	0.15	250	217	0.107	27.463	0.000	0.109	0.014	0.000	0.318	0.716	0.732
PP-16-OUT-19	2/1/2001 19:00	2.25	0.15	247	214	0.105	26.900	0.000	0.108	0.014	0.000	0.336	0.701	0.721
PP-16-OUT-20	2/1/2001 22:00	2.38	0.15	240	207	0.102	26.275	0.000	0.106	0.013	0.000	0.355	0.685	0.709
PP-16-OUT-21	2/2/2001 1:00	2.50	0.16	234	201	0.099	25.463	0.000	0.104	0.013	0.000	0.374	0.664	0.698
PP-16-OUT-22	2/2/2001 4:00	2.63	0.16	228	195	0.096	24.713	0.000	0.103	0.013	0.000	0.392	0.644	0.686
PP-16-OUT-23	2/2/2001 7:00	2.75	0.16	224	191	0.094	24.088	0.000	0.101	0.013	0.000	0.411	0.628	0.675
PP-16-OUT-24	2/2/2001 10:00	2.88	0.16	222	189	0.092	23.713	0.000	0.099	0.013	0.000	0.430	0.618	0.663
PP-16-OUT-25	2/2/2001 14:00	3.04	0.16	219	186	0.091	31.200	0.000	0.097	0.016	0.000	0.455	0.610	0.649
PP-16-OUT-26	2/2/2001 18:00	3.21	0.16	212	179	0.089	30.367	0.000	0.095	0.016	0.000	0.480	0.594	0.634
PP-16-OUT-27	2/2/2001 22:00	3.37	0.16	208	175	0.086	29.450	0.000	0.093	0.016	0.000	0.505	0.576	0.619
PP-16-OUT-28	2/3/2001 2:00	3.54	0.18	204	171	0.084	28.783	0.000	0.090	0.015	0.000	0.529	0.563	0.605
PP-16-OUT-29	2/3/2001 6:00	3.71	0.18	200	167	0.082	28.117	0.000	0.088	0.015	0.000	0.554	0.550	0.591
PP-16-OUT-30	2/3/2001 10:00	3.87	0.18	197	164	0.080	27.533	0.000	0.086	0.015	0.000	0.579	0.538	0.577
PP-16-OUT-31	2/3/2001 14:00	4.04	0.18	195	162	0.079	27.117	0.000	0.084	0.014	0.000	0.604	0.530	0.564
PP-16-OUT-32	2/3/2001 18:00	4.21	0.18	187	154	0.077	26.283	0.000	0.082	0.014	0.000	0.629	0.514	0.550
PP-16-OUT-33	2/3/2001 22:00	4.37	0.18	184	151	0.074	25.367	0.000	0.080	0.014	0.000	0.654	0.496	0.537
PP-16-OUT-34	2/4/2001 2:00	4.54	0.19	181	148	0.073	24.867	0.000	0.078	0.013	0.000	0.679	0.486	0.525
PP-16-OUT-35	2/4/2001 6:00	4.71	0.19	182	149	0.072	24.700	0.000	0.077	0.013	0.000	0.704	0.483	0.512
PP-16-OUT-36	2/4/2001 10:00	4.87	0.19	178	145	0.071	24.450	0.000	0.075	0.013	0.000	0.729	0.478	0.500
PP-16-OUT-37	2/4/2001 14:00	5.04	0.19	176	143	0.070	23.950	0.000	0.073	0.012	0.000	0.754	0.468	0.488
PP-16-OUT-38	2/4/2001 18:00	5.21	0.19	173	140	0.069	23.533	0.000	0.071	0.012	0.000	0.779	0.460	0.476
PP-16-OUT-39	2/4/2001 22:00	5.37	0.19	171	138	0.068	23.117	0.000	0.069	0.012	0.000	0.803	0.452	0.465
PP-16-OUT-40	2/5/2001 2:00	5.54	0.20	169	136	0.067	22.783	0.000	0.068	0.011	0.000	0.828	0.446	0.453
PP-16-OUT-44	2/5/2001 18:00	6.21	0.20	160	127	0.064	87.467	0.000	0.061	0.043	0.000	0.928	0.428	0.411
PP-16-OUT-48	2/6/2001 10:00	6.87	0.22	154	121	0.060	82.467	0.000	0.056	0.039	0.000	1.028	0.403	0.372
PP-16-OUT-52	2/7/2001 2:00	7.54	0.23	144	111	0.056	77.133	0.000	0.050	0.035	0.000	1.127	0.377	0.336
PP-16-OUT-56	2/7/2001 18:00	8.21	0.23	138	105	0.052	71.800	0.000	0.045	0.032	0.000	1.227	0.351	0.304
PP-16-OUT-60	2/8/2001 10:00	8.87	0.24	129	96	0.049	66.800	0.000	0.041	0.029	0.000	1.327	0.327	0.275
PP-16-OUT-64	2/9/2001 2:00	9.54	0.30	116	83	0.043	59.467	0.000	0.037	0.026	0.000	1.426	0.291	0.248
PP-16-OUT-68	2/9/2001 22:00	10.37	0.30	106	73	0.038	64.750	0.000	0.033	0.029	0.000	1.551	0.253	0.219
PP-16-OUT-72	2/10/2001 22:00	11.37	0.35	85	52	0.030	62.250	0.000	0.028	0.030	0.000	1.700	0.203	0.188
PP-16-OUT-76	2/11/2001 22:00	12.37	0.40	77	44	0.023	47.950	0.000	0.024	0.026	0.000	1.850	0.156	0.161
PP-16-OUT-80	2/12/2001 22:00	13.37	0.45	71	38	0.020	41.050	0.000	0.021	0.022	0.000	1.999	0.134	0.138
PP-16-OUT-84	2/13/2001 22:00	14.37	0.39	67	34	0.017	35.850	0.000	0.018	0.019	0.000	2.149	0.117	0.118
PP-16-OUT-88	2/14/2001 22:00	15.37	0.33	64	30	0.016	31.950	0.000	0.015	0.016	0.000	2.298	0.104	0.101
PP-16-OUT-92	2/16/2001 16:00	17.12	0.24	59	26	0.014	49.088	0.000	0.012	0.023	0.000	2.560	0.091	0.077
PP-16-OUT-96	2/18/2001 16:00	19.12	0.18	55	22	0.012	48.000	0.000	0.008	0.020	0.000	2.859	0.078	0.056
PP-16-OUT-10	2/20/2001 16:00	21.12	0.11	55	21	0.011	43.400	0.000	0.006	0.015	0.000	3.158	0.071	0.041
PP-16-OUT-10	2/22/2001 16:00	23.12	0.10	51	18	0.010	39.200	0.000	0.005	0.011	0.000	3.457	0.064	0.030
PP-16-OUT-10	2/24/2001 16:00	25.12	0.13	46	13	0.007	30.600	0.000	0.003	0.008	0.000	3.756	0.050	0.022
					Σ =	**4.451**	**2052.375**	**0.000**			**0.006**			

Mean residence time τ_a (d) =	**6.69**	**N^*t_i**
Mean detention time in one tank, t_i (d) =	**6.26**	**Solver**
Number of tanks N =	**1.07**	**Solver**
Dimensionless Variance =	**0.9354**	**1/N**
Wetland Dispersion Number $\mathscr{D}$ =	**4.9075**	**Solver**
Mass Recovery =	**62**	**%**
Volumetric Efficiency =	**0.86**	**τ_a/τ_n**

Excel Solver Routine Used to determine Peclet Number. (Pe = 1/$\mathscr{D}$)

Dimensionless Variance Guess

Pe = 0.20377 0.9354

$\mathscr{D}$

4.9075

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))

APPENDIX G.3

Phase 3 Tracer Test Data

APPENDIX G.3.1

Periphyton-Based Stormwater Treatment Area Project: Phase 3 Tracer Study Results (FSC-2 and FSC-4)

Hydraulic tracer studies were conducted at the PSTA Field Scale site (cells FSC2 and FSC4) between March 11, 2002, and April 1, 2002. These studies were performed to evaluate the hydraulic characteristics of the 5-acre wetland cells, to estimate the fraction of the applied flow that is lost through seepage, and to identify leaks between cells. This memorandum summarizes the results of these analyses.

G.3.1.1 Materials and Methods

Tracer spike solutions were prepared using a combination of a lithium chloride brine solution (nominally 35 percent LiCl) and Rhodamine WT (nominally 20 percent active ingredient). The distribution of lithium ion concentrations in the cell outflows were used to estimate hydraulic characteristics, while the Rhodamine was used as a visual tracer to detect leaks. Tracer volumes of 56.8 liters (L) LiCl and 7.6 L of Rhodamine were applied to each cell to achieve approximate well-mixed target tracer concentrations of 0.50 milligrams per liter (mg/L) as Lithium ion and 0.25 mg/L as Rhodamine. The culverts between the inflow supply canal and the pump wet wells were temporarily blocked using plastic bags and cable ties. The tracer solutions for each cell were poured directly into the wet wells and pumped into the cells. After the wet wells were pumped down, transferring the tracer into the cells, the plastic bags were removed to restore flow. The tracer solutions were applied to each cell over a period of about 10 minutes.

Automated ISCO samplers (Model 3700) were deployed at the outlets from each cell and were programmed to collect 125 milliliters (mL) samples at an initial interval of 3 hours. The time intervals were adjusted over the course of the study. The filled ISCO bottles were capped and replaced with clean bottles following each programmed cycle. Grab samples were collected at the outflows from the adjacent cells (FSC1 and FSC3) to detect cell-to-cell leaks. Groundwater well and seepage canal samples were also collected during the study.

Lithium samples were sent to PPB Laboratories in Gainesville, Florida for analysis. Lithium samples were chilled with ice for shipment to the laboratory. No other preservative was used for the lithium samples. Rhodamine samples were inspected visually on site.

Hourly cell outflow rates were measured with existing flow meters and data loggers.

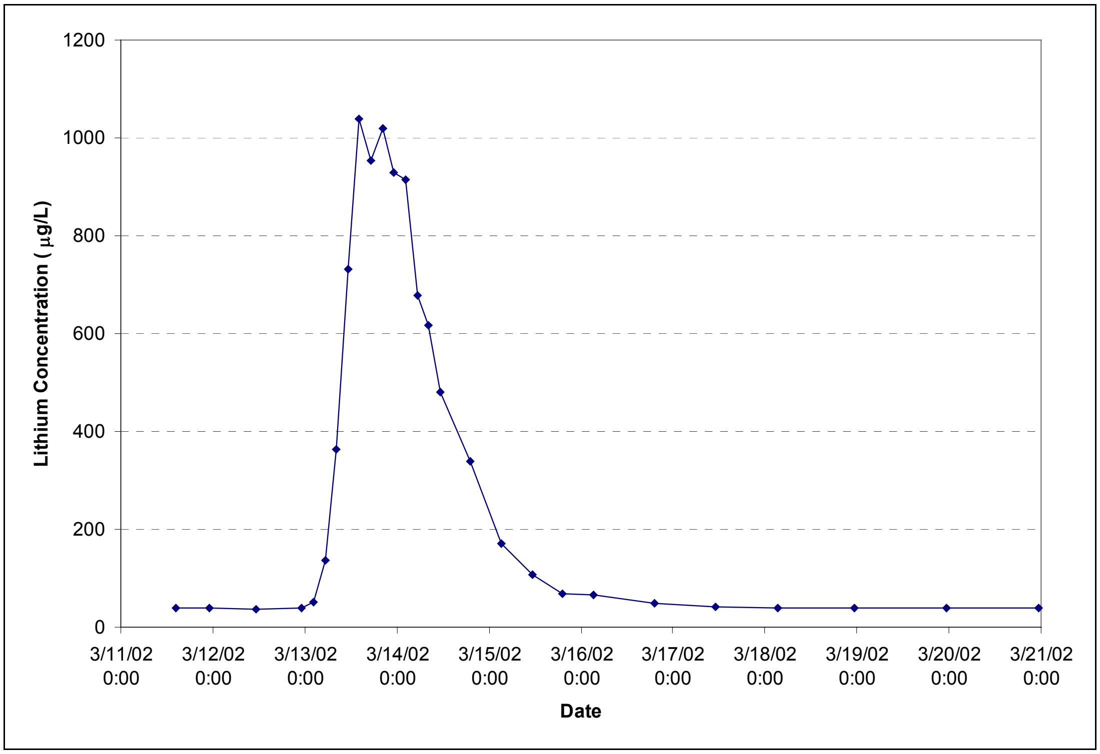
In conjunction with CH2M HILL's studies, researchers from the University of Florida Institute of Food and Agricultural Sciences (IFAS) collaborated with the South Florida Water Management District (SFWMD) to collect spatial lithium samples and internal velocity measurements. IFAS' summary memorandum is attached (Jawitz and White, 2002).

G.3.1.2 Results and Discussion

The tracer study data were interpreted following the gamma distribution method summarized by Kadlec (2001). Appendix A presents the data collected for each experiment.

Exhibits G.3.1-1 and G.3.1-2 show the tracer response curves (concentration versus time) for FSC2 and FSC4, respectively. Exhibit G.3.1-3 summarizes the hydraulic characteristics for each cell, as determined via this study.

EXHIBIT G.3.1-1
FSC2 Tracer Response Curve



Both studies exhibited poor mass recoveries caused by significant seepage losses. Although the number of tanks-in-series (N) was high for both cells, indicating excellent hydraulic performance, the magnitude of the water losses limits the utility of these parameters for predictive phosphorus removal modeling. FSC2 did have a much higher N value than FSC4 (25 tanks versus 9 tanks) as a result of the longer flow path provided by the interior berms. The similarity between nominal residence times based on inflow rates, and mean residence times, is an artifact of the leaky water balance.

EXHIBIT G.3.1-2
FSC4 Tracer Response Curve

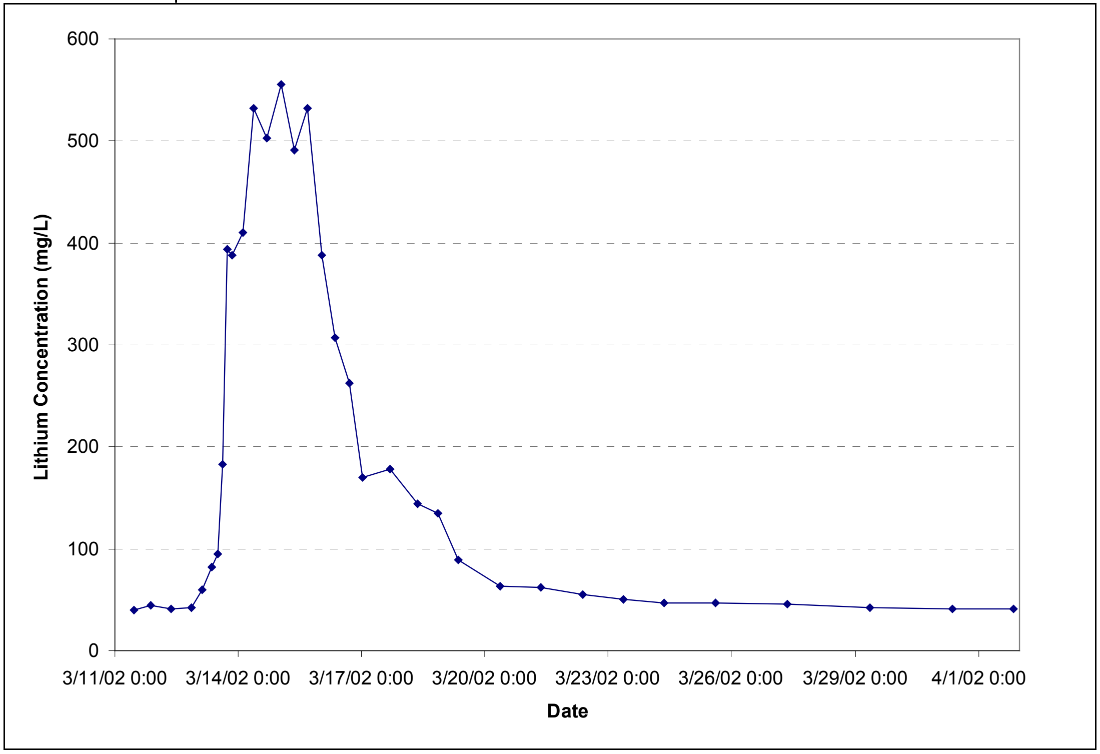


EXHIBIT G.3.1-3
Summary of Tracer Study Results

Parameter	FSC2	FSC4
Average Volume (m^3)	5,900	6,300
Average Inflow (m^3/d)	2,084	1,445
Average Outflow (m^3/d)	1,429	170
Nominal HRT (d)	2.8	4.4
Mean HRT, τ (d)	2.5	4.2
Number of Tanks, N	25.1	9.3
Volumetric Efficiency, %	60	11
Dimensionless Variance	0.04	0.11
Dispersion Number, $\mathscr{D}$	0.02	0.06
Mass Recovery (%)	45	6

Groundwater samples were collected from the interior and perimeter monitor wells during the study to investigate whether tracer could be detected in water below the wetland cells. Rhodamine was never visually observed in any of the groundwater samples. Lithium samples were sent to the laboratory to confirm the field observations. Groundwater lithium concentrations ranged from 0.015 mg/L to 0.034 mg/L. These values are similar to background surface water concentrations collected prior to tracer introduction and can not be used to confirm that vertical seepage represents a major component of the water balance.

Outlfow grab samples were collected from the adjacent cells (i.e. cells without direct application of tracer) to determine whether significant cross-talk between cells occurred. Lithium concentrations in these samples were similar to backround levels, ranging from 0.024 mg/L to 0.034 mg/L, and do not indicate that cross-talk is a major complicating factor in the water and mass balances. Individual sample results are summarized in Exhibit G.3.1-4.

EXHIBIT G.3.1-4
Lithium Concentrations in Groundwater Wells and Outflows from Adjacent Cells FSC-1 and FSC-3.

Station	Lithium Concentration (mg/L)					
	3/12/02	3/13/02	3/14/02	3/19/02	3/26/02	4/2/02
WELL-1-IN	0.028	0.025	0.029	0.024	--	0.023
WELL-1-CENTER	0.026	0.021	0.025	0.018	--	0.021
WELL-1-OUT	0.022	0.020	0.025	0.021	--	0.018
WELL-1-BERM	0.023	0.019	0.030	0.030	--	0.023
WELL-2-CENTER	0.029	0.024	0.026	0.029	--	0.018
WELL-3-IN	0.020	0.026	0.028	0.022	--	0.018
WELL-3-CENTER	0.025	0.015	0.020	0.015	--	0.016
WELL-3-OUT	0.027	0.025	0.031	0.025	--	0.026
WELL-4-CENTER	0.032	0.025	0.025	0.024	--	0.025
WELL-4-BERM	0.028	0.027	0.028	0.029	--	0.034
FSC1-OUTFLOW	0.028	0.028	0.027	0.027	0.024	--
FSC3-OUTFLOW	0.029	0.033	0.034	0.031	0.029	--

-- No sample collected

During the first week of the tracer studies, Rhodamine was observed leaking from both cells back into the inflow canal through the perimeter berm. Substantial leaks were also observed along the western edge of FSC2, with the entire seepage canal between FSC2 and FSC3 turning red by the end of the second day of studies. Exhibit G.3.1-5 shows the approximate location of these leaks. The flow rates of the leaks were not quantified, but based upon dye distribution, appear to represent a significant water loss from the system. Exhibits G.3.1-6 and G.3.1-7 provide photographic examples of the leaks in the inflow berm and from FSC2 to the seepage canal, respectively.

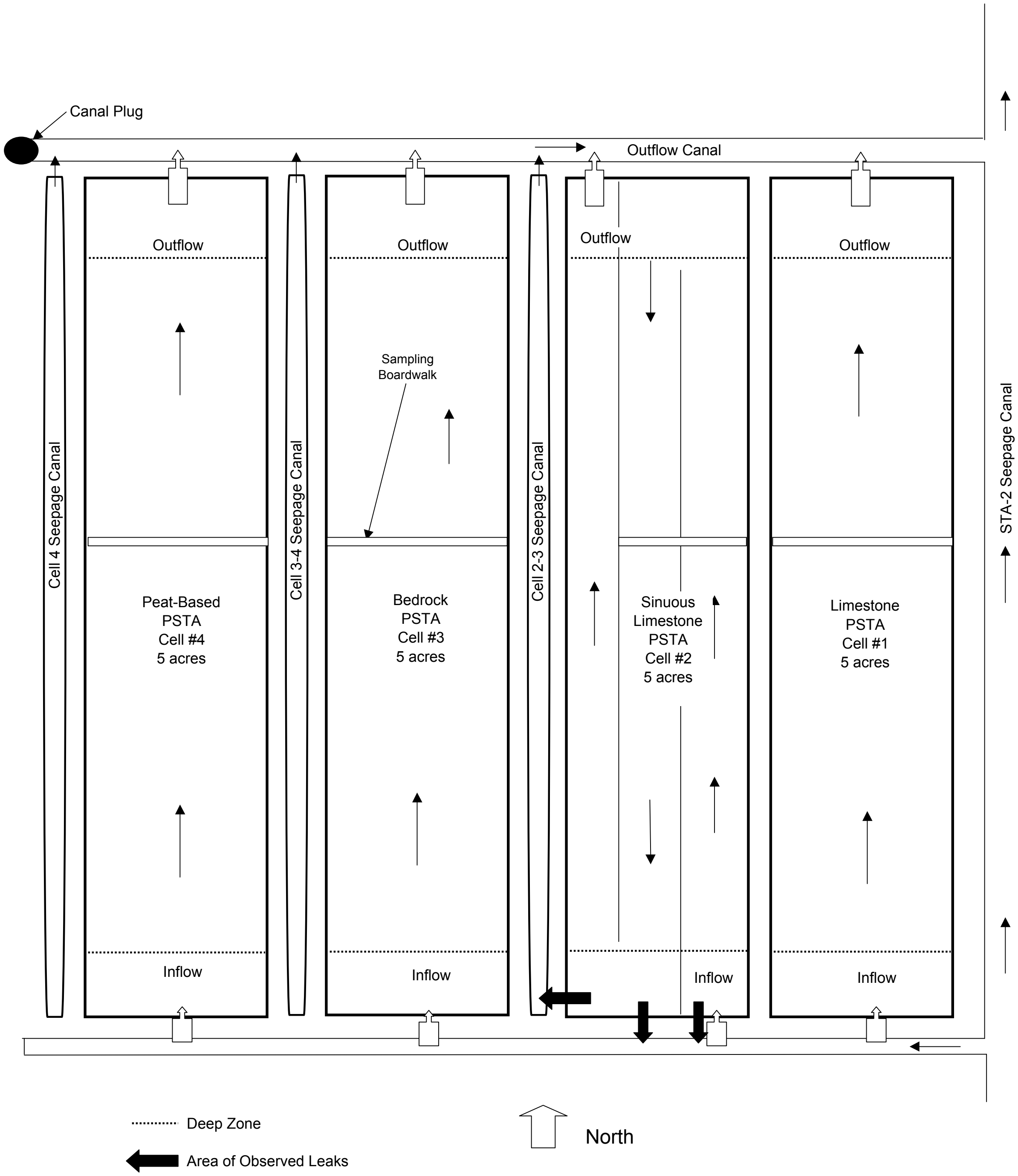


Exhibit G.3.1-5

Schematic of Field-Scale Cells Showing Locations of Observed Berm Leaks

EXHIBIT G.3.1-6
Rhodamine Dye Leaking from FSC2 Inflow Berm to Inflow Canal (3/15/2002).

EXHIBIT G.3.1-7
Rhodamine Dye Leaking from West FSC2 Berm to Seepage Canal (3/15/2002).

Rhodamine dye was also useful in showing the positive flow distribution effects of dense spikerush bands located near the inlets of each cell. Exhibit G.3.1-8 shows the initial tracer application at FSC2 indicating that the spikerush bands were effective in spreading the tracer throughout the inflow deep zones before moving downstream.

EXHIBIT G.3.1-8
Rhodamine Dye Dispersing through Inlet Deep Zone and Spikerush Bands Providing Resistance to Flow.

The SFWMD provided aerial photographs of the site on the second day following tracer application. These photographs were useful for detecting the presence or absence of dominant flow paths within the cells. Exhibit G.3.1-9 shows an example aerial photograph.

EXHIBIT G.3.1-9
Aerial Photograph Showing Uniform Movement of Tracer through FSC2. Tracer in FSC4 Slightly Favors the Eastern Side of FSC4 at the Left Edge of the Image.

G.3.1.3 Summary of IFAS and SFWMD Studies

IFAS established a mid-point transect in FSC-2 and four transects in FSC-4. All transects were oriented perpendicular to the direction of flow. Two sampling stations were located along the transect in each of three channels in FSC-2. Five evenly-spaced stations were located along each transect in FSC-4. The attached status report prepared by IFAS shows the approximate locations of the transects and are expressed in terms of the longitudinal distance from the inlet.

IFAS generated breakthrough curves to determine the time for the peak of the tracer distribution to arrive at each transect. IFAS reported mean velocities of 438 meters/day (m/d) and 93.5 m/d for FSC-2 and FSC-4, respectively (Jawitz and White, 2002). The CH2M HILL results were compared to the IFAS results by dividing the total length of the flow path (FSC-2 = 948 m; FSC-4 = 319 m) by the time to the observed peak of the tracer distributions shown in Exhibits G.3-1 and 2 (FSC-2 = 2.0 days; FSC-4 = 3.6 days). The CH2M HILL results are similar with velocities of 474 m/d for FSC-2 and 88.6 m/d for FSC-4.

Physical velocity measurements collected by the SFWMD along the same transects established for the spatial lithium sampling were inconclusive.

G.3.1.4 Conclusions

The following conclusions can be reached from the results of these studies:

- The internal berms in FSC2 appear to improve hydraulic performance.
- Rhodamine dye is useful for detecting the presence of berm leaks and evaluating internal hydraulics.
- Low mass recoveries and the visual detection of tracer in the inflow and seepage canals indicate that significant water losses occur between the inlet and outlet of each cell.
- Because groundwater and adjacent cell samples did not show elevated tracer concentrations, bank (berm) seepage may be the dominant pathway for indirectly measured water losses at the site.

G.3.1.5 References

Jawitz, J.W., and J.R. White. *Hydraulic Performance Evaluation of Periphyton Treatment Cells for the Removal of Phosphorus from Surface Waters Entering the Everglades*. Status Report prepared for the South Florida Water Management District, March 28, 2002.

Kadlec, R.H., 2001. *Tracer Testing of Green Technologies*. Memorandum, February 4, 2001.

APPENDIX G.3.2

Periphyton-Based Stormwater Treatment Area Project: Phase 3 Tracer Study Results (FSC-1 and FSC-3)

Hydraulic tracer studies were conducted at the PSTA Field-Scale site (cells FSC-1 and FSC-3) between October 29, 2002, and November 13, 2002. These studies were performed to evaluate the hydraulic characteristics of the 5-acre wetland cells, to estimate the fraction of the applied flow that is lost through seepage, and to identify obvious locations of hydraulic communication between cells. This appendix summarizes the results of these analyses. For reference, a separate TM addressing comparable testing of FSC-2 and FSC-4 was provided to South Florida Water Management District (SFWMD) in October 2002 and is provided in Appendix G.3.1.

G.3.2.1 Materials and Methods

Tracer spike solutions were prepared using a combination of a lithium chloride (LiCl) brine solution (nominally 35 percent LiCl) and Rhodamine WT (nominally 20 percent active ingredient). The distribution of lithium ion concentrations in the cell outflows was used to estimate hydraulic characteristics, while the Rhodamine was used as a visual tracer to detect obvious areas of lateral seepage. Tracer volumes of 56.8 liters (L) LiCl and 7.6 L of Rhodamine were applied to each cell to achieve approximate well-mixed target tracer concentrations of 0.50 milligrams per liter (mg/L) as lithium ion and 0.25 mg/L as Rhodamine. The culverts between the inflow supply canal and the pump wet wells were temporarily blocked using plastic bags and cable ties. The tracer solutions for each cell were poured directly into the wet wells and pumped into the cells. After the wet wells were pumped down, transferring the tracer into the cells, the plastic bags were removed to restore flow. The tracer solutions were applied to each cell for approximately 10 minutes.

Automated ISCO samplers (Model 3700) were deployed at the outlet from each cell and were programmed to collect 125 milliliter (mL) samples at an initial interval of 3 hours. The time intervals were adjusted during the course of the study. The filled ISCO bottles were capped and replaced with clean bottles following each programmed cycle. Grab samples were collected at the outflows from the adjacent cells (FSC-2 and FSC-4) to detect evidence of cell-to-cell hydraulic connection. Groundwater well and seepage canal samples were also collected during the study.

Lithium samples were sent to PPB Laboratories in Gainesville, Florida, for analysis. Lithium samples were chilled with ice for shipment to the laboratory. No other preservative was used for the lithium samples. Rhodamine samples were inspected visually onsite.

Hourly cell inflow rates were measured with existing flow meters and data loggers.

In conjunction with CH2M HILL's studies, researchers from the SFWMD collected spatial lithium samples for separate analysis and reporting. At present, results of the District's work are not available.

G.3.2.2 Results and Discussion

The tracer study data were interpreted following the gamma distribution method summarized by Kadlec (2001). The attachment presents the data collected for each experiment.

Exhibits G.3.2-1 and G.3.2-2 show the tracer response curves (concentration versus time) for FSC-1 and FSC-3, respectively. Exhibit G.3.2-3 summarizes the hydraulic characteristics for each cell, as determined by this study.

EXHIBIT G.3.2-1
FSC-1 Tracer Response Curve

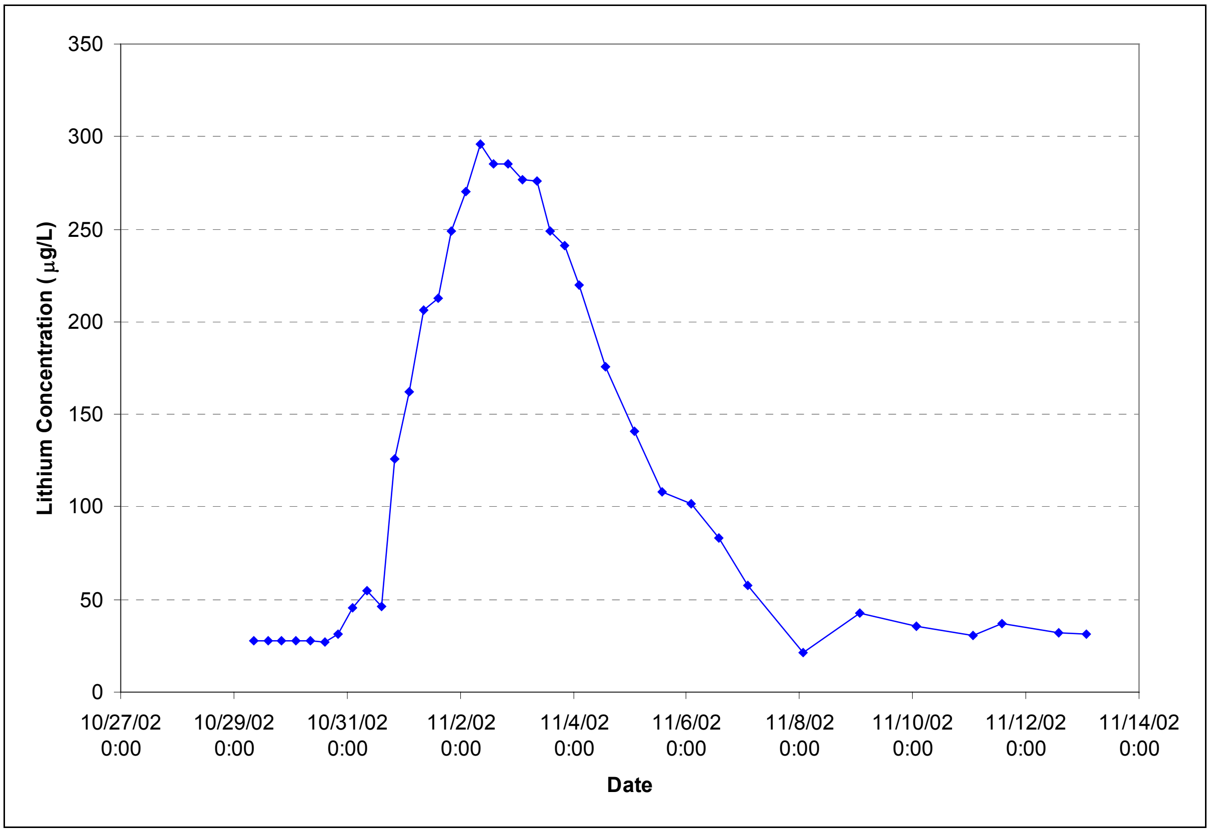


EXHIBIT G.3.2-2
FSC-3 Tracer Response Curve

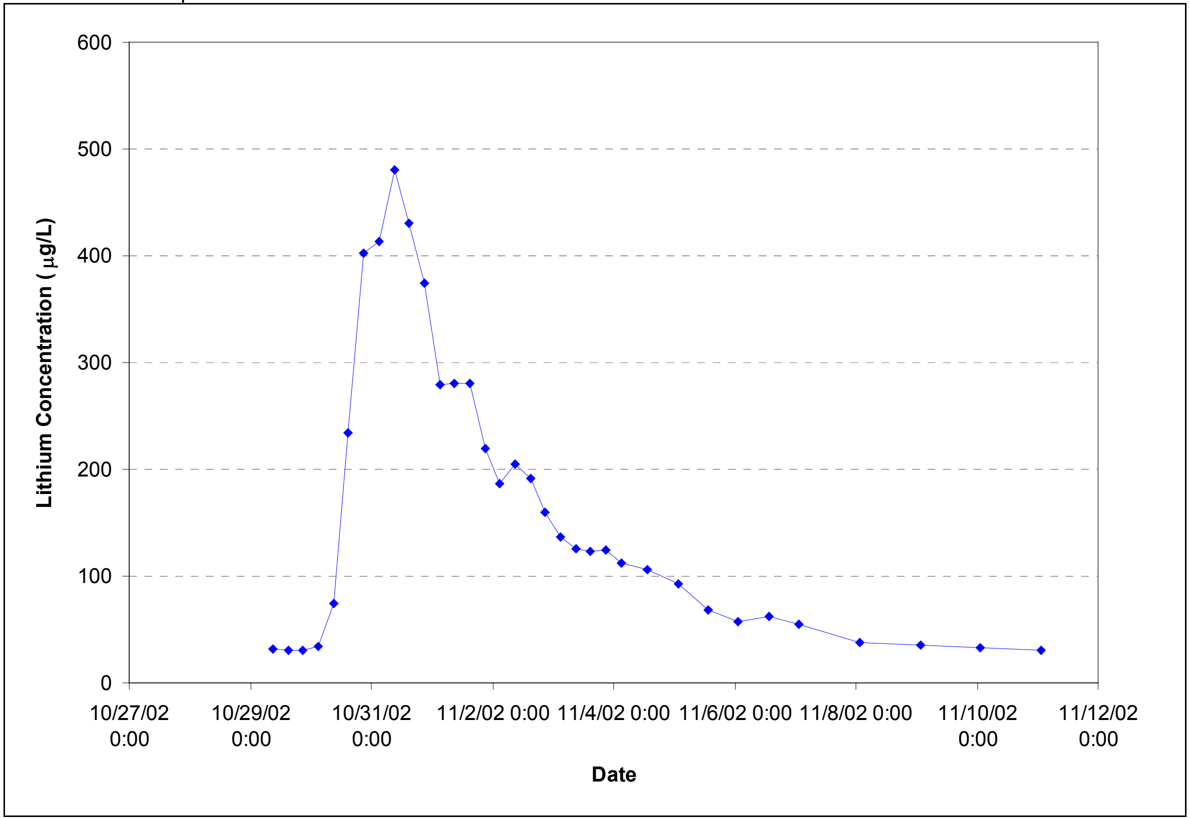


EXHIBIT G.3.2-3
Tracer Study Results

Parameter	FSC-1	FSC-3
Average Volume (m^3)	8,300	7,650
Average Inflow (m^3/d)	2,875	3,160
Average Outflow (m^3/d)	1,423	3,097
Nominal HRT (d)	2.9	2.4
Mean HRT, τ (d)	5.1	3.0
Number of Tanks, N	9.0	4.5
Volumetric Efficiency, %	88	123
Dimensionless Variance	0.11	0.22
Dispersion Number, D	0.06	0.13
Mass Recovery (%)	46	101

The experiment for FSC-1 exhibited a poor mass recovery (46 percent) caused by significant seepage losses, while the experiment for FSC-3 had an excellent mass recovery (101 percent). Water balance data for FSC-3 support the high mass recovery observed during the study. The number of tanks-in-series (N) was good for both cells, indicating excellent hydraulic performance, with 9 tanks for FSC-1 and 4 tanks for FSC-3. The N-value for FSC-1 is probably over-estimated and is an artifact of the poor mass recovery.

Groundwater samples were collected from the interior and perimeter monitor wells during the study to investigate whether tracer could be detected in water below the wetland cells. Rhodamine was never visually observed in any of the groundwater samples. Lithium samples were sent to the laboratory to confirm the field observations.

Exhibit G.3.2-4 presents a summary of the well data. Groundwater lithium concentrations ranged from 0.024 mg/L to 0.041 mg/L. These values are similar to background surface water concentrations collected prior to tracer introduction and cannot be used to confirm that vertical seepage represents a major component of the water balance. The data for the well adjacent to the FSC-1 inflow structure showed an increasing trend that may be related to observed seepage through the berm to the inflow canal.

EXHIBIT G.3.2-4
Lithium Concentrations in Groundwater Wells

	Lithium Concentration (mg/L)		
Station	**10/29/2002**	**10/30/2002**	**10/31/2002**
WELL-1-IN	0.028	0.041	0.052
WELL-1-CENTER	0.036	0.036	0.030
WELL-1-OUT	0.025	0.025	0.024
WELL-1-BERM	--	0.039	0.038
WELL-2-CENTER	0.029	0.035	--
WELL-3-IN	0.031	0.031	0.031
WELL-3-CENTER	0.038	0.038	0.037
WELL-3-OUT	0.033	0.033	0.032
WELL-4-CENTER	--	0.037	--
WELL-4-BERM	--	0.031	--

Note:

-- = No sample collected

Outflow grab samples were collected from the adjacent cells (i.e., cells without direct application of tracer) to determine whether significant “cross-talk” between cells occurred. Lithium concentrations in these samples were similar to background levels, ranging from 0.031 mg/L to 0.034 mg/L, for FSC-4, but were elevated at the outlet from FSC-2. This is consistent with observations of a leak between FSC-1 and FSC-2 (see below) and from FSC-1 back to the inflow canal. Individual sample results are summarized in Exhibit G.3.2-5.

EXHIBIT G.3.2-5
Lithium Concentrations (mg/L) at Outflows From Adjacent Cells

Date/Time	FSC-2 OUT	FSC-4 OUT
10/30/2002 09:05	0.027	0.032
10/30/2002 15:30	0.029	0.031
10/31/2002 10:15	0.105	0.031
10/31/2002 12:45	0.104	0.031
11/1/2002 08:30	0.066	0.034

During the first week of the tracer studies, Rhodamine was observed leaking from FSC-1 back into the inflow canal through the perimeter berm. At the time of this test, water elevations in FSC-1 were higher than those in FSC-2 and substantial leaks were observed along the berm between FSC-1 and FSC-2. Exhibit G.3.2-6 shows the approximate location of these leaks. The flow rates of the leaks were not quantified, but based upon dye distribution, they appear to represent a substantive water transfer. Exhibits G.3.2-7 and G.3.2-8 provide photographic examples of the leaks in the inflow berm and between FSC-1 and FSC-2, respectively.

G.3.2.3 Conclusions

The following conclusions can be reached from the results of these studies:

- Rhodamine dye is useful for detecting the presence of berm leaks and evaluating internal hydraulics.
- Low mass recoveries (FSC-1) and the visual detection of tracer in the inflow and seepage canals confirm that significant water losses occur between the inlet and outlet of each cell.
- Cross-talk between FSC-1 and FSC-2 was evident under the conditions tested.
- Previous (CH2M HILL, 2002) and current estimates of tanks-in-series for FSC-1, FSC-2, and FSC-4 are likely elevated because of the leakance and cell-to-cell transfers. The FSC-3 tracer test results, however, are considered more accurate because of the high level of tracer recovery.

G.3.2.4 References

CH2M HILL, 2002. Tracer Study Results for PSTA FSC-2 and FSC-4. Technical memorandum prepared for the South Florida Water Management District, October 11, 2002.

Kadlec, R.H., 2001. *Tracer Testing of Green Technologies*. Memorandum, February 4, 2001.

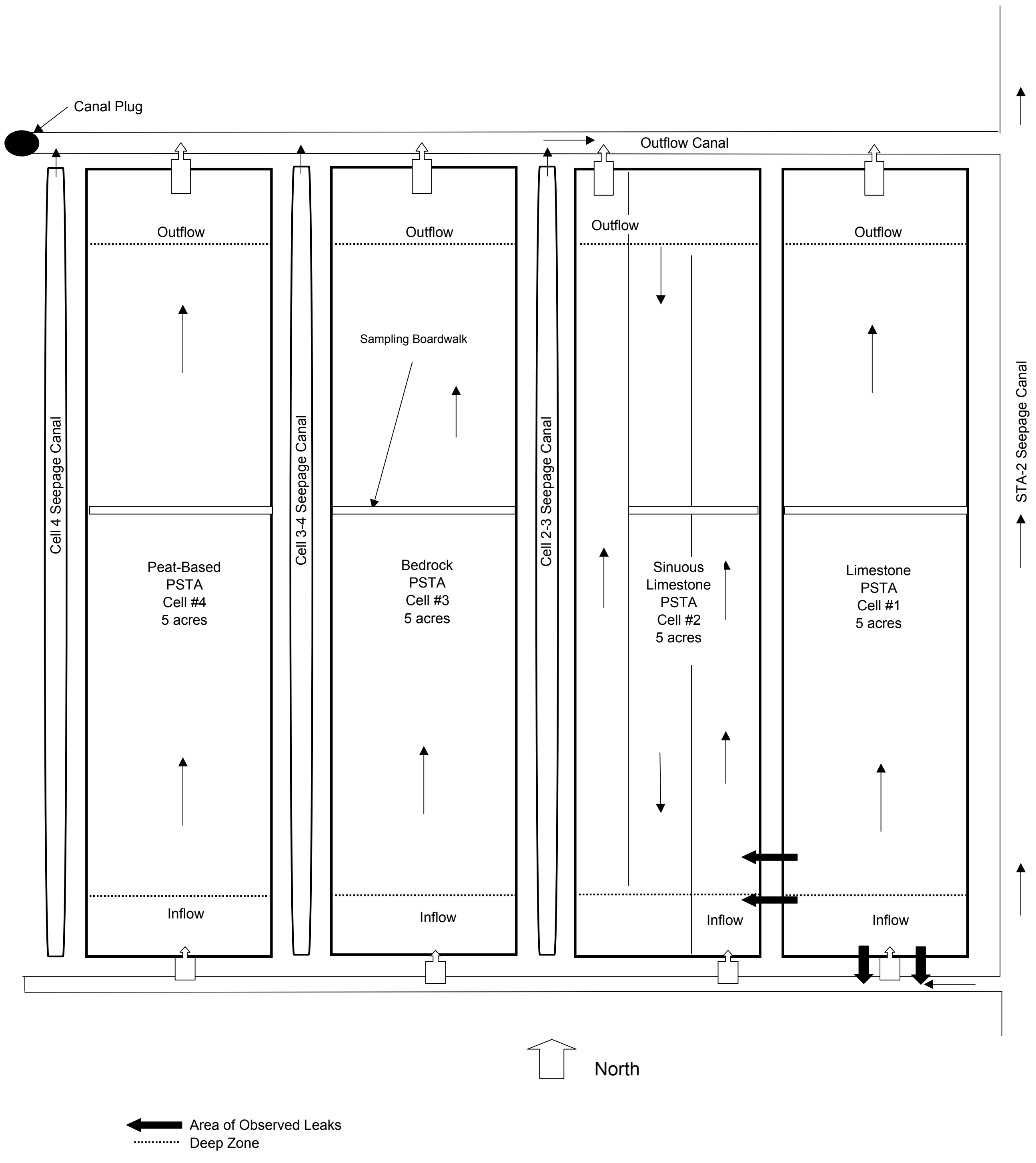


Exhibit G.3.2-6
Schematic of Field-Scale Cells Showing Locations of Observed Berm Leaks

EXHIBIT G.3.2-7

Rhodamine Dye Leaking From FSC-1 Inflow Berm to Inflow Canal (10/29/2002)

EXHIBIT G.3.2-8

Rhodamine Dye Leaking Into FSC-2 from FSC-1 (10/29/2002)

ATTACHMENT

Tracer Study Data

PSTA Phase III **FSC-1**

Volume of LiCl Applied:	**57 L**	**Average Flow:**	**1423 m^3/d**
Concentration of Li Applied:	**65,947 mg/L**	**Cell Volume:**	**8316 m^3**
Mass of Li Applied:	**3.74 kg**	**Nominal HRT:**	**5.84 d**
Date/Time of Application:	**10/29/02 8:25**	**Average HLR:**	**7.0 cm/d**

Background Li Concentration: **27.8 ug/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (μg/L)	Corrected Lithium Concentration (μg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
FSC1-1	10/29/02 8:25	0.00	1261	27.8	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FSC1-3	10/29/02 14:25	0.25	1020	27.7	0	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.000
FSC1-5	10/29/02 20:25	0.50	931	27.4	0	0.000	0.000	0.000	0.000	0.000	0.000	0.097	0.000	0.000
FSC1-7	10/30/02 2:25	0.75	1050	27.4	0	0.000	0.000	0.000	0.000	0.000	0.000	0.146	0.000	0.001
FSC1-9	10/30/02 8:25	1.00	1174	27.7	0	0.000	0.000	0.000	0.001	0.000	0.000	0.195	0.000	0.003
FSC1-11	10/30/02 14:25	1.25	1174	27.3	0	0.000	0.000	0.000	0.003	0.000	0.000	0.243	0.000	0.013
FSC1-13	10/30/02 20:25	1.50	1174	31.4	3.6	0.002	0.450	0.001	0.007	0.001	0.000	0.292	0.009	0.037
FSC1-15	10/31/02 2:25	1.75	1294	45.2	17.4	0.010	2.625	0.003	0.016	0.003	0.000	0.341	0.050	0.082
FSC1-17	10/31/02 8:25	2.00	1459	55.1	27.3	0.021	5.588	0.008	0.030	0.006	0.000	0.389	0.107	0.153
FSC1-19	10/31/02 14:25	2.25	1081	46.1	18.3	0.021	5.700	0.007	0.049	0.010	0.001	0.438	0.109	0.253
FSC1-21	10/31/02 20:25	2.50	1112	126.0	98.2	0.054	14.563	0.016	0.074	0.015	0.000	0.487	0.279	0.380
FSC1-23	11/1/02 2:25	2.75	1237	162.0	134.2	0.108	29.050	0.034	0.102	0.022	0.000	0.535	0.557	0.525
FSC1-25	11/1/02 8:25	3.00	1359	206.0	178.2	0.146	39.050	0.051	0.132	0.029	0.000	0.584	0.749	0.679
FSC1-27	11/1/02 14:25	3.25	1561	213.0	185.2	0.170	45.425	0.066	0.162	0.037	0.000	0.633	0.871	0.831
FSC1-29	11/1/02 20:25	3.50	1425	249.0	221.2	0.190	50.800	0.076	0.189	0.044	0.000	0.681	0.974	0.969
FSC1-31	11/2/02 2:25	3.75	1527	270.0	242.2	0.216	57.925	0.085	0.211	0.050	0.000	0.730	1.111	1.086
FSC1-33	11/2/02 8:25	4.00	1727	296.0	268.2	0.238	63.800	0.104	0.229	0.055	0.000	0.779	1.224	1.174
FSC1-35	11/2/02 14:25	4.25	1727	285.0	257.2	0.245	65.675	0.113	0.240	0.059	0.000	0.827	1.260	1.231
FSC1-37	11/2/02 20:25	4.50	1561	285.0	257.2	0.240	64.300	0.106	0.244	0.060	0.000	0.876	1.233	1.254
FSC1-39	11/3/02 2:25	4.75	1595	277.0	249.2	0.236	63.300	0.100	0.243	0.061	0.000	0.925	1.214	1.247
FSC1-41	11/3/02 8:25	5.00	1834	276.0	248.2	0.232	62.175	0.107	0.236	0.060	0.000	0.973	1.193	1.213
FSC1-43	11/3/02 14:25	5.25	1834	249.0	221.2	0.219	58.675	0.108	0.225	0.058	0.000	1.022	1.125	1.157
FSC1-45	11/3/02 20:25	5.50	1630	241.0	213.2	0.203	54.300	0.094	0.211	0.055	0.000	1.071	1.041	1.083
FSC1-47	11/4/02 2:25	5.75	1656	220.0	192.2	0.189	50.675	0.083	0.194	0.051	0.000	1.119	0.972	0.998
FSC1-49	11/4/02 13:45	6.22	1907	176.0	148.2	0.159	80.372	0.143	0.160	0.084	0.000	1.211	0.816	0.820
FSC1-51	11/5/02 1:45	6.72	1656	141.0	113.2	0.122	65.350	0.116	0.123	0.071	0.000	1.309	0.627	0.634
FSC1-53	11/5/02 13:45	7.22	1762	108.0	80.2	0.090	48.350	0.083	0.091	0.054	0.000	1.406	0.464	0.469
FSC1-55	11/6/02 1:45	7.72	1630	102.0	74.2	0.072	38.600	0.065	0.065	0.039	0.000	1.503	0.370	0.334
FSC1-57	11/6/02 13:45	8.22	1691	83.2	55.4	0.060	32.400	0.054	0.045	0.027	0.000	1.601	0.311	0.230
FSC1-59	11/7/02 1:45	8.72	1493	57.6	29.8	0.040	21.300	0.034	0.030	0.019	0.000	1.698	0.204	0.153
FSC1-63	11/8/02 1:45	9.72	1527	21.6	0	0.014	14.900	0.022	0.012	0.021	0.000	1.893	0.071	0.063
FSC1-67	11/9/02 1:45	10.72	1237	42.8	15	0.007	7.500	0.010	0.005	0.009	0.000	2.087	0.036	0.024
FSC1-71	11/10/02 1:45	11.72	1112	35.3	7.5	0.011	11.250	0.013	0.002	0.003	0.000	2.282	0.054	0.009
FSC1-75	11/11/02 1:45	12.72	1261	30.7	2.9	0.005	5.200	0.006	0.001	0.001	0.000	2.477	0.025	0.003
FSC1-77	11/11/02 13:45	13.22	1459	37.3	9.5	0.006	3.100	0.004	0.000	0.000	0.000	2.574	0.030	0.002
FSC1-79	11/12/02 13:45	14.22	1459	32.2	4.4	0.006	6.950	0.010	0.000	0.000	0.000	2.769	0.033	0.001
FSC1-80	11/13/02 1:45	14.72	1050	31.2	3.4	0.004	1.950	0.002	0.000	0.000	0.000	2.866	0.019	0.000
					Σ =	**3.337**	**1071.297**	**1.726**			**0.003**			

Mean residence time, t (d) =	**5.14**	**$N*t_i$**
Mean residence time in one tank, t_i (d) =	**0.57**	**Solver**
Number of tanks, N =	**8.99**	**Solver**
Dimensionless Variance =	**0.1113**	**1/N**
Wetland Dispersion Number, $\mathcal{D}$ =	**0.0591**	**Solver**
Mass Recovery =	**46%**	**%**
Volumetric Efficiency =	**88%**	**t/t_n**

PSTA Phase III **FSC-3**

Volume of LiCl Applied:	**57 L**	**Average Flow:**	**3097 m^3/d**
Concentration of Li Applied:	**65,947 mg/L**	**Cell Volume:**	**7650 m^3**
Mass of Li Applied:	**3.74 kg**	**Nominal HRT:**	**2.47 d**
Date/Time of Application:	**10/29/02 9:00**	**Average HLR:**	**15.3 cm/d**

Background Li Concentration: **31.2 ug/L**

Sample No.	Date/Time	Time (days)	Flow Rate (m^3/d)	Measured Lithium Concentration (µg/L)	Corrected Lithium Concentration (µg/L)	Measured f(t)	Measured C(t)dt	Measured QC(t)dt	Predicted f(t)	Predicted f(t)dt	$(y - ym)^2$	$\theta = t/\tau$	Measured $E(\theta) = \tau E(t)$	Predicted $E(\theta) = \tau E(t)$
FSC3-1	10/29/02 9:00	0.00	3950	31.2	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FSC3-3	10/29/02 15:00	0.25	3383	30.4	0	0.000	0.000	0.000	0.003	0.000	0.000	0.082	0.000	0.008
FSC3-5	10/29/02 21:00	0.50	3221	30.7	0	0.000	0.000	0.000	0.020	0.003	0.000	0.165	0.000	0.062
FSC3-7	10/30/02 3:00	0.75	3178	34.1	2.9	0.001	0.363	0.001	0.059	0.010	0.003	0.247	0.004	0.180
FSC3-9	10/30/02 9:00	1.00	3602	74.3	43.1	0.019	5.750	0.019	0.113	0.021	0.009	0.329	0.058	0.343
FSC3-11	10/30/02 15:00	1.25	3426	234.0	202.8	0.102	30.738	0.108	0.171	0.035	0.005	0.411	0.310	0.520
FSC3-13	10/30/02 21:00	1.50	3009	402.0	370.8	0.238	71.700	0.231	0.225	0.049	0.000	0.494	0.724	0.683
FSC3-15	10/31/02 3:00	1.75	3009	414.0	382.8	0.313	94.200	0.283	0.267	0.061	0.002	0.576	0.951	0.811
FSC3-17	10/31/02 9:00	2.00	3646	481.0	449.8	0.346	104.075	0.346	0.295	0.070	0.003	0.658	1.051	0.896
FSC3-19	10/31/02 15:00	2.25	3426	431.0	399.8	0.353	106.200	0.376	0.308	0.075	0.002	0.740	1.072	0.936
FSC3-21	10/31/02 21:00	2.50	2967	375.0	343.8	0.309	92.950	0.297	0.308	0.077	0.000	0.823	0.938	0.936
FSC3-23	11/1/02 3:00	2.75	2884	279.0	247.8	0.246	73.950	0.216	0.297	0.076	0.003	0.905	0.747	0.903
FSC3-25	11/1/02 9:00	3.00	3264	281.0	249.8	0.207	62.200	0.191	0.278	0.072	0.005	0.987	0.628	0.846
FSC3-27	11/1/02 15:00	3.25	3340	280.0	248.8	0.207	62.325	0.206	0.254	0.067	0.002	1.069	0.629	0.773
FSC3-29	11/1/02 21:00	3.50	2884	219.0	187.8	0.181	54.575	0.170	0.228	0.060	0.002	1.152	0.551	0.692
FSC3-31	11/2/02 3:00	3.75	2802	186.0	154.8	0.142	42.825	0.122	0.200	0.053	0.003	1.234	0.432	0.608
FSC3-33	11/2/02 9:00	4.00	3296	205.0	173.8	0.136	41.075	0.125	0.173	0.047	0.001	1.316	0.415	0.526
FSC3-35	11/2/02 15:00	4.25	3136	191.0	159.8	0.139	41.700	0.134	0.148	0.040	0.000	1.398	0.421	0.448
FSC3-37	11/2/02 21:00	4.50	2802	160.0	128.8	0.120	36.075	0.107	0.124	0.034	0.000	1.481	0.364	0.378
FSC3-39	11/3/02 3:00	4.75	2730	137.0	105.8	0.097	29.325	0.081	0.104	0.028	0.000	1.563	0.296	0.315
FSC3-41	11/3/02 9:00	5.00	3383	126.0	94.8	0.083	25.075	0.077	0.086	0.024	0.000	1.645	0.253	0.260
FSC3-43	11/3/02 15:00	5.25	3136	123.0	91.8	0.077	23.325	0.076	0.070	0.019	0.000	1.727	0.236	0.213
FSC3-45	11/3/02 21:00	5.50	2926	124.0	92.8	0.077	23.075	0.070	0.057	0.016	0.000	1.810	0.233	0.172
FSC3-47	11/4/02 3:00	5.75	2802	112.0	80.8	0.072	21.700	0.062	0.046	0.013	0.001	1.892	0.219	0.139
FSC3-49	11/4/02 13:30	6.19	3296	106.0	74.8	0.065	34.038	0.104	0.031	0.017	0.001	2.036	0.196	0.094
FSC3-51	11/5/02 1:30	6.69	2771	92.4	61.2	0.056	34.000	0.103	0.019	0.013	0.001	2.200	0.172	0.058
FSC3-53	11/5/02 13:30	7.19	3221	68.0	36.8	0.041	24.500	0.073	0.012	0.008	0.001	2.365	0.124	0.036
FSC3-55	11/6/02 1:30	7.69	2802	57.6	26.4	0.026	15.800	0.048	0.007	0.005	0.000	2.529	0.080	0.021
FSC3-57	11/6/02 13:30	8.19	3264	61.8	30.6	0.024	14.250	0.043	0.004	0.003	0.000	2.694	0.072	0.013
FSC3-59	11/7/02 1:30	8.69	2608	55.2	24	0.023	13.650	0.040	0.002	0.002	0.000	2.858	0.069	0.007
FSC3-63	11/8/02 1:30	9.69	2730	37.5	6.3	0.013	15.150	0.040	0.001	0.002	0.000	3.187	0.038	0.002
FSC3-67	11/9/02 1:30	10.69	2884	35.3	4.1	0.004	5.200	0.015	0.000	0.001	0.000	3.517	0.013	0.001
FSC3-71	11/10/02 1:30	11.69	2730	33.4	2.2	0.003	3.150	0.009	0.000	0.000	0.000	3.846	0.008	0.000
FSC3-75	11/11/02 1:30	12.69	2802	31.0	0	0.001	1.100	0.003	0.000	0.000	0.000	4.175	0.003	0.000
					Σ =	3.720	**1204.038**	**3.777**			**0.047**			

Mean residence time, t (d) =	**3.04**	**N^*t_i**
Mean residence time in one tank, t_i (d) =	**0.67**	**Solver**
Number of tanks, N =	**4.54**	**Solver**
Dimensionless Variance =	**0.2200**	**1/N**
Wetland Dispersion Number, $\mathcal{D}$ =	**0.1258**	**Solver**
Mass Recovery =	**101%**	**%**
Volumetric Efficiency =	**123%**	**t/t_n**

APPENDIX H

Statistical Analyses

APPENDIX H

Statistical Analyses

Statistical analyses were performed on available sampling results for the periods outlined below:

- **Period of Record (POR):** Data from this period were used to evaluate performance for the entire study period of each treatment.
- **Optimal (post-startup) Performance Period (OPP):** Based on an examination of physical, chemical, and biological time series plots, Field-Scale Cells, Test Cells, and Porta-PSTAs were determined to have equilibrated at slightly different rates, and data for each treatment revealed improved performance during an "operational" period. Data from this period were analyzed as a subset of the first dataset and represent "optimum" performance observed during the study.

All statistical evaluations for the three mesocosm scales were limited to subsets of observations from these two study periods outlined in Exhibit H-1.

Hypotheses to be tested with these data were described in detail in Section 2 of the *PSTA Research Plan* (CH2M HILL, 2001), and the primary comparisons of interest are briefly summarized below:

- Substrate type significantly affects PSTA sustainable TP settling rate (Hypothesis No. 3)
- PSTA TP export concentration is highly correlated with HLR for a given TP inflow concentration (Hypothesis No. 7)
- Water depth in the range of 30 to 60 cm does not significantly affect PSTA sustainable TP settling rate (Hypothesis No. 10)

This appendix presents highlights from the statistical analysis of the effects of the experimental treatments on TP outflow from the Test Cells and Porta-PSTAs.

H.1 Porta-PSTA Treatments

H.1.1 Methods

Summary Statistics

Two sets of summary statistics were generated for the variables listed below for both the POR and OPP.

- Total phosphorus (inflow/outflow)
- Total nitrogen, as N (inflow/outflow)
- Nitrate/nitrite, as N (inflow/outflow)
- Ammonia, as N (inflow/outflow)
- Total organic carbon (inflow/outflow)
- Total suspended solids (inflow/outflow)
- Calcium (inflow/outflow)
- Alkalinity (inflow/outflow)
- Periphyton AFDW, DW and biovolumes
- Chlorophyll *a*

- Macrophyte dry weight and stem counts
- Rainfall and evapotranspiration
- PAR (surface and bottom)
- Light extinction coefficient
- pH
- Dissolved oxygen (including % saturation)
- Flow (in, out and average)
- TP mass balance (inflow/outflow)
- Phosphorus removal rate (including %)
- TP k_1

The first set was generated using a compilation of all measured values. The aggregated monthly medians were used for the second. Summary statistics were created in Microsoft Excel® using the descriptive statistics function, and results are presented in Exhibit H-2.

Time-Series Plots

Exhibit H-3 provides a time-series plot of inflow and outflow TP concentrations for the POR to graphically demonstrate the overall phosphorus reduction observed in the Porta PSTA treatments. Additionally, time-series plots of the measured variables outlined above were created to facilitate data exploration. A spline-smoothing function line was added to each plot to better visualize each parameter trend. These plots are presented in Exhibits H-4 to H-16.

Kruskal-Wallis Test

Variability between treatment replicates was examined through simple one-way comparisons using the non-parametric Kruskal-Wallis test. Typically, in comparisons of this type, a probability of less than or equal to 0.05 would constitute a significant difference. However, because of the large number of one-way tests conducted between each set of replicates, an adjusted probability of 0.0013 was applied. Results are summarized in Exhibit H-17.

Analysis of Variance

Because of weekly measurement and replicate variability, mean and median values represented treatment performance in an analysis of variance (ANOVA) of the following dependent variables: TP outflow (TP Out), TP removal rate (removal rate) and k_1 model coefficient (k_1). TP Out represents the lowest obtainable TP concentration for that particular treatment over the designated study period, where as the removal rate and k_1 variables describe the relationship between TP inflow and outflow concentrations.

ANOVA model comparisons followed the original experimental design. Independent treatment variables were as follows: substrate type, depth, hydraulic loading rate (HLR), depth:width ratio, and flow velocity. For the six replicated treatments, three randomly selected tanks were operated under identical independent variables. ANOVAs were used to compare performance of the three replicates within a particular treatment.

Using the Splus 2000 ® statistical software package, the following two types of ANOVA models were used in the statistical analysis:

- **One-way layout model:** This model was used when comparing variability associated with one independent variable (i.e., shallow vs. deep) when all other variables were constant. In addition, one-way models were also used to compare multiple variations of an independent variable (i.e., peat vs. shellrock vs. limerock vs. calcium-amended peat) if all other conditions are identical (i.e., depth, area, HLR, and velocity). However, initial ANOVA results can only indicate that differences between treatment exists. If a significant difference between treatments was found, a multiple comparisons analysis (MCA) would be conducted to further isolate the source of the variability and indicate which treatments differ from each other. For instance, peat may be different from shellrock but not limerock, which may be different from calcium-amended peat. Under the PSTA statistical analysis, a Tukey's MCA was used when comparing significant differences between more than two variations of an independent variable.

- **Multiple factor 2^k model:** This model was applied when two or more independent variables differed between treatments [i.e., comparing depth (shallow or deep) and substrate (peat or shellrock) simultaneously]. Under this scenario, the model would compare for potential differences between depths (the two shallow treatments vs. the two deep treatments) and substrates (the two peat treatments vs. the two shellrock treatments), and for depth/substrate interactions.

To corroborate the ANOVA results, one-way nonparametric comparisons between treatments were made using the Kruskal-Wallis test with all measured values and the aggregated monthly medians for both the POR and OPP. Instead of applying a multiple comparison test, as was done for the multiple factor 2^k ANOVA models, an adjusted probability of 0.01 (as opposed to 0.05) was applied to determine significant differences.

H.1.2 Results

Replicate comparisons

Replicate results are summarized below and in Exhibit H-17.

- **Response Variables:** Eight replicate comparisons were significant for the response variables as follows: percent P removal, TP k_1, TP outflow concentration for deep and shallow peat treatments, TP outflow mass balance for shallow peat treatment, and TP outflow concentration for variable shellrock treatment.

- **Flow:** Flow was not significantly different between treatments, with the expected exception of the high-velocity, recirculation treatment (shellrock) that differed for all three measures (tank inflow and outflow and mean flow).

- **Environmental and Biological Parameters:** No significant differences found between treatments.

- **Water Quality Parameters:** Significant differences were reported for pH with respect to the shallow and recirculation shellrock treatments, and dissolved oxygen (concentration and %) for the recirculation shellrock treatment.

Overall, replicate differences were marginal, indicating that ANOVA comparisons between treatments would not result in differences resulting from replicate variability.

ANOVA Analysis

Period of Record

Nine ANOVA comparisons were run for the POR and OPP of each treatment as outlined below and in Exhibit H-18:

- Water depth over peat substrate
- Water depth over shellrock substrate
- Water depth variability over shellrock substrate
- HLR over shellrock substrate
- Sustainability over peat substrate
- Sustainability over shellrock substrate
- Substrate
- Velocity over shellrock
- Depth, substrate and depth/substrate interactions

For each time period, an ANOVA comparison was made using both the mean and median for the following three factors: TP outflow (mg/L), TP removal rate (g/m^2/y), and first-order TP removal rate (k_1 [m/y]).

Using the POR, 13 significant differences were found when treatments were compared, as summarized below and in Exhibit H-19.

- **Water Depth and Substrate:** No differences in depth were seen over peat substrates. For shellrock substrates, shallow depths increased median k_1 values as compared to deep tanks and increased median removal rates and mean and median k_1 values compared to variable tanks.
- **Substrates:** No significant differences were found between substrates.
- **Hydraulic Loading Rate:** Over the shellrock substrate, a low HLR yielded significantly lower median TP Out values, where as high HLR significantly increased mean and median removal rates and k_1 values during Phase 1.
- **Treatment Sustainability:** No significant differences between operational phases were found in Porta-PSTA mesocosm performance with peat substrates. Porta-PSTAs with shellrock substrate yielded significant differences between phases, with significantly greater mean and median removal rates and k_1 values in Phase 2 than in Phase 1.
- **Velocity:** No differences in mean or median TP Out, removal rates, or k_1 values were attributed to velocity over shellrock substrates during Phase 2.
- **Depth and Substrate Interactions:** Depth, substrates, and depth-substrate interactions produced no significant differences for comparisons between shallow and deep water depths over peat and shellrock substrates (Phase 1 treatments).

Optimal Performance Period

Using the OPP, 18 significant differences were found when treatments were compared, as summarized below and in Exhibit H-20.

- **Water Depth and Substrate:** No differences were seen between shallow and deep water depths over peat substrates during Phase 1. For shellrock substrates, shallow water depths yielded significantly greater mean and median removal rates and k_1 values when compared to deep and variable depths Porta-PSTAs during Phase 1.
- **Substrates:** No significant different differences were found between substrates.
- **Hydraulic Loading Rate:** Over the shellrock substrate, a low HLR produced significantly lower TP Out values, where as a high HLR rate produced significantly greater mean and median removal rates and k_1 values in Porta-PSTAs during Phase 1.

- **Treatment Sustainability:** No differences were seen between phases for Porta-PSTAs with either peat or shellrock substrates.
- **Velocity:** Slow velocities significantly increased mean removal rate as compared to fast velocities in Porta-PSTAs with shellrock substrates.
- **Depth and Substrate Interactions:** Based on Phase 1 results, no significant differences between depths, substrates, or depth-substrate interactions were found in regard to TP Out mean and medians values. Shallow depths significantly increased mean and median removal rates and median k_1 values.

Non-parametric ANOVA Corroboration

Kruskal-Wallis comparisons were made for the following eight treatment combinations for the POR and OPP, as outlined below and summarized in Exhibit H-21. These are identical to the ANOVA comparisons with the exception of treatment sustainability, which was not preformed using the Kruskal-Wallis test.

- **Substrate:** For Phase 1 comparisons, shellrock Porta-PSTAs produced significantly lower TP Out values than peat-based Porta-PSTAs when using all measured values for the POR and the OPP, and aggregated values for the OPP. For the Phase 2 dataset, shellrock and limerock substrates produced significantly lower TP Out values (all measured values for the POR and OPP), and greater k_1 values compared to peat and peat-amended (lime addition) substrates when using all measured values for the POR and OPP and aggregated OPP values.
- **Water Depth and Substrate:** No significant differences were observed between shallow and deep water depths over peat substrates for the response variables. Using all values for the POR and OPP and the aggregated median OPP values, TP mass balance values were highest in the shallow shellrock Porta-PSTAs, followed by the deep shellrock and then variable treatments. Shallow shellrock PSTAs also yielded greater removal rates and k_1 values than either deep or variable depth shellrock Porta-PSTAs using all and aggregated median OPP values.
- **Hydraulic Loading Rate:** A low HLR to the Porta-PSTAs yielded significantly lower TP outflow concentrations when using all values for the OPP. A high HLR produced significantly greater TP mass balance values for all four dataset combinations. A high HLR also yielded higher removal rates than the low HLR Porta-PSTAs (all values for the POR and the OPP and aggregated median values for the OPP). Significantly greater k_1 values were observed in Porta-PSTAs with a high HLR as compared to a low HLR when comparing all values for the OPP.
- **Velocity:** No significant differences were seen between slow and high velocity Porta-PSTAs for the response variables when using the four data set combinations.
- **Depth and Substrate Interactions:** Substrate, depth, and depth-substrate interactions produced no significant differences for the response variables using the four dataset combinations.

Secondary Factor Interactions

The comparatively low effect of primary factors on TP removal, coupled with the inconclusive results from the replicate evaluations, suggests that secondary factors have had little effect on TP removal over the study period. Exploratory plots for several secondary factors were graphically plotted against the primary response variable, TP Out. Plots are displayed in scatter plot matrices to allow for a rapid review of aggregated data distributions [log transformed] across numerable variables. These plots are provided in Exhibits H-22 to H-27 and show comparisons between TP Out and water quality input variables, biological measurements, environmental factors, nitrogen species intake measurements, and PAR measurements. The correlation matrices displayed below each plot provide an explicit probability of the extent of correlation, adjusted for the number of comparisons made within each set of displayed parameters.

H.2 Test Cells

H.2.1 Methods

Summary Statistics

PSTA research was conducted in three ENR Test Cells during both study phases. Treatments at this mesocosm scale were un-replicated (see Exhibit H-1). As a result, summary statistics were generated in Microsoft Excel ® using the descriptive statistics function based on monthly means and medians as opposed to the replicate means and medians used for the Porta-PSTAs. Because start-up effects were also observed in the Test Cells during the grow-in of the biological community, summary statistics were generated for the POR and the OPP.

Treatments STC-1 to STC-3 were operated during Phase 1. Based on this research, the peat soil in TC-13 was amended with lime, the water level was dropped from 60 cm to 30 cm, and the treatment was renumbered as STC-5 under Phase 2. Because the biological community was disturbed during the soil amendments, grow-in conditions were again observed in this cell for a second time. However, the water level was only dropped in TC-8 (STC-5) and TC-3 (STC-6) at the beginning of Phase 2, and thus these cells did not experience a second grow-in period. As a result, the POR and the OPP for STC-5 and STC-6 were identical. The OPP for these treatments was used when comparing performance with the other treatments. If the entire POR was used in the analysis for these treatment comparisons, uncertainly would exist as to whether differences were the result of independent treatment variables or startup effects.

Time-Series Plots

Exhibit H-29 provides a time series plot of weekly inflow and outflow TP concentrations for the POR to graphically demonstrate the overall phosphorus reduction observed in the Test Cell treatments. Additionally, time-series plots of the measured variables were created to facilitate data exploration. A spline-smoothing function line was added to each plot to better visualize each parameter trend. These plots are presented in Exhibits H-30 to H-42.

Analysis of Variance

Mean and median values were generated to represent treatment performance in an ANOVA of the following dependent variables: TP outflow (TP Out), TP removal rate (removal rate) and k_1 model coefficient (k_1).

ANOVA comparisons were conducted using the Splus 2000 ® statistical software package. The one-way layout model was for ANOVA comparisons between treatments. Because of the reduced number of independent variable combinations and the lack of treatment replication, the multiple factor 2^k model was not used in the Test Cell analysis.

H.2.2 Results

ANOVA comparisons were run for the POR and OPP of each treatment, as outlined below and in Exhibit H-43:

- Substrate (peat vs. shellrock)
- Substrate effects of peat amended vs. shellrock substrate
- Substrate effects of peat amended vs. peat substrate
- Water depth over shellrock substrate
- Water depth variability over shellrock substrate

ANOVA results are presented in Exhibit H-44 and summarized below:

- **Substrate:** No significant differences were evident between peat and shellrock substrates for the POR or OPP data sets. Shellrock yielded significantly lower mean and median TP outflow concentrations and significantly greater mean and median removal rates and k_1 values than calcium-amended peat using the OPP. No significant differences were seen between peat and calcium-amended peat substrates over the POR; however, the peat substrate yielded significantly greater median removal rates than calcium-amended peat for the OPP.

- **Water Regime:** Shallow water depth over shellrock produced significantly lower median k_1 values compared to deep shellrock when comparing the OPP. Deep and shallow shellrock produced significantly lower mean TP outflow concentrations than either variable depth or dry-out shellrock for the OPP. Shallow shellrock also resulted in significantly lower median TP outflow concentrations for the OPP than both variable depth and dry-out shellrock cells. Shallow shellrock yielded significantly greater median k_1 values compared to the variable depth shellrock.

H.3 Field-Scale Cells

H.3.1 Methods

Summary Statistics

PSTA research was conducted in four Field-Scale Cells. Treatments at this mesocosm scale were un-replicated (see Exhibit H-1). As a result, summary statistics were generated in Microsoft Excel ® using the descriptive statistics function based on monthly means and are displayed in Exhibit H-45.

Time-Series Plots

Exhibit H-46 provides a time series plot of weekly inflow and outflow TP concentrations for the POR to graphically demonstrate the overall phosphorus reduction observed in all Field-Scale Cell treatments. Additionally, time-series plots of the measured variables were created to facilitate data exploration. These plots are formatted to display individual treatments with both inflow and outflow measurements of a variable displayed on each plot. A spline-smoothing function line was added to each plot to better visualize each parameter trend. These plots are presented in Exhibits H-47 to H-69.

Analysis of Variance

Mean and median values were generated to represent treatment performance in an ANOVA of the following dependent variables: TP outflow (TP Out), TP removal rate (removal rate) and k_1 model coefficient (k_1).

ANOVA comparisons were conducted using the Splus 2000 ® statistical software package. The one-way layout model was for ANOVA comparisons between treatments. Because of the reduced number of independent variable combinations and the lack of treatment replication, the multiple factor 2^k model was not used in the Field-Scale Cell analysis.

The POR for the Field-Scale Cells was from August 2001 through September 2002. FSC-4 was constructed later than FSC-1, FSC-2 and FSC-3. As a result, FSC-4 was not in flow-through mode until December 2001. To allow for the best possible comparison between treatments, the POR used when making comparisons with FSC-4 was from December 2001 through September 2002. The OPP used for comparisons between Field-Scale Cells is from February 2002 through September 2002.

H.3.2 Results

ANOVA comparisons were run for the POR and OPP of each treatment, as outlined below and in Exhibit H-70:

- Flow (direct pathway vs. sinuous pathway)
- Substrate (limerock cap vs. scrape down to bedrock)
- Substrate (limerock cap vs. native peat)
- Substrate (scrape down to bedrock vs. native peat)

ANOVA results are presented in Exhibit H-71 and summarized below:

- **Flow Pathway:** No significant statistical differences between the direct and sinuous flow pathways for either mean or median TP outflow concentrations were measured for either the POR or OPP data sets. Further, no significant differences were observed between mean removal rates or k_1 values for either the POR or OPP data sets. However, the sinuous flow pathway did produced significantly greater median removal rates and k_1 values than the direct flow pathway using the POR data set.

- **Substrate (Limerock vs. Scrape down to Bedrock):** The bedrock substrate produced significantly lower mean TP outflow concentrations than the limerock cap substrate using the POR data set. The bedrock substrate also produced significantly greater mean and median k_1 values using the POR data set. There were no significant differences for removal rates for either the POR or OPP data sets.

- **Substrate (Limerock vs. Native Peat):** No significant differences were detected between the limerock and native peat substrates for mean or median TP outflow concentrations, removal rates or k_1 values using the POR data set. However, using the OPP data set, the limerock substrate produced significantly lower median TP Out and greater mean and median k_1 values than the native substrate.

- **Substrate (Scrape down to Bedrock vs. Native Peat):** The bedrock substrate had significantly lower mean and median TP outflow concentrations than the native peat substrate using both the POR and OPP data sets. The bedrock substrate also produced significantly greater mean and median k1 values than the native peat substrate using both the POR and OPP data sets. The native peat substrate produced significantly greater median removal rates than the bedrock substrate when using the POR data set.

H.4 Comparison Across PSTA Experimental Scales

H.4.1 Methods

Analysis of Variance

During the course of the PSTA research there have been three experimental scales: the 1m x 6m Porta-PSTA tanks, the 0.5 acre Test Cells and the 5 acre Field-Scale Cells. ANOVA comparisons between the three PSTA experimental scales were made to determine if there were significant differences in the three response variables of TP Out, removal rate and k_1 across experimental scales. ANOVA comparisons were conducted using the Splus 2000 ® statistical software package. The one-way layout model was for ANOVA comparisons between treatments. If a significant difference between treatments was found, a multiple comparisons analysis (MCA) would be conducted to further isolate the source of the variability and indicate which treatments differ from each other. A Tukey's MCA was used when comparing significant differences between the experimental scales.

H.4.2 Results

Analysis of Variance

Comparisons across PSTA scales were made for two sets of treatment combinations. The first treatment combination was rock substrate, 30 cm depth and direct flow pathway [FSC-1 vs. STC-2 (Cell 8) vs. PP-4 (Tanks 3, 5 and 10)]. The second treatment combination was peat substrate, 30 cm depth and direct flow pathway [FSC-4 vs. STC-1 (Cell 13) vs. PP-3 (Tanks 12, 14 and 17). For TC-1 (Cell 13) only the values from February 1999 through January 2001, before the soils were amended with lime, were used. The results from each of the three individual Porta-PSTA tanks were used in the analysis. The results of the ANOVA between PSTA experimental scales are presented in Exhibit H-72.

- **Rock substrate, 30 cm depth and direct flow pathway:** No difference was detected for mean TP outflow concentrations, while Test Cell 8 and Porta-PSTA Tanks 5 and 10 were found to have significantly lower median TP outflow concentrations. FSC-1 had significantly greater mean removal rates than Test Cell 8 and significantly greater median removal rates than Test Cell 8 and Porta-PSTA Tanks 3, 5 and 10. Test Cell 8 and Tank 5 had significantly greater removal rates than Tank 3. Analysis of k_1 values revealed Porta-PSTA Tanks 3 and 5 had significantly greater mean k_1 values than FSC-1, while Test Cell 8 had significantly greater median k_1 values than Porta-PSTA Tanks 3 and 10.

- **Peat substrate, 30 cm depth and direct flow pathway:** Porta-PSTA Tank 14 was found to have significantly lower mean TP outflow concentrations than FSC-4 and Test Cell 13, while there were no differences between PSTA scales for median TP outflow concentrations. FSC-4 had significantly greater mean and median removal rates than Test Cell 13 and Porta-PSTA Tanks 12, 14 and 17. Porta-PSTA Tank 14 had significantly greater mean removal rates than Test Cell 13 and Porta-PSTA Tank-12 had significantly greater median removal rates than Test Cell 13. Porta-PSTA Tank 14 had significantly greater mean and median k1 values than FSC-4, and significantly greater mean k1 values than Test Cell 13 and Porta-PSTA Tank 17. Porta-PSTA Tanks 12 and 17 had greater median k1 values than FSC-4 and Test Cell 13.

Exhibits

EXHIBIT H-1

Period of Record and Optimal Performance Periods for Porta-PSTA, Test Cell and Field-Scale Cell Treatments

Treatment	Tanks/ Cells	Phase	Period of Record (POR)	Optimal Performance Period (OPP)
Porta-PSTA Treatments				
PP-1	9, 11, 18	1	04/99 - 01/00	10/99 - 01/00
PP-2	4, 7, 8	1	04/99 - 01/00	10/99 - 01/00
PP-3	12, 14, 17	1 & 2	04/99 - 10/00	10/99 - 10/00
PP-4	3, 5, 10	1 & 2	04/99 - 10/00	10/99 - 10/00
PP-5	2, 13, 16	1	04/99 - 03/00	10/99 - 03/00
PP-6	1, 6, 15	1	04/99 - 03/00	10/99 - 03/00
PP-7	19	1 & 2	04/99 - 10/00	10/99 - 10/00
PP-8	20	1	04/99 - 01/00	10/99 - 01/00
PP-9	21	1	04/99 - 03/00	10/99 - 03/00
PP-10	22	1	04/99 - 03/00	10/99 - 03/00
PP-11	23	1 & 2	04/99 - 10/00	10/99 - 10/00
PP-12	24	1 & 2	04/00 - 10/00	10/99 - 10/00
PP-13	9, 11, 18	2	04/00 - 10/00	06/00 - 10/00
PP-14	4, 7, 8	2	04/00 - 10/00	06/00 - 10/00
PP-15	2, 13, 16	2	04/00 - 10/00	06/00 - 10/00
PP-16	1, 6, 15	2	04/00 - 10/00	06/00 - 10/00
PP-17	20	2	04/00 - 10/00	06/00 - 10/00
PP-18	21	2	04/00 - 10/00	06/00 - 10/00
PP-19	22	2	04/00 - 10/00	06/00 - 10/00
Test Cell Treatments				
STC-1	13	1	03/99 - 01/00	07/99 - 01/00
STC-2	8	1	03/99 - 03/00	07/99 - 03/00
STC-3	3	1	03/99 - 03/00	07/99 - 03/00
STC-4	13	2	04/00 - 03/01	07/00 - 03/01
STC-5	8	2	04/00 - 03/01	04/00 - 03/01
STC-6	3	2	04/00 - 03/01	04/00 - 03/01
Field Scale Cell Treatments				
FSC-1	1	1	07/01 - 09/02	07/01 - 09/02
FSC-2	2	2	07/01 - 09/02	07/01 - 09/02
FSC-3	3	3	07/01 - 09/02	07/01 - 09/02
FSC-4	4	4	07/01 - 09/02	07/01 - 09/02

EXHIBIT H-2
Summary Statistics for Porta-PSTA Measured Variables

		Summary Statistics							
		N	Min	Max	Median	Mean	95 Upper Control Limit	95 Lower Control Limit	Standard Deviation
RESPONSE VARIABLES									
Phosphorus Removal Rate ($g/m^2/yr$)	Median - POR	462	-0.32	1.14	0.20	0.20	0.22	0.19	0.19
	Median - OPP	268	-0.12	1.14	0.24	0.27	0.29	0.25	0.18
	All - POR	1591	-1.89	6.67	0.20	0.24	0.27	0.22	0.46
	All - OPP	990	-1.89	3.60	0.25	0.30	0.33	0.28	0.39
Phosphorus Removal Percent (%)	Median - POR	462	-108.54	95.81	30.50	27.84	30.21	25.47	25.91
	Median - OPP	268	-18.75	75.99	36.64	35.07	37.05	33.08	16.54
	All - POR	1590	-463.91	100.00	32.99	25.02	27.19	22.85	44.11
	All - OPP	989	-463.91	91.20	36.95	31.99	34.06	29.92	33.16
Mass Balance Outflow Total Phosphorus ($g/m^2/yr$)	Median - POR	462	0.01	1.63	0.43	0.48	0.50	0.45	0.25
	Median - OPP	268	0.06	1.63	0.44	0.50	0.53	0.47	0.25
	All - POR	1614	0.00	2.76	0.43	0.50	0.51	0.48	0.31
	All - OPP	1012	0.01	2.76	0.45	0.53	0.55	0.51	0.32
Phosphorus K_1 (m/y)	Median - POR	462	-11.63	52.16	9.69	10.20	11.05	9.34	9.37
	Median - OPP	268	-5.80	52.16	14.27	14.44	15.43	13.44	8.24
	All - POR	1591	-50.70	92.16	9.48	10.27	10.91	9.63	13.06
	All - OPP	990	-50.70	60.90	13.89	14.33	15.12	13.55	12.59
Outflow Total Phosphorus (mg/L)	Median - POR	462	0.007	0.059	0.015	0.017	0.017	0.016	0.006
	Median - OPP	268	0.007	0.028	0.015	0.015	0.015	0.014	0.004
	All - POR	1621	0.005	0.130	0.016	0.018	0.018	0.017	0.008
	All - OPP	1019	0.005	0.048	0.015	0.016	0.016	0.015	0.005
PHYSICAL PARAMETERS									
Tank Inflow (m^3/d)	Median - POR	462	0.09	2.36	0.51	0.58	0.61	0.55	0.34
	Median - OPP	268	0.09	2.36	0.56	0.67	0.72	0.63	0.38
	All - POR	1647	0.00	2.36	0.50	0.58	0.60	0.56	0.35
	All - OPP	1019	0.00	2.36	0.56	0.67	0.69	0.64	0.39
Tank Outflow (m^3/d)	Median - POR	461	0.02	2.44	0.50	0.57	0.60	0.53	0.35
	Median - OPP	268	0.09	2.44	0.55	0.66	0.71	0.62	0.38
	All - POR	1578	0.00	2.44	0.50	0.57	0.59	0.55	0.38
	All - OPP	1019	0.01	2.44	0.55	0.66	0.69	0.64	0.40
Tank Mean Flow (m^3/d)	Median - POR	462	0.09	2.40	0.50	0.57	0.61	0.54	0.35
	Median - OPP	268	0.09	2.40	0.55	0.67	0.71	0.62	0.38
	All - POR	1648	0.04	2.40	0.49	0.57	0.59	0.55	0.36
	All - OPP	1019	0.04	2.40	0.56	0.66	0.69	0.64	0.39
RAIN (m^3)	Median - POR	402	0.07	6.34	0.48	0.87	0.96	0.78	0.95
	Median - OPP	237	0.07	6.34	0.35	0.81	0.93	0.69	0.97
	All - POR	402	0.07	6.34	0.48	0.87	0.96	0.78	0.95
	All - OPP	237	0.07	6.34	0.35	0.81	0.93	0.69	0.97
ET (m^3)	Median - POR	402	0.42	2.98	0.77	0.83	0.88	0.79	0.44
	Median - OPP	237	0.42	2.98	0.75	0.81	0.87	0.75	0.48
	All - POR	402	0.42	2.98	0.77	0.83	0.88	0.79	0.44
	All - OPP	237	0.42	2.98	0.75	0.81	0.87	0.75	0.48
PAR at Water Surface (E/m^2)	Median - POR	387	42	2977	756	953	1024	882	709
	Median - OPP	225	42	1969	563	738	808	668	533
	All - POR	387	42	2977	756	953	1024	882	709
	All - OPP	225	42	1969	563	738	808	668	533
PAR at Tank Bottom (E/m^2)	Median - POR	387	1.14	2652	291	483	531	436	477
	Median - OPP	225	7.87	1261	226	336	377	295	312
	All - POR	387	1.14	2652	291	483	531	436	477
	All - OPP	225	7.87	1261	226	336	377	295	312
Extinction Coefficient (m^{-1})	Median - POR	387	-1.96	30.39	2.31	2.93	3.16	2.70	2.31
	Median - OPP	225	-1.96	10.56	2.88	3.38	3.63	3.12	1.94
	All - POR	387	-1.96	30.39	2.31	2.93	3.16	2.70	2.31
	All - OPP	225	-1.96	10.56	2.88	3.38	3.63	3.12	1.94

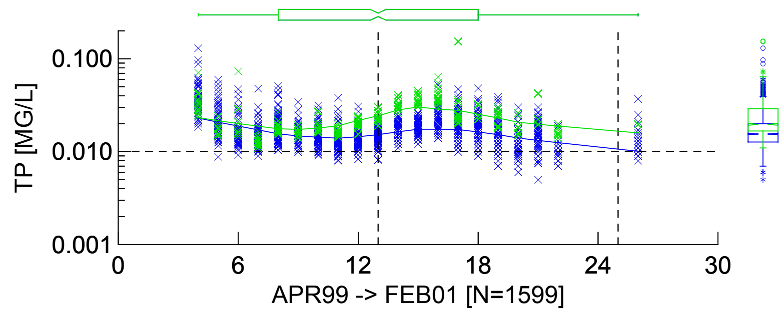
EXHIBIT H-2
Summary Statistics for Porta-PSTA Measured Variables

		Summary Statistics							
		N	Min	Max	Median	Mean	95 Upper Control Limit	95 Lower Control Limit	Standard Deviation
BIOLOGICAL PARAMETERS									
Periphyton Ash Free Dry Weight (g/m^2)	Median - POR	398	0.43	5204	140	282	328	236	468
	Median - OPP	233	0.43	2997	130	250	298	201	376
	All - POR	398	0.43	5204	140	282	328	236	468
	All - OPP	233	0.43	2997	130	250	298	201	376
Periphyton Dry Weight (g/m^2)	Median - POR	398	0.43	8344	599	792	872	712	816
	Median - OPP	233	0.43	5655	537	738	833	643	736
	All - POR	398	0.43	8344	599	792	872	712	816
	All - OPP	233	0.43	5655	537	738	833	643	736
Periphyton Chlor0phyll *a* (mg/m^2)	Median - POR	398	0.99	657	67	100	110	90	100
	Median - OPP	233	0.99	577	102	121	134	109	99
	All - POR	398	0.99	657	67	100	110	90	100
	All - OPP	233	0.99	577	102	121	134	109	99
Periphyton Biovolume (cm^3/m^2)	Median - POR	380	0.06	497	8	18	21	15	34
	Median - OPP	215	0.06	139	12	21	25	18	26
	All - POR	380	0.06	497	8	18	21	15	34
	All - OPP	215	0.06	139	12	21	25	18	26
Macrophyte Dry Weight (g/m^2)	Median - POR	277	0.00	857	39	110	130	91	165
	Median - OPP	198	0.00	857	68	144	169	118	182
	All - POR	277	0.00	857	39	110	130	91	165
	All - OPP	198	0.00	857	68	144	169	118	182
Macrophyte Stem Counts	Median - OPP	231	0.00	1072	62	140	162	118	171
	All - POR	379	0.00	1072	24	95	111	80	152
	All - OPP	231	0.00	1072	62	140	162	118	171
WATER QUALITY PARAMETERS									
Inflow Total Phosphorus (mg/L)	Median - POR	462	0.012	0.051	0.019	0.023	0.024	0.022	0.008
	Median - OPP	268	0.014	0.041	0.020	0.023	0.024	0.022	0.007
	All - POR	1631	0.011	0.154	0.020	0.025	0.026	0.024	0.017
	All - OPP	1002	0.014	0.154	0.022	0.025	0.026	0.024	0.015
Inflow Total Nitrogen (mg/L)	Median - POR	402	0.10	5.65	1.60	1.61	1.66	1.56	0.55
	Median - OPP	237	0.62	5.65	1.82	1.80	1.87	1.73	0.56
	All - POR	410	0.10	5.65	1.60	1.61	1.67	1.56	0.55
	All - OPP	237	0.62	5.65	1.82	1.80	1.87	1.73	0.56
Outflow Total Nitrogen (mg/L)	Median - POR	387	0.23	3.89	1.60	1.57	1.64	1.50	0.70
	Median - OPP	229	0.40	3.89	1.92	1.85	1.93	1.76	0.64
	All - POR	387	0.23	3.89	1.60	1.57	1.64	1.50	0.70
	All - OPP	229	0.40	3.89	1.92	1.85	1.93	1.76	0.64
Inflow NO_2/NO_3 (mg/L)	Median - POR	402	0.00	0.12	0.05	0.05	0.05	0.04	0.03
	Median - OPP	237	0.00	0.12	0.03	0.04	0.04	0.03	0.02
	All - POR	410	0.00	0.12	0.05	0.05	0.05	0.04	0.03
	All - OPP	237	0.00	0.12	0.03	0.04	0.04	0.03	0.02
Outflow NO_2/NO_3 (mg/L)	Median - POR	387	0.00	1.25	0.02	0.02	0.03	0.01	0.07
	Median - OPP	229	0.00	1.25	0.00	0.02	0.03	0.00	0.08
	All - POR	387	0.00	1.25	0.02	0.02	0.03	0.01	0.07
	All - OPP	229	0.00	1.25	0.00	0.02	0.03	0.00	0.08
Inflow NH_3 (mg/L)	Median - POR	402	0.00	0.15	0.02	0.03	0.04	0.03	0.03
	Median - OPP	237	0.00	0.12	0.03	0.04	0.04	0.04	0.03
	All - POR	410	0.00	0.15	0.02	0.03	0.04	0.03	0.03
	All - OPP	237	0.00	0.12	0.03	0.04	0.04	0.04	0.03
Outflow NH_3 (mg/L)	Median - POR	265	0.00	0.44	0.02	0.03	0.04	0.03	0.04
	Median - OPP	111	0.00	0.20	0.03	0.04	0.04	0.03	0.03
	All - POR	265	0.00	0.44	0.02	0.03	0.04	0.03	0.04
Inflow TOC (mg/L)	Median - POR	402	18.40	100.0	33.0	35.7	37.3	34.1	16.4
	Median - OPP	237	24.60	100.0	35.0	40.5	42.9	38.0	19.1
	All - POR	410	18.40	100.0	33.0	35.8	37.3	34.2	16.3
	All - OPP	237	24.60	100.0	35.0	40.5	42.9	38.0	19.1
Outflow TOC (mg/L)	Median - POR	394	18.50	69.0	33.0	33.7	34.4	32.9	7.4
	Median - OPP	229	24.30	69.0	35.0	35.9	36.8	35.0	7.1
	All - POR	394	18.50	69.0	33.0	33.7	34.4	32.9	7.4
	All - OPP	229	24.30	69.0	35.0	35.9	36.8	35.0	7.1

EXHIBIT H-2
Summary Statistics for Porta-PSTA Measured Variables

		Summary Statistics							
		N	Min	Max	Median	Mean	95 Upper Control Limit	95 Lower Control Limit	Standard Deviation
Inflow TSS (mg/L)	Median - POR	381	0.50	14.0	2.0	2.7	3.0	2.4	2.9
	Median - OPP	228	0.50	14.0	1.2	2.3	2.7	2.0	2.6
	All - POR	389	0.50	14.0	2.0	2.7	3.0	2.4	2.9
	All - OPP	228	0.50	14.0	1.2	2.3	2.7	2.0	2.6
Outflow TSS (mg/L)	Median - POR	401	0.50	38.0	2.0	3.6	4.0	3.1	4.5
	Median - OPP	236	0.50	17.0	1.3	2.0	2.3	1.7	2.1
	All - POR	401	0.50	38.0	2.0	3.6	4.0	3.1	4.5
	All - OPP	236	0.50	17.0	1.3	2.0	2.3	1.7	2.1
Inflow Calcium (mg/L)	Median - POR	381	31.50	103.0	57.0	60.0	61.6	58.4	15.8
	Median - OPP	228	43.60	100.0	60.0	64.7	66.6	62.8	14.2
	All - POR	389	31.50	103.0	57.0	60.4	62.0	58.8	15.8
	All - OPP	228	43.60	100.0	60.0	64.7	66.6	62.8	14.2
Outflow Calcium (mg/L)	Median - POR	401	24.10	90.6	51.2	52.1	53.5	50.7	14.0
	Median - OPP	236	31.00	90.6	56.2	57.7	59.4	56.1	12.8
	All - POR	401	24.10	90.6	51.2	52.1	53.5	50.7	14.0
	All - OPP	236	31.00	90.6	56.2	57.7	59.4	56.1	12.8
Inflow Alkalinity (mg/L)	Median - POR	381	160.00	304.0	210.0	211.9	215.9	208.0	39.3
	Median - OPP	228	168.00	304.0	223.5	220.2	225.0	215.4	36.8
	All - POR	389	160.00	304.0	210.0	213.3	217.2	209.3	40.0
	All - OPP	228	168.00	304.0	223.5	220.2	225.0	215.4	36.8
Outflow Alkalinity (mg/L)	Median - POR	401	71.00	280.0	189.0	188.2	192.1	184.4	39.2
	Median - OPP	236	110.00	280.0	200.0	201.8	206.3	197.4	34.4
	All - POR	401	71.00	280.0	189.0	188.2	192.1	184.4	39.2
	All - OPP	236	110.00	280.0	200.0	201.8	206.3	197.4	34.4
pH	Median - POR	453	0.00	9.02	7.85	7.49	7.66	7.33	1.80
	Median - OPP	268	0.00	8.40	7.75	7.21	7.45	6.98	1.96
	All - POR	1540	0.00	9.62	7.87	7.74	7.80	7.68	1.21
	All - OPP	1007	0.00	8.64	7.75	7.57	7.64	7.50	1.16
Dissolved Oxygen (mg/L)	Median - POR	453	0.00	18.80	7.33	7.18	7.37	6.99	2.06
	Median - OPP	268	2.48	18.80	7.13	7.12	7.35	6.89	1.92
	All - POR	1540	0.00	19.48	7.46	7.35	7.45	7.24	2.13
	All - OPP	1007	0.00	19.48	7.17	7.18	7.31	7.04	2.13
Dissolved Oxygen Saturation (%)	Median - POR	453	0	193	88	83	86	81	30
	Median - OPP	268	33	193	86	85	88	83	20
	All - POR	1540	0	196	89	85	87	84	32
	All - OPP	1007	0	196	86	86	88	85	24
Mass Balance Inflow Total Phosphorus ($g/m^2/yr$)	Median - POR	462	0.11	2.32	0.63	0.68	0.71	0.65	0.33
	Median - OPP	268	0.11	2.32	0.68	0.77	0.81	0.73	0.34
	All - POR	1623	0.00	8.14	0.62	0.73	0.76	0.71	0.53
	All - OPP	995	0.00	4.08	0.70	0.83	0.86	0.80	0.49

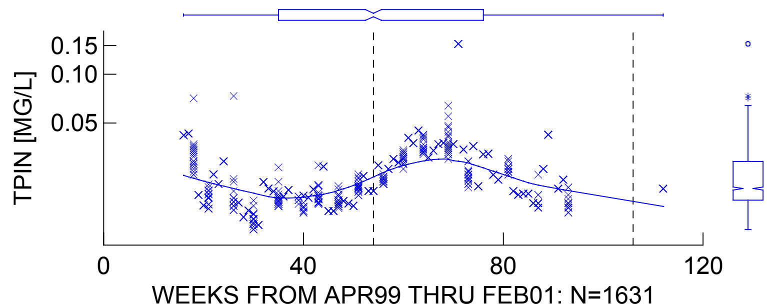
Notes:
Median - POR MEDIAN/TRTMT*TNK*MONTH POR
Median - OPP MEDIAN/TRTMT*TNK*MONTH OPP
All - POR UNAGGREGATED MEASURES POR
All - OPP UNAGGREGATED MEASURES OPP

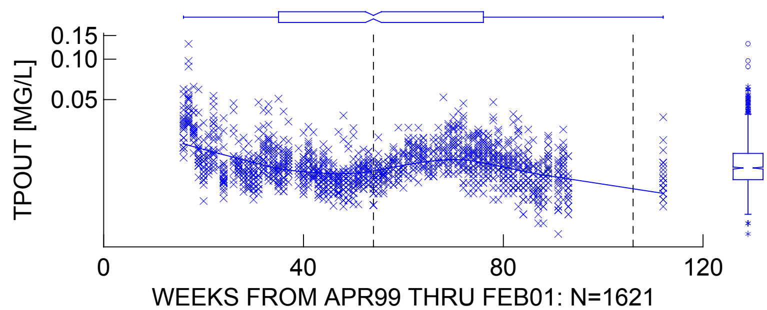


PORTA PSTAs

	INFLOW	OUTFLOW	DIFFERENCE
N	1599	1599	1599
MIN	0.011	0.005	-0.087
MAX	0.154	0.130	0.14
MEDIAN	0.020	0.016	0.006
MEAN	0.025	0.018	0.008
95CI	0.024 - 0.026	0.017 - 0.018	0.007 - 0.008
SD	0.017	0.008	0.017

EXHIBIT H-3
Time Series Plot Displaying Inflow Total Phosphorus Trend Along with Outflow Total Phosphorus Trend for all Porta PSTA Treatments Across Monitoring Months for the POR (Summary statistics are presented above)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of data range (right) and distribution of monitoring weeks (top of graph).





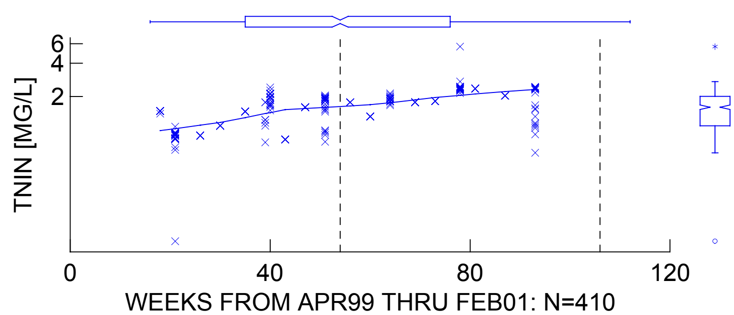


EXHIBIT H-4
Time Series Plots of Inflow Total Phosphorus (TPIN), Outflow Total Phosphorus (TPOUT), and Inflow Total Nitrogen (TNIN) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

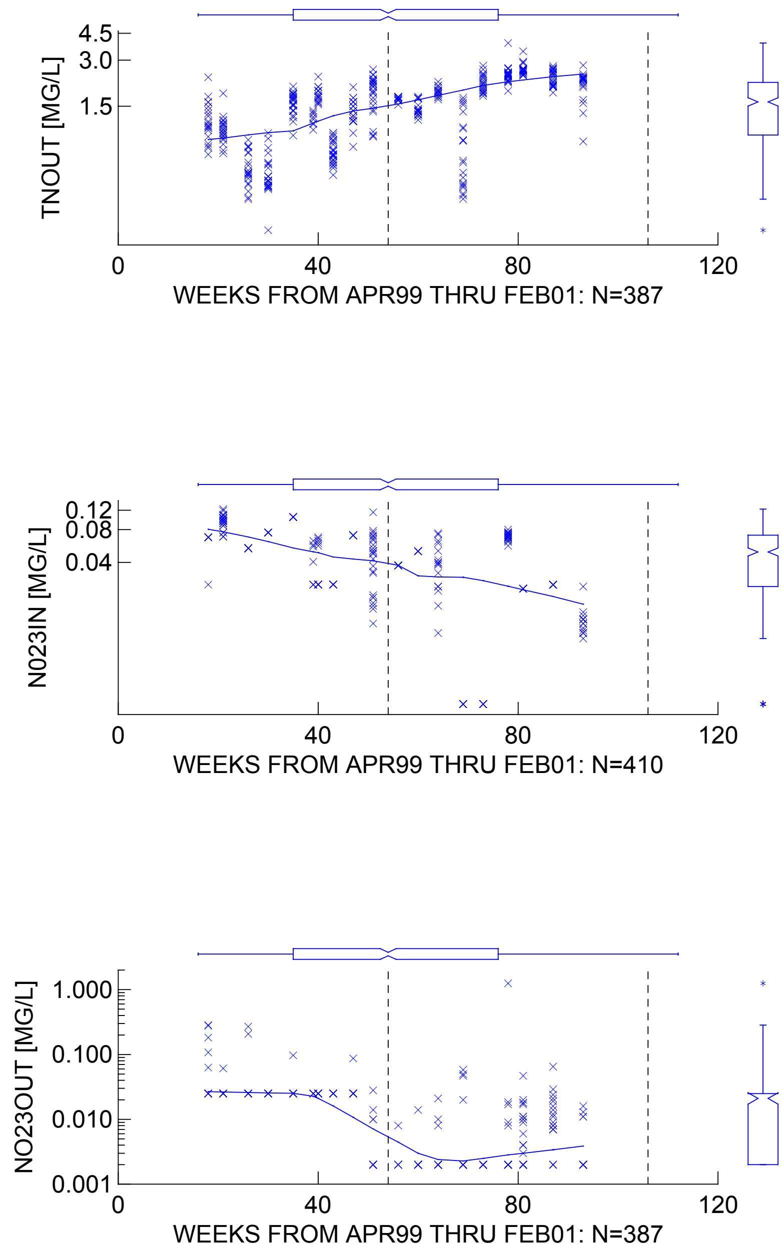
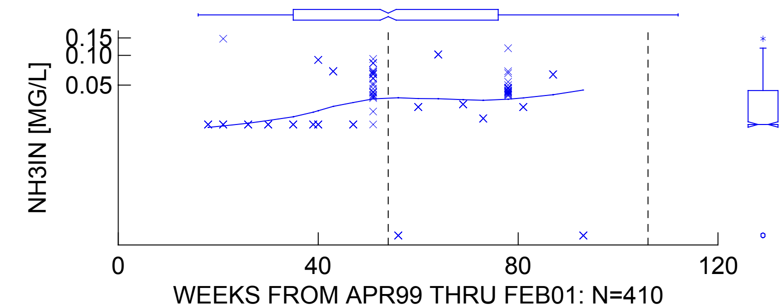
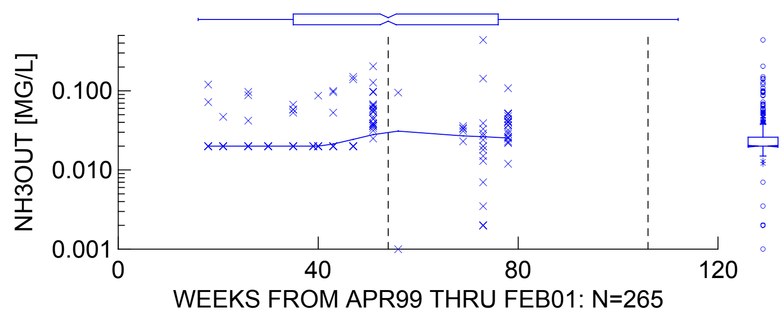


EXHIBIT H-5

Time Series Plots of Outflow Total Nitrogen (TNOUT), Inflow Nitrate/Nitrite (NO23IN), and Outflow Nitrate/Nitrite (NO23OUT) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





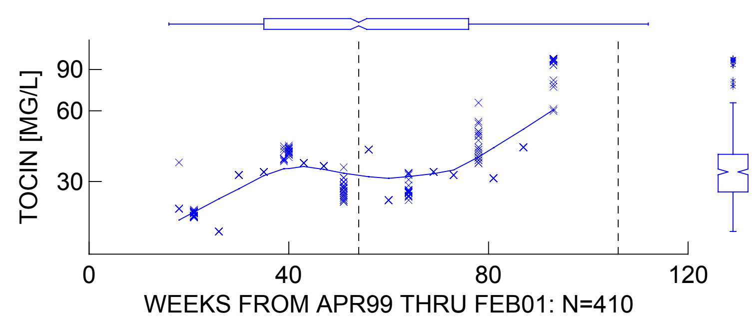
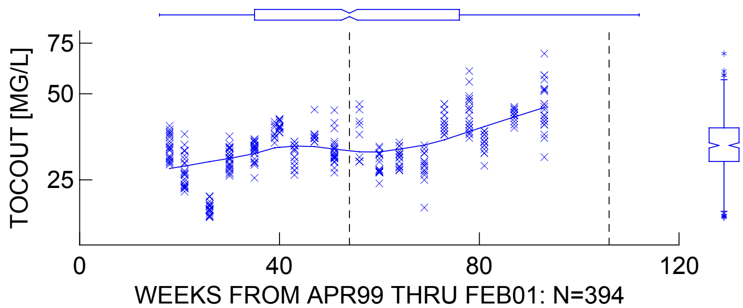
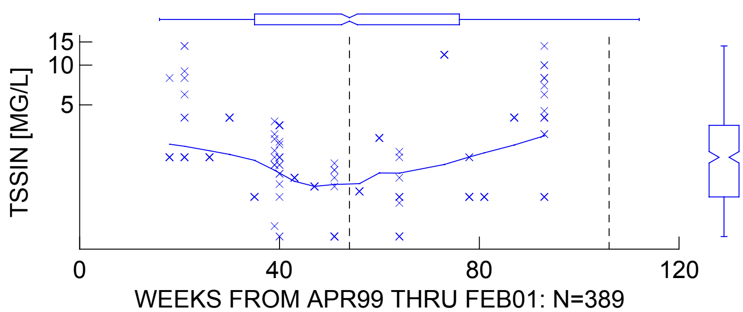


EXHIBIT H-6
Time Series Plots of Inflow Ammonia (NH3IN), Outflow Ammonia (NH4OUT), and Inflow Total Organic Carbon (TOCIN) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





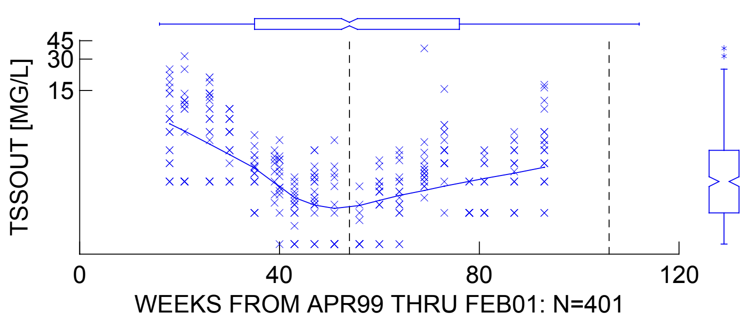


EXHIBIT H-7

Time Series Plots of Outflow Total Organic Carbon (TOCOUT), Inflow Total Suspended Solids (TSSIN), and Outflow Total Suspended Solids (TSSOUT) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

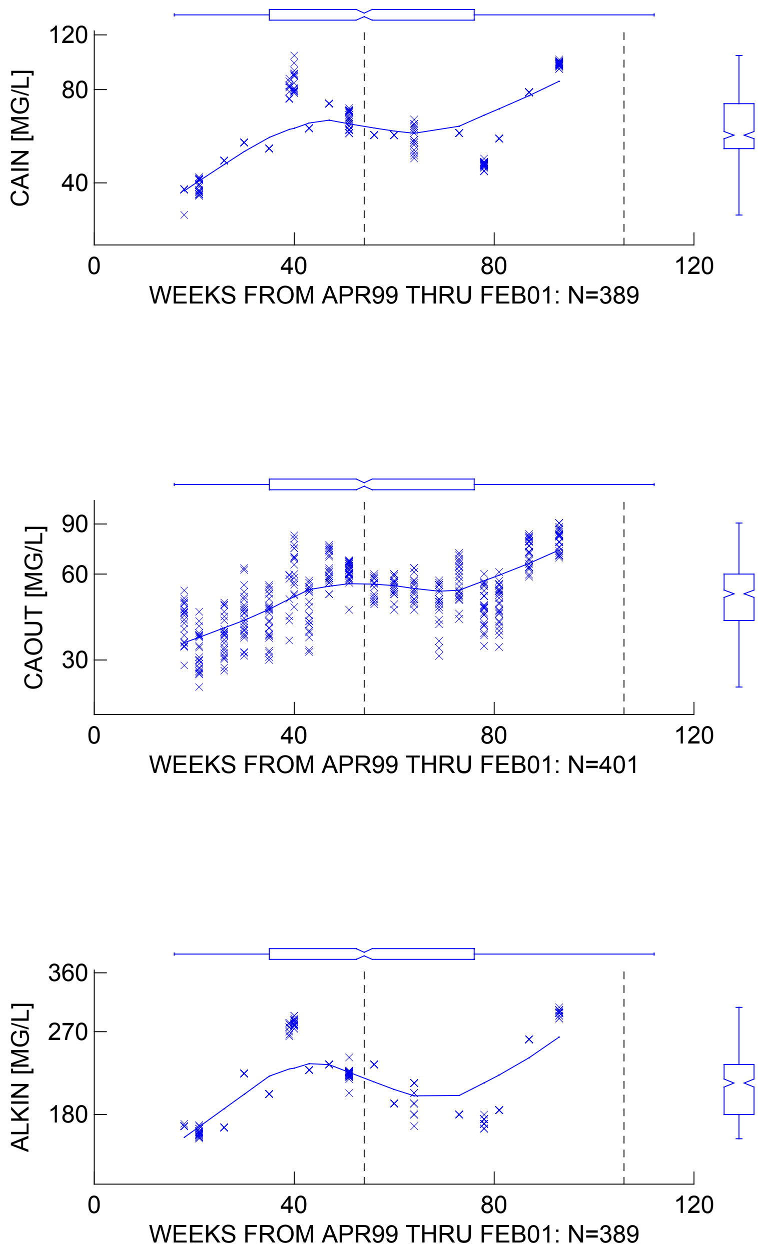
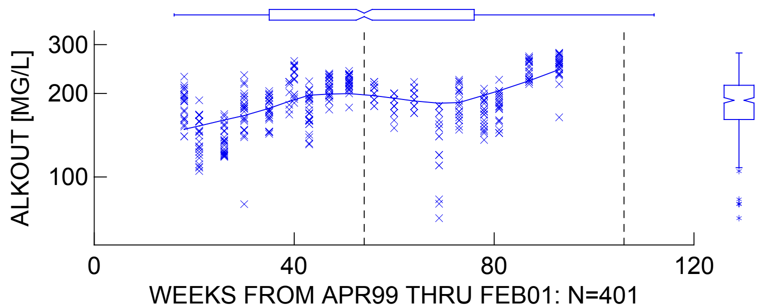
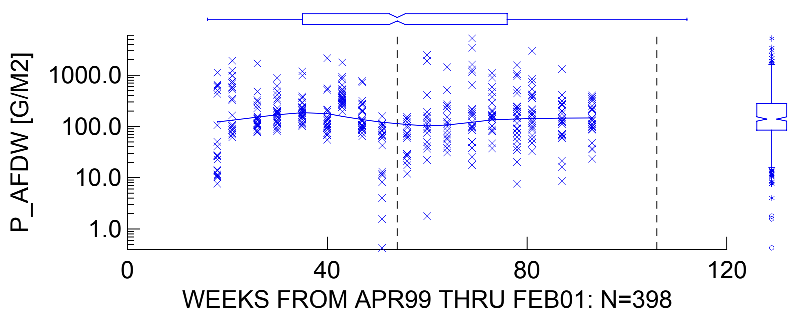


EXHIBIT H-8
Time Series Plots of Inflow Calcium (CAIN), Outflow Calcium (CAOUT), and Inflow Alkalinity (ALKIN) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





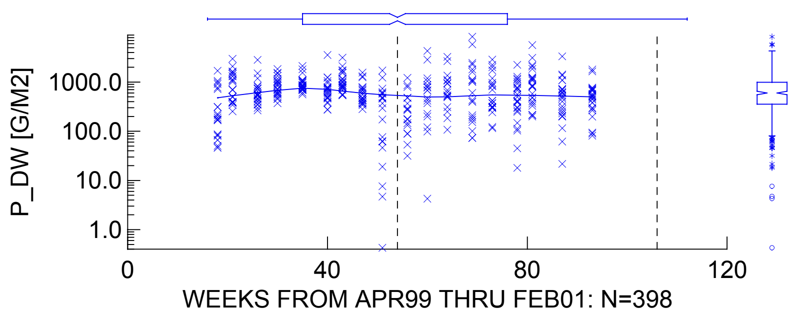


EXHIBIT H-9

Time Series Plots of Outflow Alkalinity (ALKOUT), Periphyton Ash Free Dry Weight (P_AFDW), and Periphyton Dry Weight (P_DW) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

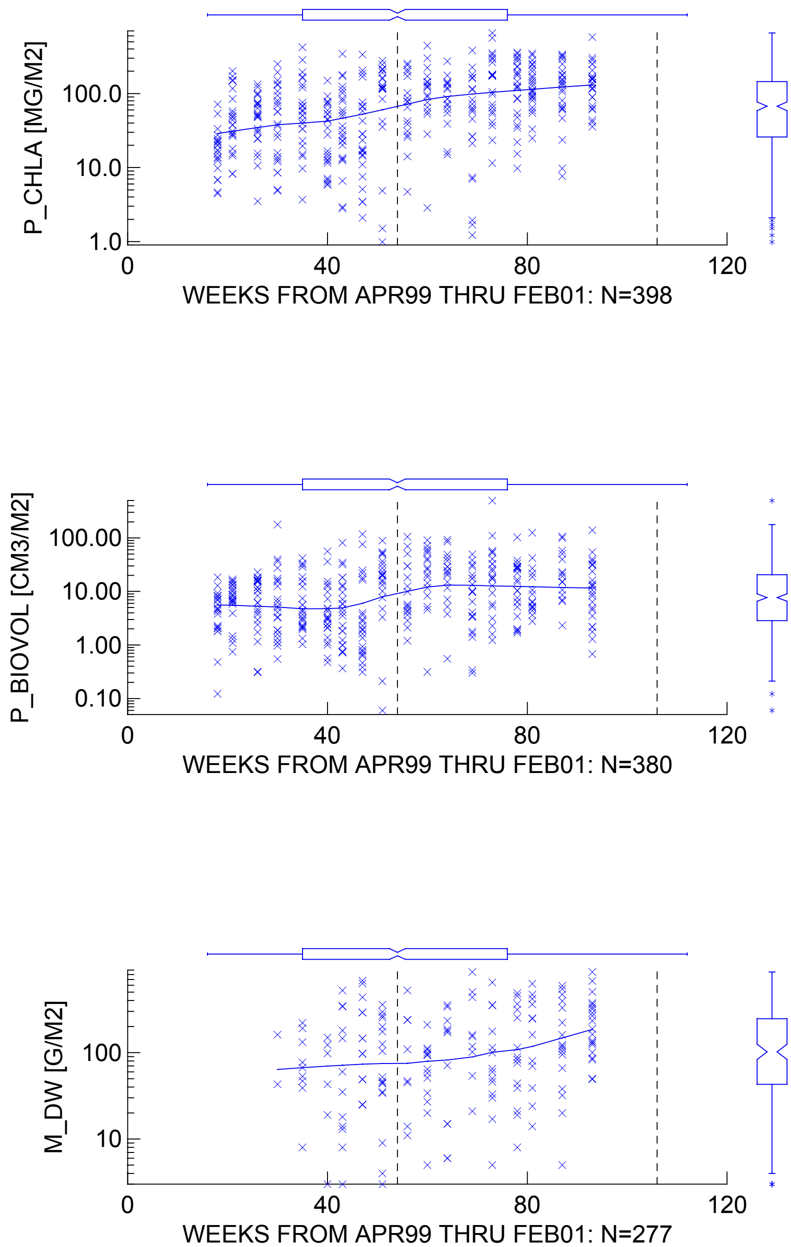
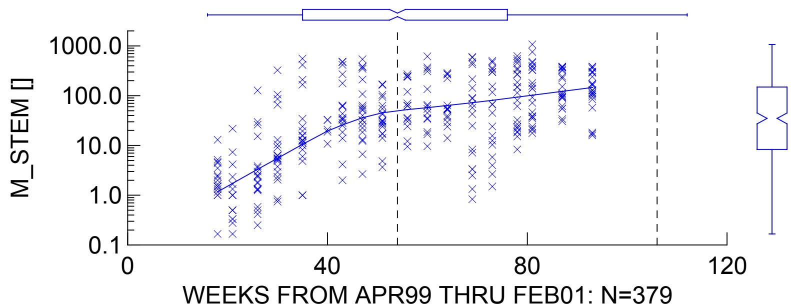
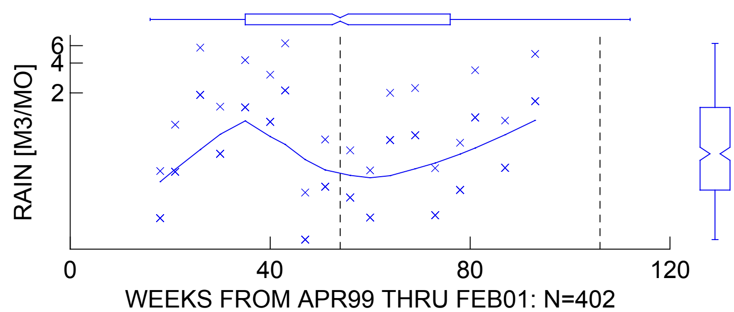


EXHIBIT H-10
Time Series Plots of Periphyton Chlorophyll A (P_CHLA), Periphyton Biovolume (P_BIOVOL), and Macrophyte Dry Weight (M_DW) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





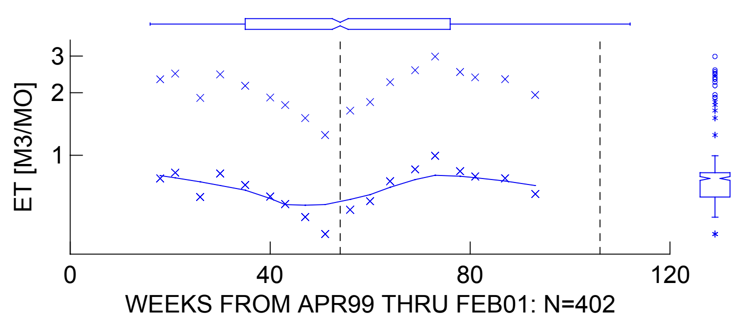
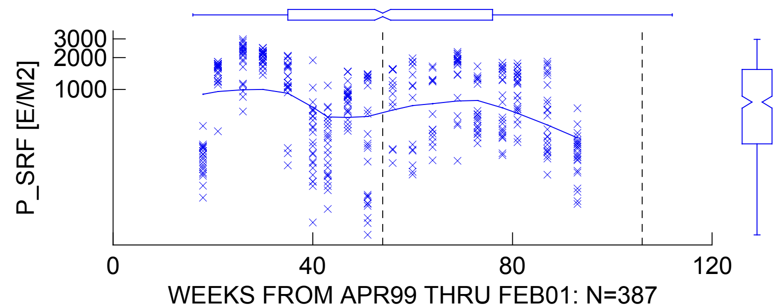
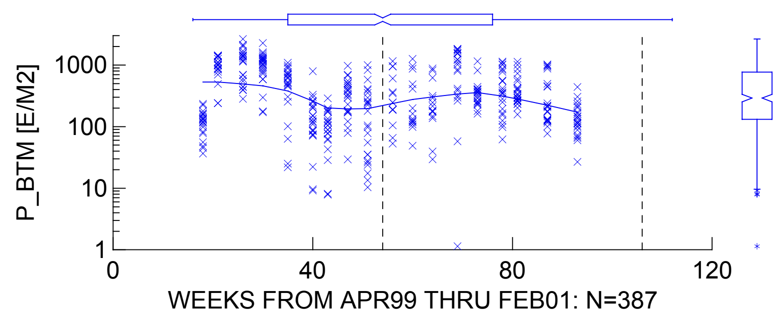


EXHIBIT H-11

Time Series Plots of Macrophyte Stem Counts (M_STEM), Rainfall (RAIN), and Evapo-Transpiration (ET) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





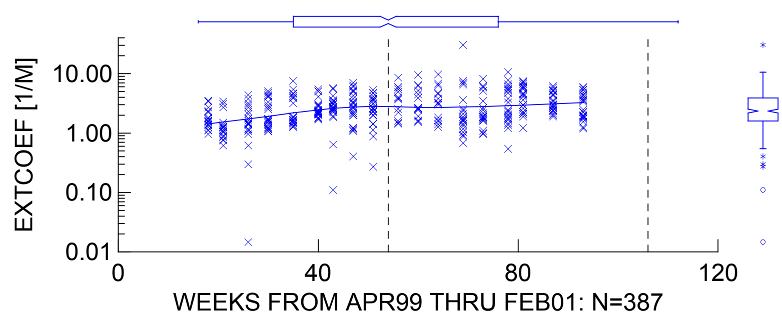
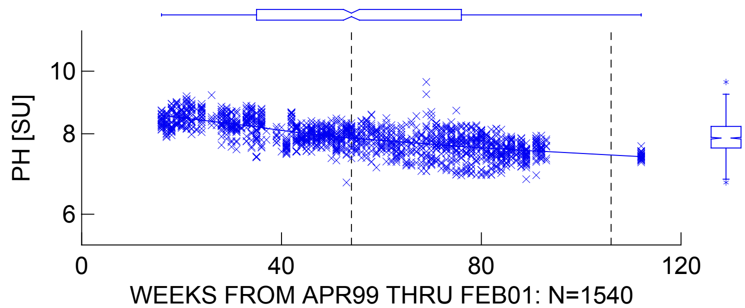
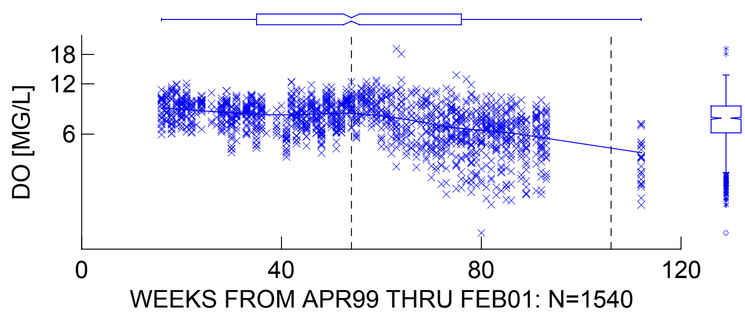


EXHIBIT H-12
Time Series Plots of PAR Measured at the Tank Surface (P_SURF), PAR Measured at the Tank Bottom (P_BTM), and Light Extinction Coefficient (EXTCOEF) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





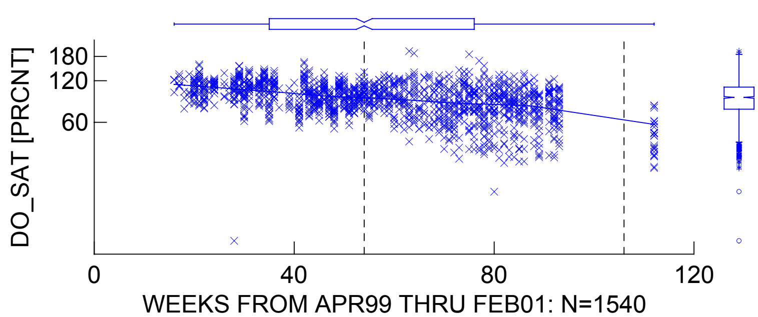
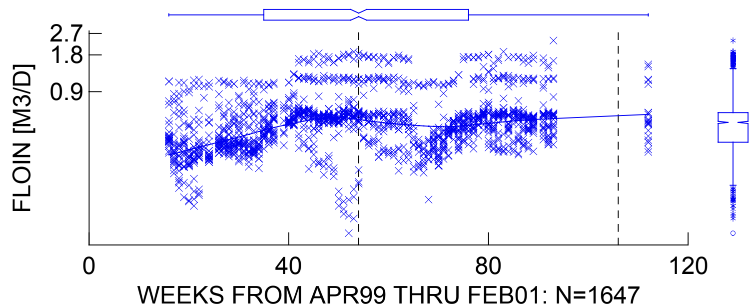
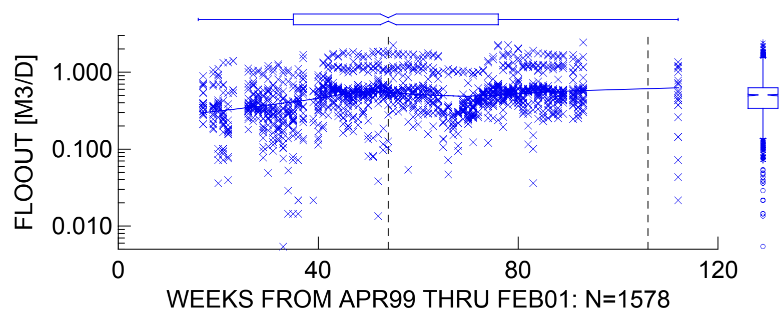


EXHIBIT H-13

Time Series Plots of pH, Dissolved Oxygen (DO) and Dissolved Oxygen Saturation (DO_SAT) for all PORTA PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





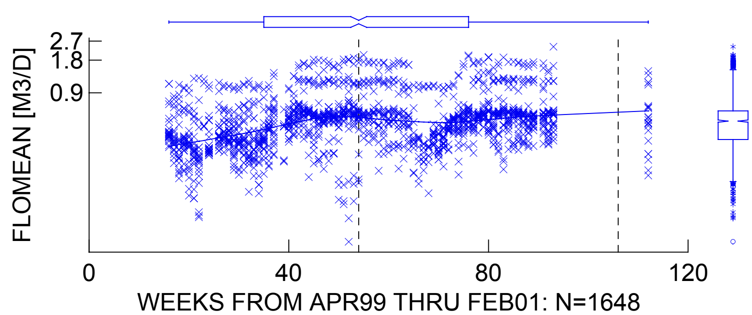
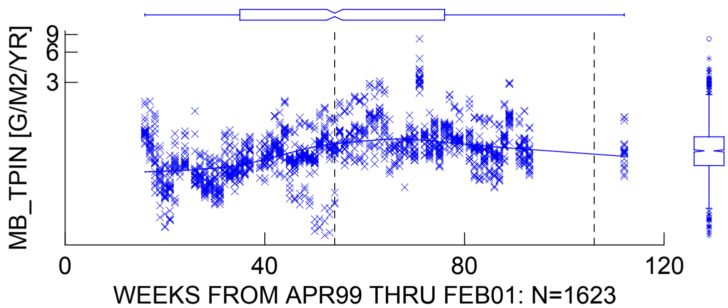
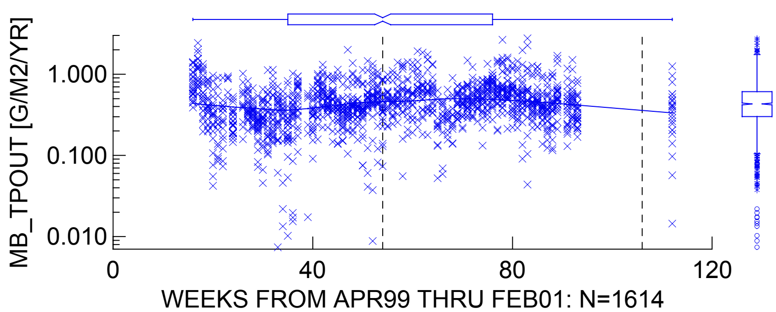


EXHIBIT H-14
Time Series Plots of Tank Inflow (FLOIN), Tank Outflow (FLOOUT), and Tank Mean Flow (FLOMEAN) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





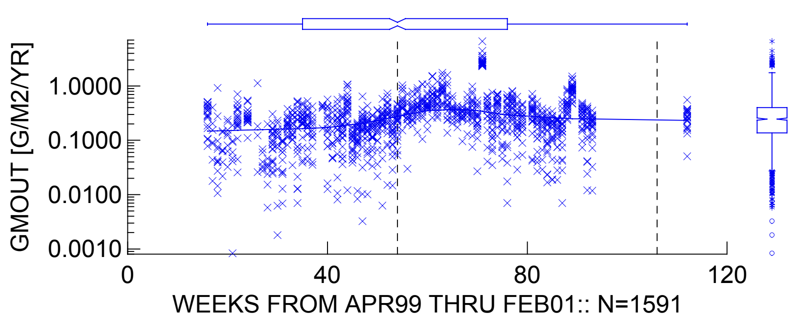
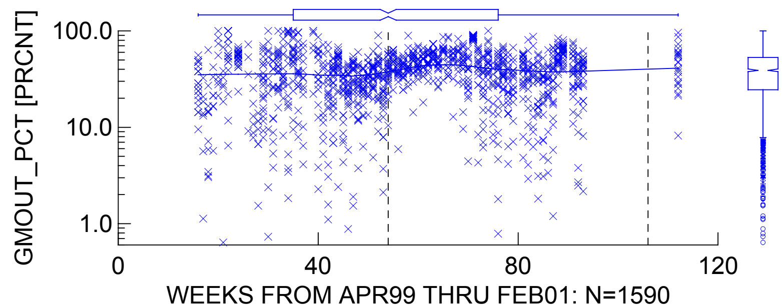


EXHIBIT H-15

Time Series Plots of Mass Balance of Inflow Total Phosphorus (MB_TPIN), Mass Balance of Outflow Total Phosphorus (MB_TPOUT), and Phosphorus Removal Rate (GMOUT) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).



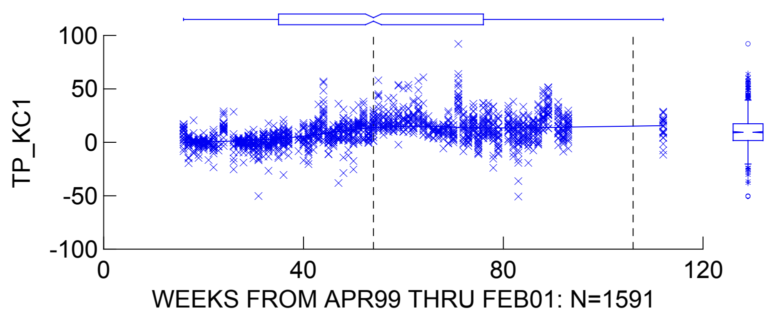


EXHIBIT H-16

Time Series Plots of Phosphorus Removal Percent (GMOUT_PCT) and Total Phosphorus Calculated First Order Removal (TP_KC1) for all Porta PSTA Monitoring Weeks for the POR (April 1999 to February 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

EXHIBIT H-17

One-way Kruskal-Wallis Comparisons Between Treatment Replicates

Significant results at the 0.0013 level are typed in bold

TREATMENT:	01:PEATdeep	02:ROCKdeepLO	03:PEATshal	04:ROCKshal	05:ROCKdeepHI	06:ROCKvar	13:PEATcaSHAL	14:ROCKlimeSHAL	15:ROCKshalRECIRC	16:ROCKvarVAR
REPLICATES:	9 11 18	4 7 8	12 14 17	3 5 10	2 13 16	1 6 15	9 11 18	4 7 8	2 13 16	1 6 15
SAMPLES:	15/3	15/3	51/12	51/12	26/6	24/6	16/4	16/4	16/4	16/4
RESPONSE VARIABLES										
Phosphorus Removal Rate ($g/m^2/yr$)	0.004	0.57	0.007	0.91	0.77	0.52	0.12	0.05	0.80	0.41
Phosphorus Removal Percent (%)	**0.000**	0.43	**0.000**	0.96	0.14	0.03	0.04	0.02	0.18	0.11
Mass Balance Outflow Total Phosphorus ($g/m^2/y$)	0.007	0.26	**0.000**	0.81	0.03	0.07	0.08	0.03	0.002	0.12
Total Phosphorus K, (m/yr)	**0.001**	0.33	**0.000**	0.57	0.89	0.06	0.06	0.03	0.12	0.41
Outflow Total Phosphorus (mg/L)	**0.001**	0.55	**0.000**	0.43	0.38	**0.000**	0.08	0.007	0.23	0.29
FLOW										
Tank Inflow (m^3/d)	0.61	0.29	0.011	0.19	0.29	0.89	0.32	0.65	**0.000**	0.19
Tank Outflow (m^3/d)	0.71	0.31	0.002	0.008	0.07	0.53	0.28	0.55	**0.001**	0.45
Mean Flow (m^3/d)	0.58	0.21	0.004	0.04	0.10	0.68	0.36	0.65	**0.000**	0.34
ENVIRONMENTAL PARAMETERS										
Rainfall (m^3)	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
ET (m^3)	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Surface PAR	0.07	0.96	0.88	0.76	0.99	0.25	0.49	0.87	0.49	0.47
Bottom PAR	0.09	0.73	0.62	0.31	0.71	0.49	0.55	0.51	0.30	0.84
Extinction Coefficient (m^{-1})	0.67	0.59	0.74	0.59	0.27	0.88	0.49	0.67	0.23	0.22
BIOLOGICAL PARAMETERS										
Periphyton Ash Free Dry Weight (g/m^2)	0.92	0.96	0.007	0.28	0.27	0.32	0.67	0.84	0.30	0.29
Periphyton Dry Weight (g/m^2)	0.92	0.96	0.004	0.26	0.08	0.65	0.55	0.84	0.24	0.33
Periphyton Chlorophyll *a* (mg/m^2)	0.78	0.73	0.38	0.74	0.04	0.42	0.29	0.55	0.39	0.23
Periphyton Biovolume(cm^3/m^2)	0.17	0.84	0.020	0.46	0.10	0.63	0.44	0.58	0.84	0.11
Macrophyte Dry Weight (g/m^2)	0.17	0.97	0.29	0.07	0.36	0.13	0.94	0.76	0.09	0.36
Macrophyte Stem Count	0.11	0.02	0.78	0.02	0.005	0.03	0.84	0.47	0.007	0.02
WATER QUALITY PARAMETERS										
Inflow Total Phosphorus (mg/L)	0.99	0.93	0.98	0.99	0.99	0.97	0.89	0.99	0.98	0.99
Inflow Total Nitrogen (mg/L)	0.72	0.95	0.91	0.75	0.98	0.89	0.44	0.74	0.39	0.69
Outflow Total Nitrogen (mg/L)	0.84	0.73	0.87	0.93	0.99	0.69	0.31	0.94	0.55	0.67
Inflow NO_2/NO_3 (mg/L)	0.95	0.95	0.99	0.98	0.77	0.96	0.94	0.82	0.94	0.97
Outflow NO_2/NO_3 (mg/L)	0.99	0.85	0.89	0.83	0.83	0.99	0.58	0.67	0.62	0.73
Inflow NH_3 (mg/L)	0.95	0.72	0.98	0.96	0.99	0.93	0.99	0.99	0.98	0.87
Inflow TOC (mg/L)	0.95	0.95	0.99	0.99	0.91	0.96	0.92	0.94	0.86	0.81
Outflow TOC (mg/L)	0.93	0.62	0.95	0.97	0.91	0.34	0.19	0.64	0.97	0.74
Inflow TSS (mg/L)	0.43	0.99	0.76	0.83	0.75	0.36	0.98	0.93	0.93	0.68
Outflow TSS (mg/L)	0.08	0.59	0.51	0.24	0.27	0.39	0.39	0.42	0.66	0.95
Inflow Calcium (mg/L)	0.72	0.95	0.99	0.99	0.99	0.78	0.94	0.98	0.94	0.92
Outflow Calcium (mg/L)	0.71	0.75	0.97	0.26	0.91	0.03	0.79	0.98	0.47	0.87
Inflow Alkalinity (mg/L)	0.95	0.95	0.99	0.99	0.77	0.99	0.97	0.94	0.94	0.94
Outflow Alkalinity (mg/L)	0.67	0.67	0.94	0.36	0.96	0.06	0.72	0.76	0.35	0.98
pH (units)	0.95	0.10	0.89	**0.000**	0.75	0.12	0.34	0.15	**0.000**	0.02
Dissolved Oxygen (DO)	0.73	0.15	0.99	0.09	0.83	0.71	0.79	0.18	**0.000**	0.61
Dissolved Oxygen Saturation (%)	0.96	0.27	0.97	0.04	0.99	0.95	0.84	0.18	**0.000**	0.76
Mass Balance Inflow Total Phosphorus ($g/m^2/y$)	0.91	0.79	0.29	0.91	0.89	0.92	0.57	0.99	0.03	0.66

Note:

By convention, a probability less than 0.05 is considered to be a rare-enough probability to support rejection of the null hypothesis of equality among replicates. However, multiple comparisons within a set of non-independent measurements requires adjustment to retain a comparable probability of rejecting the null hypothesis due to chance alone, across all comparisons. The adjustment, typically applied, results in an adjusted probability of statistically significant differences to probabilities less than approximately 0.0013.

EXHIBIT H-18

Porta-PSTA ANOVA Comparisons Run for Both the Period of Record and Optimal Performance Period

Treatment	Tanks	Independent Variables	Comparison
PP-1	9, 11, 18	Deep Peat	Depth over Peat
PP-3	12, 14, 17	Shallow Peat	
PP-2	4, 7, 8	Deep Shellrock	Depth over Shellrock
PP-4	3, 5, 10	Shallow Shellrock	
PP-2	4, 7, 8	Low HLR	HLR over Shellrock
PP-5	2, 13, 16	High HLR	
PP-2	4, 7, 8	Deep Shellrock	Depth Variability over Shellrock
PP-4	3, 5, 10	Shallow Shellrock	
PP-6	1, 6, 15	Variable Shellrock	
PP-3	12, 14, 17	Shallow Peat, Phase 1	Peat Treatment Sustainability
PP-3	12, 14, 17	Shallow Peat, Phase 2	
PP-4	3, 5, 10	Shallow Shellrock, Phase 1	Shellrock Treatment Sustainability
PP-4	3, 5, 10	Shallow Shellrock, Phase 2	
PP-3	12, 14, 17	Peat	Substrate
PP-4	3, 5, 10	Shellrock	
PP-13	9, 11, 18	Peat Calcium Amended	
PP-14	4, 7, 8	Lime Rock	
PP-4	3, 5, 10	Low Velocity	Velocity over Shellrock
PP-15	2, 13, 16	High Velocity	
PP-1	9, 11, 18	Deep Peat	Depth, Substrate, and Depth/Substrate Interaction
PP-2	4, 7, 8	Deep Shellrock	
PP-3	12, 14, 17	Shallow Peat	
PP-4	3, 5, 10	Shallow Shellrock	

EXHIBIT H-19

Period of Record ANOVA Results for Porta-PSTA Treatments

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effect of water depth on peat substrate (Phase 1)	PP-1 (deep peat) vs. PP-3 (shallow peat)	TP Out (µg/L)	Mean	0.8057	No difference in Mean TP out between depths of peat substrate
			Median	0.9868	No difference in Median TP out between depths of peat substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.1082	No difference in Mean Removal Rate between depths of peat substrate
			Median	0.2244	No difference in Median Removal Rate between depths of peat substrate
		k_1 (m/y)	Mean	0.3491	No difference in Mean k_1 between depths of peat substrate
			Median	0.5890	No difference in Median k_1 between depths of peat substrate
Effect of water depth on shellrock substrate (Phase 1)	PP-2 (deep shellrock) vs. PP-4 (shallow shellrock)	TP Out (µg/L)	Mean	0.1648	No difference in Mean TP out between depths of shellrock substrate
			Median	0.1432	No difference in Median TP out between depths of shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.1381	No difference in Mean Removal Rate between depths of shellrock substrate
			Median	0.0843	No difference in Median Removal Rate between depths of shellrock substrate
		k_1 (m/y)	Mean	0.1110	No difference in Mean k_1 between depths of shellrock substrate
			Median	0.0544	Shallow depths significantly increased Median k_1 over shellrock substrate
Effects of HLR on shellrock substrate (Phase 1)	PP-2 (low HLR) vs. PP-5 (high HLR)	TP Out (µg/L)	Mean	0.3640	No difference in Mean TP out between low and high HLR rates
			Median	0.0593	Low HLR significantly decreased Median TP out over shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0021	High HLR significantly increased Mean Removal Rate over shellrock substrate
			Median	0.0050	High HLR significantly increased Median Removal Rate over shellrock substrate
		k_1 (m/y)	Mean	0.0079	High HLR significantly increased Mean k_1 over shellrock substrate
			Median	0.0078	High HLR significantly increased Median k_1 over shellrock substrate
Effect of depth on shellrock substrate (Phase 1)	PP-2 (deep shellrock) vs. PP-4 (shallow shellrock) PP-6 (variable shellrock)	TP Out (µg/L)	Mean	0.8676	No difference in Mean TP out between depths of shellrock substrate
			Median	0.5203	No difference in Median TP out between depths of shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0853	No difference in Mean Removal Rate between depths of shellrock substrate
			Median	0.0057	Shallow depth significantly increase Median Removal Rate compared to variable shellrock tanks; deep tanks not significantly different
		k_1 (m/y)	Mean	0.0432	Shallow depths significantly increase Mean k_1 compared to variable shellrock tanks; deep tanks not significantly different
			Median	0.0125	Shallow depths significantly increase Median k_1 compared to variable shellrock tanks; deep tanks not significantly different
Effects of Phase on peat substrate	PP-3(shallow peat, Phase 1) vs. PP-3(shallow peat, Phase 2)	TP Out (µg/L)	Mean	0.5799	No difference in Mean TP Out between phases for peat substrate
			Median	0.4079	No difference in Median TP Out between phases for peat substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.1528	No difference in Mean Removal Rate between phases for peat substrate
			Median	0.4176	No difference in Median Removal Rate between phases for peat substrate
		k_1 (m/y)	Mean	0.7341	No difference in Mean k_1 between phases for peat substrate
			Median	0.6158	No difference in Median k_1 between phases for peat substrate
Effects of Phase on shellrock substrate	PP-4(shallow shellrock, Phase 1) PP-4(shallow shellrock, Phase 2)	TP Out (µg/L)	Mean	0.1161	No difference in Mean TP Out between phases for shellrock substrate
			Median	0.7685	No difference in Median TP Out between phases for shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0026	Phase II Mean Removal Rate significantly greater than Phase I
			Median	0.0245	Phase II Median Removal Rate significantly greater than Phase I
		k_1 (m/y)	Mean	0.0374	Phase II Mean k_1 significantly greater than Phase I
			Median	0.0419	Phase II Median k_1 significantly greater than Phase I

EXHIBIT H-19

Period of Record ANOVA Results for Porta-PSTA Treatments

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effects of substrate (Phase 2)	PP-3 (shallow peat)	TP Out (µg/L)	Mean	0.2576	No difference in Mean TP Out between substrates during phase II
	PP-4 (shallow shellrock)		Median	0.4063	No difference in Median TP Out between substrates during phase II
	PP-13(shallow peat w/ caoh)	P Removal Rate	Mean	0.7916	No difference in Mean Removal Rate between substrates during phase II
	PP-14(shallow limerock)	($g/m^2/y$)	Median	0.4802	No difference in Median Removal Rate between substrates during phase II
		k_1 (m/y)	Mean	0.5391	No difference in Mean k_1 between substrates during phase II
			Median	0.3930	No difference in Median k_1 between substrates during phase II
Effects of velocity on shellrock substrate	PP-4(slow velocity)	TP Out (µg/L)	Mean	0.1106	No difference in Mean TP Out between velocities over shellrock substrate
	PP-15(fast velocity)		Median	0.2502	No difference in Median TP Out between velocities over shellrock substrate
(Phase 2)		P Removal Rate	Mean	0.1108	No difference in Mean Removal Rate between velocities over shellrock substrate
		($g/m^2/y$)	Median	0.1013	No difference in Median Removal Rate between velocities over shellrock substrate
		k_1 (m/y)	Mean	0.3501	No difference in Mean k_1 between velocities over shellrock substrate
			Median	0.6559	No difference in Median k_1 between velocities over shellrock substrate
Comparison of water depth and substrate (Phase 1)	PP-1 (deep peat)	TP Out (µg/L)	Mean	0.8472	No difference across depths for Mean TP Out
	PP-2(deep shellrock)			0.8660	No difference across substrates for Mean TP Out
	PP-3(shallow peat)			0.7728	No significant depth/substrate interaction for Mean TP Out
	PP-4(shallow shellrock)		Median	0.6083	No difference across depths for Median TP Out
				0.5878	No difference across substrates for Median TP Out
				0.5878	No significant depth/substrate interaction for Median TP Out
		P Removal Rate	Mean	0.0838	No difference in Mean Removal Rate across depths
		($g/m^2/y$)		0.7548	No difference in Mean Removal Rate across substrates
				0.5237	No significant depth/substrate interaction for Mean Removal Rate
			Median	0.0612	No difference in Median Removal Rate across depths
				0.8342	No difference in Median Removal Rate across substrates
				0.6350	No significant depth/substrate interaction for Median Removal Rate
		k_1 (m/y)	Mean	0.1191	No difference across depths for Mean k_1
				0.5455	No difference across substrates for Mean k_1
				0.8307	No significant depth/substrate interaction for Mean k_1
			Median	0.2648	No difference across depths for Median k_1
				0.3905	No difference across substrates for Median k_1
				0.6549	No significant depth/substrate interaction for Median k_1

Note:

Number of Test Resulting in a Significant Difference: 13

EXHIBIT H-20

Optimal Performance Period ANOVA Results for Porta-PSTA Treatments

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effect of depth on peat substrate (Phase 1)	PP-1 (deep peat) vs. PP-3 (shallow peat)	TP Out (µg/L)	Mean	0.6513	No difference in Mean TP out between depths of peat substrate
			Median	0.5206	No difference in Median TP out between depths of peat substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.2682	No difference in Mean Removal Rate between depths of peat substrate
			Median	0.0690	No difference in Median Removal Rate between depths of peat substrate
		k_1 (m/y)	Mean	0.4927	No difference in Mean k_1 between depths of peat substrate
			Median	0.3784	No difference in Median k_1 between depths of peat substrate
Effect of depth on shellrock substrate (Phase 1)	PP-2 (deep shellrock) vs. PP-4 (shallow shellrock)	TP Out (µg/L)	Mean	0.1648	No difference in Mean TP out between depths of shellrock substrate
			Median	0.1433	No difference in Median TP out between depths of shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0061	Shallow depths significantly increased Mean Removal Rate over shellrock substrate
			Median	0.0099	Shallow depths significantly increased Median Removal Rate over shellrock substrate
		k_1 (m/y)	Mean	0.0307	Shallow depths significantly increased Mean k_1 over shellrock substrate
			Median	0.0116	Shallow depths significantly increased Median k_1 over shellrock substrate
Effects of HLR on shellrock substrate (Phase 1)	PP-2 (low HLR) vs. PP-5 (high HLR)	TP Out (µg/L)	Mean	0.0011	Low HLR significantly decreased Mean TP out over shellrock substrate
			Median	0.0024	Low HLR significantly decreased Median TP out over shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0003	High HLR significantly increased Mean Removal Rate over shellrock substrate
			Median	0.0149	High HLR significantly increased Median Removal Rate over shellrock substrate
		k_1 (m/y)	Mean	0.0004	High HLR significantly increased Mean k_1 over shellrock substrate
			Median	0.0004	High HLR significantly increased Median k_1 over shellrock substrate
Effect of depth on shellrock substrate (Phase 1)	PP-2 (deep shellrock) vs. PP-4 (shallow shellrock) PP-6 (variable shellrock)	TP Out (µg/L)	Mean	0.5023	No difference in Mean TP out between depths of shellrock substrate
			Median	0.3190	No difference in Median TP out between depths of shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0010	Shallow depths significantly increase Mean Removal Rate compared to deep and variable shellrock tanks
			Median	0.0006	Shallow depths significantly increase Median Removal Rate compared to deep and variable shellrock tanks
		k_1 (m/y)	Mean	0.0040	Shallow depths significantly increase mean k_1 compared to deep and variable shellrock tanks
			Median	0.0056	Shallow depths significantly increase median k_1 compared to deep and variable shellrock tanks
Effects of Phase on peat substrate	PP-3 (shallow peat, Phase 1) vs. PP-3 (shallow peat, Phase 2)	TP Out (µg/L)	Mean	0.2917	No difference in Mean TP Out between phases for peat substrate
			Median	0.3334	No difference in Median TP Out between phases for peat substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.9471	No difference in Mean Removal Rate between phases for peat substrate
			Median	0.3106	No difference in Median Removal Rate between phases for peat substrate
		k_1 (m/y)	Mean	0.4676	No difference in Mean k_1 between phases for peat substrate
			Median	0.3187	No difference in Median k_1 between phases for peat substrate

EXHIBIT H-20
Optimal Performance Period ANOVA Results for Porta-PSTA Treatments

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effects of Phase on shellrock substrate	PP-4(shallow shellrock, Phase 1) PP-4(shallow shellrock, Phase 2)	TP Out (µg/L)	Mean	0.5149	No difference in Mean TP Out between phases for shellrock substrate
			Median	0.5272	No difference in Median TP Out between phases for shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0983	No difference in Mean Removal Rate between phases for shellrock substrate
			Median	0.1069	No difference in Median Removal Rate between phases for shellrock substrate
		k_1 (m/y)	Mean	0.7352	No difference in Mean k_1 between phases for shellrock substrate
			Median	0.1804	No difference in Median k_1 between phases for shellrock substrate
Effects of substrate (Phase 2)	PP-3 (shallow peat) PP-4 (shallow shellrock) PP-13(shallow peat w/ caoh) PP-14(shallow limerock)	TP Out (µg/L)	Mean	0.3326	No difference in Mean TP Out between substrates
			Median	0.3655	No difference in Median TP Out between substrates
		P Removal Rate ($g/m^2/y$)	Mean	0.1341	No difference in Mean Removal Rate between substrates
			Median	0.5720	No difference in Median Removal Rate between substrates
		k_1 (m/y)	Mean	0.6082	No difference in Mean k_1 between substrates
			Median	0.6321	No difference in Median k_1 between substrates
Effects of velocity on shellrock substrate (Phase 2)	PP-4(slow velocity) PP-15(fast velocity)	TP Out (µg/L)	Mean	0.7284	No difference in Mean TP Out between velocities over shellrock substrate
			Median	0.9216	No difference in Median TP Out between velocities over shellrock substrate
		P Removal Rate ($g/m^2/y$)	Mean	0.0137	Slow velocity significantly increased Mean Removal Rate over shellrock substrate
			Median	0.9909	No difference in Median Removal Rate between velocities over shellrock substrate
		k_1 (m/y)	Mean	0.3552	No difference in Mean k_1 between velocities over shellrock substrate
			Median	0.6621	No difference in Median k_1 between velocities over shellrock substrate
Comparison of depth and substrate (Phase 1)	PP-1 (deep peat) PP-2(deep shellrock) PP-3(shallow peat) PP-4(shallow shellrock)	TP Out (µg/L)	Mean	0.3440	No difference across depths for Mean TP Out
				0.3859	No difference across substrates for Mean TP Out
				0.9315	No significant depth/substrate interaction for Mean TP Out
			Median	0.2293	No difference across depths for Median TP Out
				0.5655	No difference across substrates for Median TP Out
				0.9887	No significant depth/substrate interaction for Median TP Out
		P Removal Rate ($g/m^2/y$)	Mean	0.0060	Shallow depths significantly increased Mean Removal Rate
				0.9498	No difference in Mean Removal Rate across substrates
				0.9211	No significant depth/substrate interaction for Mean Removal Rate
			Median	0.0018	Shallow depths significantly increased Median Removal Rate
				0.8642	No difference in Median Removal Rate across substrates
				0.7133	No significant depth/substrate interaction for Median Removal Rate
		k_1 (m/y)	Mean	0.1388	No difference across depths for Mean k_1
				0.5655	No difference across substrates for Mean k_1
				0.8493	No significant depth/substrate interaction for Mean k_1
			Median	0.0553	Shallow depths significantly increased Median k_1
				0.5850	No difference across substrates for Median k_1
				0.7363	No significant depth/substrate interaction for Median k_1

Note:
Number of Test Resulting in a Significant Difference: 18

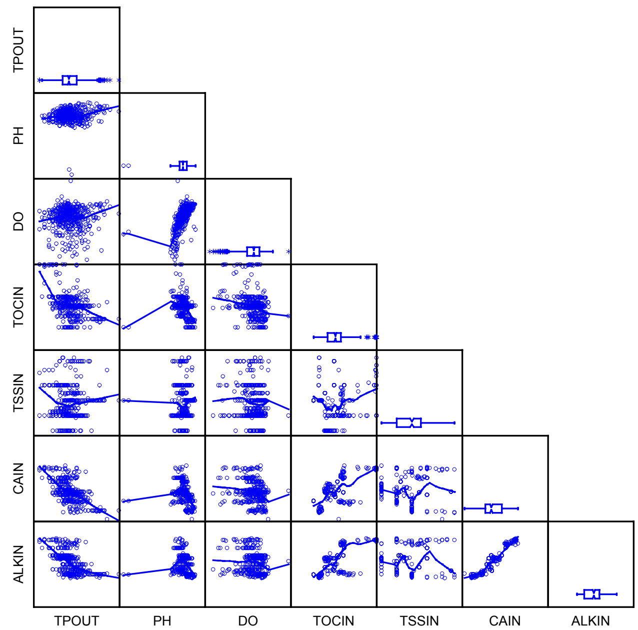
EXHIBIT H-21

Probability Results of Kruskal-Wallis Comparisons Between Porta-PSTA Treatment Factors

Significant results less than or equal to 0.01 are in typed in bold

Treatments	Variable	POR (All values)	OPP (All values)	POR (Aggregated)	OPP (Aggregated)	Effect
SUBSTRATE						
SHALLOW:	TPOUT	**0.001**	**0.001**	0.03	0.02	ROCKany<PEATany
Peat vs. Shellrock vs.	MB_TPOUT	**0.005**	0.19	0.09	0.55	ROCKany<PEATany
Calcium amended Peat	GMOUT	0.17	0.27	0.42	0.06	
vs. Lime Rock	GMOUT_PCT	0.05	0.08	0.22	0.07	
	TP_k_1	**0.004**	**0.002**	0.02	**0.01**	PEAT<ROCK
	DELTA	0.03	0.06	0.16	0.02	
SHALLOW:	TPOUT	**0.007**	**0.001**	0.05	**0.007**	ROCK<PEAT
Shallow vs. Deep	MB_TPOUT	0.79	0.19	0.98	0.25	
	GMOUT	0.96	0.31	0.73	0.19	
	GMOUT_PCT	0.71	0.15	0.74	0.12	
	TP_k_1	0.02	**0.002**	0.04	**0.006**	PEAT<ROCK
	DELTA	0.17	0.04	0.18	0.07	
WATER DEPTH						
Shallow vs. Deep	TPOUT	0.53	0.84	0.67	0.71	
	MB_TPOUT	0.77	0.73	0.79	0.49	
	GMOUT	0.10	0.41	0.78	0.82	
	GMOUT_PCT	0.13	0.49	0.89	0.69	
	TP_k_1	0.15	0.49	0.59	0.99	
	DELTA	0.13	0.34	0.58	0.58	
SHELLROCK	TPOUT	0.57	0.36	0.64	0.51	
Shallow vs. Deep	MB_TPOUT	0.12	0.48	0.45	0.44	
	GMOUT	0.69	0.08	0.54	0.23	
	GMOUT_PCT	0.24	0.18	0.25	0.42	
	TP_k_1	0.67	**0.007**	0.66	0.08	DEEP<SHAL
	DELTA	0.97	0.05	0.69	0.69	
SHELLROCK	TPOUT	0.24	0.04	0.67	0.17	
Shallow vs. Deep vs.	MB_TPOUT	**0.001**	**0.001**	0.32	**0.003**	VAR<DEEP<SHAL
Variable	GMOUT	0.29	**0.001**	0.62	**0.006**	VAR~DEEP<SHAL
	GMOUT_PCT	0.48	0.21	0.39	0.08	
	TP_k_1	0.02	**0.001**	0.42	**0.001**	VAR~DEEP<SHAL
	DELTA	0.62	0.12	0.74	0.42	
HYDRAULIC LOADING RATE						
Deep Shellrock: Low vs.	TPOUT	0.03	**0.001**	0.31	0.03	LO<HI
High	MB_TPOUT	**0.001**	**0.001**	**0.001**	**0.001**	LO<HI
	GMOUT	**0.002**	**0.001**	0.04	**0.002**	LO<HI
	GMOUT_PCT	0.31	0.61	0.37	0.27	
	TP_k_1	0.03	**0.001**	0.22	0.02	LO<HI
	DELTA	0.97	0.57	0.77	0.23	
FLOW/HLR						
Shallow Shellrock: ????	TPOUT	0.03	0.59	0.22	0.55	
	MB_TPOUT	0.82	0.14	0.99	0.25	
	GMOUT	0.34	0.93	0.41	0.63	
	GMOUT_PCT	0.66	0.32	0.99	0.19	
	TP_k_1	0.03	0.37	0.13	0.85	
	DELTA	0.05	0.66	0.14	0.43	
SUBSTRATE*DEPTH						
Deep Peat vs. Deep	TPOUT	0.58	0.28	0.81	0.56	
Shellrock vs. Shallow	MB_TPOUT	0.18	0.91	0.58	0.73	
Peat vs. Shallow	GMOUT	0.39	0.31	0.71	0.79	
Shellrock	GMOUT_PCT	0.26	0.51	0.57	0.83	
	TP_k_1	0.31	0.05	0.91	0.42	
	DELTA	0.38	0.09	0.91	0.51	

LOG[TPout * WATER QUALITYin]

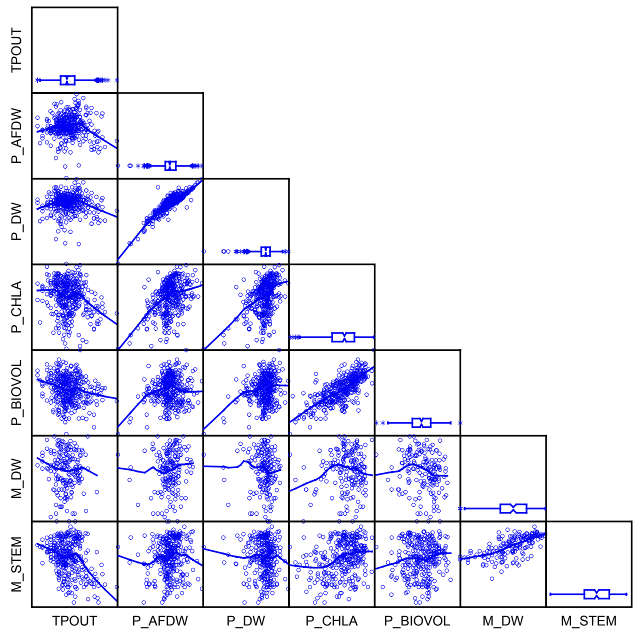


N=372

	TP_out	PH	DO	TOC_in	TSS_in	CA_in	ALK_in
TP_out	0.000						
PH	**0.000+**	0.000					
DO	1.000	**0.000+**	0.000				
TOC_in	**0.000-**	**0.000-**	**0.000-**	0.000			
TSS_in	1.000	1.000	0.686	0.110	0.000		
CA_in	**0.000-**	**0.000-**	**0.000-**	**0.000+**	1.000	0.000	
ALK_in	**0.000-**	**0.000-**	**0.000-**	**0.000+**	1.000	**0.000+**	0.000

EXHIBIT H-22
Scatter Plots and Correlation Matrix Comparing Log Transformed of TP Out Values versus Water Quality Variables Measured at the Porta PSTAs.

LOG[TPout * PHYTICS]

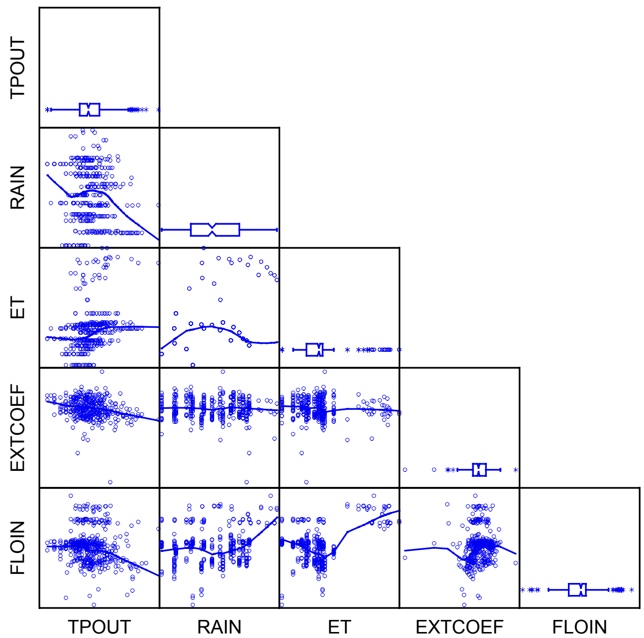


N=238

	TP_out	P_AFDW	P_DW	P_CHLA	P_BIOVOL	M_DW	M_STEM
TP_out	0.000						
P_AFDW	**0.014+**	0.000					
P_DW	0.065	**0.000+**	0.000				
P_CHLA	1.000	0.931	**0.003+**	0.000			
P_BIOVOL	1.000	1.000	1.000	**0.000+**	0.000		
M_DW	1.000	1.000	0.469	1.000	1.000	0.000	
M_STEM	1.000	1.000	1.000	1.000	1.000	**0.000+**	0.000

EXHIBIT H-23
Scatter Plots and Correlation Matrix Comparing Log Transformed TP Out Values versus Periphyton and Macrophyte Variables Measured at the Porta PSTAs.

LOG[TPout * EXTERNALS]

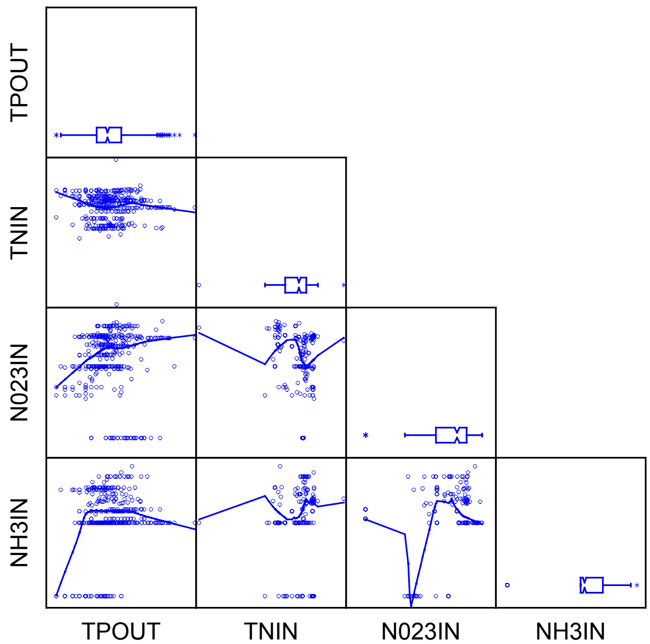


N=387

	TP_out	RAIN	ET	EXTCOEF	FLO_in
TP_out	0.000				
RAIN	**0.013-**	0.000			
ET	**0.000+**	**0.000+**	0.000		
EXTCOEF	**0.005-**	1.000	1.000	0.000	
FLO_in	0.648	**0.000+**	**0.000+**	1.000	0.000

EXHIBIT H-24
Scatter Plots and Correlation Matrix Comparing Log Transformed TP Out Values versus Environmental Parameters Measured at the Porta PSTAs.

LOG[TPout * NITROGENin]

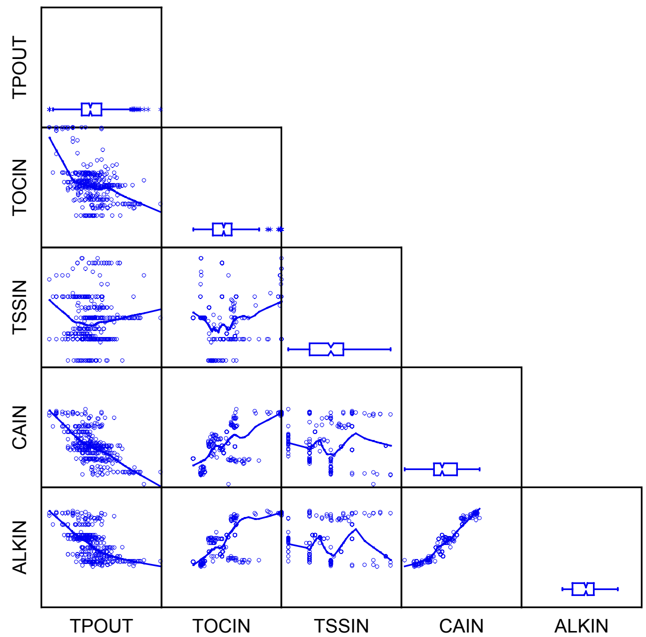


N=402

	TP_out	TN_in	NO23_in	NH3_in
TP_out	0.000			
TN_in	1.000	0.000		
NO23_in	**0.018** +	**0.000** -	0.000	
NH3_in	1.000	0.263	0.102	0.000

EXHIBIT H-25
Scatter Plots and Correlation Matrix Comparing Log Transformed TP Out Values versus Inflow Nitrogen Parameters Measured at the Porta PSTAs.

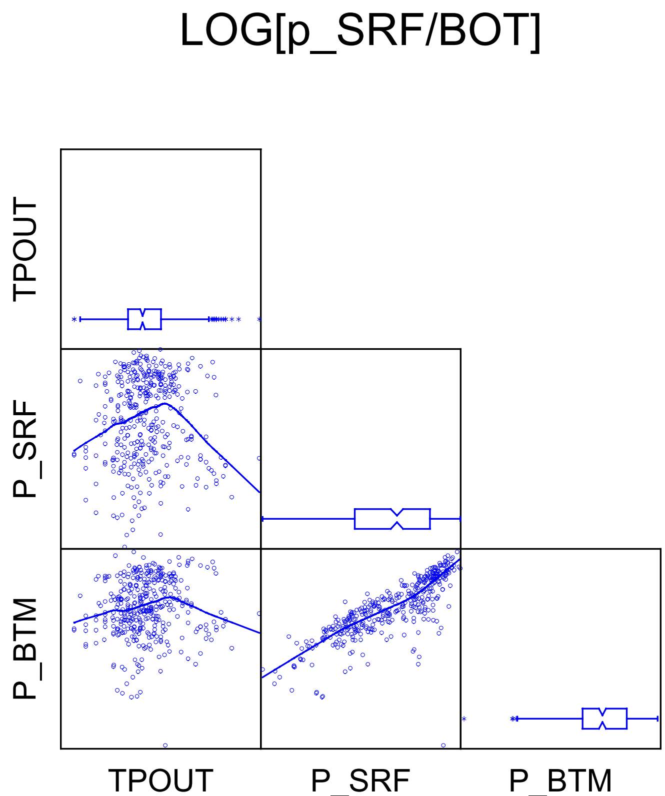
LOG[TPout * WATER QUALITYin]



N=381

	TP_out	TOC_in	TSS_in	CA_in	ALK_in
TP_out	0.000				
TOC_in	**0.000 -**	0.000			
TSS_in	1.000	0.055	0.000		
CA_in	**0.000 -**	**0.000 +**	1.000	0.000	
ALK_in	**0.000 -**	**0.000 +**	1.000	**0.000 +**	0.000

EXHIBIT H-26
Scatter Plots and Correlation Matrix Comparing Log Transformed TP Out Values versus Inflow Water Quality Parameters Measured at the Porta PSTAs.



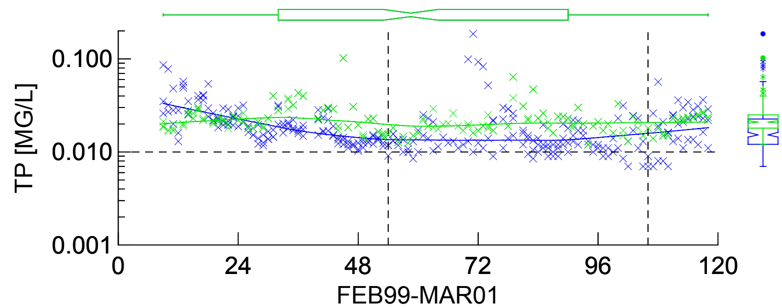
N=387

	TP_out	P_SRF	P_BTM
TP_out	0.000		
P_SRF	1.000	0.000	
P_BTM	0.248	**0.000 +**	0.000

EXHIBIT H-27
Scatter Plots and Correlation Matrix Comparing Log Transformed TP Out Values versus PAR Values Measured at the Porta PSTAs.

EXHIBIT H-28
Summary Statistics for 37 Parameters Measured at the PSTA Test Cells

	MIN	MAX	MEAN	MEDIAN	SD	CV	95UCL
RESPONSE VARIABLE							
Phosphorus Removal Rate ($g/m^2/yr$)	-2.60	1.55	0.08	0.10	0.37	4.93	0.11
Phosphorus Removal Percent (%)	-864.05	100.00	6.29	32.45	98.46	15.67	16.35
Mass Balance Outflow Total Phosphorus ($g/m^2/yr$)	0.00	2.90	0.34	0.25	0.30	0.89	0.37
Phosphorus K_1 (m/y)	-42.12	45.91	4.79	5.03	10.81	2.26	5.89
Outflow Total Phosphorus (mg/L)	0.007	0.1860	0.0202	0.0153	0.0164	0.0008	0.0218
PHYSICAL FACTORS							
Extinction Coefficient (m^{-1})	1.03	19.45	4.88	2.77	4.41	0.91	5.78
PAR at Water Surface (E/m^2)	135.60	2095.45	1052.40	1079.48	565.89	0.54	1168.65
PAR at Tank Bottom (E/m^2)	1.90	1684.12	470.80	376.72	382.27	0.81	549.33
Cell Inflow (m^3/d)	0.00	262.03	121.74	122.72	37.49	0.31	125.42
Cell Outflow (m^3/d)	0.00	287.28	117.52	112.17	49.11	0.42	122.43
Cell Mean Flow (m^3/d)	7.61	272.63	120.17	116.64	40.18	0.33	124.12
RAIN (m^3)	1.83	968.48	266.44	133.29	300.01	1.13	325.80
ET (m^3)	179.32	569.70	295.41	298.92	78.66	0.27	310.97
BIOLOGICAL FACTOR							
Microphyte Dry Weight (g/m^2)	0.00	1630.00	261.91	139.00	317.71	1.21	342.44
Periphyton Ash Free Dry Weight (g/m^2)	4.95	1816.05	244.65	140.07	334.18	1.37	312.78
Periphyton Biovolume (cm^3/m^2)	0.24	110.92	16.84	9.99	20.21	1.20	21.31
Periphyton Chlorophyll *a* (mg/m^2)	1.94	536.04	146.31	121.31	131.93	0.90	173.20
Periphyton Dry Weight (g/m^2)	27.71	5040.55	789.49	463.75	938.79	1.19	980.86
WATER QUALITY							
Inflow Alkalinity (mg/L)	120.00	318.00	252.05	258.50	44.10	0.17	257.40
Outflow Alkalinity (mg/L)	100.00	288.00	223.66	237.00	51.30	0.23	233.52
Inflow Calcium (mg/L)	43.61	100.00	69.29	70.87	13.57	0.20	70.99
Outflow Calcium (mg/L)	15.70	106.00	54.60	57.40	17.13	0.31	58.09
Dissolved Oxygen (mg/L)	0.17	11.95	6.25	7.13	3.15	0.50	6.56
Dissolved Oxygen Saturation (%)	0.00	157.95	72.82	82.79	41.75	0.57	76.98
Mass Balance Inflow Total Phosphorus ($g/m^2/yr$)	0.00	1.76	0.41	0.36	0.24	0.58	0.44
Inflow NH3 (mg/L)	0.020	0.230	0.076	0.054	0.060	0.007	0.088
Outflow NH3 (mg/L)	0.002	0.113	0.023	0.020	0.017	0.007	0.027
Inflow NO_2/NO_3 (mg/L)	0.002	0.305	0.067	0.047	0.059	0.008	0.075
Outflow NO_2/NO_3 (mg/L)	0.002	0.093	0.013	0.002	0.017	0.001	0.017
pH (units)	0.000	9.572	7.923	7.918	0.864	0.109	8.009
Inflow Total Nitrogen (mg/L)	0.62	3.69	2.10	2.18	0.56	0.27	2.17
Outflow Total Nitrogen (mg/L)	0.44	3.46	1.86	1.97	0.77	0.41	2.02
Inflow TOC (mg/L)	21.65	50.10	36.37	36.40	6.11	0.17	37.11
Outflow TOC (mg/L)	20.70	69.00	39.12	39.50	8.20	0.21	40.67
Inflow Total Phosphorus (mg/L)	0.012	0.102	0.023	0.021	0.011	0.0004	0.024
Inflow TSS (mg/L)	0.50	14.00	3.11	3.00	2.41	0.78	3.40
Outflow TSS (mg/L)	0.50	26.00	4.24	3.00	4.19	0.99	5.05



TEST CELL PSTA UNITS

	INFLOW	OUTFLOW	DIFFERENCE
N	267	275	263
MIN	0.012	0.007	-0.170
MAX	0.102	0.186	0.090
MEDIAN	0.021	0.015	0.005
MEAN	0.023	0.020	0.003
95CI	0.022 – 0.025	0.018 – 0.022	0.001 – 0.006
SD	0.011	0.016	0.021

EXHIBIT H-29

Time Series Plot Displaying Inflow and Outflow Total Phosphorus Trend for all PSTA Test Cell Treatments for Monitoring Weeks for the POR (Summary statistics are presented above.)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of data range (right) and distribution of monitoring weeks (top of graph).

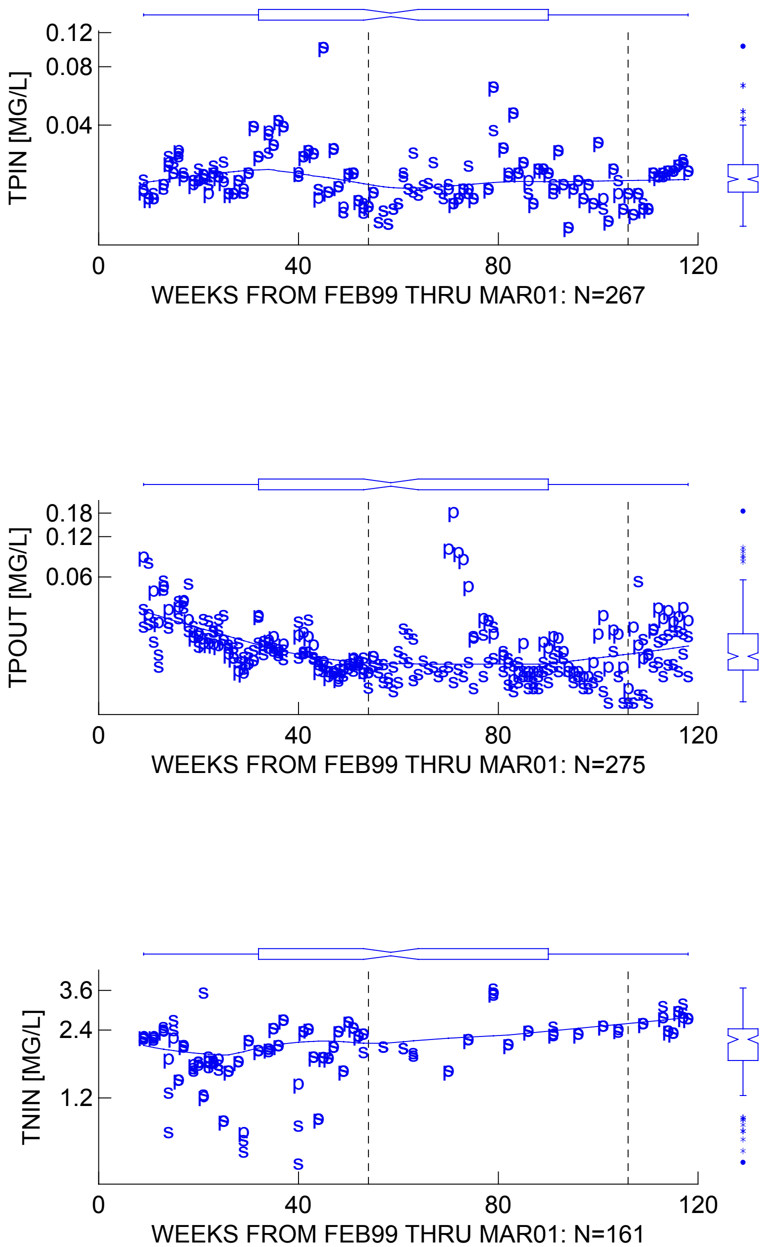


EXHIBIT H-30

Time Series Plots of Inflow Total Phosphorus (TPIN), Outflow Total Phosphorus (TPOUT), and Inflow Total Nitrogen (TNIN) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

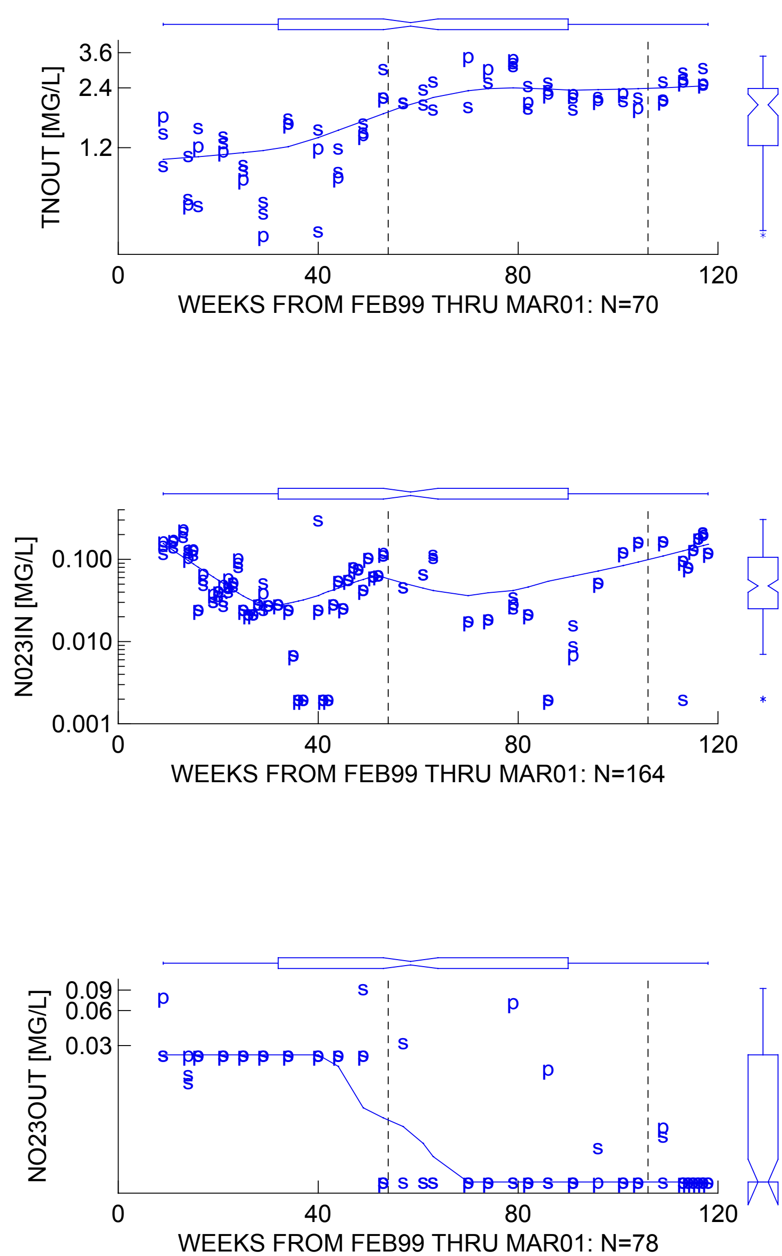


EXHIBIT H-31

Time Series Plots of Outflow TN (TNOUT), Inflow Nitrate/Nitrite (NO23IN), and Outflow Nitrate/Nitrite (NO23OUT) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

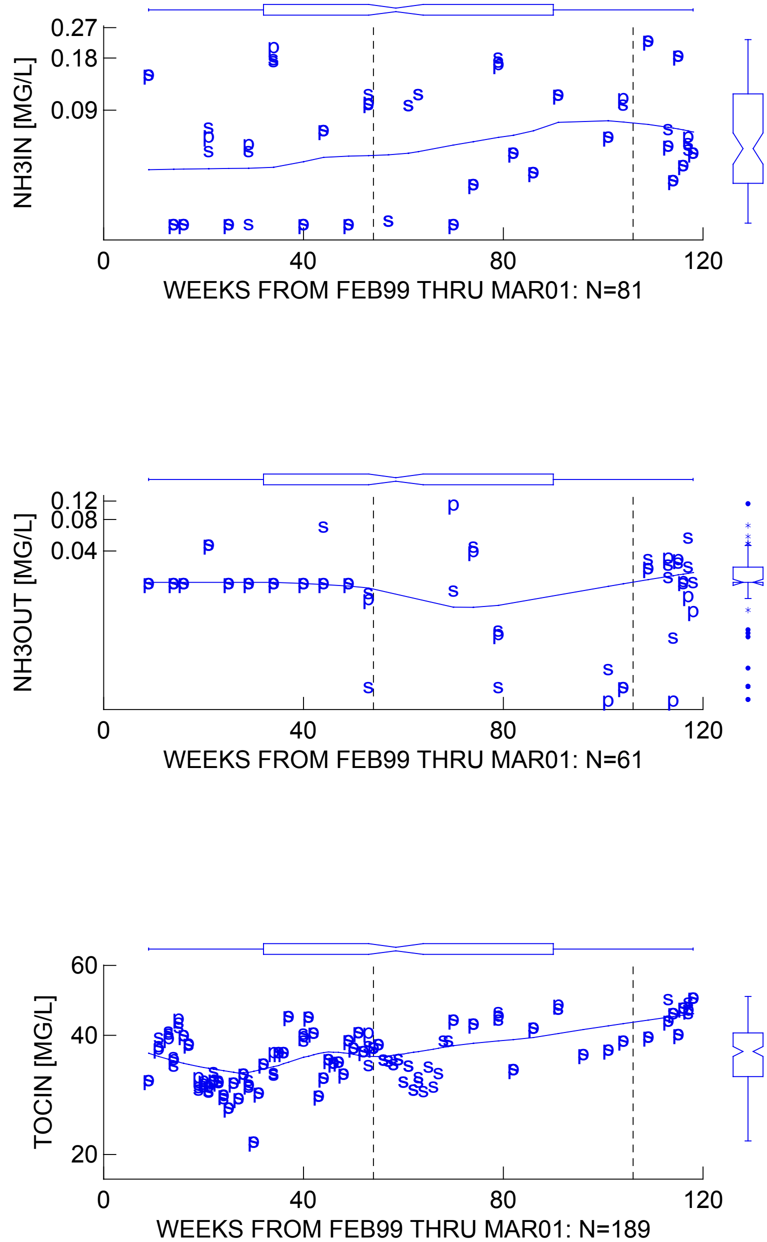
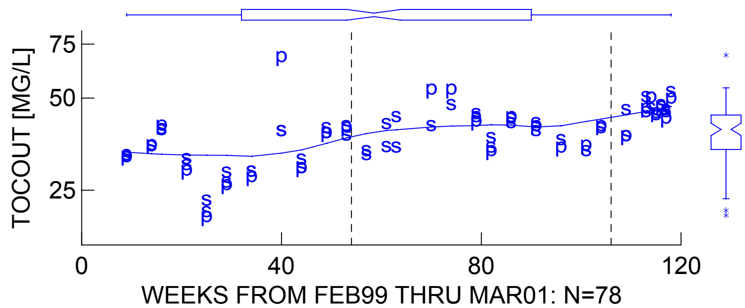
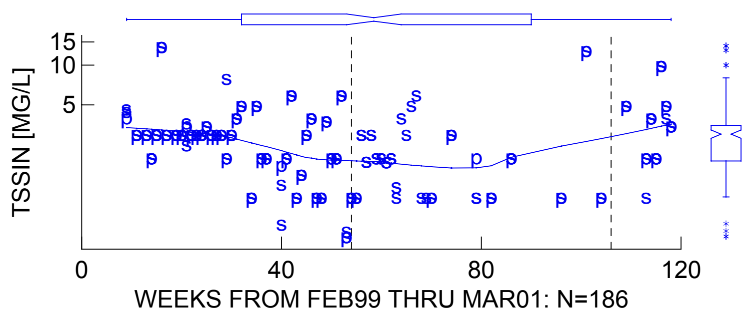


EXHIBIT H-32

Time Series Plots of Inflow Ammonia (NH3IN), Outflow Ammonia (NH4OUT), and Inflow Total Organic Carbon (TOCIN) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





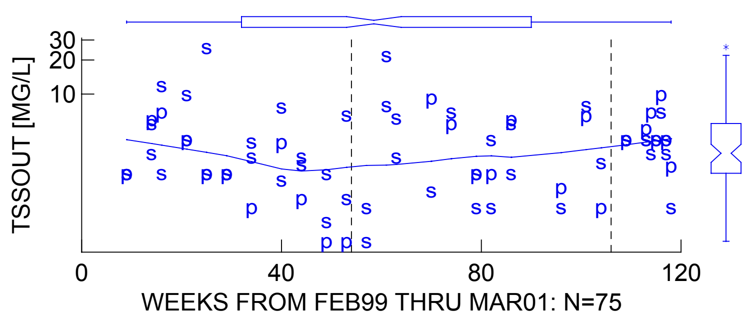


EXHIBIT H-33

Time Series Plots of Outflow Total Organic Carbon (TOCOUT), Inflow Total Suspended Solids (TSSIN), and Outflow Total Suspended Solids (TSSOUT) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

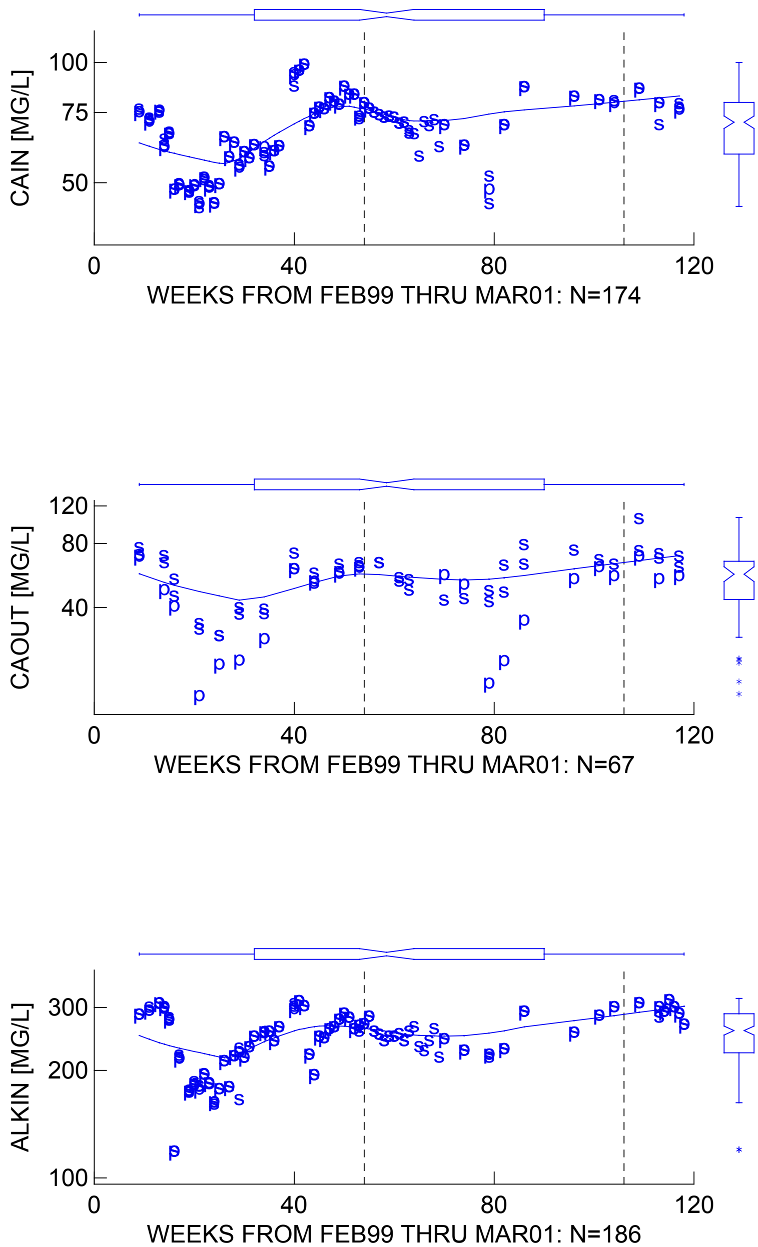
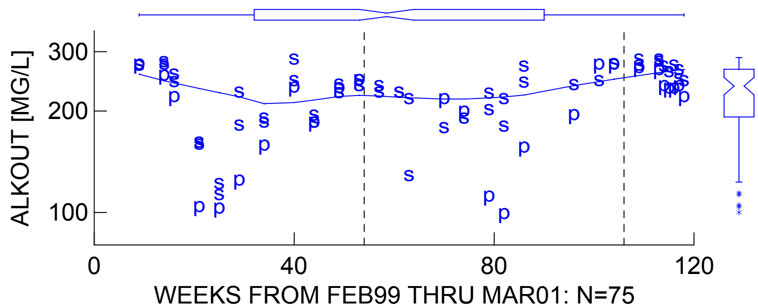
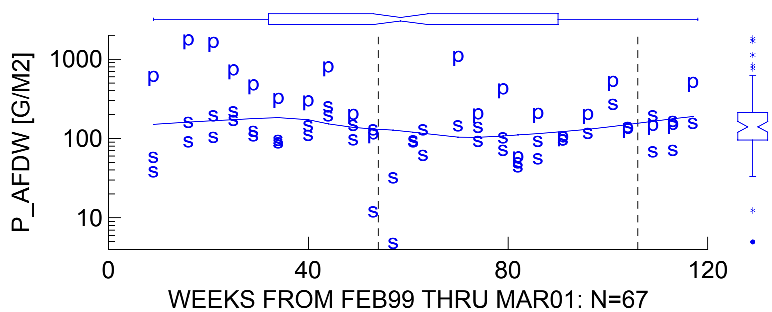


EXHIBIT H-34

Time Series Plots of Inflow Calcium (CAIN), Outflow Calcium (CAOUT), and Inflow Alkalinity (ALKIN) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





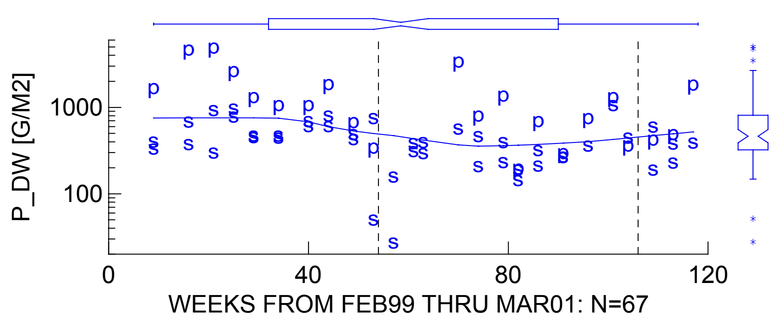


EXHIBIT H-35

Time Series Plots of Outflow Alkalinity (ALKOUT), Periphyton Ash Free Dry Weight (P_AFDW), and Periphyton Dry Weight (P_DW) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

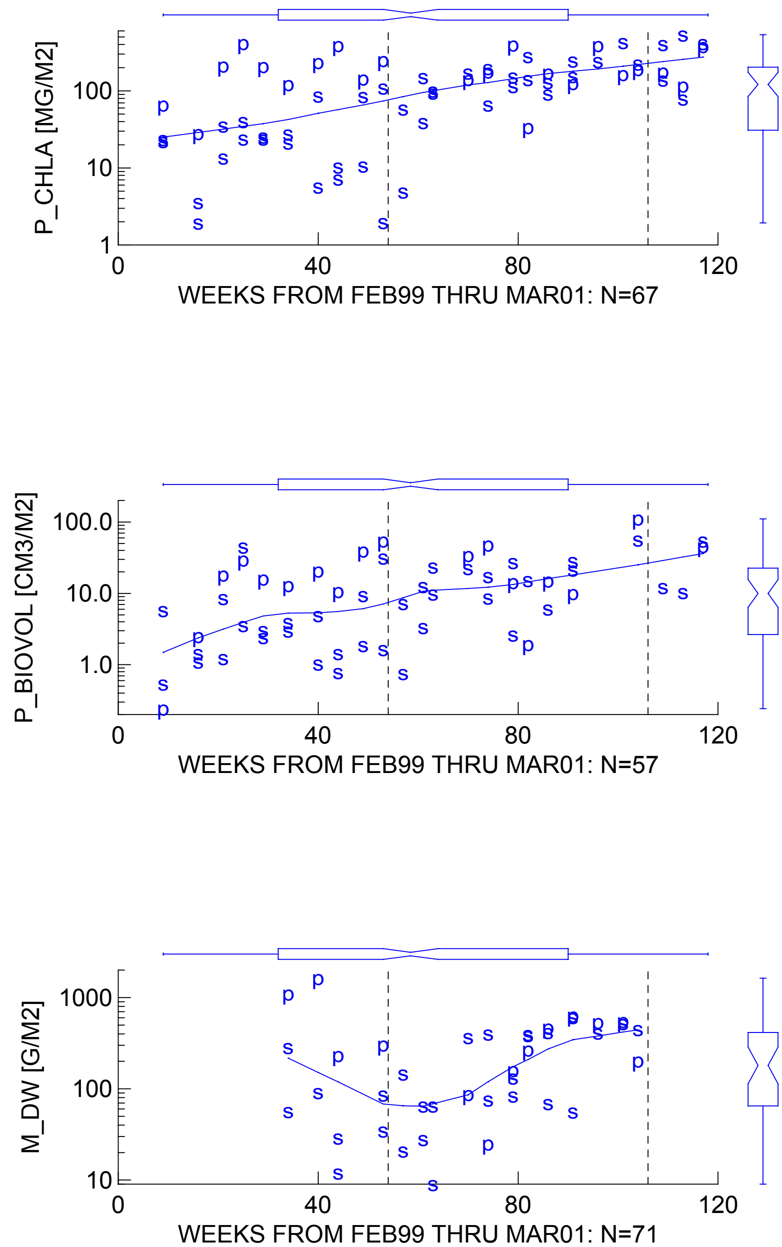
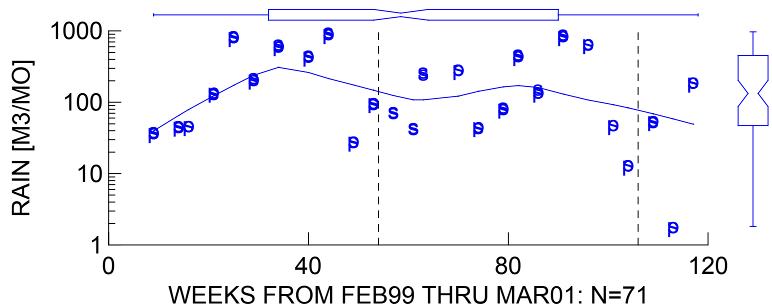


EXHIBIT H-36

Time Series Plots of Periphyton Chlorophyll *a* (P_CHLA), Periphyton Biovolume (P_BIOVOL), and Macrophyte Dry Weight (M_DW) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).



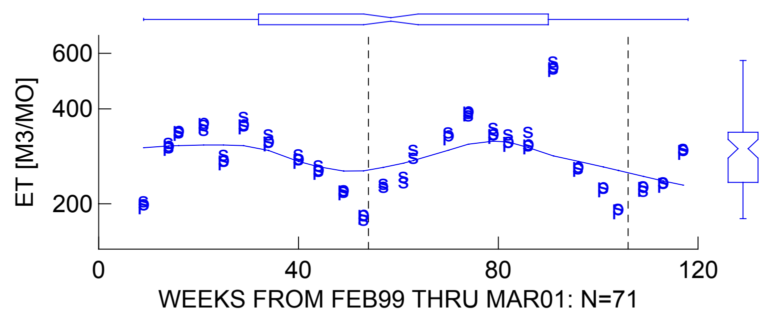
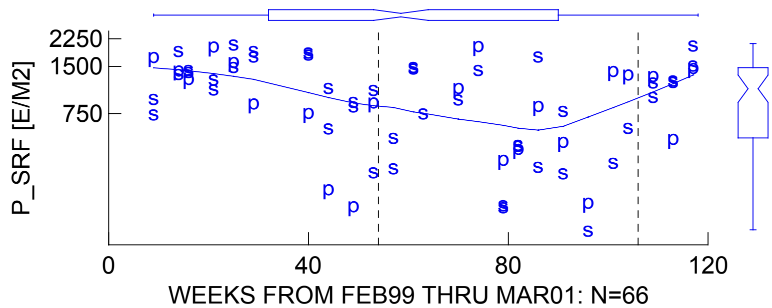
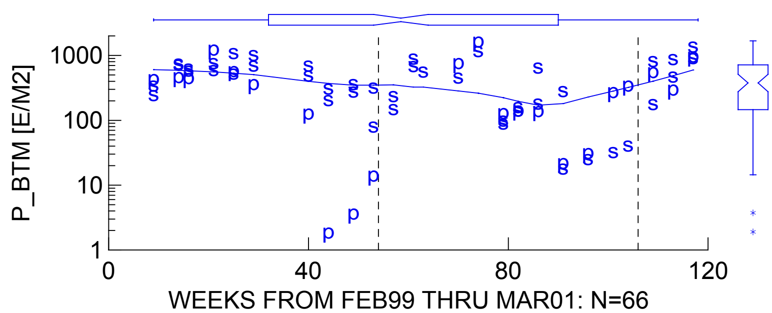


EXHIBIT H-37
Time Series Plots of Rainfall (RAIN), and Evapo-Transpiration (ET) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





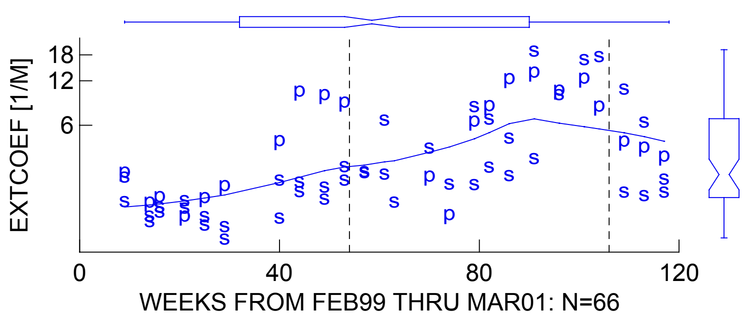
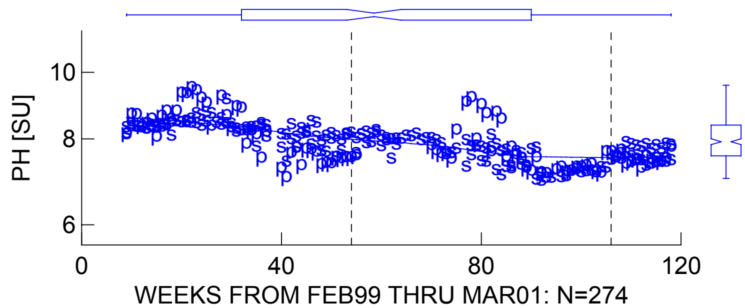
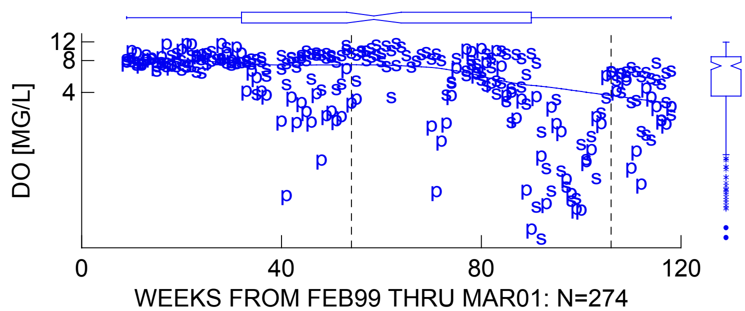


EXHIBIT H-38
Time Series Plots of PAR Measured at the Tank Surface (P_SURF), PAR Measured at the Tank Bottom (P_BTM), and Light Extinction Coefficient (EXTCOEF) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





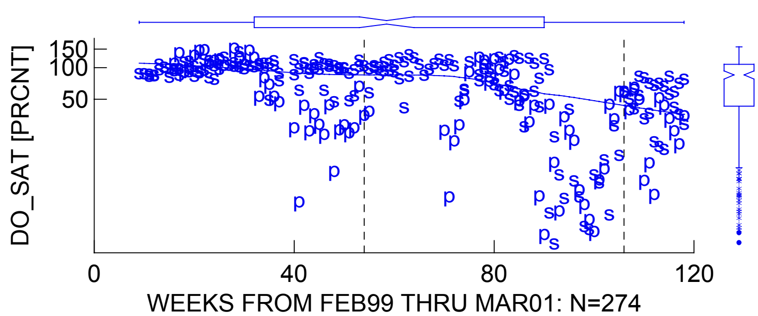
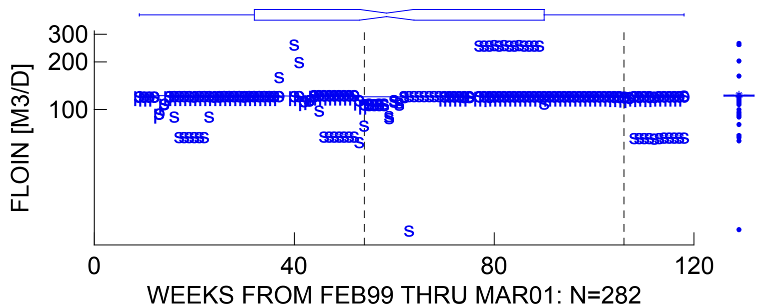
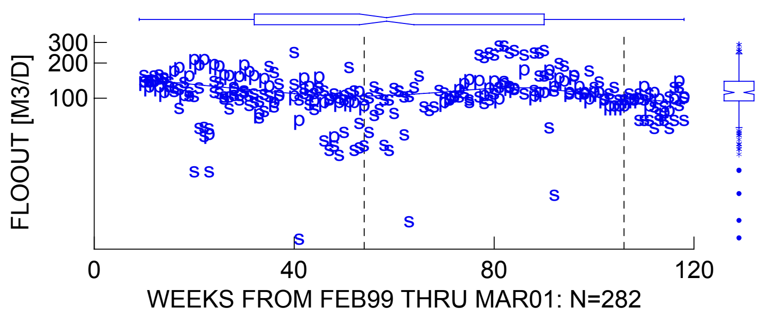


EXHIBIT H-39
Time Series Plots of pH, Dissolved Oxygen (DO), and Dissolved Oxygen Saturation (DO_SAT) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





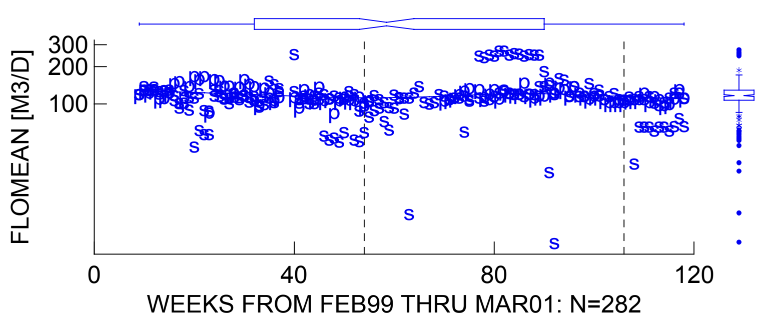
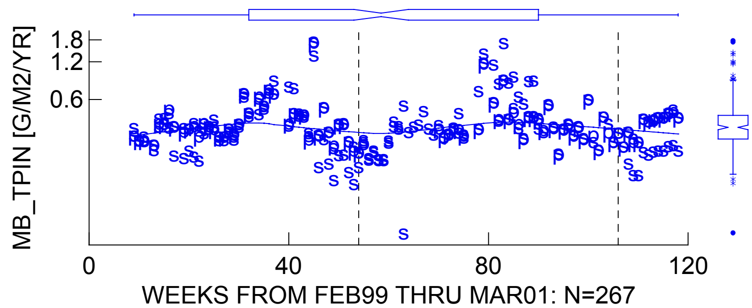
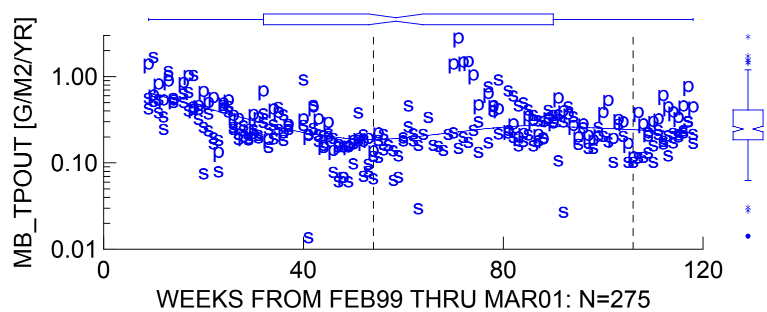


EXHIBIT H-40

Time Series Plots of Tank Inflow (FLOIN), Tank Outflow (FLOOUT), and Tank Mean Flow (FLOMEAN) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).





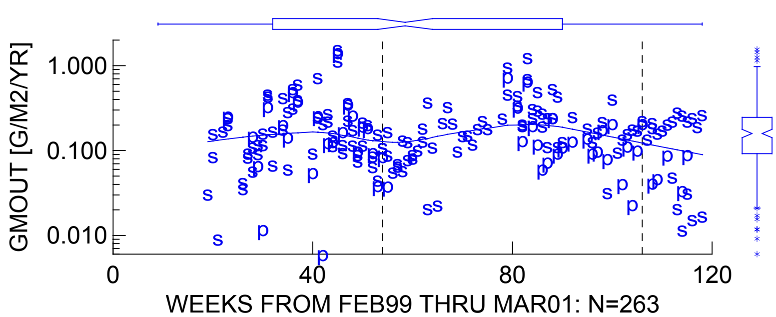


EXHIBIT H-41
Time Series Plots of Mass Balance of Inflow Total Phosphorus (MB_TPIN), Mass Balance of Outflow Total Phosphorus (MB_TPOUT), and Phosphorus Removal Rate (GMOUT) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to February 2001)
Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

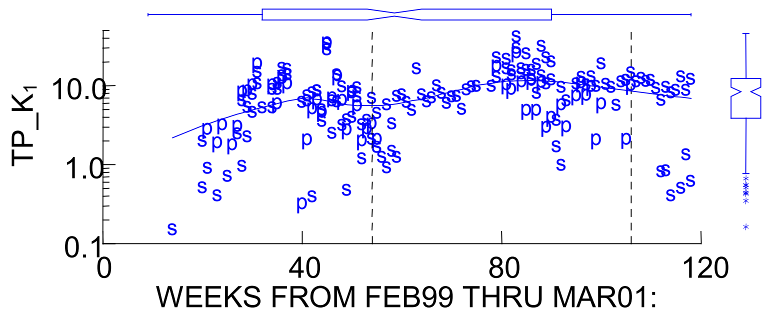


EXHIBIT H-42

Time Series Plots of Total Phosphorus Calculated First Order Removal (TP_K_1) for PSTA Test Cell Monitoring Weeks for the POR (April 1999 to March 2001)

Vertical dashed lines represent January 2000 and January 2001. Box plots represent distribution of the data range (right) and distribution of monitoring weeks (top of graph).

EXHIBIT H-43

Test Cell ANOVA Comparisons

Treatment	Cells	Independent Variables	Comparison
STC-1	13	Deep Peat	POR
STC-2	8	Deep Shellrock	Substrate Effects
STC-1	13	Deep Peat	OPP
STC-2	8	Deep Shellrock	Substrate Effects
STC-2	8	Deep Shellrock	OPP
STC-5	8	Shallow Shellrock	Depth Effects
STC-4	13	Shallow Calcium Amended Peat	OPP
STC-5	8	Shallow Shellrock	Substrate Effects
STC-1	13	Deep Peat	POR
STC-4	13	Shallow Calcium Amended Peat	Effect of Amending Peat Substrate
STC-1	13	Deep Peat	OPP
STC-4	13	Shallow Calcium Amended Peat	Effect of Amending Peat Substrate
STC-2	8	Deep Shellrock	OPP
STC-3	3	Variable Shellrock	Effects of Varying
STC-5	8	Shallow Shellrock	Depth on
STC-6	3	Dry-Out Shellrock	Shellrock Substrate

EXHIBIT H-44
Test Cell ANOVA Results

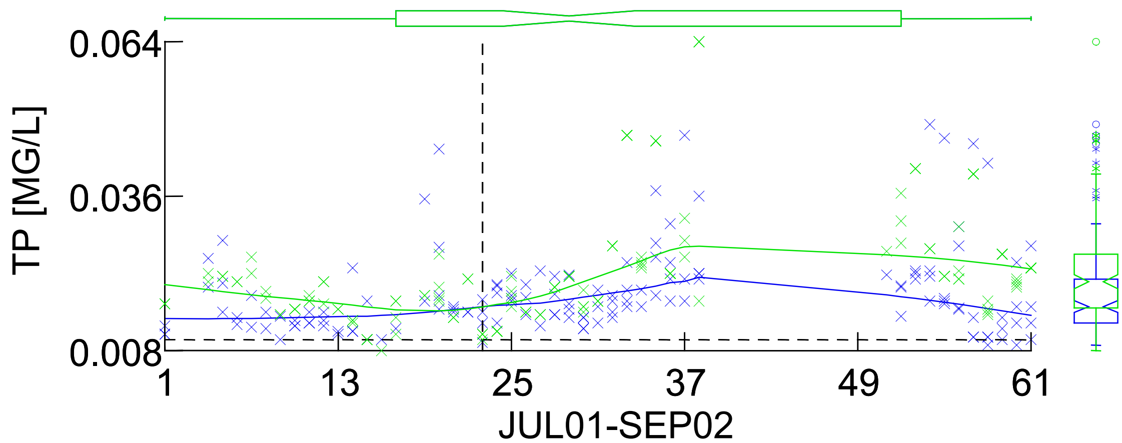
Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effect of Substrate	STC-1 (deep peat) vs.	TP Out (µg/L)	Mean	0.2928	No difference in mean TP Out between substrates for the Phase 1 POR
	STC-2 (deep shellrock)		Median	0.3289	No difference in median TP Out between substrates for Phase 1 POR
Phase 1		P Removal Rate	Mean	0.2461	No difference in mean Removal Rate between substrates for Phase 1 POR
POR		($g/m^2/y$)	Median	0.1587	No difference in median Removal Rate between substrates for Phase 1 POR
		k_1 (m/y)	Mean	0.4392	No difference in mean k_1 between substrates for the entire Phase 1 POR
			Median	0.3251	No difference in median k_1 between substrates for the entire Phase 1 POR
Effect of Substrate	STC-1 (deep peat) vs.	TP Out (µg/L)	Mean	0.0808	No difference in mean TP Out between substrates for the Phase 1 OPP
	STC-2 (deep shellrock)		Median	0.0812	No difference in median TP Out between substrates for the Phase 1 OPP
Phase 1		P Removal Rate	Mean	0.5808	No difference in mean Removal Rate between substrates for the Phase 1 OPP
OPP		($g/m^2/y$)	Median	0.4924	No difference in median Removal Rate between substrates for the Phase 1 OPP
		k_1 (m/y)	Mean	0.3705	No difference in mean k1 between substrates for the Phase 1 OPP
			Median	0.1380	No difference in median k1 between substrates for the Phase 1 OPP
Effects of Depth on Shellrock Substrate	STC-2 (deep shellrock) vs.	TP Out (µg/L)	Mean	0.1931	No difference in mean TP Out between depths of shellrock substrate
	STC-5 (shallow shellrock)		Median	0.0692	No difference in median TP Out between depths of shellrock substrate
		P Removal Rate	Mean	0.8852	No difference in mean Removal Rates between depths of shellrock substrate
OPP		($g/m^2/y$)	Median	0.6363	No difference in median Removal Rates between depths of shellrock substrate
		k_1 (m/y)	Mean	0.1666	No difference in mean k_1 between depths of shellrock substrate
			Median	0.0162	Shallow shellrock had significantly greater median k_1 values than deep shellrock
Effects of Substrate	STC-4 (shallow peat_caoh) vs.	TP Out (µg/L)	Mean	0.0023	Shallow shellrock had significantly lower mean TP Out values than shallow peat_caoh substrate
	STC-5 (shallow shellrock)		Median	0.0047	Shallow shellrock had significantly lower median TP Out values than shallow peat_caoh substrate
Phase 2		P Removal Rate	Mean	0.0207	Shallow shellrock had significantly greater mean Removal Rates than shallow peat_caoh substrate
OPP		($g/m^2/y$)	Median	0.0069	Shallow shellrock had significantly greater median Removal Rates than shallow peat_caoh substrate
		k_1 (m/y)	Mean	0.0011	Shallow shellrock had significantly greater mean k_1 values than shallow peat_caoh substrate
			Median	0.0003	Shallow shellrock had significantly greater median k_1 values than shallow peat_caoh substrate

EXHIBIT H-44
Test Cell ANOVA Results

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effects of amending peat substrate POR	STC-1 (deep peat) vs. STC-4 (shallow peat_caoh)	TP Out (µg/L)	Mean	0.4216	No difference for mean TP Out between peat and peat amended soils over the POR
			Median	0.4633	No difference for median TP Out between peat and peat amended soils over the POR
		P Removal Rate ($g/m^2/y$)	Mean	0.9262	No difference for mean Removal Rates between peat and peat amended soils over the POR
			Median	0.9864	No difference for median Removal Rates between peat and peat amended soils over the POR
		k_1 (m/y)	Mean	0.5439	No difference for mean k1 values between peat and peat amended soils over the POR
			Median	0.6606	No difference for median k1 values between peat and peat amended soils over the POR
Effects of amending peat substrate OPP	STC-1 (deep peat) vs. STC-4 (shallow peat_caoh)	TP Out (µg/L)	Mean	0.3021	No difference for mean TP Out between peat and peat amended soils over the OPPs
			Median	0.4754	No difference for median TP Out between peat and peat amended soils over the OPPs
		P Removal Rate ($g/m^2/y$)	Mean	0.1306	No difference for mean Removal Rates between peat and peat amended soils over the OPPs
			Median	0.0567	Deep peat had significantly greater median Removal Rates than peat amended substrate over the OPP
		k^1 (m/y)	Mean	0.1170	No difference for mean k1 values between peat and peat amended soils over the OPP
			Median	0.1500	No difference for median k1 values between peat and peat amended soils over the OPP
Effects of varying depth on shellrock substrate OPP	STC-2 (deep shellrock) vs. STC-3 (variable shellrock) vs. STC-5 (shallow shellrock) vs. STC-6 (dry-out shellrock)	TP Out (µg/L)	Mean	0.0021	Deep and shallow shellrock significant lower than dry-out shellrock, shallow shellrock lower than variable shellrock for mean TP Out.
			Median	0.0006	Shallow shellrock significantly lower than variable shellrock and dry-out shellrock for median TP Out.
		P Removal Rate ($g/m^2/y$)	Mean	0.8808	No difference in mean Removal Rates across different shellrock depths.
			Median	0.5380	No difference in median Removal Rates across different shellrock depths.
		k_1 (m/y)	Mean	0.0838	No difference in mean k_1 values across different shellrock depths.
			Median	0.0201	Shallow shellrock significantly greater than variable shellrock for median k_1 values. No other significant differences.

EXHIBIT H-45
Summary Statistics for 37 Parameters Measured at the PSTA Field-Scale Cells

	N	MIN	MAX	MEAN	MEDIAN	SD	CV	95LCL	95UCL
RESPONSE VARIABLE									
Phosphorus Removal Rate ($g/m^2/yr$)	42	0.01	1.62	0.54	0.43	0.41	0.75	0.42	0.67
Phosphorus Removal Percent (%)	42	1.70	93.70	60.30	62.30	22.80	0.40	53.20	53.20
Mass Balance Outflow Total Phosphorus ($g/m^2/yr$)	42	0.03	0.63	0.30	0.30	0.17	0.57	0.25	0.36
Phosphorus K_1 (m/y)	42	-11.00	46.80	7.10	5.30	11.60	1.60	3.50	10.70
Outflow Total Phosphorus (mg/L)	42	0.010	0.045	0.019	0.018	0.008	0.393	0.017	0.022
PHYSICAL FACTORS									
Extinction Coefficient (m^{-1})	34	0.8	5.0	2.4	2.3	1.0	0.4	2.1	2.7
PAR at Water Surface (E/m^2)	35	247.4	2293.3	1069.3	1039.3	519.2	0.5	890.9	1247.6
PAR at Tank Bottom (E/m^2)	34	127.6	1430.5	641.9	677.2	319.4	0.5	530.5	753.3
Cell Inflow (m^3/d)	43	424.6	3459.7	2013.2	2195.3	796.1	0.4	1768.2	2258.2
Cell Outflow (m^3/d)	43	0.0	2628.3	1008.7	863.5	724.0	0.7	785.9	1231.5
Cell Mean Flow (m^3/d)	43	256.7	2704.7	1511.0	1534.9	669.4	0.4	1305.0	1717.0
HLR Inflow (cm^3/d)	43	2.1	17.1	9.9	10.8	3.9	0.4	8.7	11.2
HLR Outflow (cm^3/d)	43	0.0	13.0	5.0	4.3	3.6	0.7	3.9	6.1
Cell Mean HLR (cm^3/d)	43	1.3	13.4	7.5	7.6	3.3	0.4	6.4	8.5
BIOLOGICAL FACTOR									
Periphyton Ash Free Dry Weight (g/m^2)	25	5.0	241.4	87.5	77.1	60.9	0.7	62.3	112.6
Periphyton Chlorophyll *a* (mg/m^2)	23	0.005	0.983	0.104	0.039	0.207	1.987	0.150	0.193
Periphyton Dry Weight (g/m^2)	21	11.0	1207.1	430.3	408.4	312.1	0.7	288.2	572.4
WATER QUALITY									
Inflow Alkalinity (mg/L)	41	200.0	337.5	283.2	280.0	33.9	0.1	272.5	293.9
Outflow Alkalinity (mg/L)	35	184.0	325.0	261.5	265.0	32.5	0.1	250.4	272.7
Inflow Chlorides (mg/L)	35	124.0	290.0	197.3	190.0	47.3	0.2	181.1	213.5
Outflow Chlorides (mg/L)	32	95.4	289.5	193.3	187.1	49.5	0.3	175.4	211.1
Inflow Calcium (mg/L)	41	45.7	103.0	75.6	77.3	13.6	0.2	71.3	79.9
Outflow Calcium (mg/L)	35	31.6	106.0	68.2	69.3	18.1	0.3	62.0	74.4
Dissolved Oxygen (mg/L)	43	4.3	13.9	7.9	7.6	1.8	0.2	7.4	8.5
Dissolved Oxygen Saturation (%)	43	52.1	147.4	97.5	99.8	19.3	0.2	91.5	103.4
Mass Balance Inflow Total Phosphorus ($g/m^2/yr$)	43	0.10	2.04	0.83	0.72	0.46	0.55	0.69	0.97
Inflow NH3 (mg/L)	30	0.03	0.38	0.10	0.10	0.06	0.59	0.08	0.13
Outflow NH3 (mg/L)	28	0.03	0.70	0.10	0.08	0.13	1.27	0.05	0.15
Inflow NO_2/NO_3 (mg/L)	30	0.03	0.81	0.20	0.11	0.22	1.08	0.12	0.28
Outflow NO_2/NO_3 (mg/L)	28	0.03	0.80	0.14	0.08	0.19	1.35	0.07	0.21
pH (units)	43	7.6	8.5	8.1	8.1	0.2	0.0	8.0	8.1
Inflow Total Nitrogen (mg/L)	33	0.20	3.63	1.66	1.75	1.02	0.62	1.30	2.02
Outflow Total Nitrogen (mg/L)	30	0.06	3.23	1.80	2.05	0.84	0.47	1.49	2.11
Inflow TOC (mg/L)	33	32.0	43.6	38.6	39.0	2.6	0.1	37.6	39.5
Outflow TOC (mg/L)	27	32.0	46.0	38.8	39.0	3.1	0.1	37.6	40.1
Inflow Total Phosphorus (mg/L)	41	0.010	0.040	0.020	0.020	0.010	0.29	0.020	0.02
TDS (mg/L)	43	0.5	1.0	0.8	0.8	0.1	0.1	0.7	0.8
Inflow TSS (mg/L)	29	0.8	65.0	7.9	4.9	12.7	1.6	3.0	12.7
Outflow TSS (mg/L)	27	0.8	11.0	2.9	2.5	2.1	0.7	2.1	3.8



	INFLOW	OUTFLOW	DIFFERENCE
N	148	143	143
MINIMUM	0.008	0.009	-0.027
MAXIMUM	0.064	0.049	+0.043
MEDIAN	0.021	0.016	0.004
MEAN	0.023	0.018	0.005
95CI	0.021– 0.024	0.017 – 0.020	0.003 – 0.006
STD DEV	0.011	0.008	0.012

EXHIBIT H-46
Time Series Plot Displaying Inflow Total Phosphorus Trend (green) Along with Outflow Total Phosphorus Trend (blue) for all Field Scale Cell Treatments Across Monitoring Weeks for the POR (Summary statistics are presented above)
Vertical dashed line represents January 2002. Box plots represent distribution of data range (right) and distribution of monitoring weeks (top of graph).

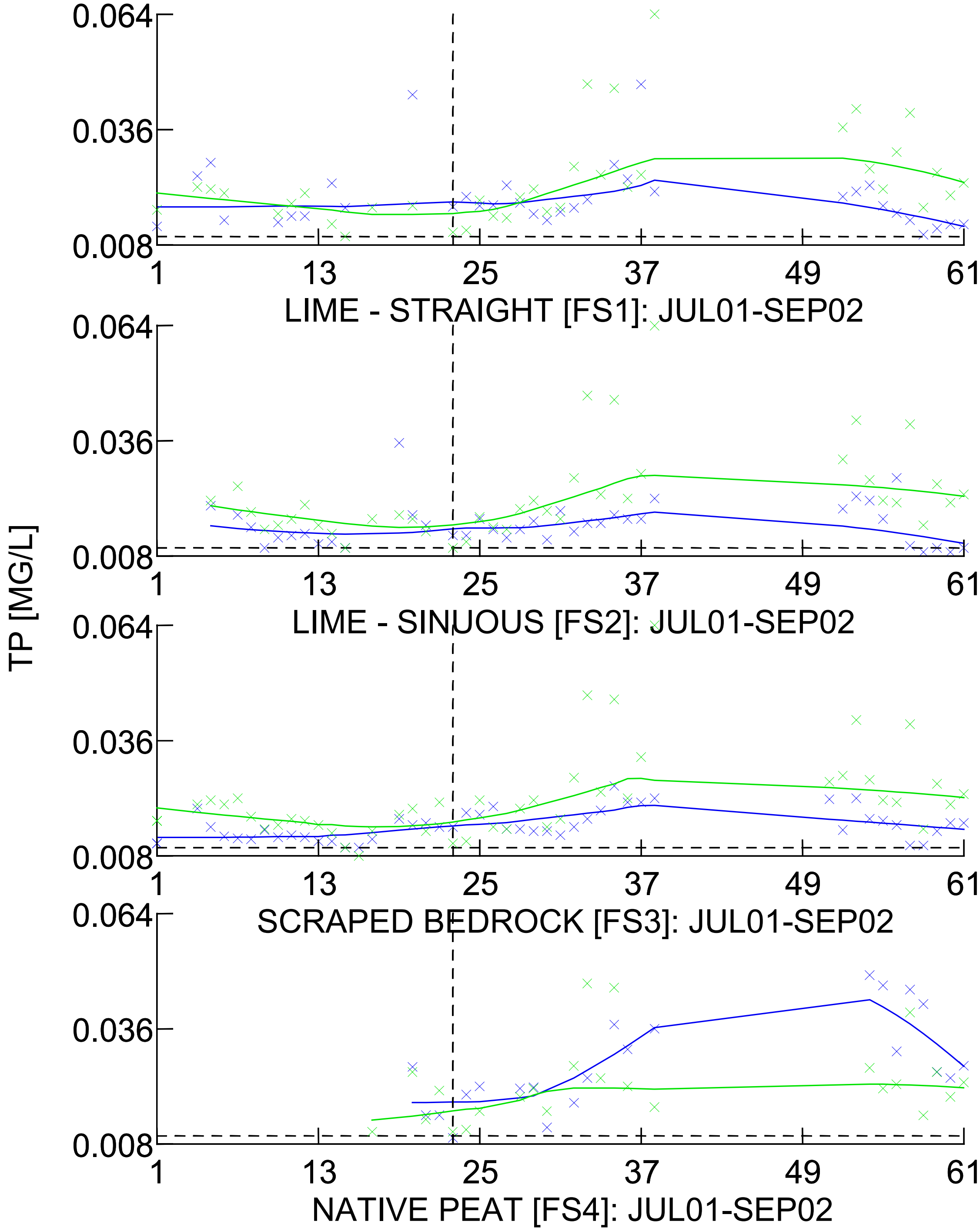


EXHIBIT H-47

Time Series Plot Displaying Inflow Total Phosphorus Trend (green) Along with Outflow Total Phosphorus Trend (blue) for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002, horizontal dashed line represents 0.010 mg/L Total Phosphorus concentration.

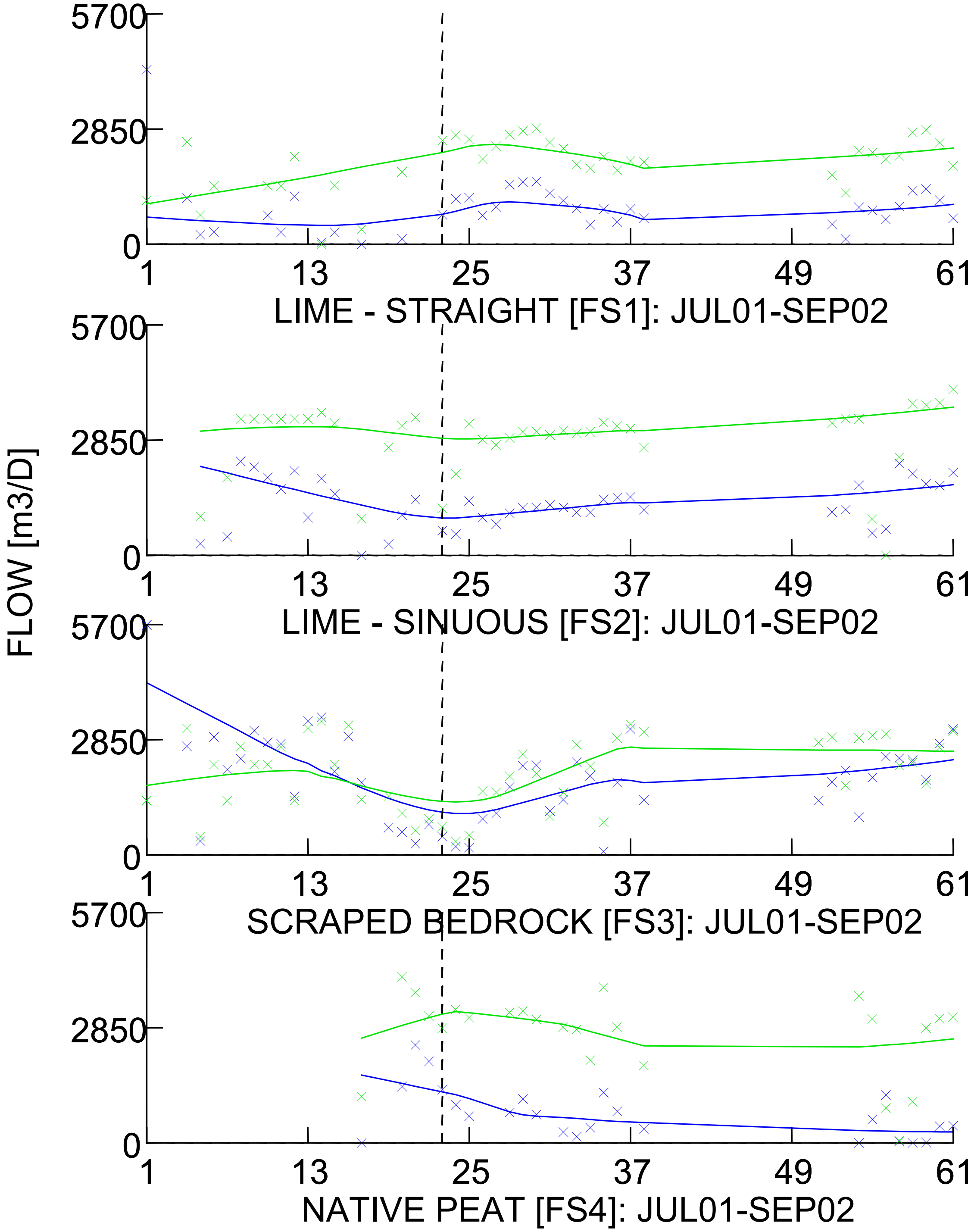


EXHIBIT H-48

Time Series Plot Displaying Cell Inflow Trend (green) Along with Cell Outflow Trend (blue) for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

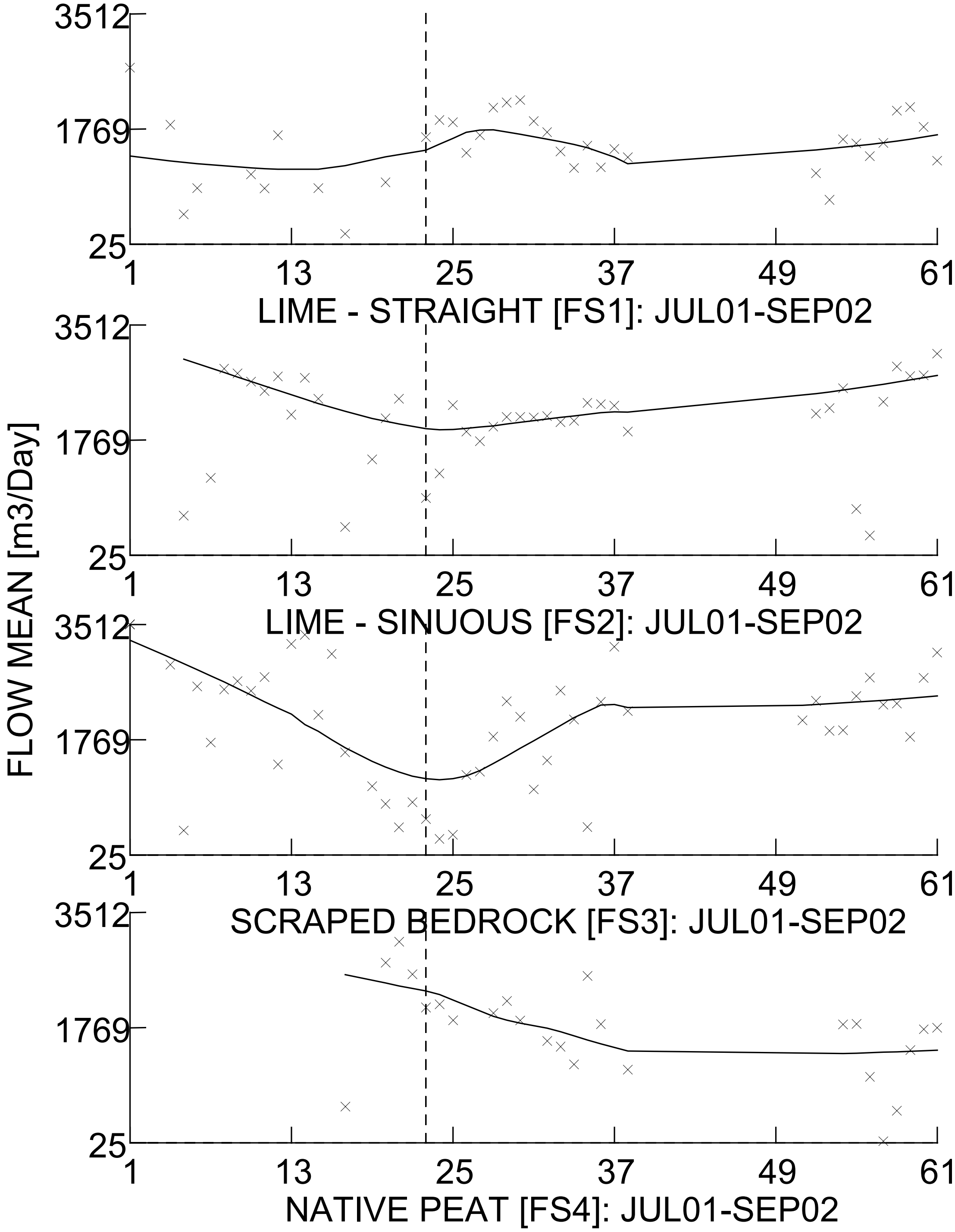


EXHIBIT H-49
Time Series Plot Displaying Mean Flow Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002.

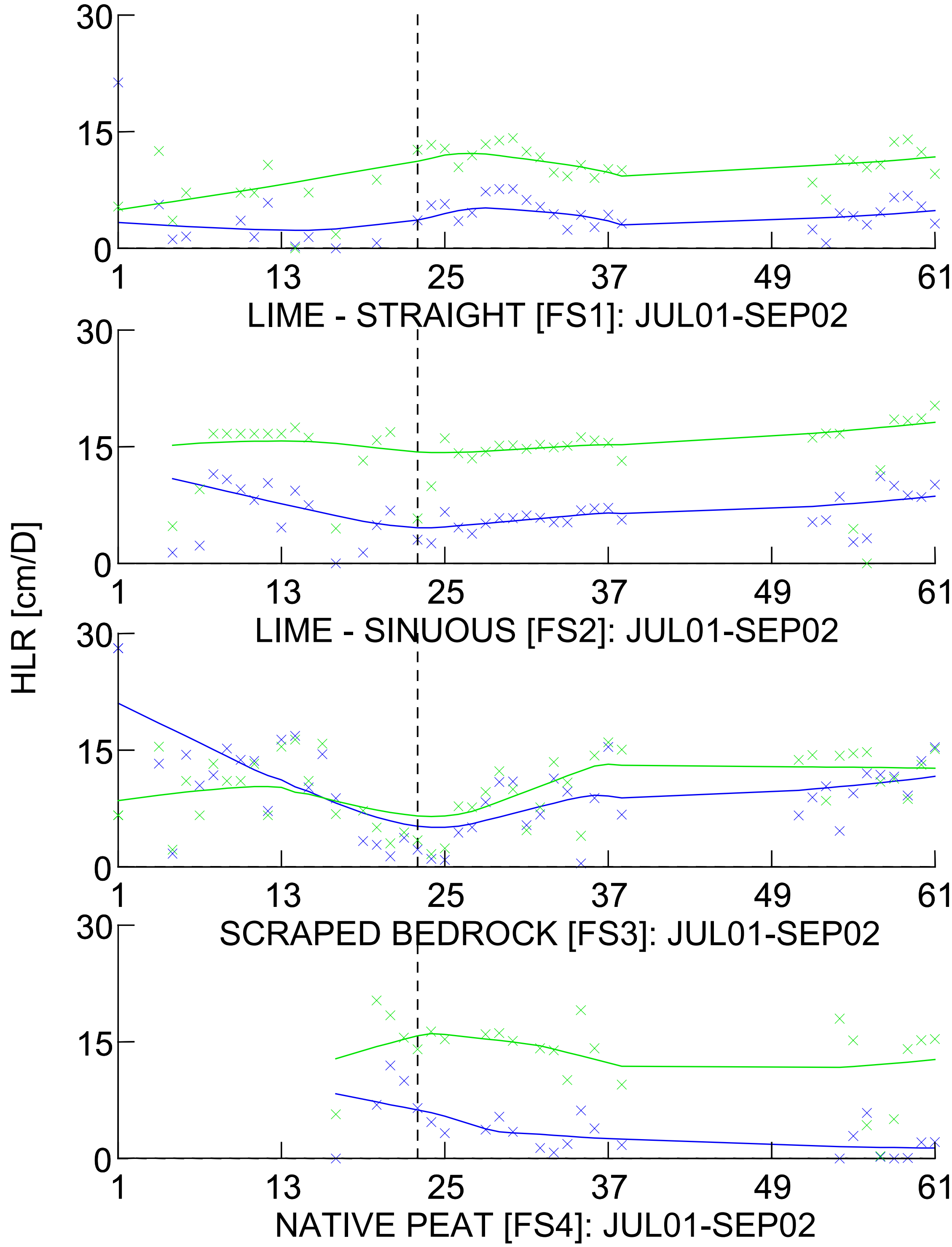


EXHIBIT H-50
Time Series Plot Displaying Cell Inflow Hydraulic Loading Rate Trend (green) Along with Cell Outflow Hydraulic Loading Rate Trend (blue) for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002.

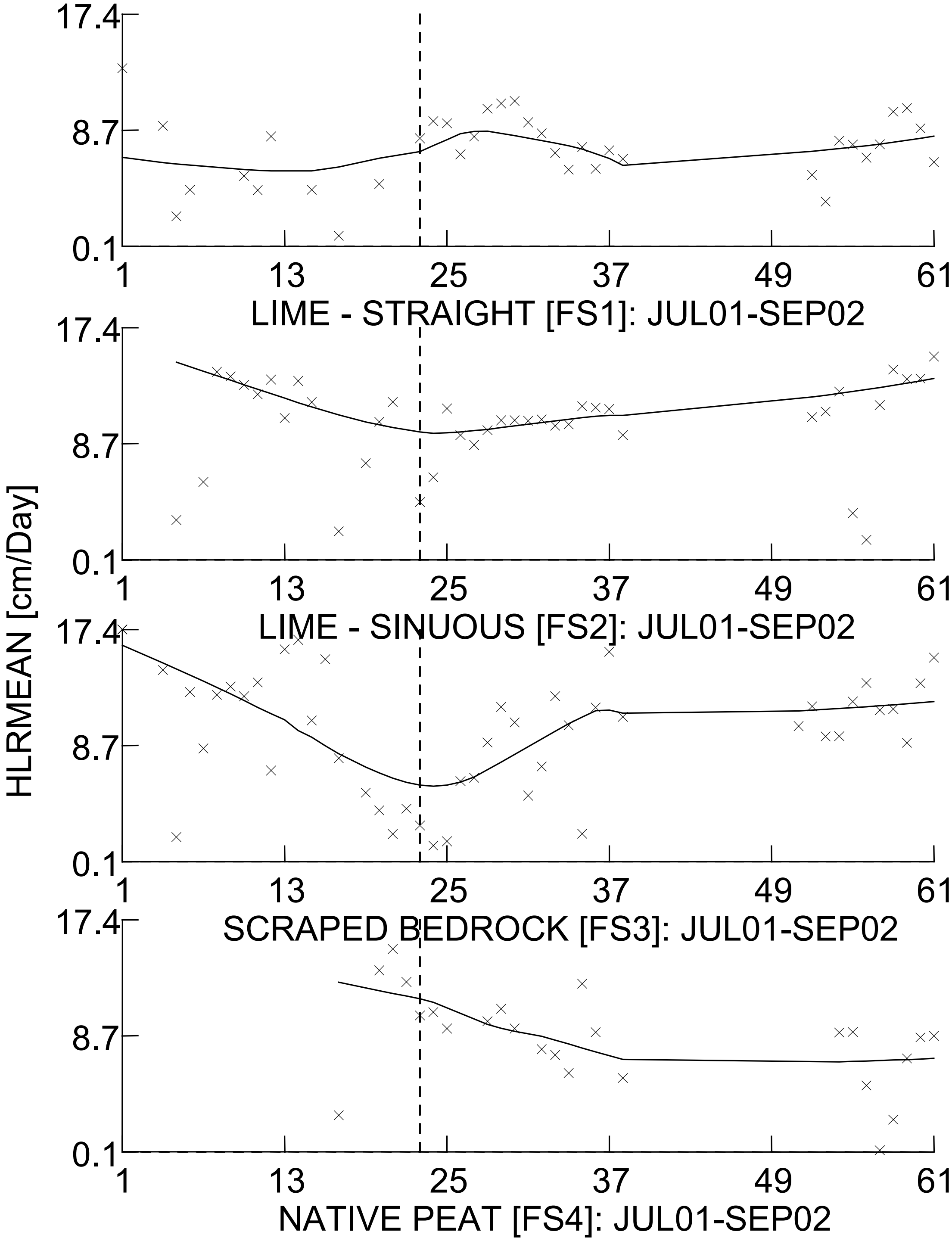


EXHIBIT H-51
Time Series Plot Displaying Mean Hydraulic Loading Rate Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002.

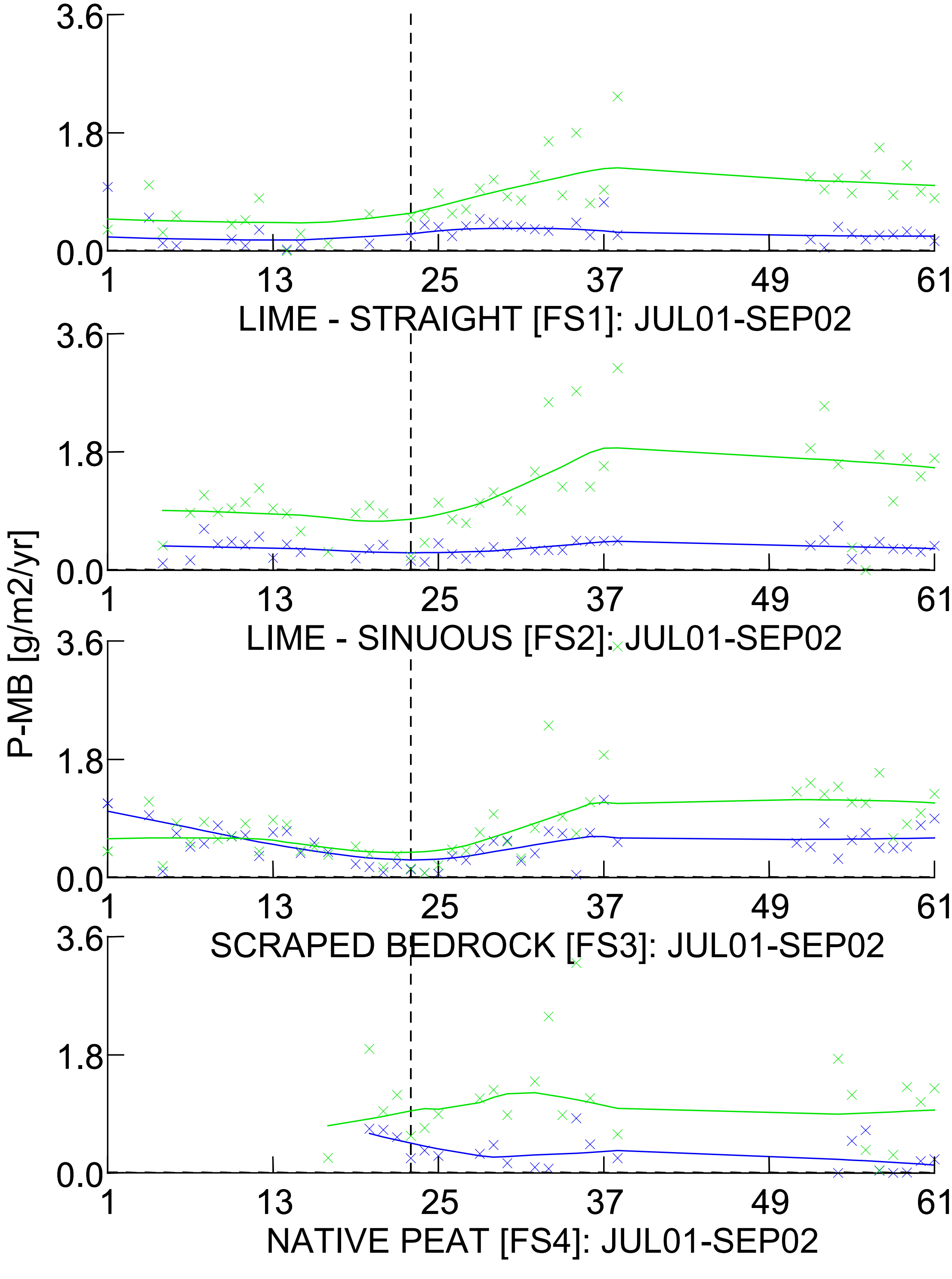


EXHIBIT H-52

Time Series Plot Displaying Inflow Phosphorus Mass Balance Trend (green) Along with Outflow Phosphorus Mass Balance Trend (blue) for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

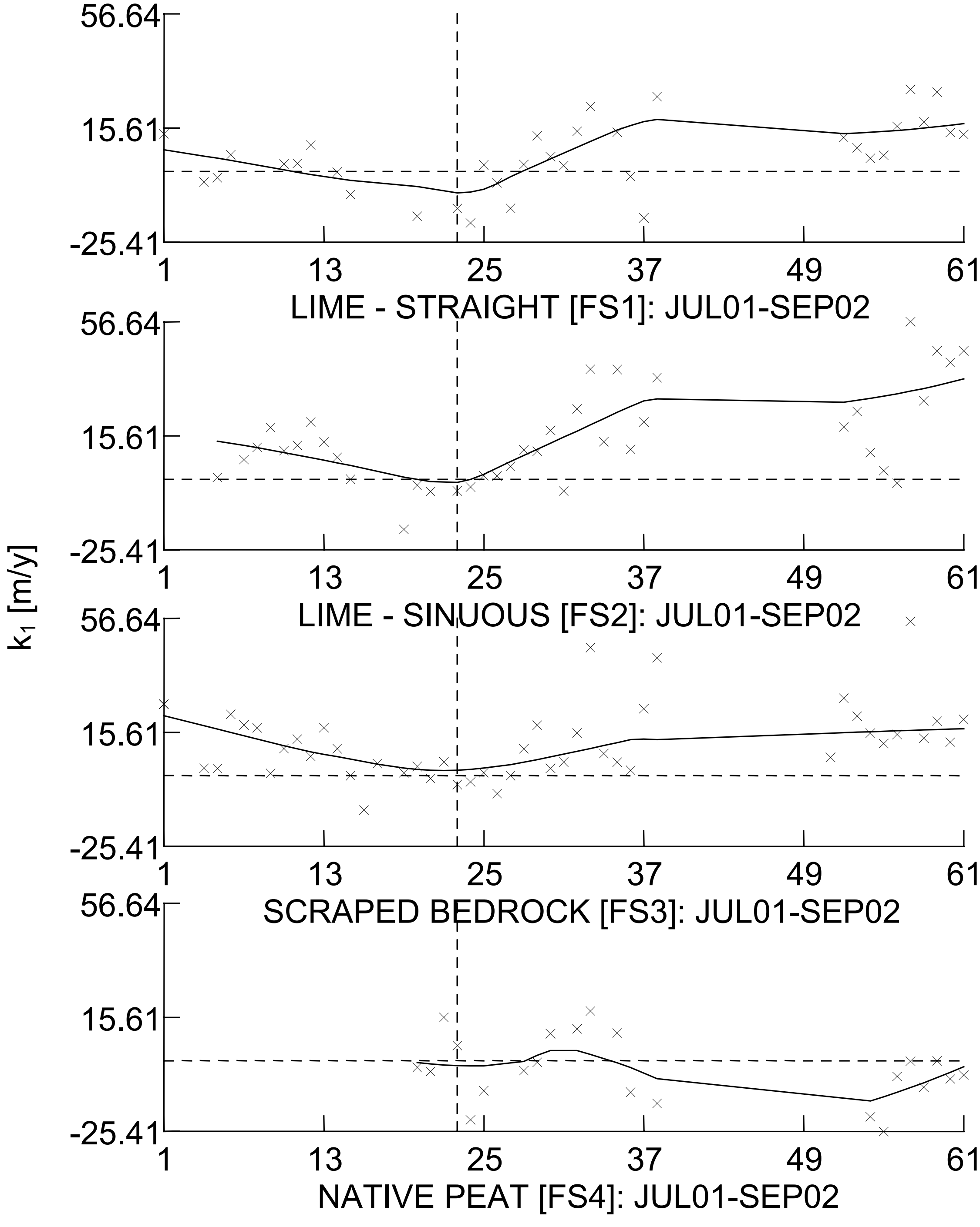


EXHIBIT H-53

Time Series Plot Displaying k_1 Model Coefficient Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002, horizontal dashed line represents a coefficient value of zero.

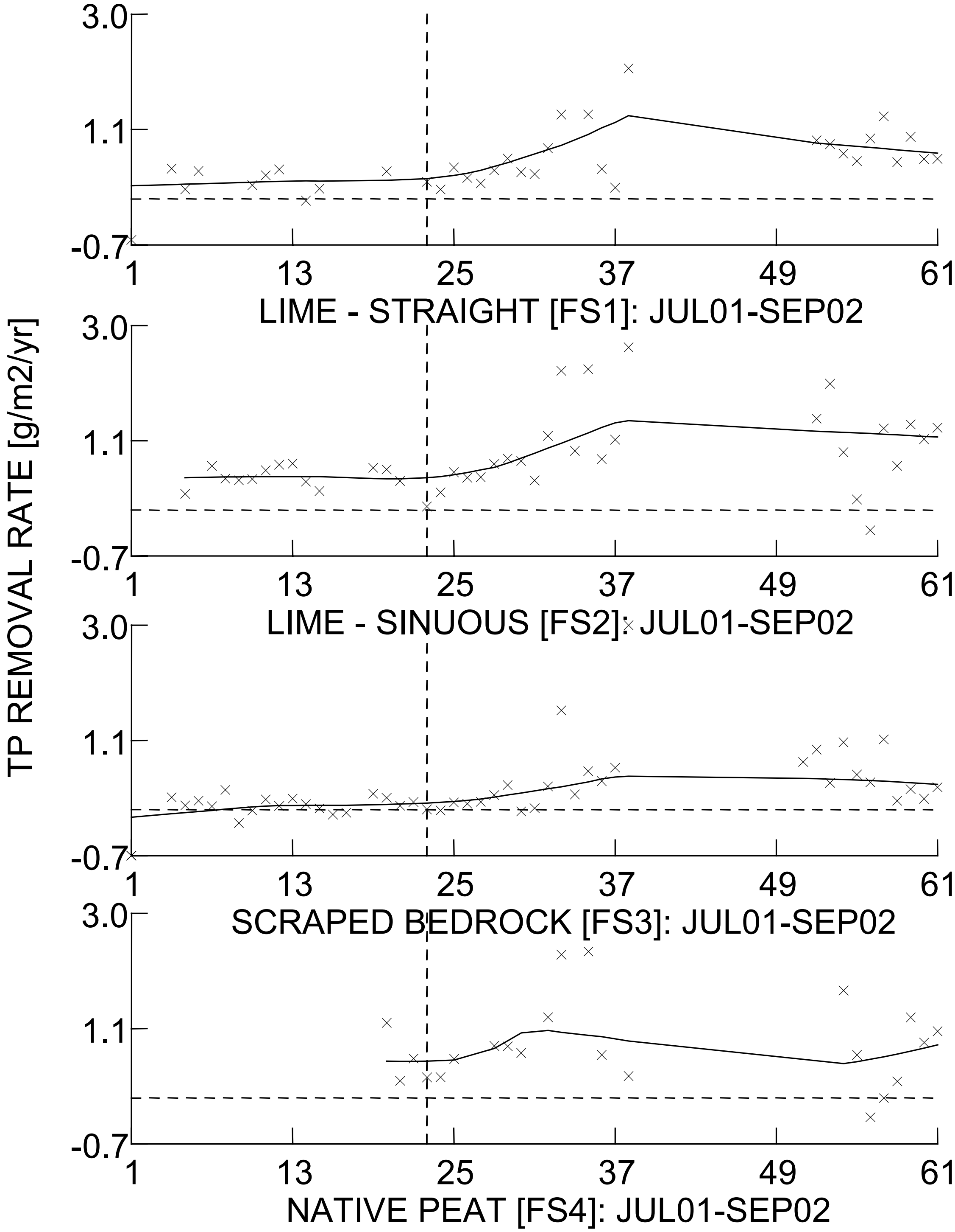


EXHIBIT H-54

Time Series Plot Displaying Total Phosphorus Removal Rate Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002, horizontal dashed line represents a removal rate of zero.

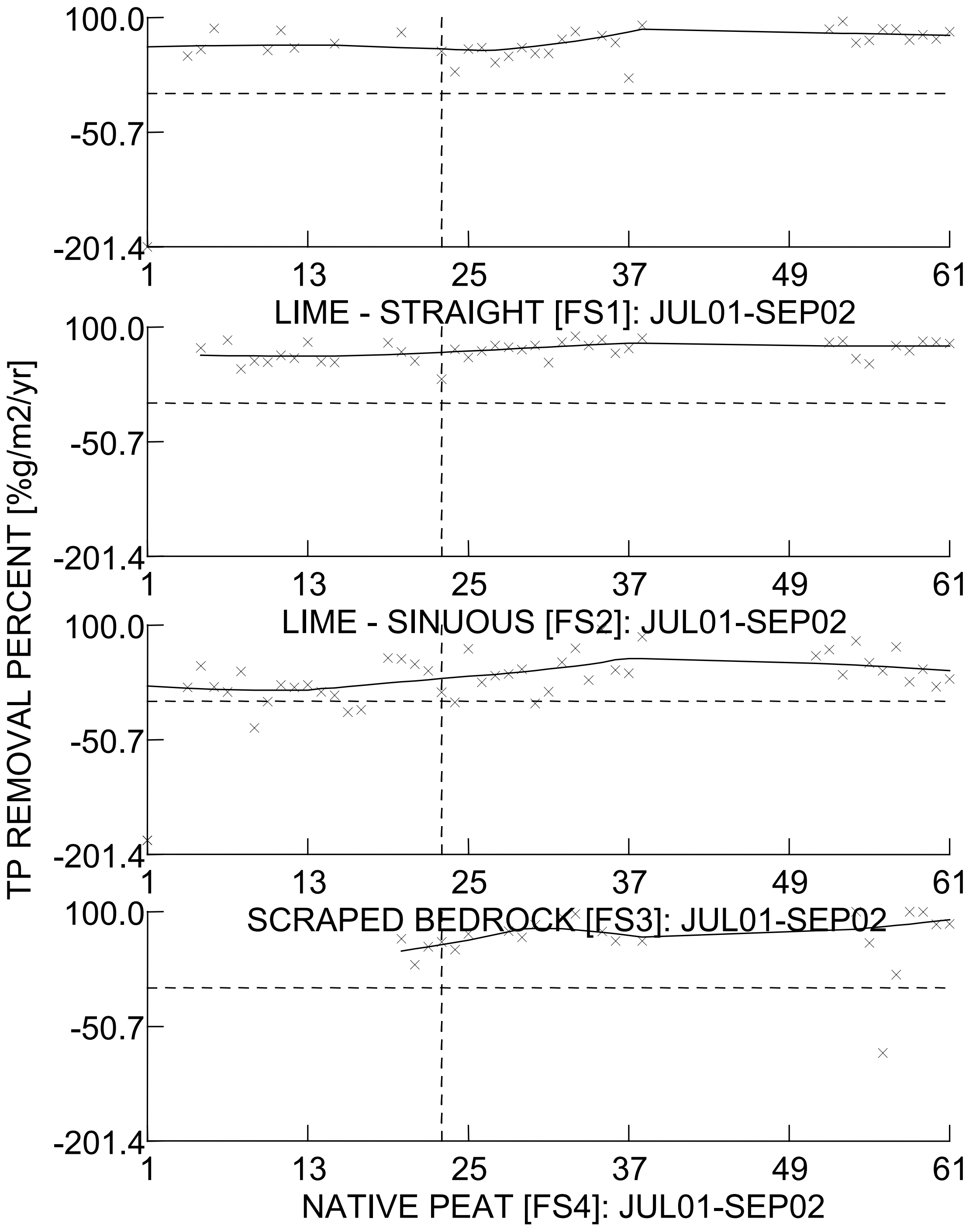


EXHIBIT H-55
Time Series Plot Displaying Total Phosphorus Removal Percent Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002, horizontal dashed line represents a removal percent of zero.

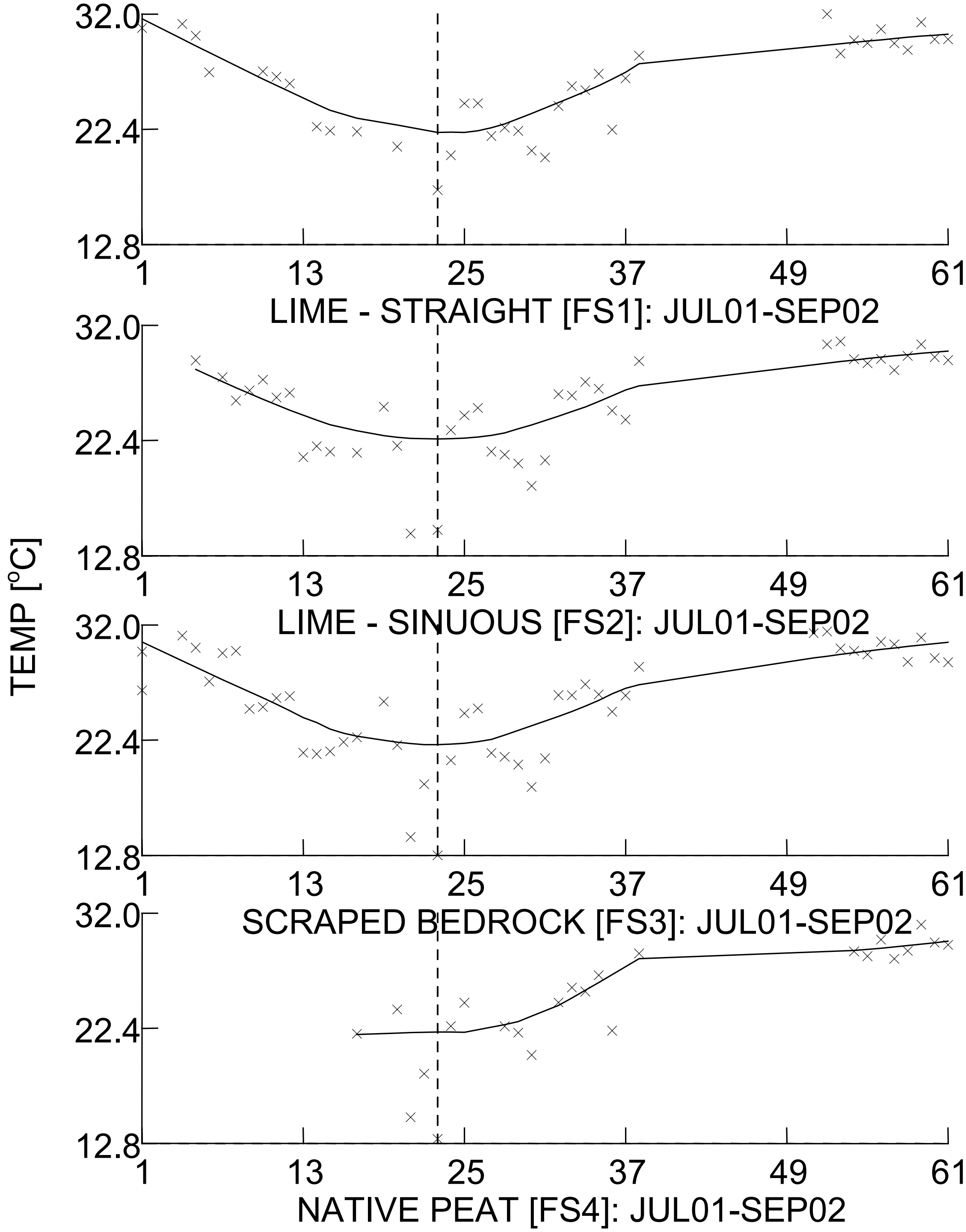


EXHIBIT H-56
Time Series Plot Displaying Temperature Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002.

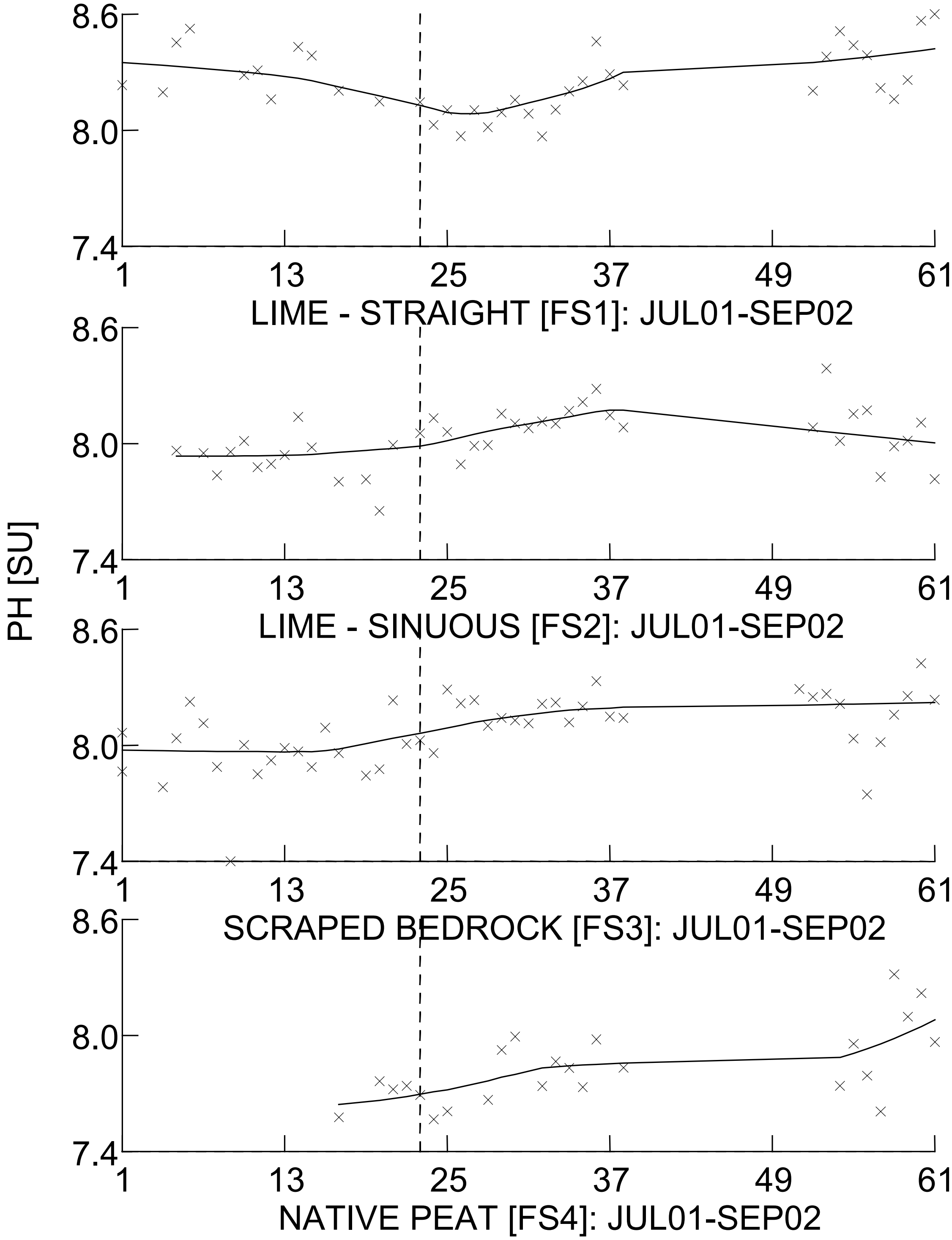


EXHIBIT H-57

Time Series Plot Displaying pH Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

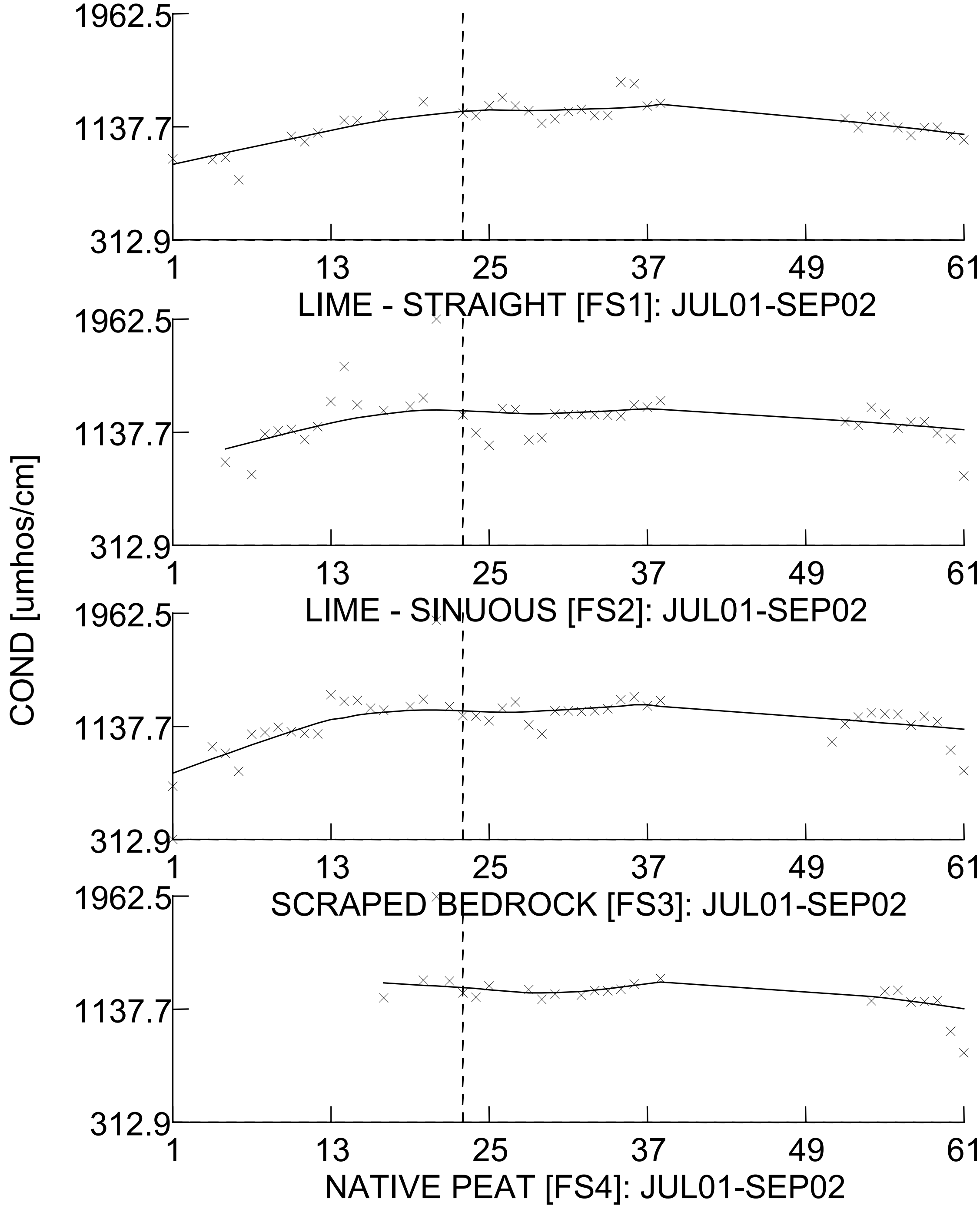


EXHIBIT H-58

Time Series Plot Displaying Conductivity Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

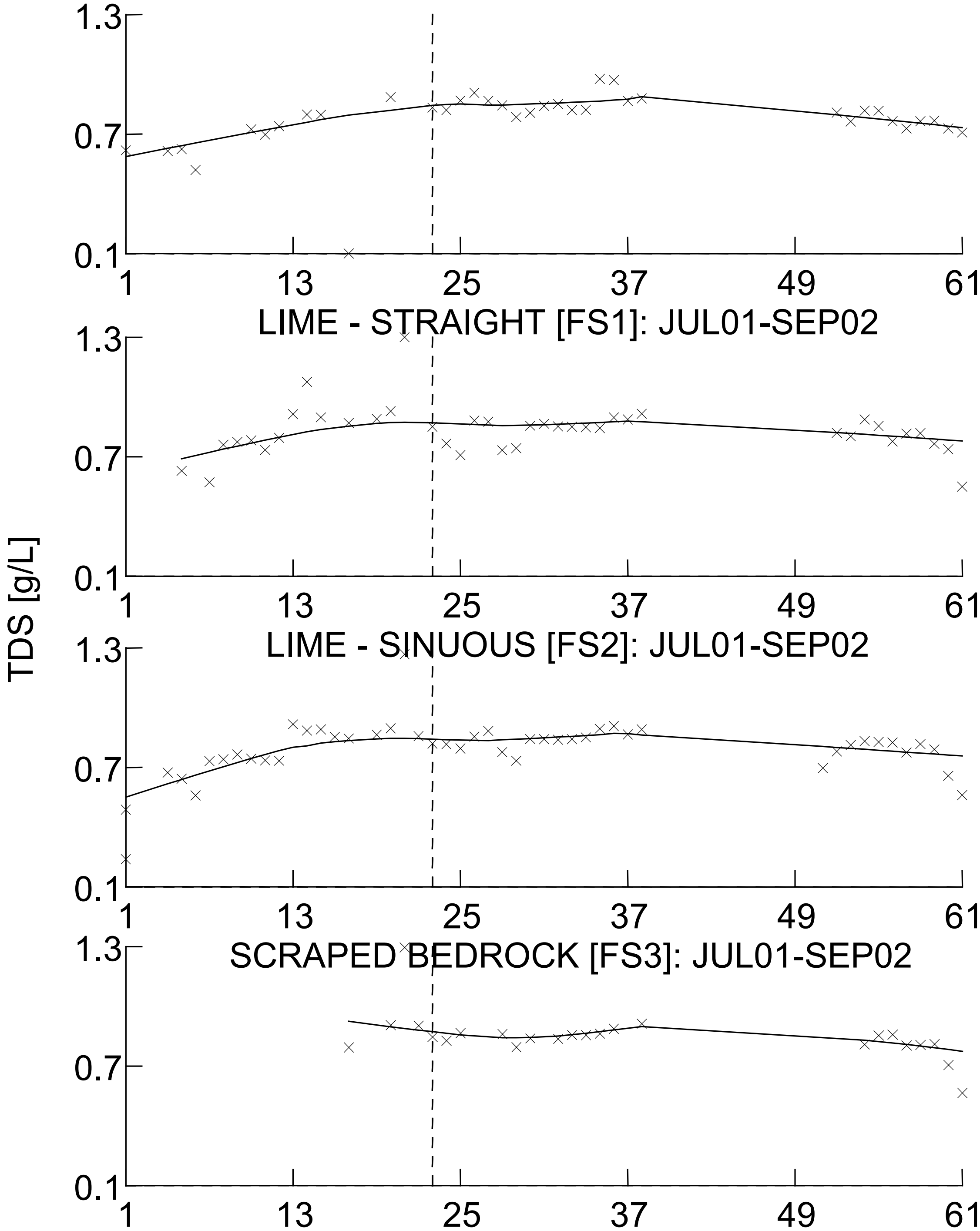


EXHIBIT H-59

Time Series Plot Displaying Total Dissolved Solids Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

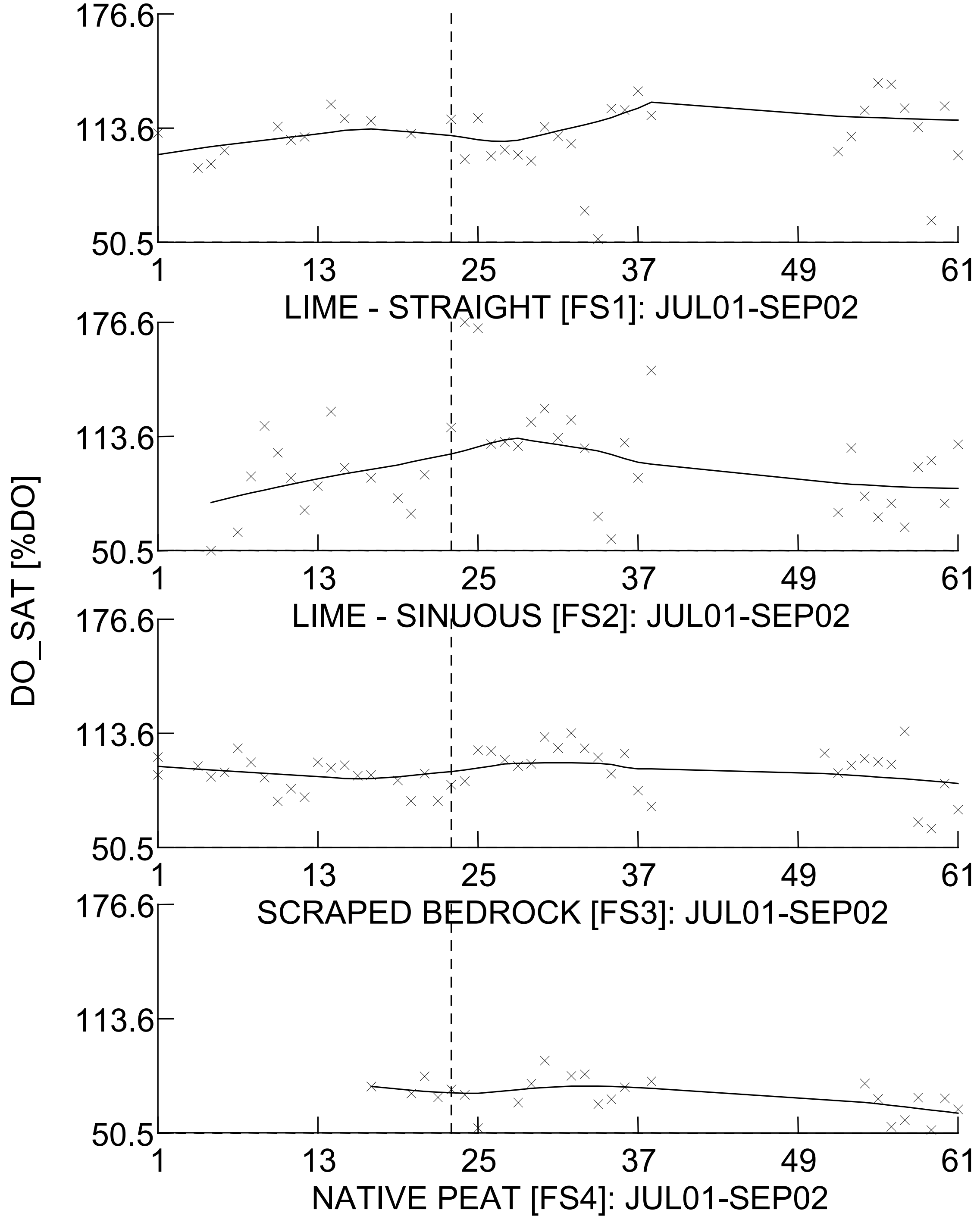


EXHIBIT H-60
Time Series Plot Displaying Dissolved Oxygen Percent Saturation Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR
Vertical dashed line represents January 2002.

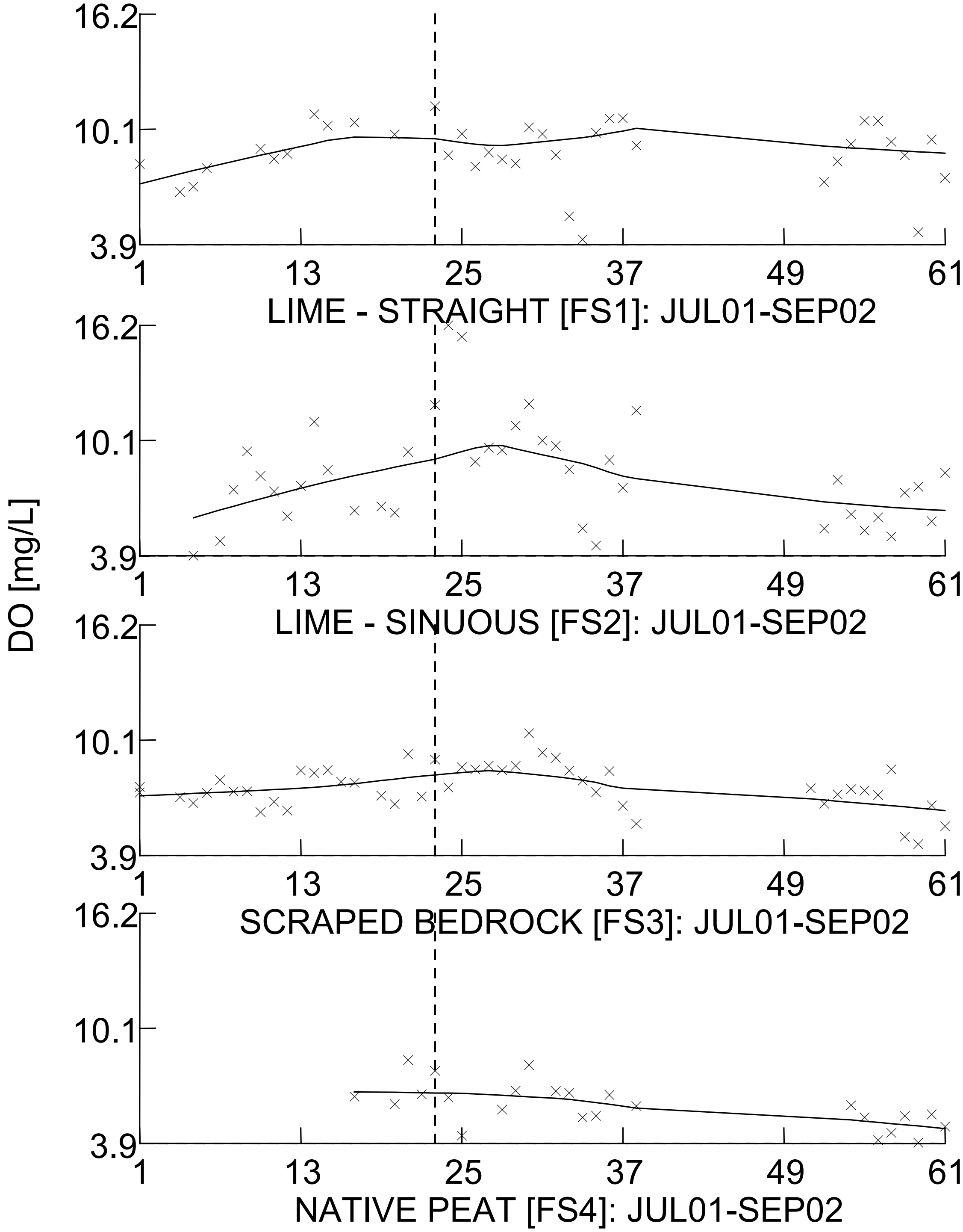


EXHIBIT H-61

Time Series Plot Displaying Dissolved Oxygen Trend for Individual Field Scale Cell Treatments Across Monitoring Weeks for the POR

Vertical dashed line represents January 2002.

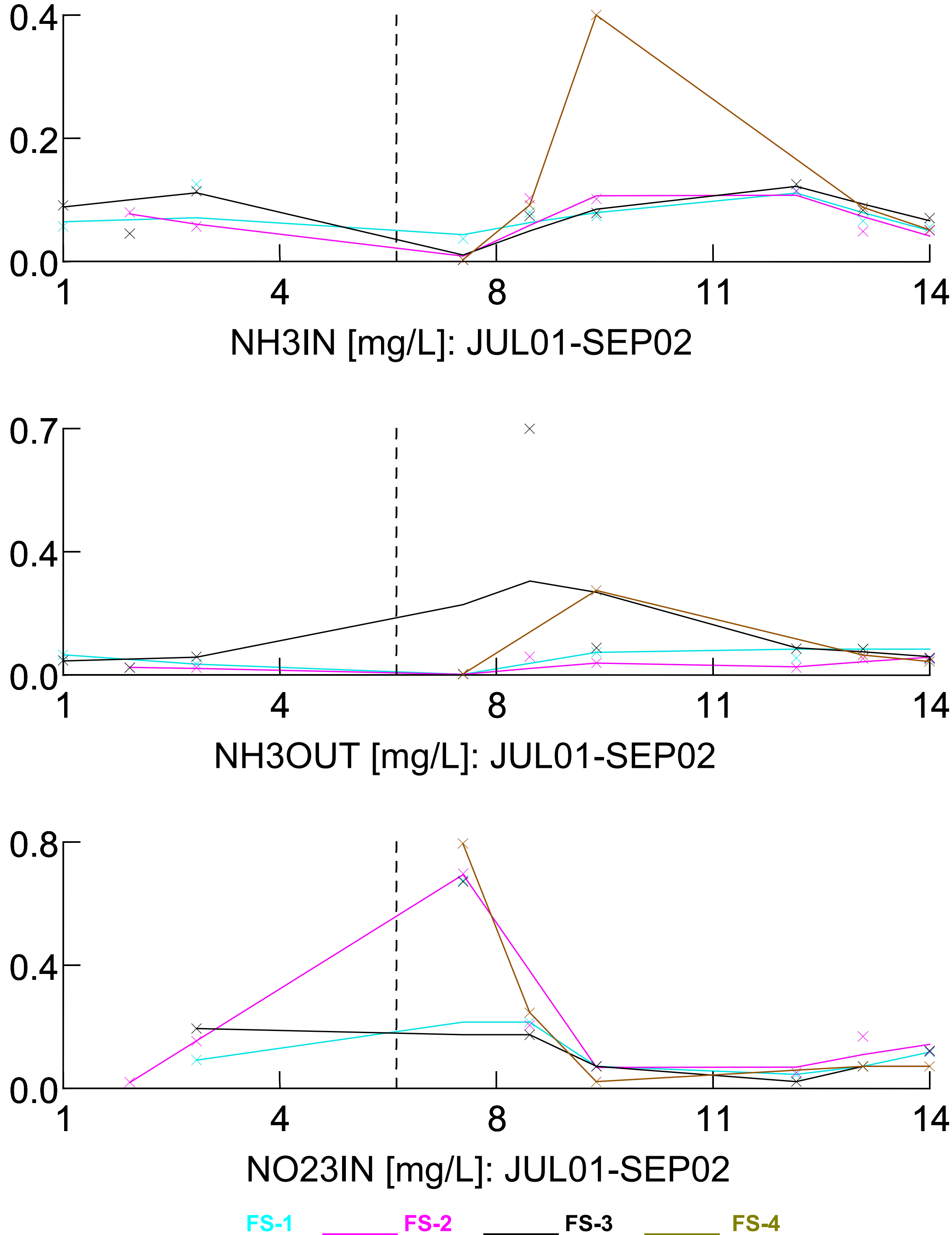


EXHIBIT H-62

Time Series Plots Displaying Inflow Ammonia (NH3IN), Outflow Ammonia (NH3OUT) and Inflow Nitrate/Nitrite (NO23IN) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR

Vertical dashed line represents January 2002.

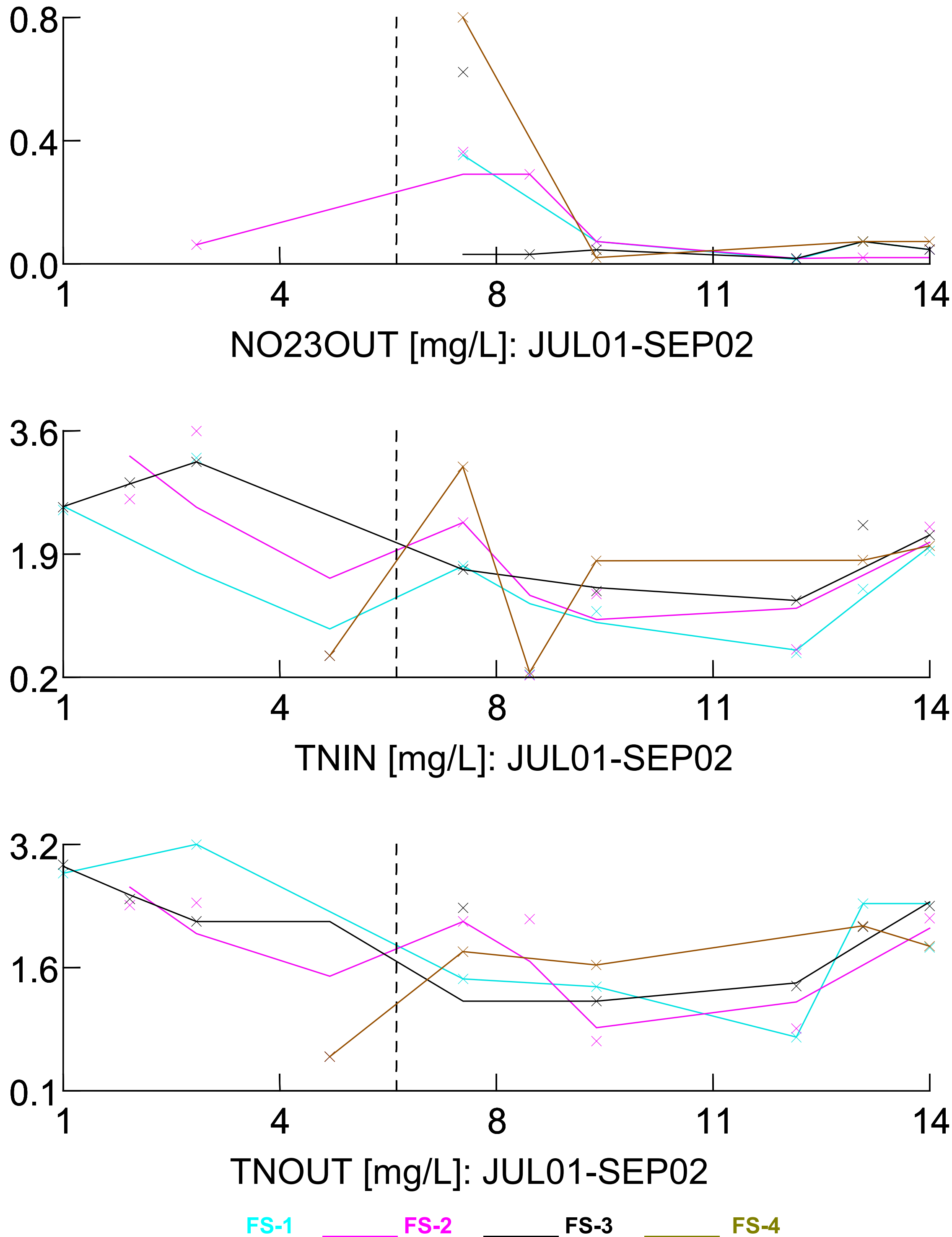


EXHIBIT H-63
Time Series Plots Displaying Outflow Nitrate/Nitrite (NO23OUT), Inflow Total Nitrogen (TNIN) and Outflow Total Nitrogen (TNOUT) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR
Vertical dashed line represents January 2002.

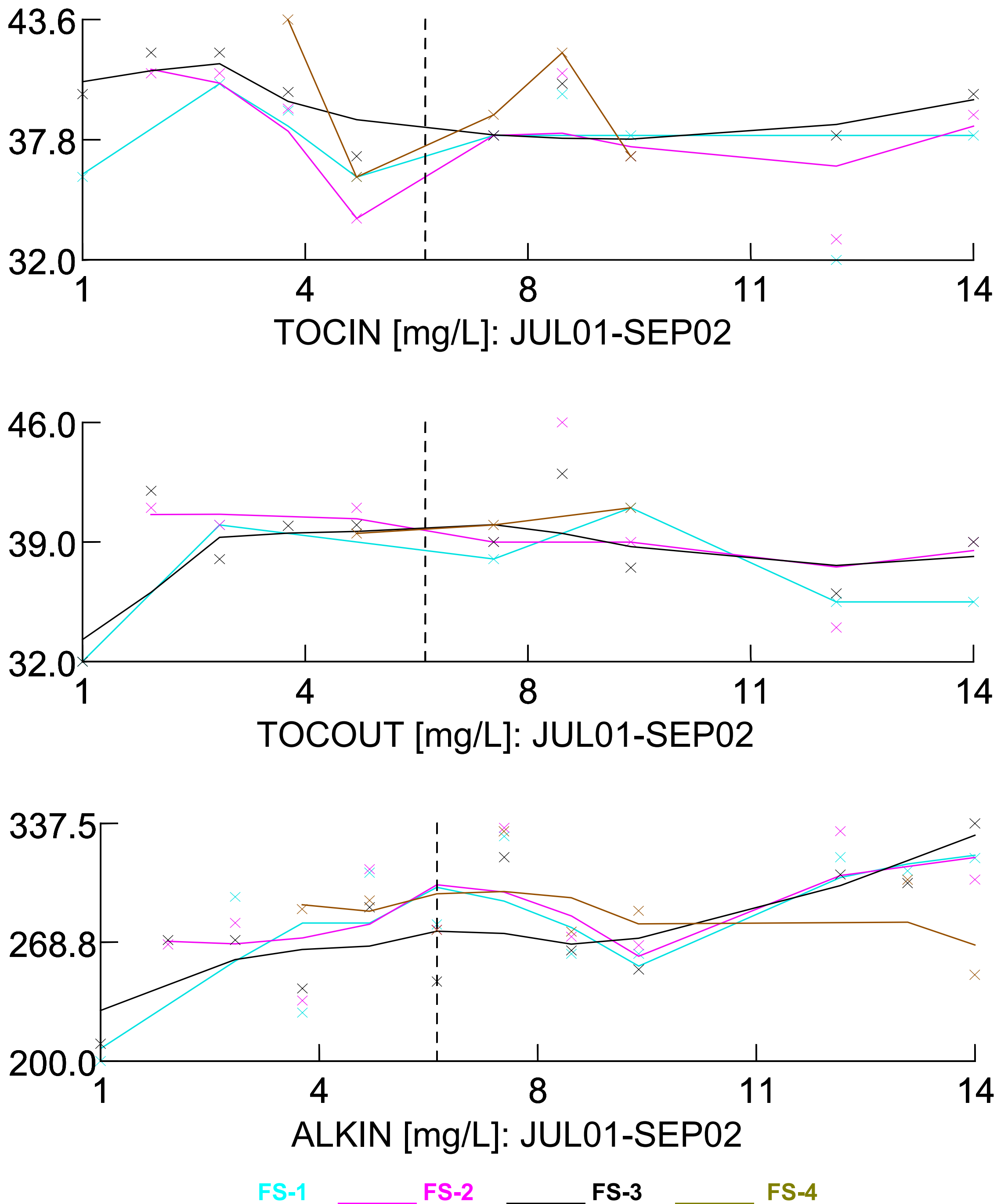


EXHIBIT H-64
Time Series Plots Displaying Inflow TOC (TOCIN), Outflow TOC (TOC OUT) and Inflow Alkalinity (ALKIN) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR
Vertical dashed line represents January 2002

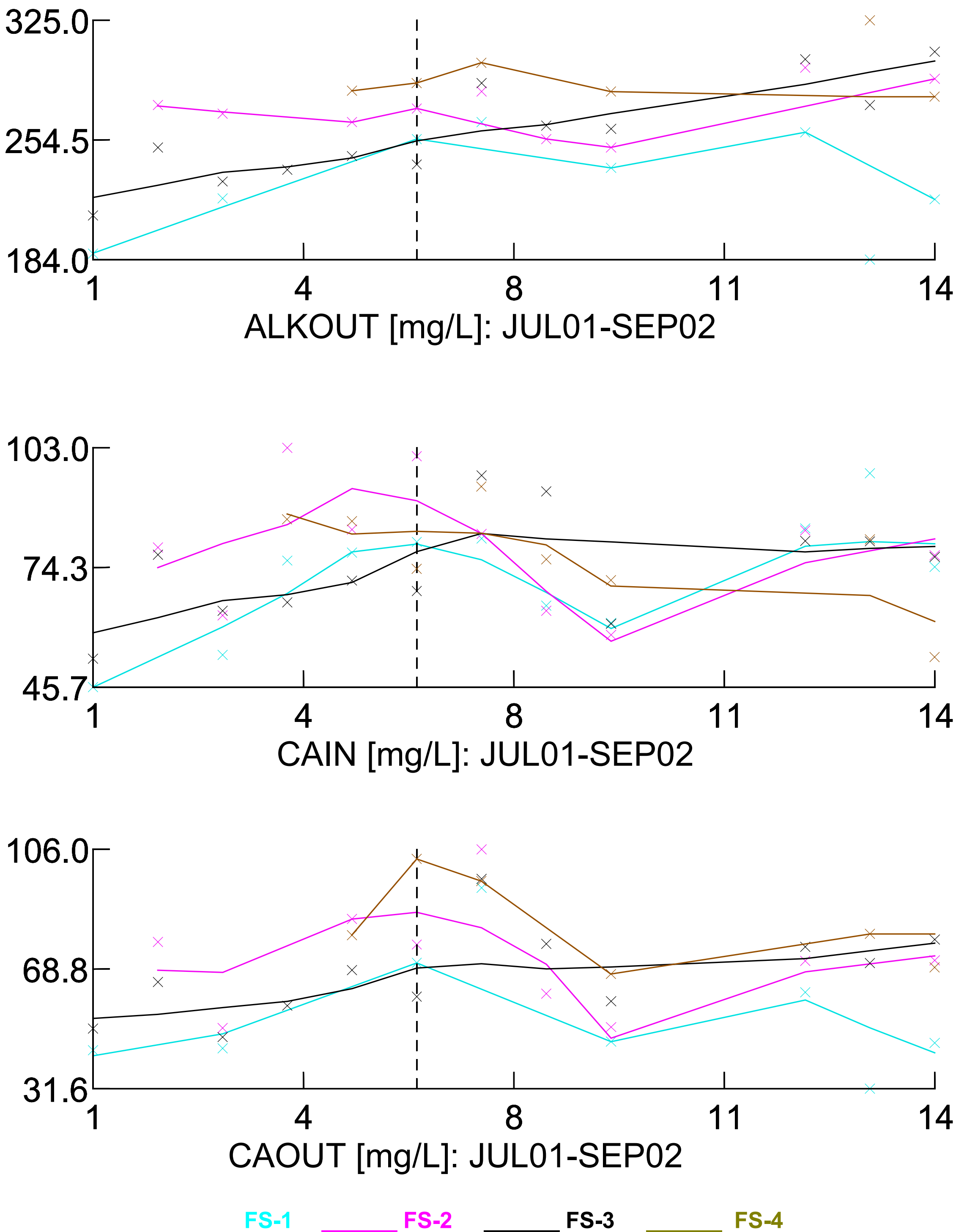


EXHIBIT H-65

Time Series Plots Displaying Outflow Alkalinity (ALKOUT), Inflow Calcium (CAIN) and Outflow Calcium (CAOUT) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR

Vertical dashed line represents January 2002

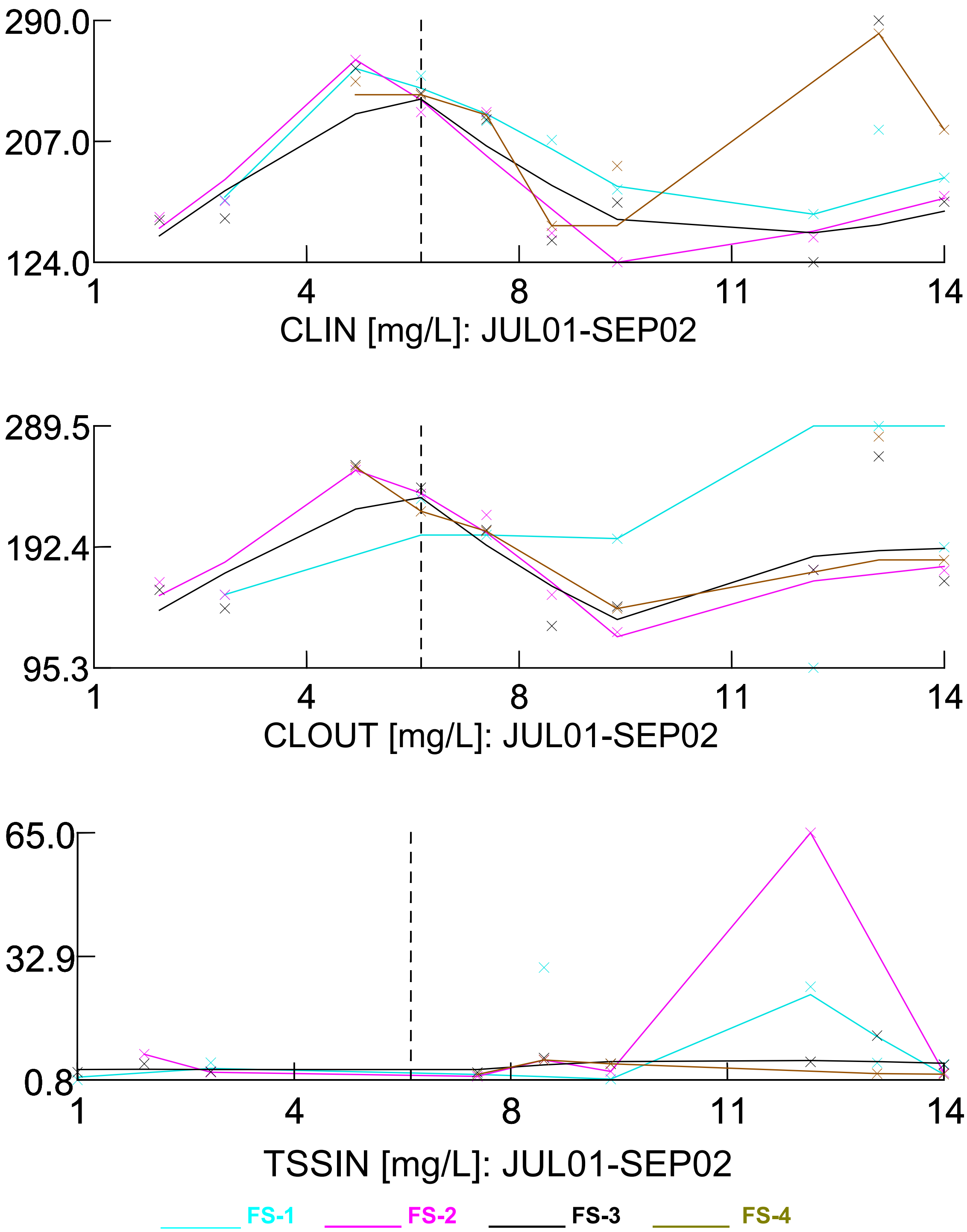


EXHIBIT H-66

Time Series Plots Displaying Inflow Chlorides (CLIN), Outflow Chlorides (CLOUT) and Inflow Total Suspended Solids (TSSIN)Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR

Vertical dashed line represents January 2002

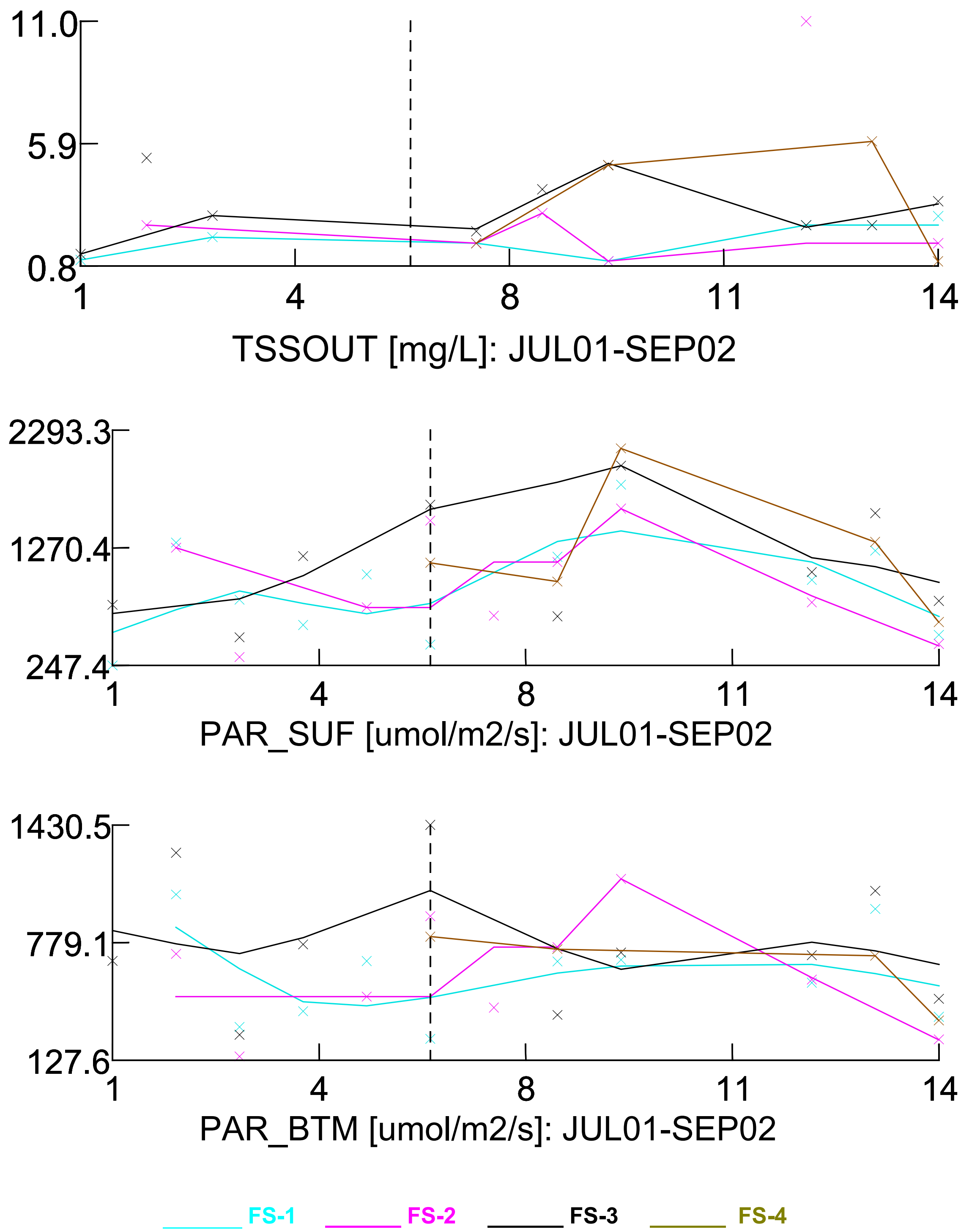


EXHIBIT H-67
Time Series Plots Displaying Outflow Total Suspended Solids (TSSOUT), Surface PAR (PAR_SUF) and Bottom PAR (PAR_BTM) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR
Vertical dashed line represents January 2002

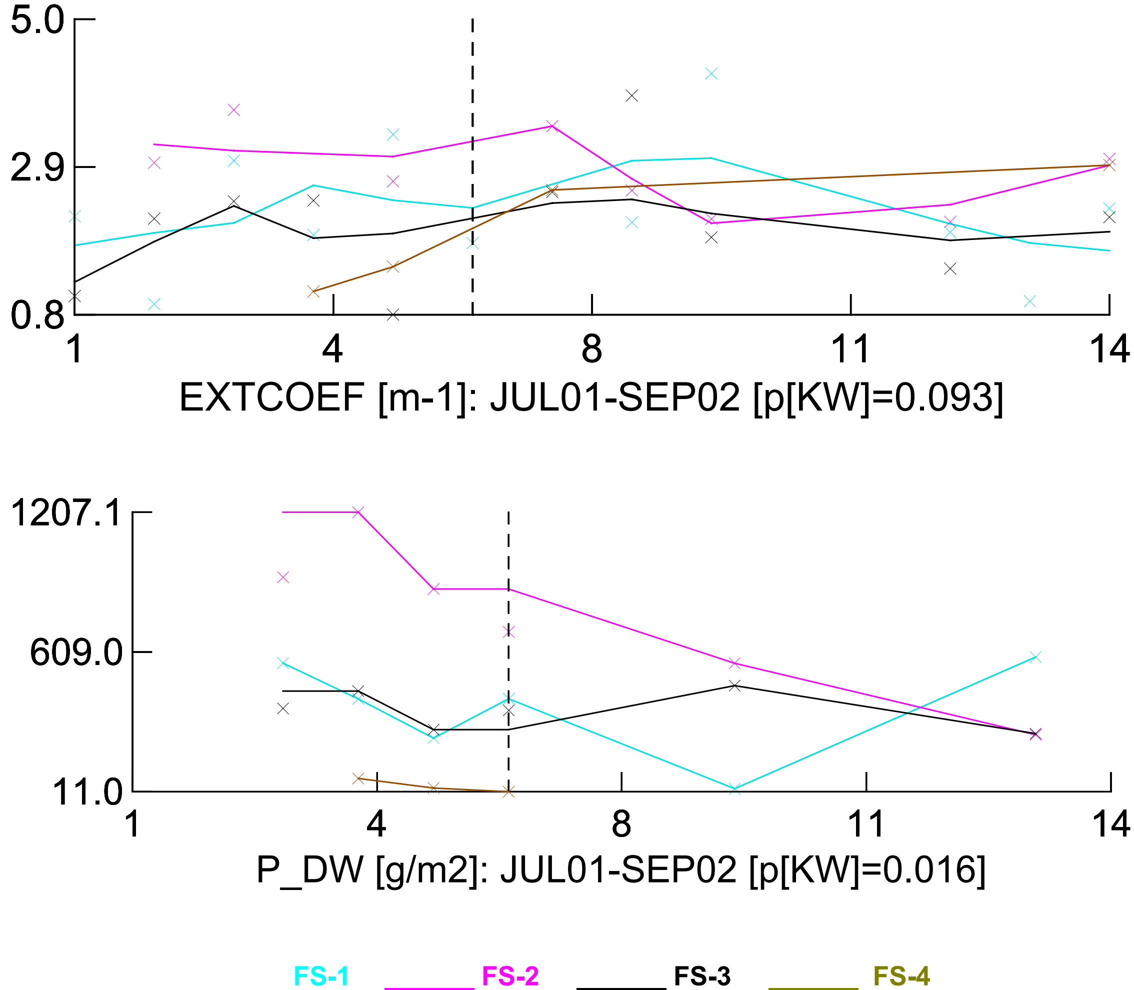


EXHIBIT H-68
Time Series Plots Displaying Light Extinction Coefficient (EXTCOEFF) and Periphyton Dry Weight (P_DW) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR
Vertical dashed line represents January 2002.

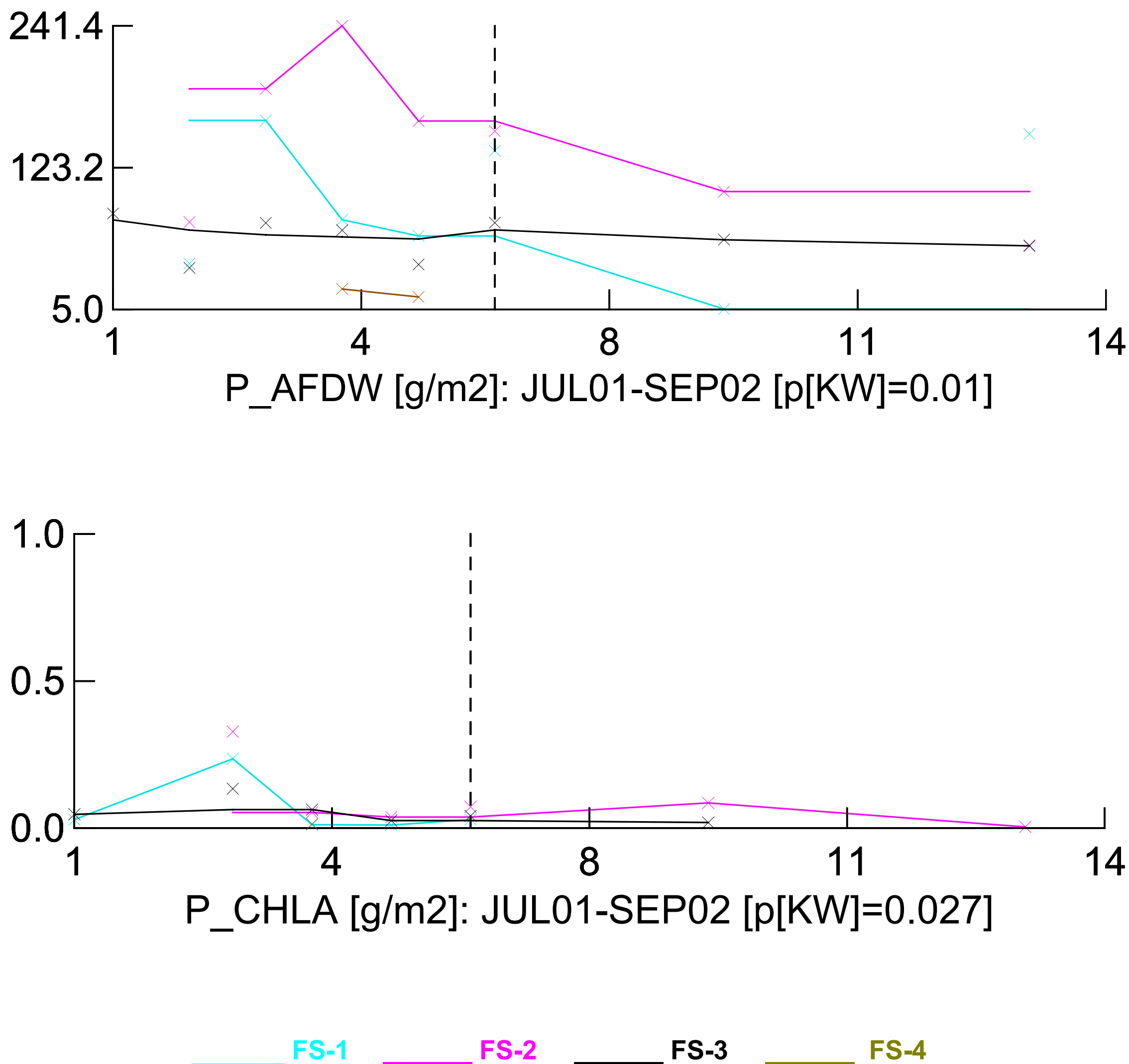


EXHIBIT H-69

Time Series Plots Displaying Periphyton Ash Free Dry Weight (P_AFDW) and Periphyton Chlorophyll A (P_CHLA) Trends for Individual Field Scale Cell Treatments Across Monitoring Months for the POR

Vertical dashed line represents January 2002.

EXHIBIT H-70

Field Scale Cell ANOVA Comparisons

Treatment	Cells	Independent Variables	Comparison
FSC-1	1	Direct Flow	POR
FSC-2	2	Sinuous Flow	Flow Effects
FSC-1	1	Direct Flow	OPP
FSC-2	2	Sinuous Flow	Flow Effects
FSC-1	1	Limerock Cap	POR
FSC-3	3	Scrape down to Bedrock	Substrate Effects
FSC-1	1	Limerock Cap	OPP
FSC-3	3	Scrape down to Bedrock	Substrate Effects
FSC-1	1	Limerock Cap	POR
FSC-4	4	Native Peat	Substrate Effects
FSC-1	1	Limerock Cap	OPP
FSC-4	4	Native Peat	Substrate Effects
FSC-3	3	Scrape down to Bedrock	POR
FSC-4	4	Native Peat	Substrate Effects
FSC-3	3	Scrape down to Bedrock	OPP
FSC-4	4	Native Peat	Substrate Effects

EXHIBIT H-71
Field Scale Cell ANOVA Results

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effect of Flow Pattern POR	FS-1 (direct flow) vs. FS-2 (sinuous flow)	TP Out (µg/L)	Mean	0.0679	No difference in mean TP Out between flow pathways
			Median	0.0800	No difference in median TP Out between flow pathways
		P Removal Rate ($g/m^2/y$)	Mean	0.1686	No difference in mean Removal Rate between flow pathways
			Median	0.0402	Sinuous flow pathway had significantly greater median Removal Rates values than direct flow pathway
		k_1 (m/y)	Mean	0.1178	No difference in mean k_1 between flow pathways
			Median	0.0464	Sinuous flow pathway had significantly greater median k_1 values than direct flow pathway
Effect of Flow Pattern OPP	FS-1 (direct flow) vs. FS-2 (sinuous flow)	TP Out (µg/L)	Mean	0.2544	No difference in mean TP Out between flow pathways
			Median	0.2173	No difference in median TP Out between flow pathways
		P Removal Rate ($g/m^2/y$)	Mean	0.3755	No difference in mean Removal Rate between flow pathways
			Median	0.0743	No Difference in median Removal Rate between flow pathways
		k_1 (m/y)	Mean	0.2009	No difference in mean k_1 between flow pathways
			Median	0.0952	No difference in median k1 between flow pathways
Effect of Substrate POR	FS-1 (lime rock cap) vs. FS-3 (scrape down to bedrock)	TP Out (µg/L)	Mean	0.0390	Scrape down to bedrock had significantly lower mean TP Out values than lime rock cap
			Median	0.0685	No difference in median TP Out between rock substrates
		P Removal Rate ($g/m^2/y$)	Mean	0.3153	No difference in mean Removal Rate between rock substrates
			Median	0.0734	No difference in median Removal Rate between rock substrates
		k_1 (m/y)	Mean	0.0423	Scrape down to bedrock had significantly greater mean k_1 values than lime rock cap
			Median	0.0492	Scrape down to bedrock had significantly greater median k_1 values than lime rock cap
Effect of Substrate OPP	FS-1 (lime rock cap) vs. FS-3 (scrape down to bedrock)	TP Out (µg/L)	Mean	0.3167	No difference in mean TP Out between rock substrates
			Median	0.2786	No difference in median TP Out between rock substrates
		P Removal Rate ($g/m^2/y$)	Mean	0.3470	No difference in mean Removal Rate between rock substrates
			Median	0.0506	No difference in median Removal Rate between rock substrates
		k_1 (m/y)	Mean	0.1701	No difference in mean k_1 between rock substrates
			Median	0.2202	No difference in median k_1 between rock substrates

EXHIBIT H-71
Field Scale Cell ANOVA Results

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Effects of Substrate	FS-1 (lime rock cap) vs.	TP Out (µg/L)	Mean	0.4099	No difference in mean TP Out between substrates
	FS-4 (native peat)		Median	0.3620	No difference in median TP Out between substrates
		P Removal Rate	Mean	0.3476	No difference in mean Removal Rates between substrates
POR[1]		($g/m^2/y$)	Median	0.2977	No difference in median Removal Rates between substrates
		k_1 (m/y)	Mean	0.2514	No difference in mean k_1 between substrates
			Median	0.1627	No difference in median k1 between substrates
Effects of Substrate	FS-1 (lime rock cap) vs.	TP Out (µg/L)	Mean	0.0607	No difference in mean TP Out between substrates
	FS-4 (native peat)		Median	0.0413	Lime rock cap had significantly lower mean TP Out values than native peat
		P Removal Rate	Mean	0.4716	No difference in mean Removal Rates between substrates
OPP		($g/m^2/y$)	Median	0.3648	No difference in median Removal Rates between substrates
		k_1 (m/y)	Mean	0.0457	Lime rock cap had significantly greater mean k_1 values than native peat
			Median	0.0317	Lime rock cap had significantly greater median k_1 values than native peat
Effects of Substrate	FS-3 (scrape down to bedrock) vs.	TP Out (µg/L)	Mean	0.0111	Scrape down to bedrock had significantly lower mean TP Out values than native peat
	FS-4 (native peat)		Median	0.0087	Scrape down to bedrock had significantly lower median TP Out values than native peat
		P Removal Rate	Mean	0.1118	No difference in mean Removal Rates between substrates
POR[1]		($g/m^2/y$)	Median	0.0473	Native peat had significantly greater median Removal Rates that scrape down to bedrock
		k_1 (m/y)	Mean	0.0076	Scrape down to bedrock had significantly greater mean k_1 values than native peat
			Median	0.0103	Scrape down to bedrock had significantly greater median k_1 values than native peat
Effects of Substrate	FS-3 (scrape down to bedrock) vs.	TP Out (µg/L)	Mean	0.0112	Scrape down to bedrock had significantly lower mean TP Out values than native peat
	FS-4 (native peat)		Median	0.0102	Scrape down to bedrock had significantly lower median TP Out values than native peat
		P Removal Rate	Mean	0.2112	No difference in mean Removal Rates between substrates
OPP		($g/m^2/y$)	Median	0.0985	No difference in median Removal Rates between substrates
		k_1 (m/y)	Mean	0.0063	Scrape down to bedrock had significantly greater mean k_1 values than native peat
			Median	0.0097	Scrape down to bedrock had significantly greater median k_1 values than native peat

1 = POR for comparisons made with FSC-4 is from December 2001 through September 2002

EXHIBIT H-72
Results of ANOVA comparisons of response variables across PSTA scales

Analysis	Treatments	Parameter (units)	Summary Statistic	Probability of greater F	Outcome Description
Rock Substrate	FSC-1 vs.	TP Out (µg/L)	Mean	0.0710	No difference in mean TP Out across scales for rock substrates
	STC-2 (Cell 8) vs.		Median	0.0000	TC-8, PP-5 and PP-10 have significantly lower median TP Out than PP-3
	PP-4 (Tanks 3, 5 and 10)	P Removal Rate	Mean	0.0146	FSC-1 has significantly greater mean Removal Rates than TC-8
		($g/m^2/y$)	Median	0.0000	FSC-1 has significantly greater median removal rates than TC-8, PP-3, PP-5 and PP-10. TC-8 and PP-5 have significantly greater median removal rates than PP-3
		k_1 (m/y)	Mean	0.0157	PP-3 and PP-5 have significantly greater mean k_1 values than FSC-1
			Median	0.0001	TC-8 has significantly greater median k_1 values than PP-3 and PP-10.
Peat Substrate	FSC-4 vs.	TP Out (µg/L)	Mean	0.0113	PP-14 has significantly lower mean TP Out than FSC-4 and TC-13
	STC-1 (Cell 13) vs.		Median	0.0687	No difference in median TP Out across scales for peat substrates
	PP-3 (Tanks 12, 14 and 18).	P Removal Rate	Mean	0.0000	FSC-4 has significantly greater mean removal rates than TC-13, PP-12, PP-14 and PP-17. PP-14 has significantly greater mean removal rates than TC-13.
		($g/m^2/y$)	Median	0.0000	FSC-4 has significantly greater median removal rates than TC-13, PP-12, PP-14 and PP-17. PP-12 has significantly greater median removal rates than TC-13.
		k_1 (m/y)	Mean	0.0003	PP-14 has significantly greater mean k_1 values than FSC-4, TC-13 and PP-17
			Median	0.0000	PP-12 and PP-17 have significantly greater median k_1 values FSC-4 and TC-13. PP-14 has significantly greater median k_1 values than FSC-4.

APPENDIX I

Field-Scale Soil Amendment Study

APPENDIX I.1

Literature Review and Study Plan

July 12, 2002

Ms. Lori Wenkert
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33416

Subject: Soil Amendment Literature Review for the PSTA Research and Demonstration Project (C-E8624)

Dear Lori:

We are enclosing ten (10) copies of the referenced document along with an additional camera-ready copy that the District can use to make internal copies should the need arise. This report is the finalized version of the draft submitted in May 2002, and provides a literature review on soil amendments that are available to reduce the release of labile phosphorus from agricultural muck soils typical of the PSTA Field-Scale site.

Copies of the full document are being sent to the following interested parties:
Frank Nearhoof and Taufiqal Aziz at the Florida Department of Environmental Protection, Nick Aumen at the National Park Service, Ron Jones at FIU (c/o Evelyn Gaiser), Bob Kadlec, and Bill Walker. These additional copies will be shipped no later than tomorrow.

As always, please feel free to contact me should any questions arise regarding the enclosures.

Sincerely,

CH2M HILL

Ellen B. Patterson
Associate Scientist

DFB31003697333.doc/021920002

c Jana Newman/SFWMD
Steve Gong/CH2M HILL
Bob Knight/WSI
David Stites/CH2M HILL
Jim Bays/CH2M HILL

Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project Soil Amendment Literature Review

Prepared for

South Florida Water Management District

Prepared by

CH2MHILL

July 2002

Contents

Abbreviations and Acronyms

BMP	Best Management Practices
cm	centimeter
DRP	dissolved reactive phosphorus
EAA	Everglades Agricultural Area
ENR	Everglades Nutrient Removal
FAC	Florida Administrative Code
g/m^2	grams per square meter
$g/m^2/yr$	grams per square meter per year
kg	kilogram
µg/L	micrograms per liter
mg/L	milligrams per liter
mg	milligrams
m^2	square meter
P	phosphorus
PACl	polyaluminum chloride
P/L	phosphorus per liter
PSTA	Periphyton-Based Stormwater Treatment Area
SAV	submerged aquatic vegetation
SFWMD	South Florida Water Management District
SJRWMD	St. Johns Water Management District
TP	total phosphorus
USACE	United States Army Corps of Engineers
WTR	water treatment residuals

SECTION 1

Introduction

SECTION 1

Introduction

An important finding from the Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project is that antecedent soil conditions have an effect on the phosphorus (P) removal performance of the system. The initial concentration of available P and the method used for initial substrate modification may have a significant effect on cost and land areas required for full-scale PSTA implementation. In addition, the type of soil and its antecedent P concentration also affects the rate of development of rooted emergent plant communities. If left unmanaged, macrophytes may out-compete a periphyton-dominated plant community on organic soils and at higher P loading conditions. Under some conditions, rooted macrophytes may also promote release of P from the soil to the water column.

In the PSTA Research and Demonstration Project test cells and mesocosms, addition of shellrock or limerock caps over the native peat was successful in reducing P release from the underlying peat. Based on a preliminary evaluation of constructability, this cap may need to be up to 2 feet thick. However, this approach is viewed as being very costly for large-scale PSTA implementation, and mechanisms to achieve this separation of the peat-based P from the water column are desired. Additional focused research needs to be conducted to investigate alternatives for achieving this separation. Potential soil amendments are to be evaluated under the following three tasks:

- **Literature Review:** Summarize existing information on soil amendments that could be applied to a full-scale PSTA in terms of advantages and disadvantages of each amendment.
- **Bench-Scale Testing:** Using soils from the PSTA Field-Scale Cell 4 (peat-based), conduct a preliminary bench-scale laboratory study to determine the general properties and effectiveness of a select group of soil amendments and an effective application rate. Based on data obtained under this task, two amendments would be selected for field testing. The need for this task has been re-evaluated and the budget transferred to enhanced mesocosm studies based on a literature-based selection of preferred amendments and effective dosages.
- **Mesocosm Studies:** Perform mesoscom studies of the two (increased to three with elimination of the bench-scale testing) top-ranked soil amendments on P removal capacity and vegetation development in field mesocoms located at the PSTA Field-Scale site.

Ultimately, these tasks will result in a recommendation of a cost-effective soil amendment that may be used in place of limerock for a full-scale PSTA constructed on a peat substrate.

As outlined under the first task, literature on soil amendments was reviewed to explore available treatments to reduce the release of P from agricultural muck soils typical of the PSTA Field-Scale site. The results of this review are presented in this report. Further, this report outlines a "path forward" for continued soil amendment research under the PSTA project based on the results of the literature review.

This report is organized as follows:

- **Section 2:** Overview of Potential Soil Amendments
- **Section 3:** Soil Amendment Effectiveness
- **Section 4:** Soil Amendment Sources and Estimated Costs
- **Section 5:** Potential Environmental Concerns
- **Section 6:** Overall Soil Amendment Recommendations
- **Section 7:** Proposed Soil Amendment Study Plan
- **Section 8:** Works Cited

SECTION 2

Overview of Potential Soil Amendments

SECTION 2

Overview of Potential Soil Amendments

2.1 Background

Based on the available literature, relatively few examples exist where soils have been amended with the intent to manage P flux (e.g., Moore and Miller, 1994; Daniel and Haustein, 1998). Of these, the majority are for P control in lakes or on upland soils, with only a small subset relevant to shallow wetland saturated soil conditions (e.g., Ann, 1995; Ann et al., 2000a; Matichenkov et al., 2001).

In lake management, the amendment dosage is designed to treat the water column and “cap” sediment P flux for a specified period (based on estimates of soluble P in surficial sediments). Under these situations, the water column is expected to be sufficiently deep to allow full flocculation to take place, and the sediments are presumed to remain relatively undisturbed. Several soil amendments have been investigated for upland P runoff control and include the following:

- Alum water treatment residuals (WTRs) from potable water treatment systems with aluminum and iron compounds and sodium carbonate and polymers (e.g., Eaton and Sims, 2001; Gallimore et al., 1999; Codling et al., 2000)
- HiClay® Alumina, a proprietary product of General Chemical Corporation (Daniel and Haustein, 1998)
- Bauxite and cement kiln dust and alum hydrosolids (Peters and Basta, 1996).

Several soil amendments have been investigated for phosphorus control for upland sites being converted to wetlands and include the following:

- **St. Johns River Water Management District (SJRWMD):** Researched the use of alum, lime, calcium carbonate, gypsum, and alum WTR on muck soils in areas being restored to wetland habitat (unpublished). In addition, SJRWMD applied alum WTR to several thousand acres of muck soil being converted to wetland habitat; however, the site has yet to be flooded.
- **University of Florida:** Studied the effects of a variety of chemical amendments on P solubility in wetland organic soils (Ann et al., 2000a, and 2000b; Matichenkov et al., 2001).
- **DB Environmental.** Studied the effects of lime additions to a Stormwater Treatment Area (STA-1W, Cell 5) (DB Environmental, 2002).

2.2 Available Materials

Numerous materials may be used to remove P from water, or sequester P in solids, such as animal waste or municipal sewage solids (biosolids). The most commonly used materials are listed in Exhibit 2-1, and can be broadly categorized as aluminum-, calcium-, and iron-based compounds.

EXHIBIT 2-1

Compounds with Phosphorus Adsorptive Properties Used in Water or Solids Treatment for P Removal

Chemical	Formula or Constituents	Chemical Characteristic	Available Forms/Comments
Alum	$AL_2\ (SO_4)_{3\ +}$ 14 H_20	Alkaline, low solubility	Dry or in slurry; variable percentages highly caustic and reactive.
Sodium aluminate	$Na_2Al_2O_4$	Weakly alkaline	Dry, damp, or in solution as a pH stabilizer with alum extremely reactive and caustic. Commonly used as an additive to improve flocculation characteristics through pH mediation.
Polyaluminum chloride	$AL_2(OH)_nCl_{6-n}$+nH_20	Mildly acidic	Product of hydrated alumina and hydrochloric acid. Dry or in slurry.
Lime (Quick Lime)	CaO	Strongly alkaline	Dry produced by the heating of lime to ~1000° C used in wastewater treatment for removal of phosphates.
Slaked or hydrated lime	$Ca(OH)_2$	Alkaline, low solubility	Dry or slurry – results from the mixing of quicklime and water in an exothermic reaction.
Agricultural lime/limerock	$CaMg(CO_3)_2$ and impurities	Weakly alkaline	Dry ground limerock; also known as dolomite.
Calcium Carbonate	$CaCO_3$	Weakly alkaline	Dry or damp.
Ferric Chloride	$Fe\ Cl_3$	Strong acid	Dry or liquid available in small quantities in reagent grade levels. Available in bulk as liquid in commercial grade for potable water treatment. May contain metal contaminants depending on source.
Ferric Sulfate	$Fe_2(SO4)_3$	Strong Acid	See ferric chloride.
Wollastonite	$CaSiO_3$ (pure) usually available as calcium metasilicate mineral	Neutral	Inosilicate mineral used in ceramics, paint filler. Recently proposed for treatment of stormwater P in northeast U.S.
Polymers	Polyelectrolyte	Anionic or cationic polymers-neutral pH	Liquid or dry forms added to increase precipitation rates, and to reduce coagulant uses. Not effective in soluble P removal.
Recmix/Tenn. Slag	Ca/Mg silicates and impurities	Alkaline	By-products of steel productions. Used as soil amendments to augment plant growth. P and metals are contaminants.
Water Treatment Residual (WTR)	Raw potable water constituents (organic carbon forms, trace metals, and minerals), flocculants, (aluminum or iron compounds) polymers, and activated carbon	Neutral to slightly alkaline	Dry or damp bulk material. Variable P adsorptive capacity by source.
HiClay® Alumina	Alum and short paper fibers	Unknown – proprietary material	Damp bulk material by-product of alum production and other bauxite-based processes.
Gypsum or Recycled Gypsum	$CaSO_4.(2H_2O)$ hydrated calcium sulfate	Neutral	Dry bulk recycled waste product from building and manufacturing industries. May contain paint or other materials.

Key points regarding the available compounds are as follows:

- Aluminum or iron compounds listed in Exhibit 2-1 are often employed in generating WTRs and biosolids (Soil and Engineering Technology [SWET], 2001: Appendix C).
- Sodium aluminate and polymers are used as additives in the flocculation process to manage pH (sodium aluminate) and improve floccing characteristics (polymers).
- Chemical processes by which P is removed using the compounds listed in Exhibit 2-1, and the behavior of the these chemical compounds are well known, with two exceptions: Polyaluminum chloride is a relatively new compound in the industry, and agricultural lime is not typically used in water treatment.
- Calcium carbonate is often a by-product of potable water treatment.
- Limerock and calcium carbonate are used for soil pH amendment ("soil sweetening"), but have been tested in P removal tests (e.g., DeBusk et al., 1997; Ann, 1995; Ann et al., 2000a, and 2000b; St. John River Water Management District [SJRWMD], unpublished).
- HiClay® Alumina is a proprietary material developed by General Chemical Corporation (Daniel and Haustein, 1998) from clay and pulp paper waste, and has demonstrated some effectiveness in removing P from animal wastes.
- Calcium carbonate, precipitated from a Gainesville Regional Utilities Water Treatment Plant, and recycled gypsum were not found to be effective in trapping P leaching from organic soils in central Florida (SJRWMD, unpublished).
- Aluminum-based WTR was found to be effective in reducing soluble P in mineral soils (Peters and Basta, 1996), in muck soils (Ann et al., 2000a), and in sequestering P leaching from muck soils (SJRWMD, unpublished).

2.3 Chemical Reactions and P Immobilization

Chemical reactions for calcium, iron and aluminum-based compounds are provided below (Viessman and Hammer, 1985). The basic reaction creates insoluble precipitates from the reaction of PO_4 with multivalent metal ions in excess concentrations. In each reaction, hydroxyl and phosphate ions compete for attachment to the metal ion, with the reaction kinetics moving the reaction toward phosphate attachment. Flocculation removes solids with any associated P as well. Phosphate removal is often at a lower rate than stoichiometry predicts because of other water characteristic (pH, alkalinity, etc.) (Metcalf and Eddy, 1979).

2.3.1 Lime (Calcium Hydroxide)

$$CaO\ (solid) + 3H_2O + 2(PO_4)^{3-} \longleftrightarrow Ca_3(PO_4)_2\ (solid) + 6\ OH^-$$

or

$$Ca(HCO_3)_2 + Ca(OH)_2 \longleftrightarrow 2CaCO_3\ (solid) + 2H_2O$$

$$5\ Ca_2+ +4OH^- + 3(HPO_4)^2 \longleftrightarrow Ca_5(OH)(PO_4)_3\ (hydroxylapatite\ solid) + 3H_2O$$

Lime doses for removal (precipitation) of phosphates in water treatment are based primarily on the alkalinity of the water rather than the phosphate concentrations, as the precipitation is a result of excess calcium ion in the water column (Metcalf & Eddy, 1979).

2.3.2 Iron

$FeCl_3 + 3\ H_2O \longleftrightarrow Fe(OH)_3 + 3\ HCL$

$FeCl_3 + PO_4^{\ 3-} \longleftrightarrow FePO_4$ (solid) $+ 3\ Cl^-$

$Fe^{3+} + HnPO_4^{\ 3-} \longleftrightarrow FePO_4 + nH+$ (for general ferric iron reactions)

2.3.3 Alum

$Al_2(SO_4)_3 \cdot 14.3\ H_20 + 2(PO_4)^{3-} \longleftrightarrow 2\ AlPO_4$ (solid) $3(SO_4)^{\ 2-} + 14.3\ H_2O$

2.3.4 Polyaluminum Chloride (Aluminum Chloride)

Polyaluminum chloride coagulants are a group of aggregates, with the general formula of $Al_2(OH)_x Cl_{(6-x)}$, where x ranges from 0 to 6 (General Chemical Corporation, 2002). The partially hydrolyzed aluminum chloride has a similar reaction to alum but with a by-product of chlorides rather than sulfates.

Polyaluminum chloride is less commonly used, and limited full-scale data are available to compare its performance to that of alum. It is reported to have stronger, faster settling flocs than alum in some applications (USACE, 2001). The product is reported in commercial descriptions as percent AL_2O_3, which would be the formula used to calculate doses. It is important to note that chlorides are sometimes partially substituted with sulfates, which is not a desirable product.

In theory, aluminum and iron reactions precipitate a mole of phosphate for each mole of metal added. However, an overdose is typically used to account for competing substrates, particularly organic ions (Metcalf & Eddy, 1979).

2.3.5 Sodium Aluminate

Sodium aluminate results in a basic rather than acidic product, and is used as a buffering agent with alum and polyaluminum chloride. It works better in hard than soft waters (USACE, 2001). The mechanism of action is:

$2\ NaAlO_2\ CO_2 + 3H_2O \longleftrightarrow 2Al(OH)_3$ (solid) $+ Na_2CO_3$

2.3.6 Polymers

A variety of polymers (as referred to as polyelectrolytes) are used as coagulant aids in P removal. Water-soluble organic polymers come in anionic, cationic, and non-ionic forms; the main form of action is through interparticle electrolytic bridging. The efficiency of the reaction depends on the exact characteristics of the particles to be coagulated, the concentration, and the amount of mixing (USACE, 2001). There are a large number of polymers on the market, and comprehensive testing has not been performed.

2.3.7 Wollastonite

Wollastonite is a mineral mined in a number of U.S. states and has a high P adsorption capacity (Goehring et al., 1995). This compound can potentially bind 5 milligrams (mg) P per g substrate. Debusk et al. (1997) tested Wollastonite for removal of stormwater runoff pollutants, and found it more effective in stormwater total phosphorus (TP) removal than sand, peat, or limerock when compared in a laboratory column study. During this study, an 88 percent TP removal was reported with an inflow concentration of 0.41 milligrams per liter (mg/L) and a retention time of 4 to 6 hours. The exact mechanism of P removal by Wollastonite is unclear at this time.

2.3.8 Recmix and Tennessee Slag

Recmix and Tennessee Slag are industrial by-products that are rich in calcium (20 to 30 percent) and silicate (16 to 20 percent) (Matichenkov et al., 2001). Recmix is production during the processing of steel and is sold by PRO-CHEM Chemical Company (FL). Tennessee Slag is a by-product from electric production of phosphorus, and is sold by the Calcium Silicate Corporation (TN). Both by-products include relatively high P concentrations (up to 2 percent) and are reportedly used as soil amendments for agricultural production (Matichenkov et al., 2001). Recently, research has been sponsored by the District on their capacity to adsorb P in organic soils and to reduce leaching (Matichenkov et al., 2001). Small-scale laboratory tests indicated that Recmix and TN Slag had P sorption potential similar to pure $CaSiO_3$ (Wollastonite). However, the small scale of these experiments, the P concentration range tested (>10,000 µg P/L in solution), and the high P content of these materials and the significant concentrations of other contaminants including a broad range of heavy metals, preclude serious consideration of their use for P control in PSTA.

2.3.9 Water Treatment Residuals (WTRs)

WTRs are a by-product of potable water treatment. Flocculants are generally used to remove fines and color, and improve taste and odor characteristics. The residuals include those materials from the source water, the flocculant (usually an iron or aluminum compound), and often polymers and activated carbon, depending on the particular plant. Because each plant unit process is developed for the source water, the characteristics of this material vary widely between plants. The historic method of disposal has been disposal in landfills or in running waters during high water or flood periods. The material has successfully removed P from animal wastes, soil runoff, and reduced leaching from wetland soils (e.g., SWET, 2001; Daniel and Haustein, 1998; Gallimore et al., 1999; Peters and Basta, 1996; Codling et al., 2000).

2.3.10 HiClay Alumina

HiClay® alumina is a waste product from aluminum sulfate (alum) production, and contains a high aluminum concentration. According to Daniels and Haustein (1998), “It is the remaining clay-like material from the digestion of bauxite in sulfuric acid – analogous to being a very highly weathered natural clay. ” The mechanism of action is not available, but it has been shown to significantly reduce soil runoff P (easily extractable P fractions) of test plots (Daniels and Haustein, 1998), although it was found to be much less effective than WTR.

2.3.11 Recycled Gypsum

The mechanism of P adsorption by gypsum is assumed to be similar to that of ferric chloride. No specific discussion of the chemistry was provided in the review material.

SECTION 3

Soil Amendment Effectiveness

SECTION 3

Soil Amendment Effectiveness

3.1 Background

Additive effects on P runoff or sediment flux are evaluated in terms of the reduction of the P concentration, either in the runoff or in the water column above the sediment. During this review, research was not identified where a "seal" or cap on the sediment was evaluated, except in lake restoration applications. When applying alum to lakes, the intent is to develop a sufficient floc layer to physically cover the sediment, and thus ensure trapping of P leaching from below. As new organic material settles from the water column, it slowly covers the floc layer, and after some time period, the layer becomes completely buried.

The use of soil amendments creates a different scenario where the mixing of soil with an amendment immobilizes the P. In surface applications, a chemical layer is created that is more or less successful in reducing the amount of P that moves off the soil site or out of the sediment into the water column. The stability of immobilized P is a function of the chemical binding agent and, to a greater or lesser extent, other physical/chemical properties, such as redox potential (Ann et al., 2000b).

3.2 Relevant Soil Amendment Research

3.2.1 Lake Apopka

3.2.1.1 Bench-Scale Testing

Under work conducted by Ann et al. (2000a), organic soils at Lake Apopka were thoroughly mixed in the laboratory with several doses of amendments followed by the measurement of water column P concentrations and other parameters for 12 weeks. Amendments tested included: alum, calcium carbonate, ferric chloride, slaked lime, agricultural lime (dolomite), and combinations of alum and lime with calcium carbonate. Dosage rates are provided in Exhibit 3-1.

This research found that agricultural lime and calcium carbonate had little effect on controlling P release. The most effective amendment was ferric chloride (after treatment, water column P concentrations of less than 50 micrograms per liter [µg/L]) followed by alum, and then hydrated-lime, which had water-column P concentrations of less than 100 µg/L.

High rates of amendments were necessary because of "complexation of P binding cations (Ca, Fe, Al) with organic matter" (Ann et al., 2000a). In each case, the highest dose was most effective in eliminating P flux from those soils and thus represents a worst-case upper boundary for a South Florida treatment, where the soils are lower in total P (see Section 3.3) but the desired goal is the complete elimination of P flux. Soil amendments that are more sensitive to redox changes, such as those utilizing iron as the binding agent, were found to be less dependable for P sequestration (Ann et al., 2000b).

EXHIBIT 3-1
Experimental Soil Amendment Dosages Used for Lake Apopka and STA-1W

Chemical	Ann et al., 2000a g/kg soil	Ann et al., 2000a kg/m^2	Lake Apopka kg/m^2	STA-1W kg/m^2
Alum	14.5	0.81	0.28	NA
	23	1.29	NA	NA
Aluminum-WTR	NA	NA	0.80	NA
Ferric chloride	7.1	0.40	NA	NA
	11.5	0.64	NA	NA
Lime (Calcium Hydroxide)	30	1.68	0.75	0.05
	75	4.20	NA	0.14
Calcium Carbonate	NA	NA	0.46	NA

Notes:
Application rates were taken from Ann et al. (2000a) for laboratory testing of treatment of farmed organic soils around Lake Apopka, Florida, and from DB Environmental, Inc. for chamber tests at STA-1W Cell 5.
Bulk density value Ann et al. (2000a) = 0.28 g/cm^3. Bulk density Lake Apopka data = 1.07 g/cm^3
NA = not analyzed

3.2.1.2 Field Testing

In replicate 100 square meter (m^2) plots on organic soils at Lake Apopka, the following amendments were surface-applied and tested for their ability to "cap" flux of P from the organic soils: alum, alum sludge, calcium carbonate sludge (water treatment plant by-product), and calcium hydroxide (slaked lime) (SJRWMD, unpublished). The study goal was to maintain a low TP concentration (<0.20 mg TP/L) in the water column. Dosage rates were more than sufficient to cap a 3 g/m^2 flux of P (2.3 mg/m^2/d for 3 years), based on the work in Ann et al. (2000a). The anticipated total P flux value was estimated as the total soluble P flux after initial flooding of similar soils at Lake Apopka (Coveney et al., unpublished).

Under this study, the total P concentration in the initial flood water was 1.1 mg P/L, and ranged between 0.6 to 1.2 mg/L TP. Study results are as follows:

- Lime and aluminum-WTR treated cells maintained water-column concentrations of between 0.1 and 0.2 mg TP/L during a 5-month sampling period.
- Alum-treated cells performed similarly to aluminum-WTR and lime at the beginning of the test, but water column P concentrations began to rise after approximately 2.5 months and remained above 0.2 mg/ L TP thereafter.
- Calcium carbonate treatment was ineffective.
- Some difficulty remains in interpreting the results unequivocally because the control cell water column P concentrations (TP and dissolved reactive phosphorus [DRP]) also fell

significantly during the study, although not as much or as rapidly as in the treatment cells.

In a parallel study of soil P conditions in the 100 m^2 plots, Reddy et al. (1998) found that while the surface-applied chemical amendments reduced water-column P levels, the amendments did not affect soil P profiles, suggesting that the effect of the surface application was to provide a partial chemical barrier to soil-water-column P exchanges. He also noted that based on methane evolution, aluminum-WTR stimulated microbial activity. The other compounds (calcium carbonate, calcium hydroxide, and aluminum sulfate) did not.

3.2.2 Stormwater Treatment Area 1-West

Reduction of P flux from flooded, formerly farmed organic soils in the Everglades Agricultural Area (EAA) were tested by additions of slaked lime (calcium hydroxide) to the water surface of *in-situ* chambers (46-centimeter [cm] diameter transparent fiberglass cylinders) at Cell 5 of Stormwater Treatment Area (STA)-1W (DB Environmental, 2002). The treatment goal was to reduce water-column P concentrations. The dosage rate was based on jar tests of lime effects on water-column DRP levels.

Soils in Cell 4 had measured labile P concentrations averaging approximately 100 milligrams per kilogram (mg/kg) dry soil (Figure 22 in DB Environmental, 2002). Flux rates estimated from porewater equilibrators varied from 0.1 mg DRP/m^2/d at the inflow to 0.007 mg/m^2/d at the outflow site (DB Environmental, 2002). However, sediment P recycle rates for the submerged aquatic vegetation (SAV) process model were set at 3.68 g/m^2/yr (10 mg/m^2/d) for post-Best Management Practices (BMP) waters, and 1.88 g/m^2/yr (5 mg/m^2/d) for post-STA waters. Those recycling rates were based on a linear proportion of the storage quantity per unit time in the model (DB Environmental, 2002). The use of those rates may have been influenced by findings in the same report that DRP losses from calcium-bound and organic-bound P pools were major sources of released P during experimentally created periods of anoxia.

Water column P concentrations were tracked in each experimental column and a control column after appliction of the material to the surface of the water in each column. The highest dose (139 g/m^2 lime) was effective in significantly reducing water-column P during the 28-day test period. The lower dose (46 g/m^2) chamber maintained water-column concentrations lower than that of the control cell for approximately 14 days after dosing. Control-column P concentrations also fell during the first week of the test, to approximately the levels of the treatment chambers, but began increasing again after 2 weeks. These results suggest that the dose was insufficient to effectively eliminate sediment flux. The authors concluded that the enclosure effects were very important, and that it was not clear what would happen in an application to the larger system. It was speculated that wind-generated turbulence could either prolong or shorten the period of effective P removal.

3.3 Available PSTA Field-Scale Cell 4 Soil Data

For comparative purposes, Exhibit 3-2 summarizes available soil data for the PSTA Field-Scale Cell 4 (peat-based cell) (CH2M HILL, 2002) and the Lake Apopka soil-amendment research site (Ann et al., 2000a; Reddy et al., 1998).

For Lake Apopka, soil data were available for numerous sites. For the purposes of this review, soil data with bulk density values comparable to the PSTA Field-Scale Cell 4 (peat-based cell) were averaged for comparative purposes. Labile inorganic P was measured in both cases as $NaCO_3$-extractable (Hieltjes and Lijklema, 1980).

EXHIBIT 3-2
Soil Characteristics of the PSTA Field-Scale Cell 4 (February 2001) and Lake Apopka Soil Amendment Sites

Parameter	PSTA Field-Scale Cell 4	Lake Apopka
Sample Soil Moisture	69.8%	NA
Soil Bulk density (g cm^{-3} dry material)	0.2 g cm^{-3}	1.07 (average)
Percent Organic Matter	20%	18%–35%
Labile Inorganic P (mg/kg DRP)	4.2% (16 mg/kg)	23.1% (187 mg/kg)
Estimated Soluble inorganic P porewater concentration	3.15 mg/L[a]	2–6 mg / L[b]
Total Inorganic P (1M HCl extractable)	16.1% (60 mg/kg)	71.0% (574 mg/kg)
Labile organic P	19.8% (73 mg/kg)	NA
Total P	350 mg/kg	809 mg/kg (average)

Notes:
NA = not available.
[a]Porewater concentration estimated by multiplying average bulk density and soil burden values, assuming a negligible reduction of water volume in a unit volume of saturated peat soil.
[b]Porewater measured with soil equilibrators in 5 of 15 experimental mesocosms.

The peat soils in the Field-Scale Cell 4 were less highly loaded with P than the farmed organic soils at Lake Apopka (Reddy, 1995), which have been tested for P immobilization with some of the compounds considered here (Ann et al., 2000a). At the Apopka site, the soil was compressed by construction machinery prior to sampling, resulting in an average bulk density value of 1.07 g/cubic centimeter (cm^3). In contrast, the PSTA Field-Scale soils in Cell 4 (peat-based) were not compressed and thus had a lower bulk density value (0.2 g/cm^3). The bulk density of uncompressed soils at Apopka averaged approximately 0.28 g/cm^3 (Reddy, 1995), a value comparable to PSTA Cell 4.

The total P concentration in the PSTA Field-Scale Cell 4 soil is approximately half of or less than the soil burden found at sites in Lake Apopka. In addition, the PSTA Field-Scale Cell 4 soil contains one-third less total available inorganic P than found at Lake Apopka.

A porewater soluble inorganic P concentration for the PSTA Field-Scale Cell 4 of 3.15 mg/L was estimated by multiplying the soil dry bulk density and soil burden (mg/kg) values. At Lake Apopka, this parameter is typically measured in the soil with soil equilibrators. Values ranged from 2 to 6 mg/L for DRP.

Further, P exchange rates or flux to the water column at several Apopka sites ranged from 0.6 to 2.3 mg/m^2/d (Reddy, 1995). The lowest rates were associated with sites with approximately half of the soluble inorganic P found in the PSTA peat soil. The Apopka soils also contained much higher TP levels. The highest values were found in soils with soluble inorganic P concentrations three or more times greater than the PSTA soil levels. Therefore, a P release rate from the PSTA FSC-4 soils may be at the lower end of this range (0.6 mg m^{-2} d^{-1} or less).

3.4 Performance-Based Recommendations

Based on historical studies, potential soil amendments that are likely to be the most effective for P immobilization in flooded peat soils may be ranked as follows based only on performance: 1) PACl, 2) hydrated lime, 3) iron-WTR, and 4) ferric chloride. The reasons for this ranking are summarized below.

- Concern over potential environmental effects of adding sulfur ions to the Everglades is sufficient to eliminate sulfur-containing compounds, such as alum. An aluminum chloride compound is a logical first substitute for alum, with lime as the second choice because of its relatively lower reactivity.
- Combinations of alum and calcium carbonate (Ann et al., 2000a) and PACl and calcium carbonate have been found to be effective soil amendments. It may be appropriate to buffer the PACl with sodium aluminate as is done in water treatment applications to control pH changes.
- The third recommended soil amendment is iron-WTR because Codling et al. (2000) found iron-WTR to be at least somewhat effective in upland soil treatment. Further research is not available on iron-WTR performance in saturated conditions. The question of the performance of an iron-based material under anaerobic conditions is of particular concern in this application.
- WTRs are relatively easily obtained but vary considerably in performance characteristics (Vickie Hoge, Personal Communication 2002). A sampling program to verify quality and adjust application rates might be necessary as part of a large-scale application process. Iron-based WTRs are typically either ferric chloride or ferric sulfate-based. As concluded above, only a non-sulfur-containing material will be suitable for work in South Florida.
- As stated in Ann et al. (2000a) and a subsequent study concerning the effects of redox potential on the solubility of P in these amended soils (Ann et al., 2000b), amendments that are more sensitive to redox changes, such as iron compounds, make less dependable P binders. Because periphyton algal systems typically go dry as part of the annual cycle, treatment with aluminum or calcium compounds may be a more dependable approach.
- Dolomite (agricultural lime) and calcium carbonate have not performed effectively in P immobilization in soils. Research data on polyaluminum chloride or aluminum chloride are not available on which to base a further performance comparison. The remaining compounds (HiClay® alumina and gypsum) with sulfate components are not further considered for the reason stated above concerning the potential effects of sulfate additions to the South Florida environment.

SECTION 4

Soil Amendment Sources and Estimated Costs

SECTION 4

Soil Amendment Sources and Costs

4.1 Soil Amendment Sources and Approximate Unit Costs

The chemical amendments common to the water and wastewater treatment industries are likewise commonly available from large chemical supply firms. Prices vary regionally, and market prices are often determined by competitive bid. The amount purchased is also a significant factor in the price. Bulk purchases (e.g., by the ton or 1,000-gallon increments) will be less expensive per pound or gallon than smaller amounts. Further, the cost for by-products vary based on proximity to the site and whether the materials are considered waste and will thus require disposal if not otherwise purchased. Exhibit 4-1 summarizes estimated prices for various amendments based on information from related CH2M HILL projects or current quotes from vendors. Because prices vary widely, costs shown merely indicate the potential range for large-scale application.

4.2 Soil Amendment Application Methods and Estimated Costs

4.2.1 Application Methods

Possible amendment application methods are outlined in Exhibit 4-2. Equipment is available to apply soil amendments (liquid or solid), such as lime. Land application is the best known and available service. Firms, such as Douglass Fertilizer (407-682-6100, Altamonte Springs), a Florida firm familiar with working in peat/muck soils, have specialized (low footprint weight) machinery for work in loose soils (e.g., peat) or in wetter conditions. Specialized equipment may be required for applying sludge, materials that are generally not spread, such as ferric chloride, or recycled materials that have variable characteristics.

References to application of solid amendments in aquatic environments were not found in the literature. In flooded areas, an alternative method is to use a boat-mounted liquid sprayer for amendment application. Generally, small lakes are considered better candidates for full chemical treatment because of logistic and equipment limitations.

4.2.2 Estimated Costs

Application costs vary based on amount applied per unit area, total area, current chemical bulk costs, transport/shipment distance, site conditions, and site accessibility. The bid price from a full-service contractor (i.e., one that sells and applies the amendments) may be lower than separate bids from two specialized firms (i.e., one vendor for purchasing and another for application).

4.2.2.1 Soil Amendment Dosages

For comparative purposes, soil amendment dosages were calculated using the top four performing amendments as discussed in Section 3 (PACl, hydrated lime, iron-WTR, and ferric chloride) and soil data for PSTA Field-Scale Cell 4 (CH2M HILL, 2002).

EXHIBIT 4-1
Potential Sources for Soil Amendments and Estimated Costs [1,2]

Material	Cost	Source	Comments
Alum	$168 / ton delivered ($0.19/kg)	General Chemical Corp., Inc.	CH2M HILL unpublished chemical price spreadsheet
Sodium aluminate	$1.77 / kg drum	General Chemical Corp., Inc.	Camford Chemical Report/Chemical Prices August 28, 2000.
Polyaluminum chloride	$450–$550/ton ($0.51–$0.61/ kg)	General Chemical Corp., Inc.	Camford Chemical Report/Chemical Prices August 28, 2000.
Slaked lime (hydrated lime)	$136 / ton (60%–75%) ($0.15/kg) CaO (pure) $413/ton ($0.46/kg)	Ash Grove Cement Chemical Lime Corporation	Lower cost is based on bulk purchase. Higher cost is current for an SJRWMD project using relatively small amounts (V. Hoge personal communication, 2002).
Agricultural lime/limrock	$9-$22/ton (Current Kentucky price) ($0.01–$0.02/kg)	Locally available from various sources	Ground rock – variable composition depending on source mine.
Calcium Carbonate	$16–$18/ton ($0.02 /kg)	Various sources	Camford Chemical Report/Chemical Prices August 28, 2000.
Ferric Chloride	$316/ton as $FeCl_3$ ($0.35/kg)	American International Chemical	CH2M HILL unpublished chemical price spreadsheet
Polymers (various)[3]	$1.55–$17.50 / gallon. ($0.41–$4.63/liter)	Nalco, Polydyne	Price typically between $2 and $7 per gallon. May drop below $1/gal with bulk purchase (> 1000 gals).
Water Treatment Residual (WTR)	Free to $25/ton (on spot recycle market. ($0–$0.03/kg)	Potable water treatment plants	Trucking costs additional
HiClay® Alumina	Cost not available	Proprietary Chemical from General Chemical Corp., Inc.	
Recycled Gypsum	Free–$10/ton ($0–$0.01/kg)	Recycling spot market	Trucking costs additional. Cost will vary based on landfill tipping fees and local trucking costs.
Flyash	NA but likely low cost or free	Recycling spot market	

Notes:
[1]Costs are typically reported in english units as shown.
[2]Metric units are provided for comparison.
[3]"Polymer" describes a wide range of substances with concentrations ranging from 2% to 70%. Use dilutions are typically less than 10% (www.tramfloc.com)

EXHIBIT 4-2
Soil Amendment Application Methods and Estimated Costs

Amendment type	Application site	Application method	Spreading costs per acre	Comments
Dry materials (e.g., lime alum)	Upland or drawdown condition	Dry spreader	$25–$75/acre	Familiarity with the material, area to be spread, and site conditions influence cost. (Vickie Hoge and David Stites, personal communication, 2002).
Sludge or damp materials	Upland or drawdown (planting) condition	Spreader – shaker bed or manure type	$50–$100/acre	Costs depend on equipment modifications necessary to handle the material and rate of application.
Liquids or slurry	Upland or drawdown condition	Spray truck	Variable - $10/acre or more	Various vendors have equipment and operators. Costs may be significantly lower for vendors that also provide spreading services.
Liquids or slurry	Wetland or lake	Boat sprayer	Variable – depends on rate of application	Difficulties include the small volume of amendment that can be put on a barge (typically 1,000 gals or less), vegetation that makes pulling a barge difficult, and shallow water requiring low or no-draft boats.

Notes:

Information on spreading costs is based on large-scale spreading activities of both dry and damp solids at Lake Apopka, Florida, in 1998 and 1999 and ongoing work applying lime and alum at the Lake Griffin Flow-Way in Lake County, Florida. SJRWMD is responsible for both projects.

The spreading of recycled materials may require negotiation with a specialized firm based on the specific application method.

The calculation methods and assumptions are detailed in the Appendix. Doses were estimated for a low- and high-level application. The low-level application is equivalent to twice the dose that would treat labile inorganic P and labile organic P. The labile components are those most likely to be released, and thus provide a reasonable low estimate of reactant needed. The high dose was equivlent to twice the dose necessary to treat the total P content of the soil. This is conservative in stoichiometric terms, but an effective application may also need to account for P in the water column and the effects over time of water movement on the amendment. Estimated doses for lime were increased by an additional factor of 10x due to the findings of Ann et al. (2000a) and DB Environmental (2002), both of which indicated that the applied calcium was only partially effective. This assumption results in calculated lime dosages in a range similar to those found to be effective by the other researchers. Estimated dosages are summarized in Exhibit 4-3.

EXHIBIT 4-3
Estimated Soil Amendment Doses for the PSTA Field-Scale Peat Soils

Amendment	Stoichiometric Amount		Product Dosage	
	Low Dose (g/m^2)	High Dose (g/m^2)	Low Dose (g/m^2)	High Dose (g/m^2)
Polyaluminum chloride	113	445	226	890
Lime ($Ca[OH]_2$)	86	336	172	671
Ferric Chloride	47	186	94	372
Iron WTR	NA	NA	516	2144

Notes:
NA=No stoichiometric relationship exists.
(see the Appendix for calculations)

The iron-WTR dose cannot be directly calculated. Therefore, an assumption was made that approximately 20 percent of the original dose activity remained in the material. The material was assumed to be composed of 90 percent iron (ferric and ferrous hydroxide and phosphate, and iron-organic) complexes with the remaining 10 percent composed of other additives and precipitated material from raw water.

4.2.2.2 Estimated Amendment Costs

Based on the estimated costs provided in Exhibit 4-1 and product dosages presented in Exhibit 4-3, estimated per-acre application costs were calculated for each of the four best-performing amendments (see Exhibit 4-4). Ferric chloride is the least expensive of the four per unit area followed by iron-WTR, lime, and PACl.

EXHBIT 4-4
Estimated Per-Acre Application Costs for Soil Amendments

Amendment	Low Dose		High Dose	
	Low Dose (g/m^2)	Cost per acre	High Dose (g/m^2)	Cost per acre
PACl	226	$562	890	$2,100
Lime ($Ca[OH]_2$)	172	$370	671	$1,300
Ferric chloride	94	$183	372	$577
Iron-WTR	516	$288	2,144	$881

Notes:
See the Appendix for sample calculations of dosages.
Dosages are described as product application rates.
Soil depth to be treated was assumed to be 20 cm.
Low dose based on soil labile inorganic P concentration; high dose based on labile inorganic P plus labile organic P concentrations.
Iron-WTR costs assumed to include a $50/ton shipping plus $100/acre spreading costs. Spreading costs are included in each dollar amounts and are assumed to be $50 per acre for PACl, lime, and ferric chloride.
All costs are rounded to the nearest dollar.

4.3 Cost-Based Recommendations

A ranking of potential soil amendments based on estimated costs is: ferric chloride, iron-WTR, hydrated lime (delivered as CaO and slaked on-site), and then PACl, which is significantly more costly than the other three. While WTRs may be almost free, the trucking and handling expenses for these materials result in overall costs that are approximately equal to the use of new chemicals. The potential difficulty in handling materials with relatively unknown characteristics makes them less attractive. The main drawback to any of the new chemicals is that they are caustic. However, the procedures for handling these materials are well known and do not typically present operational problems.

SECTION 5

Potential Environmental Concerns

SECTION 5

Potential Environmental Concerns

5.1 Potential Environmental Concerns

Available and pre-tested amendments may not all be suitable for wetland application as described below:

- Alum has sulfate, which is a concern in South Florida because of the potential stimulation of mercury cycling. The same is true for gypsum (although not yet shown to be effective in this area), and high clay alumina, which is manufactured from a process involving sulfuric acid.
- Recycled materials come with a variety of concerns with some related to chemical composition and additives, such as paint.
- Concerns over the use of WTR include: potential contaminants (i.e., metals or herbicides), present in treatment-plant water-column contaminants such as arsenic in alum, and the perception that a "waste product" is being disposed in an improper fashion.

For these reasons, it is unlikely that by-products and recycled materials will be acceptable for general application in the Everglades area. Agricultural lime (crushed limestone or dolomite) does not have any likely contaminants, but conversely may have little benefit in P removal for this situation. Thus, this compound is not considered a candidate for further testing.

Manufactured chemical compounds (i.e., alum, sodium aluminate, poly sodium aluminate chloride, quick lime, and hydrated lime) are most likely to have the fewest contaminants in the lowest concentrations. Ferric chloride in bulk may contain high heavy metals levels, as it is generally technical grade material that is a by-product of steel-making processes.

To simplify the selection process, the remaining discussion will focus on those compounds with the highest probability of gaining acceptance with respect to environmental protection: hydrated lime, polyaluminum chloride, ferric chloride, and iron-WTR. Potential concerns related to the application of these soil amendments are summarized in Exhibits 5-1 and 5-2.

EXHIBIT 5-1

Potential Amendment Constituents and Related Water Quality Concerns

Soil Amendment	Chemical(s) of Concern
Alum	Aluminum, sulfate, arsenic pH
Polyaluminum chloride	Aluminum, chloride, pH
Sodium aluminate	Aluminum, sodium, pH
Hydrated lime	pH
Iron compounds	Iron, pH
All	Specific conductance

EXHBIT 5-2
Applicable Water Quality Standards for Consideration of Potential Soil Amendments

Chemical	Water Class	Water Quality Standard
Aluminum	Class II	≤1.5 mg/L
Arsenic (total)	All Classes	≤50 mg/L
Chlorine (total residual)	Class I	≤250 mg/L
Conductance	Class I, III (fresh)	Shall not be increased more than 50% above background or to 1,275 microhms/cm, whichever is greater.
Iron	Class I, II Class III (fresh)	≤0.3 mg/L ≤1.0 mg/L
pH	Class I and IV	Standard units shall not vary more than one unit above or below natural background if the pH is lowered to less than 6 units or raised above 8.5 units. If natural background is less than 6 units, the pH shall not vary below natural background or vary more than one unit above natural background. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below background.
	Class III	Standard units shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal waters as defined in Section 62-302.520(3)(b), of the Florida Administrative Code (FAC) or more than two-tenths of a unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), FAC, provided that the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units, in predominantly fresh waters or 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths of a unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coastal waters, or more than two-tenths of a unit below natural background of open waters.
Substances in concentrations that injure are chronically toxic to or produce adverse physiological or behavioral response in humans, plants, or animals	All Classes	None shall be present.

The greatest potential concerns are likely to be associated with increases in aluminum concentrations in the water column or changes in mercury cycling (if sulfur-containing compounds are used). Changes in pH are a major concern with the use of aluminum, iron, or most calcium compounds, but the potential changes can be predicted through simple (jar) test, and buffering compounds (such as sodium aluminate when using alum) added to reduce pH shifts. Ann et al. (2000b) recommended the use of lime materials because of their effectiveness in immobilizing P under heavily reduced conditions. They note that formation of Al/Fe-bound P compounds is also expected to increase soil pH to the 6.0 to 7.0 range when liming the soil. Shifts in pH of overlying water may be more difficult to predict for sediment surface applications, because the application cannot be easily simulated in the lab and effects cannot be as easily simulated. Reddy et al. (1998) showed clear increases in water-column pH after surface application of alum or lime or $CaCO_3$ sludge to mesocosms constructed in area of previously farmed organic soils.

Aluminum is an acute toxin to some algae, and 50 percent reductions in biological activity were found in a range of total Al concentrations in magnitude of 10^2 to 10^3 µg/L (Gensemer and Playle, 1998). Data for cyanobacteria, chlorophyceae, and bacillariophyceae were reported from 15 research articles. Few studies of Al effects on aquatic macroinvertebrates were found but researchers stated: "There is little evidence that Al itself has any influence on macrophyte community structure."

Aquatic invertebrates were found to be less sensitive to Al than fish (e.g., Ormerod et al., 1987), but in other reported research, the effects of increases in acidity and aluminum concentrations were not separated. Al is believed to be an additive stress to H^+ effects (Gensemer and Playle, 1998). Al's main effect on fish is osmoregulatory failure from Al precipitation on gills. Fish in hard waters are apparently less sensitive to Al because of higher Ca concentrations in harder waters.

Elevated levels of chloride ion were also found in the wetland cells of the Managed Wetland Project (CH2M HILL, 2001). Samples collected from the first third of the ½-acre cell had elevations as high as approximately 300 mg/L (ferric-chloride-treated water), which was significantly higher than control concentrations (which were no higher than approximately 200 mg/L at any point in the cell during the experimental period). Chloride levels fell from the high points during passage through the wetland, but did not fall to background levels. Reduction of chloride ion concentrations were also noted in flow-through SAV mesocosms (DB Environmental, Inc., 1999) operated at the SFWMD Everglades Nutrient Removal (ENR) Test Cell site.

As a product of total ionic species in the water column, specific conductance can be affected as the net result of chemical treatments that release ions into the water column. Significant changes in specific conductance were not apparent in mesocosm tests conducted by SJRWMD (unpublished). Ann et al. (2000a, 2000b) did not report specific conductance in the floodwaters in her experimental columns.

Application of additional sulfur ions to South Florida soils has been a concern because of its potential stimulation of mercury biomethylation. While not yet clearly demonstrated, the use of alum or other compounds should be avoided if others are available that can achieve the same goals. Sulfate concentrations in the Managed Wetland treatment-cell water column was not significantly different than that in the control cells (CH2M HILL, 2001).

5.2 Environmental-Based Recommendations

Of the compounds that are known to be effective in sequestering P, hydrated lime (calcium hydroxide) presents the least risk to the environment. The primary effect of this compound is a temporary pH shift resulting from the materials' initial reaction with water, which subsides over time. After lime, the next two amendments with the least environmental risk are ferric chloride and iron-WTR. These two amendments have potential environmental concerns related to elevated iron and chloride concentrations and pH levels. Polyaluminum chloride would be in fourth place, with aluminum and pH as the primary concerns for this compound.

SECTION 6

Overall Soil Amendment Recommendations

SECTION 6

Overall Soil Amendment Recommendations

In summary, the viable soil amendments (lime, PACl, ferric chloride, and iron-WTR) evaluated in the previous sections may be ranked with respect to performance, cost, and environmental protection as summarized in Exhibit 6-1. Based on overall scores, the top three soil amendment candidates for the PSTA Field-Scale demonstration study are lime, ferric chloride, and PACl. Iron-WTR ranks closely with PACl, but was rejected for this study because of uncertain availability and consistency of chemical composition.

EXHBIT 6-1
Comparison of Material Rankings for Performance, Cost, and Environmental Risk

Material	Overall	Performance	Cost-Effectiveness	Environmental Protection
Lime	1	2	3	1
Ferric Chloride	2	4	1	2
PACl	3	1	4	4
Iron-WTR	4	3	2	3

Note:
Low number indicates higher ranking.

Hydrated lime (calcium hydroxide) has well-known characteristics at moderate cost, is environmentally benign, and has been shown to be equally effective in some cases with aluminum compounds. In full-scale applications, hydrated lime will be produced onsite from CaO. While aluminum chloride might be slightly more effective, it has higher potential environmental risks. Ferric chloride has lowest estimated cost but uncertain long-term performance and potentially greater environmental risk. PACl requires the highest dosage at the highest cost per unit, and is thus the most expensive, putting it in third place. In fourth place, iron-WTR has the risk of unknown performance and potentially higher application costs. If available, iron-WTR may be a potential alternative if the material is available and sufficiently active. Water treatment plants in South Florida appear to be switching from alum to ferric sulfate (not ferric chloride) as a cost-saving initiative (Jim Gianatasio, personal communication, 2002). Thus, a local source would need to be identified.

SECTION 7

Proposed Soil Amendment Study Plan

SECTION 7

Proposed Soil Amendment Study Plan

Phase 3 PSTA research is currently scheduled to be completed in December 2002. Given the importance of documenting the results of the study in the final project report, data collection and analysis for the soil amendment study needs to be completed by September 2002. Because a 5-month field-testing program is currently planned, it is recommended that the bench-scale soil amendment tests be eliminated from the work plan and that mesocosm studies be initiated immediately using information obtained from the literature review. While a bench-scale test may provide interesting data, the focus of the research should remain on how well these amendments perform under field conditions.

Key elements of the proposed soil amendment mesocosm study include:

- Under the soil amendment study scope of work, two soil amendments were to be field-tested. Because budget allocated for the bench-scale testing may be available for the mesocosm study, it is recommended that the top three recommended soil amendments be field-tested: hydrated lime, PACl, and ferric chloride.
- Each soil amendment will be tested at a low and high dose as follows:
  - Hydrated lime at 172 and 671 g/m^2
  - PACl at 226 and 890 g/m^2
  - Ferric chloride at 94 and 372 g/m^2
- The study will be comprised of six different treatments plus a control (un-amended soil). Each treatment will be replicated twice for a total of 14 mesocosms.
- Mesocosms will be placed at the PSTA Field-Scale site west of STA-2. These tanks will be small, plastic watering troughs (approximately 2 m x 0.5 m x 0.5 m) and will be purchased from a local vendor. A small head tank will be used to maintain a relatively constant inflow of water to the mesocosms. The water source will be the PSTA Field-Scale inflow canal, which receives water from STA Cell 3 and the STA-2 seepage canal.
- Each mesocosm will contain 20 cm of peat soil from the Field-Scale site. Amendments will be mixed into the upper 10 cm of the soil (to best simulate a large-scale application to farmed soils), and application will be done prior to flooding. Water levels will be maintained in the tanks for 1 to 2 days prior to initiating flow-through.
- Water depth will be maintained at 30 cm for the duration of the study.
- Mesocosms will not be planted nor seeded with periphyton. Any germinating macrophytes will be removed during the study period. Naturally-colonizing periphyton will be allowed to grow.

The mesocosms study will be initiated in May 2002 and will continue for a 5-month study period. The proposed monitoring plan for this study is detailed in Exhibit 7-1 and summarized below:

- Weekly monitoring of field parameters, flows, and P (TP, total dissolved P, and dissolved reactive P)
- Bi-weekly monitoring of metal parameters of concern, such as iron and aluminum
- Monthly monitoring of nitrogen species and total organic carbon
- Start and end monitoring of soil conditions
- Biological sampling at the end of the experimental period.

The results of the soil amendment study will be presented in the PSTA Phase 1, 2, and 3 project report, currently scheduled to be finalized in December 2002.

EXHIBIT 7-1

Proposed Monitoring Plan for PSTA Soil Amendment Study

Parameter	Sampling Frequency over 5 months	Number of Samples: #Replicates	# Treatments	# Samples	QC	Total
Field Meter Readings (weekly)						
Dissolved oxygen	5	2	7	280	na	280
pH	5	2	7	280	na	280
Conductivity	5	2	7	280	na	280
Total Dissolved Solids (note a)	5	2	7	280	na	280
Turbidity (note a)	5	2	7	280	na	280
Water Quality Analyses						
Inflow Sampling (not covered under routine monitoring)						
Iron	BW	1	1	10	2	12
Chlorides	BW	1	1	10	2	12
Aluminum	BW	1	1	10	2	12
Sulfate	BW	1	1	10	2	12
Dissolved Alumimum	BW	1	1	10	2	12
Mesocosm Sampling						
Phosphorus (P) Series						
Total P	W	2	7	280	56	336
Dissolved Reactive P	W	2	7	280	56	336
Total Dissolved P	W	2	7	280	56	336
Nitrogen (N) Series						
Total N	M	2	7	70	14	84
Ammonia N	M	2	7	70	14	84
Total kjeldahl N	M	2	7	70	14	84
Nitrate+nitrite N	M	2	7	70	14	84
Iron	BM	2	7	140	28	168
Chlorides	BM	2	7	140	28	168
Aluminum	BM	2	7	140	28	168
Sulfate	BM	2	7	140	28	168
Dissolved Alumimum	BM	2	7	140	28	168
Total suspended solids	BM	2	7	140	28	168
Total organic carbon	M	2	7	70	14	84
Calcium	BM	2	7	140	28	168
Alkalinity	BM	2	7	140	28	168
Biological Analyses (end only)						
Biomass (AFDW)	E	2	7	14	3	17
Wet weight	E	2	7	14	3	17
Dry weight	E	2	7	14	3	17
Calcium	E	2	7	14	3	17
Phosphorus (P) Series						
Total P	E	2	7	14	3	17
Total Inorganic P	E	2	7	14	3	17
Non-reactive P	E	2	7	14	3	17
Total kjeldahl N	E	2	7	14	3	17
Sediments (start and end point only)						
Total P	S/E	2	7	28	6	34
Phosphorus Sorption/Desorption	S/E	2	7	28	6	34
Non reactive P (fractionation)	S/E	2	7	28	6	34
Aluminum	S/E	2	7	28	6	34
Calcium	S/E	2	7	28	6	34
Iron	S/E	2	7	28	6	34
Total kjeldahl N	S/E	2	7	28	6	34
Total organic carbon	S/E	2	7	28	6	34
Bulk density	S/E	2	7	28	6	34
Solids (percent)	S/E	2	7	28	6	34

Notes:
W=weekly
M=monthly
S/E=start and end
E=end
BM=Bi-monthly

SECTION 8

Works Cited

SECTION 8

Works Cited

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Appendix

APPENDIX

Calculation of Soil Amendment Dosages

Soil amendment dosage rates were based on available soil P data for Field-Scale Cell 4, and stoichiometric relationships between the metal (aluminum, calcium, or iron) and soil P. WTRs do not have a defined chemical formula or molecular weight, and so best professional judgement was applied as necessary.

For the calculations, it was assumed that the total soil mass of P (labile inorganic and labile organic P or total P) is or has the potential to be in the form of dissolved reactive P ($PO4^-$). The dose amount needed to treat the labile inorganic P contents of a m^2 of soil 20-cm in depth (a typical plow layer) was determined by calculating a rate based on a 100 percent product yield. That amount was adjusted for the fraction of available reactant in the soil amendment material to be applied, and then multiplied by integer values to develop dosage rates. The multiplication factor is based on other research results and experience. A minimum factor greater than two is usually applied in wastewater treatment applications for 95 percent removal. Dosages may go as high as 10 times the stoichiometric calculation amount depending on the application purpose (Metcalf & Eddy, 1979).

Dosages were calculated as follows:

1) The mass (kg) of soil in a 1-m^2, 20-cm-deep treatment volume was calculated:
    a) Soil dry bulk density=0.2 g/cm^3
    b) Volume of soil=200,000 cm^3/treatment volume
    c) Mass=200,000*0.2=40 kg/treatment volume
2) The amount of labile inorganic and organic P in that amount of soil was calculated:
    a) Labile inorganic P=15.77 mg/kg dry soil (CH2M HILL, 2002)
    b) Labile organic P=73.0 mg/kg dry soil (CH2M HILL, 2002)
    c) Total labile P=15.77+73.0=88.8 mg/kg dry soil
    d) Total labile P mass=88.8 mg/kg*40 kg=3.55 g P*0.95=3.37 g per m^2 treatment area. (The dry mass was adjusted to account for the estimated volume taken up by solids in the saturated soil column=95 percent. It was made equivalent to a conservative measure of porosity for these soils.)
    e) Total P mass: 350.4 mg P/kg *40*0.95=13.3 g.
3) Chemical dose for exact treatment of 3.4 and 13.3 g P/m^2 was calculated:
    a) Polyaluminum chloride does not have a specific formula, and in product specifications is reported as percent Al_2O_3 (aluminum oxide from the reaction with water). Assuming that it is essentially modified aluminum chloride, and performs

relatively the same with respect to the metal reaction (1:1 molar ratio of Al:P), a calculation for aluminum oxide has been substituted here for prediction purposes:

i) Al:P weight ratio=0.87

ii) Al: Al_2O_3 weight ratio=0.26

iii) Aluminum as a fraction liquid PACl product =0.10

iv) Amount PACl product needed for total labile P=(3.34 g x 0.87)/(0.26 x 0.10)=113 g/m^2

v) Amount PACl needed for total P = (13.3x0.87)/(0.26x0.10)=445 g/m^2

b) For lime (calcium hydroxide):

i) Ca: P weight ratio=1.29

ii) Ca: CaO weight ratio=0.71

iii) Dry slaked lime active component fraction (CaO fraction)=0.72

iv) Estimated effectiveness of Ca for P binding from published references=0.1

v) Amount dry lime product needed for total labile P=(3.4 g x 1.29)/(0.71 x 0.72 x 0.1) = 86 g/m^2

vi) Amount dry lime product needed for total P=(13.3 g x 1.29)/(0.71 x 0.72 x 0.1)=336 g/m^2

c) For ferric chloride:

i) Iron:P weight ratio=1.80

ii) Fe3+: FeCl3 weight ration=0.34

iii) Active fraction component of $FeCl_3$ product=0.38

iv) Amount of $FeCl_3$ liquid product needed for total labile P=(3.4 g x 1.80)/(0.34 x 0.38)=47 g/m^2

v) Amount of $FeCl_3$ liquid product needed for total P=(13.3 g x 1.80)/(0.34 x 0.38)=186 g/m^2

Active component fractions of materials were found on the Internet in advertising materials for firms selling PACl, $FeCl_3$, and $Ca(OH)_2$. Values are approximate and will vary slightly depending on the vendor. Information for hydrated lime was taken from high calcium slaked lime material produced by General Chemical Corporation, Inc. because of its high active percentage of CaO. In large applications, lime is delivered as dry quicklime (CaO) and slaked on site. The calculation values for the performance of hydrated lime were based on the reported performance of slaking the high calcium CaO product.

In each case, the chemically calculated dose was then doubled for application, assuming that there would be competing reactions in the soil that would reduce the amount of P trapped per unit amendment applied. Because there is a continual bacterial conversion of complex organic and lightly sorbed inorganic P to dissolved reactive P, the low dose accounted for all the inorganic P in the sediments. The high dose provides a conservative amount of amendment that accounts for the total sediment P and additional P for incoming water-column P adsorption.

APPENDIX I.2

Summary Report

PSTA Research and Demonstration Project Field-Scale Soil Amendment Study Report

Prepared for

South Florida Water Management District

Prepared by

CH2MHILL

March 2003

Contents

Exhibits

Executive Summary

The South Florida Water Management District (District) and CH2M HILL conducted a soil amendment study at the Periphyton-Based Stormwater Treatment Area (PSTA) Field-Scale Site (located next to Stormwater Treatment Area 2 [STA-2]) between August and December 2002. The purpose of this study was to test the effects of three chemical amendments on the release of total phosphorus (TP) from onsite organic soils (peat). These soils have been found to be problematic when used in PSTAs, because of their release of labile phosphorus (P), which creates substantive PSTA start-up challenges impacting system effectiveness and sustainability. Identification of a functional and affordable approach to isolation or immobilization of the residual labile total phosphorus is desired in order to increase PSTA implementability while decreasing cost.

The three amendments tested (i.e., aluminum-, iron-, and calcium-based chemicals) have all been found to be effective for P retention in other studies (CH2M HILL, 2002b). The primary goal of this study was to determine if any of these amendments were effective for the site-specific soil conditions at the project site.

Within the time-frame and doses tested in this study, TP releases from the organic soils were not completely controlled by any of the amendments tested. Aluminum- and iron-based amendments were found to be more effective than calcium-based amendments in this study. This was partly due to the method of lime addition that resulted in some dissolution of the organic soils and increased releases of organic P and nitrogen (N). None of the amendments created exceedances in any Class III water quality standards. Based on the results of this study, it is recommended that future work continue with these three possible amendments at higher doses and over a longer timeframe.

SECTION 1
Introduction

The South Florida Water Management District (District) constructed the Field-Scale Periphyton Stormwater Treatment Area (PSTA) Demonstration facility west of Stormwater Treatment Area 2 (STA-2) at the southern end of the Everglades Agricultural Area (EAA) in 2000-2001 (CH2M HILL, 2003). The Field-Scale PSTA facility consists of inflow and outflow works and four 5-acre constructed PSTA cells and has been used for testing design, construction, and operation issues related to effectively implementing full-scale PSTAs for P removal elsewhere in the EAA. Operations and routine monitoring at this facility started in late July 2001 and continued through December 2002. The Field-Scale PSTA study constitutes Phase 3 of the three-phase PSTA Research and Demonstration program. Phases 1 and 2 included development of PSTAs at smaller spatial scales (0.0015 to 0.5 acres) and tests for the effectiveness of numerous design and operational alternatives.

Because of the known potential for total phosphorus (TP) release from the organic soils, three of the Field-Scale PSTA cells received significant soil modifications. The first two Field-Scale cells (FSC-1 and FSC-2) had their existing organic soils covered with approximately 0.6 m (2 ft) of limerock, while the third cell (FSC-3) had complete removal of organic soils to expose the underlying limestone caprock. The fourth cell (FSC-4) included existing organic soils that have been used for farming for many years. This cell was found to have high initial labile P (orthophosphate adsorbed to soil surface in equilibrium with dissolved orthophosphate) and input/output TP sampling indicated a significant net release of labile P resulting from flow-through operations (CH2M HILL, 2003). This type of release had been observed previously in the smaller PSTA test systems (Porta-PSTAs and PSTA Test Cells) studied by the District (CH2M HILL, 2002a), and it was anticipated to occur at the Field-Scale site. Thus, the Field-Scale system monitoring confirmed the need for soil amendments if PSTAs are to be constructed over comparable organic soils. A soil amendment study was included in the PSTA Phase 3 demonstration project plan to provide information concerning other, possibly cost-effective approaches for inactivating releases of soil P in peat-based soils.

The purpose of this technical memorandum is to document of the methods and results of the PSTA Phase 3 Soil Amendment Study. A literature review describing other Florida research concerning soil amendments for control of TP was prepared as a standalone project deliverable by CH2M HILL (2002b). That report provided the detailed basis for selecting the three chemical amendments tested at the PSTA Field-Scale site, the chemical doses tested for each of those three amendments, and the monitoring plan for assessing soil amendment effectiveness.

SECTION 2
Materials and Methods

Influent water to the Field-Scale Cell facility can be conveyed from two sources: the western STA-2 seepage canal or Cell 3 of STA-2. These water sources can be used independently or by blending. During this portion of the Phase 3 study period, waters delivered to the Field-Scale site were drawn from Cell 3 of STA 2. For the soil amendment study, a battery-powered pump was used to move water from the influent canal into a head tank. Water then flowed by gravity to fourteen soil amendment tanks. These plastic tanks had a nominal wetted surface area of 1.14 m^2 each and were set up at the southeast corner of the PSTA Field-Scale site. A photograph of the soil amendment tanks is provided in Exhibit 2-1. Exhibit 2-2 schematically illustrates the PSTA Field-Scale Demonstration Project layout with the location of the soil amendment tanks shown.

EXHIBIT 2-1
Photograph of Soil Amendment Experimental Layout

The experimental design included three chemical amendments, each tested at two application rates, with two replicates of each rate. This design constitutes a 3x2x2 factorial experiment and required 12 tanks plus 2 controls for a total of 14 tanks. Exhibit 2-3 schematically shows treatment assignments for the fourteen tanks. Each plastic tank was partially filled with approximately 15-cm of organic (i.e., peat) soil stockpiled during site construction. All large limestone rocks were removed from the organic soil, and the soil surface in each tank was approximately leveled following soil placement.

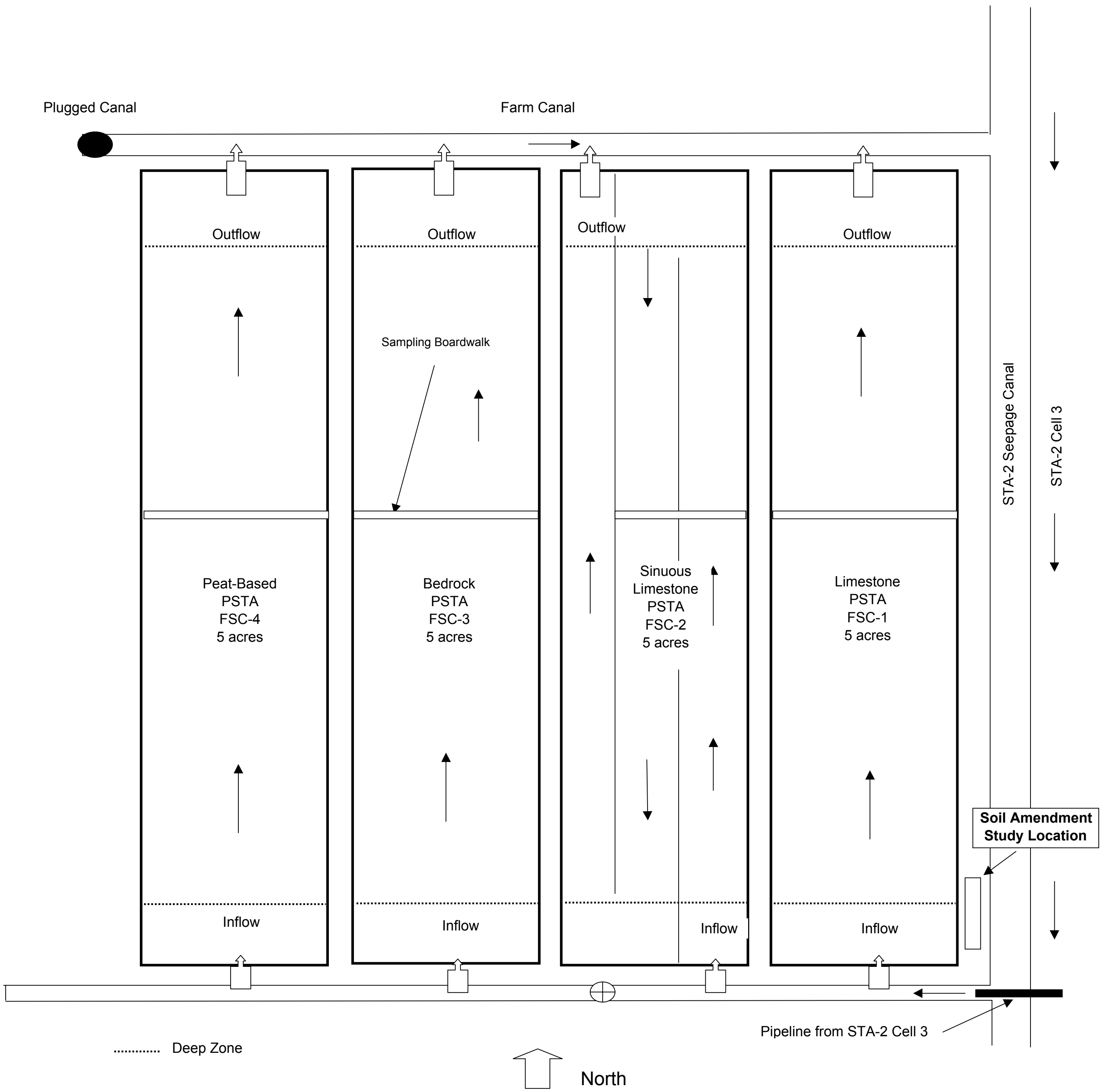
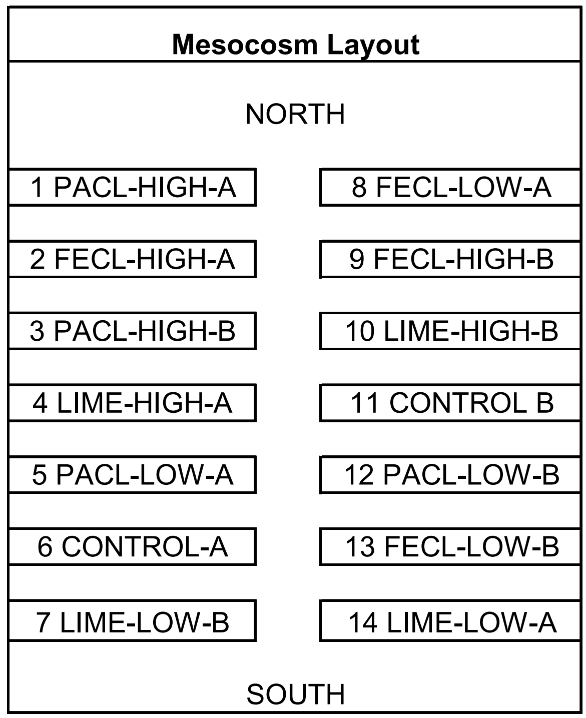


EXHIBIT 2-2
Schematic of Field-Scale Cells Showing Soil Amendment Study Location

EXHIBIT 2-3
Schematic Diagram of Soil Amendment Study Experimental Design



Notes:
PACL = Poly-aluminum chloride
FECL = Ferric chloride
LIME = Hydrated lime
A = Replicate A
B = Replicate B

The three soil amendment chemicals tested were poly-aluminum chloride (PACL), ferric chloride ($FeCl_3$), and hydrated lime (CaOH). Chemical descriptions, target application rates, and active ingredients added to the tanks are summarized in Exhibit 2-4. The soil amendments were added to the tanks on August 13, 2002. All applications were first diluted into approximately 10-L of inlet canal water, stirred well, and then applied with a perforated bucket over the entire surface area of the soil in the tanks. Every effort was made to ensure applications were evenly distributed over the soil surface in the mesocosms. These soils were unsaturated at the time of application, and the applied water was observed to percolate fairly evenly through the 15-cm soil column. Shortly after application, soils were sampled in all of the tanks for chemical analysis. Three 5.1-cm diameter cores were collected from three locations in each tank and composited to form a single pre-startup sample. Preliminary samples from the control tanks that did not receive soil amendments provide a baseline for soil conditions in all of the tanks prior to chemical amendment.

The tanks were saturated with water and flooded to an approximate depth of 30 cm on August 28, 2002. The tanks remained in batch-mode (no flow-through) for the first two months of the study to allow initial sorption of labile P from the soils by the amendment chemicals prior to commencing flow-through operation.

Flow-through conditions were initiated in all tanks on October 22, 2002. The design inflow rate was 0.79 milliliters per second (mL/s) to simulate a nominal hydraulic loading rate of 6 centimeters per day (cm/d). Inflows were controlled by use of 2.54-cm PVC ball valves located at one end of the oval tanks, while outflows were controlled through 2.54-cm PVC fittings located at the opposite end of the tanks.

Inflow rates were measured weekly. On several occasions the inflow pump failed, and there were no inflows or outflows at the time the field team arrived at the site for routine water quality monitoring. Under this scenario, a zero flow was recorded as the initial value and then the final flow was recorded after flow was re-established.

EXHIBIT 2-4
Chemical Application Rates for the PSTA Soil Amendment Treatments

Treatment	Chemical	Dose	Replicate	Tank #	Amount Added	Units	Active Ingredient	Estimated Active Ingredient Added (g/m^2)
CONTROL A	none	none	A	6	none	none	none	none
CONTROL B	none	none	B	11	none	none	none	none
PACL-LOW-A	PACL	LOW	A	5	105	mL	Al	5.96
PACL-LOW-B	PACL	LOW	B	12	105	mL	Al	5.96
FECL3-LOW-A	FECL3	LOW	A	8	88	mL	Fe	12.4
FECL3-LOW-B	FECL3	LOW	B	13	86	mL	Fe	12.2
LIME-LOW-A	LIME	LOW	A	14	196	grams	Ca	88.5
LIME-LOW-B	LIME	LOW	B	7	196	grams	Ca	88.5
PACL-HIGH-A	PACL	HIGH	A	1	410	mL	Al	23.3
PACL-HIGH-B	PACL	HIGH	B	3	410	mL	Al	23.3
FECL3-HIGH-A	FECL3	HIGH	A	2	338	mL	Fe	47.8
FECL3-HIGH-B	FECL3	HIGH	B	9	338	mL	Fe	47.8
LIME-HIGH-A	LIME	HIGH	A	4	763	grams	Ca	345
LIME-HIGH-B	LIME	HIGH	B	10	765	grams	Ca	346

Note: Mesocosm area is approximately 1.14 m^2

Chemical Descriptions

Polyaluminum chloride (SternPAC):	in solution, 33% chemical by weight, 5.4% aluminum by weight, specific gravity 1.2 g/cm^3
Ferric chloride:	in solution, 33.7% by weight, 11.7% ferric iron by weight, specific gravity 1.378 g/cm^3
Lime (hydrated):	solid powder, no information provided (assume 72% active as CaO and Ca:CaO ratio = 0.71)

During the period of batch-mode operation, water levels were checked weekly, and inlet valves were only opened to bring water levels up to the overflow level without creating an outflow. During flow-through operations, water inflow rates were checked weekly by use of a stopwatch and graduated cylinder and adjusted as necessary to approximate the desired nominal inflow rate.

Inflow water quality was measured at the head tank that fed the individual soil amendment tanks. Water quality samples were collected below the surface at the approximate mid-point of the tanks during the batch-mode study. During flow-through operations water quality samples were collected from the tank outflow.

Parameters monitored weekly included:

- Total suspended solids (TSS)
- Calcium (Ca)
- Alkalinity
- Chlorides (Cl)
- Dissolved and total aluminum (Al) and iron (Fe)
- TP
- Total dissolved P (TDP)
- Soluble reactive P (SRP)

The following analyses were conducted monthly:

- Total Kjeldahl nitrogen (TKN)
- Nitrate + nitrite-nitrogen (NO_x-N)
- Total ammonia nitrogen (NH_4-N)

Field measurements (i.e., temperature, dissolved oxygen [DO], pH, conductivity, and total dissolved solids [TDS]) were collected at in the center of the tanks. Concentrations of total particulate P (TPP), dissolved organic P (DOP), organic nitrogen (Org-N), and total nitrogen (TN) were calculated from the other measured constituents. An additional set of soil core samples was collected on November 13, 2002. Final water quality samples were collected, and flows to all tanks were stopped on December 18, 2002.

There was no inoculation of periphyton in the soil amendment tanks, and these treatments were not intended to simulate performance of a periphyton-dominated wetland. Therefore, P removal mechanisms being examined were only intended to include the reactions between the water, soil, and presence or absence of chemical amendment. However, various macrophytic plant species colonized the soil amendment tanks during the period of the study. The two principal types of macrophytic plants were submerged aquatics and rooted emergents. Both of these types of invasive macrophytes are detrimental to periphyton systems relying on surface or benthic algal communities by blocking light and competing for resources. Initially, seedlings of these plants were removed, but it was found that pulling the rooted plants greatly impacted water quality, creating turbidity that would not settle over a 1-week period. Following this recognition, no additional plants were removed until the end of the study when all remaining plants were harvested, weighed, and analyzed for dry weight and TP. No samples were collected for quantification of periphyton, and no significant filamentous algal populations were visibly noticed.

SECTION 3

Results and Discussion

3.1 Inflows

Exhibit 3-1 summarizes the average flow rate data for the flow-through period. Detailed flow records are summarized in Appendix A. The average flows summarized in Exhibit 3-1 include all of these values and therefore represent conservative estimates of inflow. Estimated average inflows ranged from 0.73 to 0.96 mL/s for the 7 treatments. These flow rates are equivalent to estimated hydraulic loading rates between 5.6 and 7.3 cm/d.

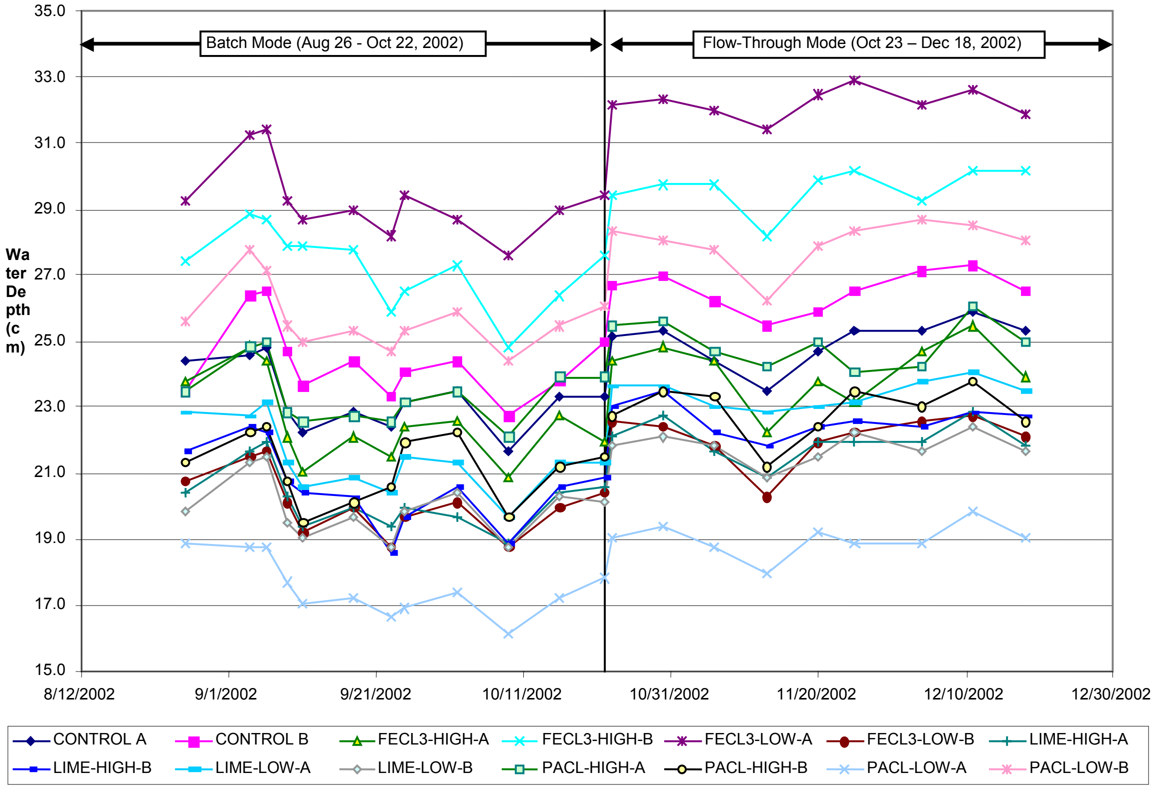
EXHIBIT 3-1
Estimated Average Inflows During The Flow-Through Period in the PSTA Soil Amendment Treatments (October 23 - December 18, 2002)

Soil Amendment Treatment	Average Inflow (mL/s)	Average HLR (cm/d)
Control	0.91	6.9
FECL-High	0.73	5.6
FECL-Low	0.95	7.2
Lime-High	0.87	6.6
Lime-Low	0.91	6.9
PACL-High	0.96	7.3
PACL-Low	0.83	6.3

3.2 Water Depths

Exhibit 3-2 illustrates the time series of water depths in the soil amendment study tanks through the period-of-record. Average water depths during the batch study ranged from approximately 18 to 29 cm and from 19 to 32 cm during the flow-through study. There was considerable variation in the estimated water depth between tanks and replicates (about 14 cm maximum difference). These differences were due to the variability of soil depths in the tanks.

EXHIBIT 3-2
Time Series of Weekly Water Depths in the PSTA Soil Amendment Treatments



SECTION 4

General Water Quality

Water quality data by treatment are summarized in Exhibits 4-1 and 4-2. Detailed data are provided in Appendix B, and charts with detailed data are provided in Appendix C. Mean values and 2 standard errors (S.E.) are summarized in these exhibits. Mean values that are significantly different from the inflow and control values, determined using a 95% level (α = 0.05) t-test, are highlighted in Exhibits 4-1 and 4-2.

4.1 Batch-Mode

During the batch-mode study period from August 28, 2002 through October 22, 2002, concentrations of TDP, DOP, TN, and Ca in the standing mesocosm water were significantly elevated in the controls compared to the inflow water (see Exhibit 4-1). In the $FeCl_3$-high treatment, conductivity, TDS, DOP TSS, Ca, and Cl concentrations were all significantly higher than in the inflow water. Conductivity, TDS, Ca, and Cl were also higher than in the control. Alkalinity and pH were lower in this treatment than in the control, and SRP was lower than in the inflow. In the $FeCl_3$-low treatment, the only significant differences were that DOP, TSS, and Ca were higher than in the inflow.

The lime treatments showed the greatest changes with respect to the inflow and control water quality. Both the high and low lime treatments had elevated TP, TDP, and DOP concentrations compared to the inflow and the control, and TPP was higher than the inflow samples. The average concentrations of TN, TKN, NH_4-N, and Org-N were also significantly higher in both treatments than in the inflow, and in the high lime treatment, these N forms were also higher than in the control. Conductivity, TDS, DO, Ca, and alkalinity were all lower in the high lime treatment than in the control. Ca in the low lime treatment was higher than in the inflow.

In the PACL-high treatment the following parameters were significantly higher in the mesocosm water than in the inflow: Conductivity, TDS, TSS, Ca, Cl, and total Al. Conductivity, TDS, and Cl were also higher in this treatment than in the control, and pH was lower. In the PACL-low treatment, only Ca was significantly higher than in the inflow, and no parameters were significantly different from the control tanks.

4.2 Flow-Through Mode

Exhibit 4-2 provides the detailed water quality summary for the flow-through period from October 23 until December 18, 2002. During this period the following parameters were significantly elevated in the control outflow compared to the inflow: pH, TP, TDP, DOP, TN, TKN, Org-N, Cl, and total Al. Alkalinity was significantly lower in the control than in the inflow. Average concentrations of TP, TDP, and DOP were significantly elevated in all of the chemical treatments compared to the inflow but not different from the controls except for TDP being higher in the high lime treatment. A similar pattern was observed for TN, TKN, and Org-N. Alkalinity was lower in both $FeCl_3$ treatments, the high lime treatment and in both PACL treatments than in the inflow and pH was higher in the $FeCl_3$-low, low lime, and PACL-high

EXHIBIT 4-1

Summary of Batch-Mode Water Quality for the PSTA Soil Amendment Treatments (August 28 - October 22, 2002)

						$FECL_3$				LIME				PACL			
		INFLOW		**CONTROL**		**High**		**Low**		**High**		**Low**		**High**		**Low**	
Parameter	**Units**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**
Temp	^oC	29.4	1.0	29.7	0.9	29.7	0.8	29.9	0.8	30.1	0.9	30.1	0.9	29.8	0.9	29.9	0.8
pH	Units	8.32	0.09	8.34	0.04	8.21 (b)	0.04	8.30	0.04	8.46 (b)	0.06	8.36	0.04	8.24 (b)	0.04	8.29	0.04
Cond	µmhos/cm	1,060	131	1,117	62	1,401 (a,b)	66	1,197	64	970 (b)	69	1,099	65	1,268 (a,b)	65	1,166	62
TDS	g/L	0.68	0.08	0.72	0.04	0.90 (a,b)	0.04	0.77	0.04	0.62 (b)	0.04	0.70	0.04	0.81 (a,b)	0.04	0.75	0.04
DO	mg/L	7.07	0.84	5.96	0.62	6.09	0.53	6.13	0.73	4.82 (a)	0.55	5.80	0.55	6.12	0.54	5.89	0.48
TP	µg/L	23	4	30	5	23	2	28	2	50 (a,b)	5	44 (a,b)	4	27	4	25	2
TDP	µg/L	10	2	14 (a)	1	12	2	14	2	29 (a,b)	4	21 (a,b)	2	12	2	13	2
SRP	µg/L	5	2	3	1	2 (a)	1	3	1	3	1	4	1	4	1	3	1
TPP	µg/L	13	4	16	5	11	2	14	2	20 (a)	3	22 (a)	4	14	4	12	3
DOP	µg/L	4	3	10 (a)	2	10 (a)	2	10 (a)	3	26 (a,b)	5	18 (a,b)	3	8	3	9	3
TN	mg/L	2.08	0.30	2.87 (a)	0.45	2.37	0.47	2.76	0.53	5.09 (a,b)	1.06	3.66 (a)	0.49	2.45	0.93	2.73	0.51
TKN	mg/L	2.07	0.31	2.76	0.43	3.25	1.61	2.70	0.50	5.01 (a,b)	1.09	3.62 (a)	0.50	2.37	0.86	2.68	0.50
NOX	mg/L	0.10	0.00	0.18	0.15	0.10	0.00	0.13	0.06	0.10	0.00	0.10	0.00	0.14	0.07	0.12	0.04
NH3	mg/L	0.10	0.04	0.07	0.02	0.07	0.02	0.07	0.02	0.38 (a,b)	0.22	0.10	0.02	0.11	0.02	0.10	0.02
ORG N	mg/L	1.97	0.33	2.69	0.42	3.17	1.60	2.63	0.51	4.63 (a,b)	1.17	3.52 (a)	0.51	2.26	0.86	2.58	0.50
TSS	mg/L	1.8	0.5	5.0	3.6	3.7 (a)	1.2	3.5 (a)	1.2	4.3	2.7	4.6 (a)	1.8	4.5 (a)	1.6	2.9	0.9
CA	mg/L	70	14	109 (a)	8	147 (a,b)	9	117 (a)	8	82 (b)	11	110 (a)	10	123 (a)	8	114 (a)	7
ALK	mg/L	298	26	313	14	270 (b)	18	284	20	200 (a,b)	29	289	18	281	22	304	15
Cl	mg/L	212	33	207	25	327 (a,b)	47	247	21	204	23	221	28	281 (a,b)	34	238	34
Dis. Al	mg/L	0.12	0.10	0.08	0.05	0.12	0.07	0.16	0.11	0.07	0.05	0.06	0.05	0.17	0.10	0.14	0.08
Total Al	mg/L	0.13	0.10	0.43	0.52	0.69	1.00	0.62	0.47	0.31	0.32	0.30	0.16	0.45 (a)	0.22	0.25	0.08
Total Fe	mg/L	0.33	0.20	0.49	0.23	0.62	0.25	0.54	0.26	0.43	0.21	0.53	0.26	0.53	0.23	0.51	0.25

Notes:

(a) = significantly different than the inflow (95% confidence interval)

(b) = significantly different than the control (95% confidence interval)

SE = Standard errors

EXHIBIT 4-2

Summary of Flow-Through Water Quality for the PSTA Soil Amendment Treatments (October 23 - December 18, 2002)

						$FECL_3$				LIME				PACL			
		INFLOW		CONTROL		High		Low		High		Low		High		Low	
Parameter	**Units**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**	**Avg**	**2SE**
Temp	^{o}C	22.6	2.4	26.0	1.9	25.9	1.9	25.6	2.1	26.3	1.9	26.1	1.9	25.7	1.9	25.9	2.0
pH	Units	8.39	0.12	8.77 (a)	0.13	8.43 (b)	0.11	9.19 (a,b)	0.21	8.31 (b)	0.08	8.74 (a)	0.23	8.91 (a)	0.21	8.69	0.23
Cond	µmhos/cm	1,138	131	1,149	86	1,452 (a,b)	113	1,111	76	1,229	101	1,174	100	1,211	102	1,194	85
TDS	g/L	0.73	0.13	0.73	0.07	0.93 (b)	0.09	0.70	0.06	0.78	0.08	0.75	0.08	0.77	0.08	0.76	0.07
DO	mg/L	10.8	3.3	14.1	2.1	12.2	1.9	16.5 (a)	2.0	9.1 (b)	2.0	13.0	2.7	15.6	2.1	13.0	2.8
TP	µg/L	18	2	37 (a)	10	32 (a)	5	25 (a)	4	56 (a)	17	29 (a)	5	27 (a)	3	33 (a)	7
TDP	µg/L	8	2	16 (a)	3	18 (a)	2	15 (a)	2	25 (a,b)	4	15 (a)	2	17 (a)	2	20 (a)	4
SRP	µg/L	6	2	6	2	6	2	5	2	7	2	5	1	5	2	9	3
TPP	µg/L	10	2	21	10	13	4	11	4	31 (a)	16	14	5	10	3	15	5
DOP	µg/L	4	2	10 (a)	3	13 (a)	3	10 (a)	2	18 (a)	5	10 (a)	3	12 (a)	3	11 (a)	3
TN	mg/L	1.25	0.04	1.88 (a)	0.38	2.19 (a)	0.29	1.97 (a)	0.22	3.57 (a)	1.25	2.02 (a)	0.53	1.93 (a)	0.12	2.04 (a)	0.51
TKN	mg/L	1.22	0.04	1.86 (a)	0.37	2.16 (a)	0.29	1.95 (a)	0.22	3.49 (a,b)	1.21	1.95 (a)	0.53	1.91 (a)	0.12	2.01 (a)	0.51
NOX	mg/L	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
NH3	mg/L	0.16	0.01	0.16	0.03	0.17	0.02	0.15	0.01	0.28	0.20	0.15	0.01	0.16	0.01	0.16	0.03
ORG N	mg/L	1.06	0.05	1.70 (a)	0.37	2.00 (a)	0.30	1.80 (a)	0.22	3.21 (a,b)	1.07	1.80 (a)	0.52	1.74 (a)	0.11	1.85 (a)	0.50
TSS	mg/L	2.5	1.4	5.0	3.8	4.3	2.1	5.9	4.1	5.8	3.3	4.5	2.7	2.3	1.1	3.5	1.9
CA	mg/L	81.4	7.3	58.7	21.3	95.8	23.9	48.1 (a)	11.2	96.1	22.0	89.4	24.6	60.7	16.5	65.8	22.3
ALK	mg/L	260	13	182 (a)	24	171 (a)	17	148 (a)	18	233 (a,b)	13	228	50	144 (a,b)	11	179 (a)	24
Cl	mg/L	192	16	243 (a)	23	330 (a,b)	37	250 (a)	26	241 (a)	21	237 (a)	14	267 (a)	28	245 (a)	17
Dis. Al	mg/L	0.08	0.07	0.04	0.02	0.06	0.06	0.03	0.00	0.09	0.07	0.10	0.08	0.15	0.10	0.12	0.07
Total Al	mg/L	0.03	0.00	0.09 (a)	0.07	0.05	0.04	0.07	0.05	0.14 (a)	0.10	0.27 (a)	0.23	0.16 (a)	0.11	0.23 (a)	0.16
Total Fe	mg/L	0.20	0.04	0.16	0.04	0.27	0.04	0.15	0.02	0.31 (a,b)	0.07	0.27	0.10	0.17	0.03	0.20	0.05

Notes:

(a) = significantly different than the inflow (95% confidence interval)

(b) = significantly different than the control (95% confidence interval)

SE = Standard errors

treatments than in the inflow. Total Al was significantly higher in both PACL treatments than in the inflow (but not compared to the controls). Total Fe was not significantly different between any of the treatments and the inflow and controls.

SECTION 5

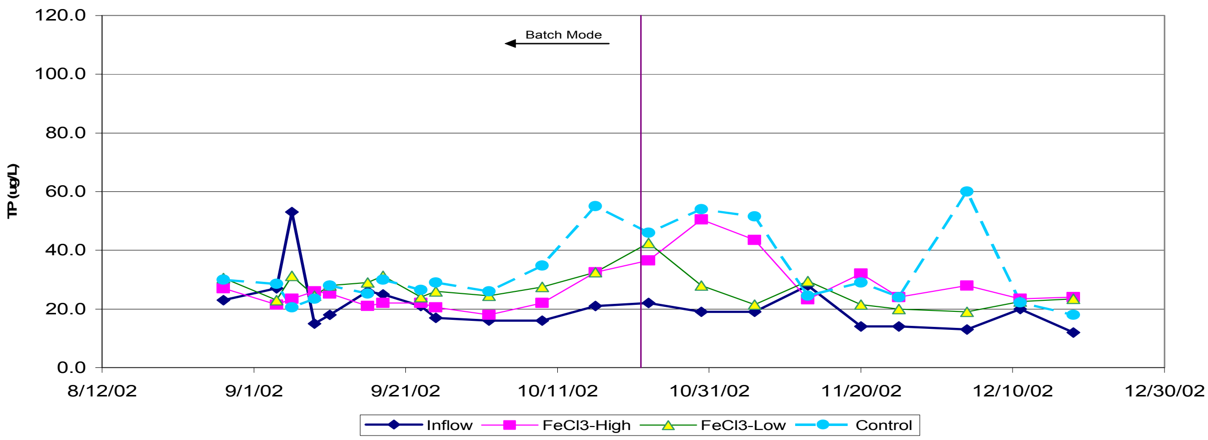
Effects of Soil Amendments on TP

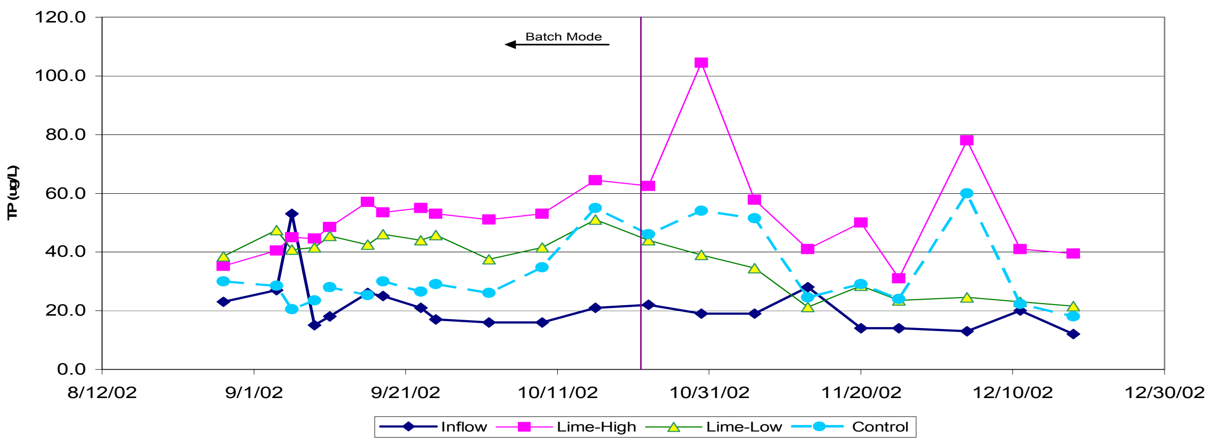
Exhibit 5-1 provides a time-series graph of the TP results by treatment. Outflow TP concentrations were higher in all treatments than in the inflow on most sampling dates. High and low lime treatments consistently resulted in higher TP outflow concentrations than the controls. The PACL and $FeCl_3$ treatment TP concentrations were similar or lower than the TP concentrations that were measured in the control tanks.

Exhibit 5-2 provides a summary of the average period-of-record P results by fraction and treatment. All TP averages are higher in the treatments and controls compared to the inflow. However, the $FeCl_3$ and PACL treatments all had lower average TP and TPP concentrations than the controls. Both the total dissolved and total particulate P fractions are higher in the controls and treatments than in the inflow. Average concentrations of TDP and DOP were not very different between the $FeCl_3$ and PACL treatments and the controls. Average SRP concentrations were generally lower in the controls and in all three treatments than in the inflow.

EXHIBIT 5-1

Time Series Plots of Average TP Water Concentrations in the PSTA Soil Amendment Treatments





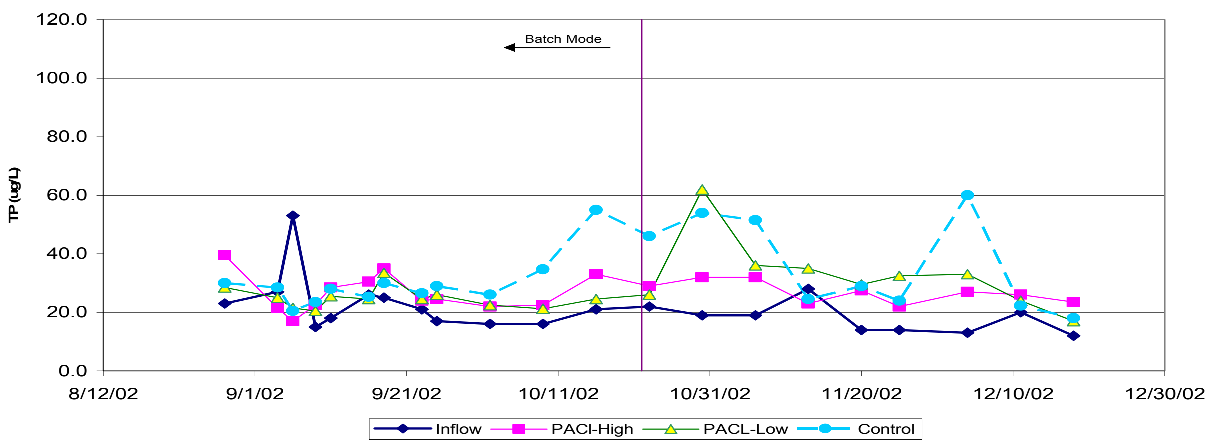


EXHIBIT 5-2
Period-of-Record Average Surface Water P Concentrations By Fraction in the PSTA Soil Amendment Treatments

Treatment	Average Concentration (µg/L)				
	TP	TDP	SRP	TPP	DOP
Inflow	20.9	9.5	5.5	11.4	4.0
Control	32.7	14.7	4.7	18.3	10.0
$FeC1_3$-High	27.0	15.2	4.1	12.1	11.5
$FeC1_3$-Low	26.7	14.1	4.1	12.4	10.0
Lime-High	52.7	27.2	5.2	25.3	21.8
Lime-Low	37.2	18.5	4.5	18.5	13.5
PACL-High	26.8	14.3	4.3	12.3	10.3
PACL-Low	28.2	15.9	6.2	13.2	10.1

SECTION 6

Macrophyte Populations

Exhibit 6-1 summarizes the macrophyte data collected near the end of the soil amendment study. Percent cover was estimated on November 13, 2002. Macrophytes were harvested from the soil amendment tanks on December 23, 2002. Estimated plant cover was lowest in the lime treatments and highest in the PACL treatments. The dominant macrophyte was stonewort (*Chara* sp.), a submerged aquatic calcareous macrophytic alga. The dominant emergent macrophyte was toothcup (*Ammannia coccinea*), followed by a lower density of narrow-leaf cattail (*Typha latifolia*). Average ending macrophyte biomass estimates ranged from 47 to 317 g dry weight/m^2. Average TP concentrations in the combined plants ranged from 140 to 870 mg/kg for calculated TP densities between 7 and 199 mg/m^2. This range is equivalent to an estimated 8.2 to 227 mg TP per tank.

EXHIBIT 6-1
Estimated Average Final Macrophyte Cover and Phosphorus Content in the PSTA Soil Amendment Treatments

	Percent Cover (%)		Final Plant Sampling				
	SAV	EMG	Wet Wt (g)	Total Solids (%)	TP (mg/kg)	Est. Dry Wt (mg/m^2)	Est. TP (mg/m^2)
CONTROL	65	5	1,650	18.3	345	285	87.1
FECL3-HIGH	60	4	1,915	14.0	870	232	199
FECL3-LOW	93	2	2,305	15.7	295	317	93.1
LIME-HIGH	1	0	233	11.5	140	46.9	6.6
LIME-LOW	48	2	1,435	14.0	550	220	58.5
PACL-HIGH	65	3	2,460	12.9	840	285	199
PACL-LOW	55	8	1,650	17.1	465	232	121

Notes:

SAV = Submerged aquatic vegetation

EMG = Emergent vegetation

SECTION 7

Soils

A summary of the soil chemistry in the soil amendment tanks is provided in Exhibit 7-1. Detailed soils data are provided in Appendix D. The estimated wet bulk density values were variable with lowest estimates in the controls, the lime treatments, and in the PACL-low treatment. The soil pH was neutral in all treatments except the high lime where it was higher. The soil moisture content in all treatments was similar, between 71 percent and 79 percent of the soil wet weight. The TP in all treatments was also similar with the exception of the PACL-low treatment, which had higher soil TP than the other treatments. Average soil Ca was measurably elevated in the high lime treatment compared to the others but not in the low lime treatment. Concentrations of soil magnesium were similar for all treatments. Fe concentrations were measurably (but not significantly) higher in the $FeCl_3$ treatments than in the others. Concentrations of Al in the PACL tank soils were not different than those in the other treatments.

EXHIBIT 7-1
Summary of Soil Chemistry in the PSTA Soil Amendment Treatments

Treatment	Est. Wet Bulk Density (g/cm^3)	pH	Moisture Content (%)	TP (mg/kg)	Average Soil (mg/kg)			
					Total Ca	Total Mg	Total Fe	Total Al
CONTROL	0.33	7.4	74	542	59,226	7,966	9,436	15,201
FECL3-HIGH	0.70	7.2	78	567	59,078	7,852	**11,021**	13,927
PECL3-LOW	0.53	7.3	74	557	69,434	7,881	**10,144**	13,824
LIME-HIGH	0.37	8.4	71	557	**80,910**	8,675	9,265	14,412
LIME-LOW	0.36	7.7	79	554	**63,426**	8,338	8,977	14,120
PACL-HIGH	0.59	7.3	74	531	63,991	8,537	9,528	**15,420**
PACL-LOW	0.32	7.4	75	725	61,461	8,459	9,325	**14,577**

Exhibit 7-2 provides a summary of the final soil metal concentrations estimated in units of g/m^2, the same units shown in Exhibit 2-3 for the soil amendment doses. Based on this comparison it is clear that the concentrations of active chemical added to each treatment are relatively small compared to the total metal content of the existing soils.

EXHIBIT 7-2
Estimated Soil Metals Per Unit Area in the PSTA Soil Amendment Treatments

Treatment	Average Soil (g/m^2)		
	Total Ca	Total Fe	Total Al
CONTROL	720	132	219
FECL3-HIGH	1402	280	359
FECL3-LOW	1613	216	335
LIME-HIGH	1361	169	266
LIME-LOW	758	114	183
PACL-HIGH	1633	240	398
PACL-LOW	765	129	197

SECTION 8

Conclusions

The following conclusions are supported by the results of the PSTA Phase 3 soil amendment study:

- Within the timeframe of this study (approximately 4 months), average concentrations of SRP were reduced in several of the soil amendment treatments compared to the inflow and the controls, but water column TP concentrations were not reduced by any of the tested soil amendments compared to the inflow water.
- Increasing TP concentrations in all of the treatments compared to the inflow were the result of increasing concentrations of both particulate and dissolved organic P fractions.
- TP generally increased compared to the inflow both during a batch-mode operation with no flow and during flow-through operation.
- In this study the $FeCl_3$ and PACL treatments were more effective for controlling TP than the hydrated lime treatment.
- Within the range of the chemical doses tested in this study, no elevated water column concentrations of Fe were detected that were above the Class III water quality standard of 1 mg/L. There are no Florida Class III water quality criteria for Al or Ca.
- The pH, conductivity, and alkalinity changes in response to the chemical doses did not exceed allowable Class III criteria. There is no Class III criterion for chlorides.
- Organic N was generally released from the soils in all of the tanks, as indicated by surface water increases in TKN between the inflow and the outflow.
- Average TSS concentrations generally increased in all of the tank outflows compared to the inflows.
- Alkalinity generally decreased in all of the treatments compared to the inflow, possibly due to release of organic acids from the peat and, in PACL-treated mesocosms, acidity generated by aluminum hydrolysis.
- The lime treatments apparently solubilized some of the organic soils due to the method of chemical addition of a hydrated solution to dry soils, resulting in the highest water column concentrations for TP and organic N, and lower soil bulk density estimates.
- If practical, soil amendments should be added to flooded or saturated soils to avoid impacts on soil structure and to provide a thicker more even coating of the active chemical at the soil/water interface.
- Periphyton did not visibly colonize any of the soil amendment tanks over the period of this study; however, dense populations of submerged aquatic macrophytes and scattered rooted, emergent plants were present in several of the treatments.
- A period of 4 months was not adequate for the full quantification of effectiveness of the soil amendments tested. Effects of startup responses to initial soil saturation, plant succession, and seasonality were likely not complete within the study time frame.

SECTION 9

Summary and Recommendations

Soil amendments as tested in this study were not found to be effective for the control or reduction of initial releases of TP from peat soils. Detailed environmental processes leading to these results could not be determined based on the study scope and design. It is possible that this study did not run for a duration sufficient to accurately assess the efficacy of the tested soil amendment treatments. For example, the low lime treatment outflow TP was decreasing compared to the controls by the mid-point of the study. Also, the soil amendment doses selected for this study may have been lower than actually needed to control TP in these specific organic soils. Plant community development could not be adequately controlled in the test systems to completely eliminate potential effects of rooted plants on soil P releases. For these reasons, it is concluded that the scope and duration of this study were not sufficient to fully investigate the efficacy and cost-effectiveness of chemical soil amendments.

Due to the importance and potential cost savings of finding an effective control of P releases from agricultural peat soils in the EAA, it is recommended that additional soil amendment studies be conducted to more completely test this method of constructing effective treatment wetlands on organic agricultural soils. Higher soil amendment loading rates should be tested, including at least two to ten times the highest application rates tested in this study. Study duration should be at least one year. Treatments with and without periphyton and plants should be fully tested. Non-soil control treatments should also be added. In future studies, it is recommended that soil amendments be added to flooded and saturated soils.

SECTION 10
References

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Appendix A
Soil Amendment Study Detailed Flow Data

Appendix A-1

Detailed Flow Data for the Soil Amendment Tanks

Tank	Date	Time	Flows (mL/sec)	
			Inflow	Outflow
1	10/23/2002	10:07	0.00	--
	10/23/2002	10:07	1.83	--
	10/23/2002	12:50	0.83	--
	10/30/2002	12:30	0.13	1.50
	10/30/2002	14:12	1.00	--
	11/06/2002	13:50	0.70	--
	11/06/2002	15:05	1.30	--
	11/13/2002	13:15	0.00	0.00
	11/13/2002	13:50	0.00	0.00
	11/20/2002	11:23	0.00	0.00
	11/20/2002	12:38	2.87	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:07	0.00	0.00
	12/04/2002	12:08	0.00	--
	12/04/2002	13:08	2.50	--
	12/11/2002	10:02	0.00	0.00
	12/11/2002	12:00	1.83	--
	12/18/2002	10:11	0.10	0.00
	12/18/2002	12:27	--	0.00
2	10/22/2002	10:51	2.10	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:07	0.83	--
	10/23/2002	12:50	0.80	--
	10/30/2002	12:30	0.07	0.83
	10/30/2002	14:12	1.20	--
	11/06/2002	--	1.33	--
	11/06/2002	--	1.20	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:23	0.30	0.00
	11/20/2002	12:38	2.17	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:08	0.00	0.00
	12/04/2002	12:08	0.93	--
	12/04/2002	13:09	1.47	--
	12/11/2002	10:02	0.00	0.00
	12/11/2002	12:00	1.67	--
	12/18/2002	10:11	0.00	0.00
	12/18/2002	12:27	--	0.00
3	10/22/2002	10:54	2.80	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:07	2.93	--
	10/23/2002	12:50	2.73	--
	10/30/2002	12:30	0.27	1.20
	10/30/2002	14:12	2.13	--
	11/06/2002	--	2.07	--
	11/06/2002	--	1.67	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:23	0.73	0.00
	11/20/2002	12:38	1.97	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:09	0.00	0.00
	12/04/2002	12:09	0.00	--
	12/04/2002	13:09	2.87	--
	12/11/2002	10:03	0.00	0.00
	12/11/2002	12:01	1.90	--
	12/18/2002	10:11	0.53	0.00
	12/18/2002	12:27	--	0.00

Appendix A-1

Detailed Flow Data for the Soil Amendment Tanks

Tank	Date	Time	Flows (mL/sec)	
			Inflow	Outflow
4	10/22/2002	10:54	2.60	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:08	1.83	--
	10/23/2002	12:51	1.77	--
	10/30/2002	12:31	0.10	1.57
	10/30/2002	14:13	0.93	--
	11/06/2002	--	0.03	--
	11/06/2002	--	2.67	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:23	0.27	0.00
	11/20/2002	12:39	2.63	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:10	0.00	0.00
	12/04/2002	12:09	0.17	--
	12/04/2002	13:09	1.20	--
	12/11/2002	10:03	0.00	0.00
	12/11/2002	12:01	1.60	--
	12/18/2002	10:12	0.33	0.00
	12/18/2002	12:29	--	0.00
5	10/22/2002	10:55	1.60	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:08	0.80	--
	10/23/2002	12:51	0.63	--
	10/30/2002	12:31	0.17	3.17
	10/30/2002	14:13	1.57	--
	11/06/2002	--	0.33	--
	11/06/2002	--	2.50	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:24	0.60	0.00
	11/20/2002	12:39	1.83	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:12	0.00	0.00
	12/04/2002	12:10	0.00	--
	12/04/2002	13:10	2.53	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:03	1.83	--
	12/18/2002	10:12	0.17	0.00
	12/18/2002	12:29	--	0.00
6	10/22/2002	10:55	2.20	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:08	1.93	--
	10/23/2002	12:51	1.73	--
	10/30/2002	12:31	0.20	1.17
	10/30/2002	14:13	1.93	--
	11/06/2002	--	0.17	--
	11/06/2002	--	2.67	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:24	0.30	0.00
	11/20/2002	12:39	1.73	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:13	0.00	0.00
	12/04/2002	12:10	0.13	--
	12/04/2002	13:10	2.27	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:03	2.33	--
	12/18/2002	10:12	0.37	0.00
	12/18/2002	12:29	--	0.00

Appendix A-1

Detailed Flow Data for the Soil Amendment Tanks

Tank	Date	Time	Flows (mL/sec) Inflow	Outflow
7	10/22/2002	10:56	3.80	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:09	1.70	--
	10/23/2002	12:51	1.13	--
	10/30/2002	12:32	0.03	2.00
	10/30/2002	14:14	1.63	--
	11/06/2002	--	0.73	--
	11/06/2002	--	2.50	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:25	0.00	0.00
	11/20/2002	12:40	1.57	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:14	0.00	0.00
	12/04/2002	12:11	0.20	--
	12/04/2002	13:10	2.33	--
	12/11/2002	10:04	0.00	0.00
	12/11/2002	12:04	1.87	--
	12/18/2002	10:12	0.33	0.00
	12/18/2002	12:29	--	0.00
8	10/22/2002	10:57	2.70	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:09	0.67	--
	10/23/2002	12:52	2.27	--
	10/30/2002	12:32	0.20	1.20
	10/30/2002	14:14	1.67	--
	11/06/2002	--	0.00	--
	11/06/2002	--	2.40	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:25	1.97	0.00
	11/20/2002	12:40	1.83	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:16	0.00	0.00
	12/04/2002	12:11	2.73	--
	12/04/2002	13:10	1.37	--
	12/11/2002	10:04	0.00	0.00
	12/11/2002	12:04	2.27	--
	12/18/2002	10:14	0.57	0.00
	12/18/2002	12:30	--	0.00
9	10/22/2002	10:57	3.00	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:10	1.23	--
	10/23/2002	12:52	0.77	--
	10/30/2002	12:32	0.07	0.60
	10/30/2002	14:14	1.97	--
	11/06/2002	--	0.17	--
	11/06/2002	--	2.63	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:25	0.47	0.00
	11/20/2002	11:40	1.00	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:17	0.00	0.00
	12/04/2002	12:12	0.00	--
	12/04/2002	13:11	1.00	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:05	1.23	--
	12/18/2002	10:14	0.30	0.00
	12/18/2002	12:30	--	0.00

Appendix A-1

Detailed Flow Data for the Soil Amendment Tanks

Tank	Date	Time	Flows (mL/sec) Inflow	Outflow
10	10/22/2002	10:58	2.60	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:10	1.10	--
	10/23/2002	12:52	1.03	--
	10/30/2002	12:33	0.13	1.23
	10/30/2002	14:15	1.03	--
	11/06/2002	--	0.43	--
	11/06/2002	--	2.70	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:26	0.33	0.00
	11/20/2002	12:40	1.50	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:18	0.00	0.00
	12/04/2002	12:12	0.30	--
	12/04/2002	13:11	3.00	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:04	2.00	--
	12/18/2002	10:14	0.90	0.00
	12/18/2002	12:30	--	0.00
11	10/22/2002	10:58	1.90	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:11	1.07	--
	10/23/2002	12:52	1.13	--
	10/30/2002	12:33	0.33	1.67
	10/30/2002	14:15	1.87	--
	11/06/2002	--	0.47	--
	11/06/2002	--	2.07	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:26	0.63	0.00
	11/20/2002	12:41	1.80	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:19	0.00	0.00
	12/04/2002	12:13	0.60	--
	12/04/2002	13:11	2.27	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:05	1.93	--
	12/18/2002	10:19	0.57	0.00
	12/18/2002	12:30	--	0.00
12	10/22/2002	10:59	3.70	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:11	1.00	--
	10/23/2002	12:53	0.80	--
	10/30/2002	12:34	0.07	1.07
	10/30/2002	14:16	1.80	--
	11/06/2002	--	0.53	--
	11/06/2002	--	2.33	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:26	0.80	0.00
	11/20/2002	12:41	2.07	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:20	0.00	0.00
	12/04/2002	12:13	0.73	--
	12/04/2002	13:12	1.37	--
	12/11/2002	10:04	0.00	--
	12/11/2002	12:05	1.47	--
	12/18/2002	10:19	0.13	0.00
	12/18/2002	12:31	--	0.00

Appendix A-1

Detailed Flow Data for the Soil Amendment Tanks

Tank	Date	Time	Flows (mL/sec) Inflow	Outflow
13	10/22/2002	10:59	2.50	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:11	2.03	--
	10/23/2002	12:53	1.50	--
	10/30/2002	12:34	0.20	1.33
	10/30/2002	14:16	1.07	--
	11/06/2002	--	0.33	--
	11/06/2002	--	1.43	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:27	0.10	0.00
	11/20/2002	12:41	2.00	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:21	0.00	0.00
	12/04/2002	12:14	1.13	--
	12/04/2002	13:12	1.43	--
	12/11/2002	10:05	0.00	0.00
	12/11/2002	12:05	1.33	--
	12/18/2002	10:19	0.27	0.00
	12/18/2002	12:31	--	0.00
14	10/22/2002	11:00	2.20	--
	10/23/2002	10:07	0.00	--
	10/23/2002	10:12	0.83	--
	10/23/2002	12:53	1.97	--
	10/30/2002	12:34	0.07	1.90
	10/30/2002	14:16	1.23	--
	11/06/2002	--	0.10	--
	11/06/2002	--	2.23	--
	11/13/2002	--	0.00	0.00
	11/13/2002	--	0.00	0.00
	11/20/2002	11:27	0.50	0.00
	11/20/2002	12:42	2.17	0.00
	11/25/2002	--	0.00	0.00
	11/25/2002	14:22	0.00	0.00
	12/04/2002	12:14	0.67	--
	12/04/2002	13:12	2.00	--
	12/11/2002	10:05	0.00	--
	12/11/2002	12:05	2.27	--
	12/18/2002	10:19	0.53	0.00
	12/18/2002	12:21	--	0.00

Appendix B
Soil Amendment Study Detailed Water Quality Data

Appendix B-1

Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Tank Detail)

Tanks In Batch Mode until 10/22/02

				TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL A	SA-6	Weekly	08/25/2002	0.023	0.032	0.007	0.011	0.002	0.003	0.016	0.021	0.005	0.008
			09/01/2002	0.040	0.026	0.011	0.013	0.008	0.004	0.030	0.013	0.000	0.005
			09/08/2002	0.017	0.031	0.011	0.014	0.009	0.002	0.006	0.017	0.000	0.013
			09/15/2002	0.026	0.030	0.007	0.010	0.002	0.002	0.018	0.021	0.005	0.008
			09/22/2002	0.019	0.034	0.012	0.015	0.010	0.007	0.008	0.020	0.000	0.005
			09/29/2002	0.016	0.030	0.007	0.016	0.001	0.002	0.009	0.014	0.006	0.014
			10/06/2002	0.016	0.044	0.009	0.013	0.008	0.005	0.007	0.031	0.001	0.008
			10/13/2002	0.021	0.077	0.019	0.020	0.002	0.003	0.002	0.057	0.017	0.017
			10/20/2002	0.022	0.060	0.008	0.016	0.001	0.009	0.014	0.044	0.007	0.007
			10/27/2002	0.019	0.075	0.007	0.025	0.011	0.002	0.012	0.050	0.000	0.023
			11/03/2002	0.019	0.063	0.009	0.021	0.010	0.013	0.010	0.042	0.000	0.008
			11/10/2002	0.028	0.024	0.011	0.023	0.011	0.003	0.017	0.001	0.000	0.020
			11/17/2002	0.014	0.033	0.005	0.016	0.001	0.008	0.009	0.017	0.004	0.008
			11/24/2002	0.014	0.020	0.006	0.012	0.001	0.007	0.008	0.008	0.005	0.005
			12/01/2002	0.013	0.032	0.016	0.024	0.002	0.005	0.000	0.008	0.014	0.019
			12/08/2002	0.020	0.028	0.007	0.014	0.012	0.003	0.013	0.014	0.000	0.011
			12/15/2002	0.012	0.021	0.006	0.013	0.002	0.002	0.006	0.008	0.004	0.011
CONTROL B	SA-11	Weekly	08/25/2002	0.023	0.028	0.007	0.010	0.002	0.003	0.016	0.018	0.005	0.007
			09/01/2002	0.040	0.023	0.011	0.015	0.008	0.007	0.030	0.009	0.000	0.005
			09/08/2002	0.017	0.021	0.011	0.012	0.009	0.002	0.006	0.010	0.000	0.013
			09/15/2002	0.026	0.025	0.007	0.010	0.002	0.001	0.018	0.019	0.005	0.009
			09/22/2002	0.019	0.022	0.012	0.017	0.010	0.001	0.008	0.005	0.000	0.015
			09/29/2002	0.016	0.022	0.007	0.019	0.001	0.001	0.009	0.003	0.006	0.018
			10/06/2002	0.016	0.026	0.009	0.011	0.008	0.003	0.007	0.015	0.001	0.008
			10/13/2002	0.021	0.033	0.019	0.013	0.002	0.009	0.002	0.020	0.017	0.004
			10/20/2002	0.022	0.032	0.008	0.012	0.001	0.008	0.014	0.020	0.007	0.004
			10/27/2002	0.019	0.033	0.007	0.010	0.011	0.002	0.012	0.024	0.000	0.008
			11/03/2002	0.019	0.040	0.009	0.012	0.010	0.009	0.010	0.028	0.000	0.003
			11/10/2002	0.028	0.025	0.011	0.020	0.011	0.002	0.017	0.005	0.000	0.018
			11/17/2002	0.014	0.025	0.005	0.024	0.001	0.006	0.009	0.001	0.004	0.018
			11/24/2002	0.014	0.028	0.006	0.018	0.001	0.002	0.008	0.010	0.005	0.016
			12/01/2002	0.013	0.088	0.016	0.011	0.002	0.009	0.000	0.077	0.014	0.002
			12/08/2002	0.020	0.017	0.007	0.009	0.012	0.006	0.013	0.008	0.000	0.003
			12/15/2002	0.012	0.015	0.006	0.008	0.002	0.009	0.006	0.007	0.004	0.000
FECL3-HIGH-A	SA-2	Weekly	08/25/2002	0.023	0.029	0.007	0.009	0.002	0.001	0.016	0.020	0.005	0.008
			09/01/2002	0.040	0.020	0.011	0.011	0.008	0.002	0.030	0.009	0.000	0.006
			09/08/2002	0.017	0.025	0.011	0.010	0.009	0.004	0.006	0.015	0.000	0.005
			09/15/2002	0.026	0.020	0.007	0.010	0.002	0.001	0.018	0.011	0.005	0.009
			09/22/2002	0.019	0.020	0.012	0.015	0.010	0.005	0.008	0.005	0.000	0.007
			09/29/2002	0.016	0.020	0.007	0.015	0.001	0.001	0.009	0.005	0.006	0.014
			10/06/2002	0.016	0.024	0.009	0.010	0.008	0.005	0.007	0.014	0.001	0.005
			10/13/2002	0.021	0.036	0.019	0.019	0.002	0.001	0.002	0.017	0.017	0.018
			10/20/2002	0.022	0.033	0.008	0.019	0.001	0.002	0.014	0.014	0.007	0.017
			10/27/2002	0.019	0.047	0.007	0.020	0.011	0.002	0.012	0.027	0.000	0.018
			11/03/2002	0.019	0.051	0.009	0.025	0.010	0.017	0.010	0.026	0.000	0.008
			11/10/2002	0.028	0.022	0.011	0.017	0.011	0.006	0.017	0.005	0.000	0.011
			11/17/2002	0.014	0.033	0.005	0.025	0.001	0.004	0.009	0.008	0.004	0.021
			11/24/2002	0.014	0.023	0.006	0.021	0.001	0.002	0.008	0.002	0.005	0.019
			12/01/2002	0.013	0.026	0.016	0.024	0.002	0.002	0.000	0.002	0.014	0.022
			12/08/2002	0.020	0.024	0.007	0.014	0.012	0.010	0.013	0.010	0.000	0.004
			12/15/2002	0.012	0.023	0.006	0.014	0.002	0.002	0.006	0.009	0.004	0.012
FECL3-HIGH-B	SA-9	Weekly	08/25/2002	0.023	0.025	0.007	0.010	0.002	0.002	0.016	0.015	0.005	0.008
			09/01/2002	0.040	0.025	0.011	0.013	0.008	0.002	0.030	0.012	0.000	0.011
			09/08/2002	0.017	0.026	0.011	0.012	0.009	0.001	0.006	0.014	0.000	0.010
			09/15/2002	0.026	0.023	0.007	0.007	0.002	0.001	0.018	0.016	0.005	0.006
			09/22/2002	0.019	0.023	0.012	0.013	0.010	0.001	0.008	0.011	0.000	0.016
			09/29/2002	0.016	0.016	0.007	0.008	0.001	0.001	0.009	0.008	0.006	0.008
			10/06/2002	0.016	0.020	0.009	0.016	0.008	0.006	0.007	0.004	0.001	0.010
			10/13/2002	0.021	0.029	0.019	0.023	0.002	0.001	0.002	0.006	0.017	0.022
			10/20/2002	0.022	0.040	0.008	0.017	0.001	0.003	0.014	0.023	0.007	0.014
			10/27/2002	0.019	0.054	0.007	0.020	0.011	0.016	0.012	0.034	0.000	0.004
			11/03/2002	0.019	0.036	0.009	0.019	0.010	0.002	0.010	0.017	0.000	0.017
			11/10/2002	0.028	0.025	0.011	0.022	0.011	0.003	0.017	0.003	0.000	0.019
			11/17/2002	0.014	0.031	0.005	0.016	0.001	0.013	0.009	0.015	0.004	0.003
			11/24/2002	0.014	0.025	0.006	0.013	0.001	0.006	0.008	0.012	0.005	0.007
			12/01/2002	0.013	0.030	0.016	0.021	0.002	0.003	0.000	0.009	0.014	0.019
			12/08/2002	0.020	0.023	0.007	0.012	0.012	0.010	0.013	0.011	0.000	0.002
			12/15/2002	0.012	0.025	0.006	0.014	0.002	0.001	0.006	0.011	0.004	0.013

Appendix B-1
Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Tank Detail)
Tanks In Batch Mode until 10/22/02

				TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
FECL3-LOW-A	SA-8	Weekly	08/25/2002	0.023	0.028	0.007	0.009	0.002	0.002	0.016	0.019	0.005	0.007
			09/01/2002	0.040	0.027	0.011	0.012	0.008	0.002	0.030	0.015	0.000	0.007
			09/08/2002	0.017	0.023	0.011	0.010	0.009	0.005	0.006	0.014	0.000	0.003
			09/15/2002	0.026	0.024	0.007	0.010	0.002	0.002	0.018	0.014	0.005	0.008
			09/22/2002	0.019	0.021	0.012	0.013	0.010	0.004	0.008	0.009	0.000	0.006
			09/29/2002	0.016	0.025	0.007	0.013	0.001	0.004	0.009	0.013	0.006	0.009
			10/06/2002	0.016	0.027	0.009	0.010	0.008	0.004	0.007	0.017	0.001	0.006
			10/13/2002	0.021	0.032	0.019	0.020	0.002	0.002	0.002	0.012	0.017	0.018
			10/20/2002	0.022	0.032	0.008	0.017	0.001	0.007	0.014	0.015	0.007	0.010
			10/27/2002	0.019	0.025	0.007	0.019	0.011	0.002	0.012	0.006	0.000	0.017
			11/03/2002	0.019	0.021	0.009	0.011	0.010	0.008	0.010	0.010	0.000	0.003
			11/10/2002	0.028	0.024	0.011	0.018	0.011	0.002	0.017	0.006	0.000	0.016
			11/17/2002	0.014	0.020	0.005	0.017	0.001	0.002	0.009	0.003	0.004	0.015
			11/24/2002	0.014	0.015	0.006	0.012	0.001	0.005	0.008	0.003	0.005	0.008
			12/01/2002	0.013	0.016	0.016	0.013	0.002	0.002	0.000	0.003	0.014	0.011
			12/08/2002	0.020	0.019	0.007	0.009	0.012	0.011	0.013	0.010	0.000	0.000
			12/15/2002	0.012	0.026	0.006	0.010	0.002	0.002	0.006	0.016	0.004	0.008
FECL3-LOW-B	SA-13	Weekly	08/25/2002	0.023	0.033	0.007	0.010	0.002	0.001	0.016	0.023	0.005	0.009
			09/01/2002	0.040	0.028	0.011	0.011	0.008	0.008	0.030	0.017	0.000	0.000
			09/08/2002	0.017	0.030	0.011	0.014	0.009	0.002	0.006	0.016	0.000	0.013
			09/15/2002	0.026	0.036	0.007	0.014	0.002	0.002	0.018	0.025	0.005	0.013
			09/22/2002	0.019	0.029	0.012	0.018	0.010	0.001	0.008	0.012	0.000	0.014
			09/29/2002	0.016	0.024	0.007	0.024	0.001	0.001	0.009	0.000	0.006	0.023
			10/06/2002	0.016	0.028	0.009	0.014	0.008	0.007	0.007	0.014	0.001	0.007
			10/13/2002	0.021	0.033	0.019	0.024	0.002	0.002	0.002	0.009	0.017	0.022
			10/20/2002	0.022	0.053	0.008	0.018	0.001	0.016	0.014	0.035	0.007	0.002
			10/27/2002	0.019	0.031	0.007	0.019	0.011	0.002	0.012	0.012	0.000	0.017
			11/03/2002	0.019	0.022	0.009	0.013	0.010	0.005	0.010	0.009	0.000	0.008
			11/10/2002	0.028	0.035	0.011	0.017	0.011	0.008	0.017	0.018	0.000	0.009
			11/17/2002	0.014	0.023	0.005	0.014	0.001	0.004	0.009	0.010	0.004	0.010
			11/24/2002	0.014	0.025	0.006	0.011	0.001	0.005	0.008	0.014	0.005	0.006
			12/01/2002	0.013	0.022	0.016	0.015	0.002	0.007	0.000	0.007	0.014	0.008
			12/08/2002	0.020	0.026	0.007	0.019	0.012	0.002	0.013	0.007	0.000	0.017
			12/15/2002	0.012	0.021	0.006	0.014	0.002	0.003	0.006	0.007	0.004	0.011
LIME-HIGH-A	SA-4	Weekly	08/25/2002	0.023	0.036	0.007	0.015	0.002	0.003	0.016	0.021	0.005	0.013
			09/01/2002	0.040	0.050	0.011	0.028	0.008	0.004	0.030	0.022	0.000	0.022
			09/08/2002	0.017	0.055	0.011	0.037	0.009	0.005	0.006	0.018	0.000	0.034
			09/15/2002	0.026	0.069	0.007	0.035	0.002	0.002	0.018	0.031	0.005	0.033
			09/22/2002	0.019	0.067	0.012	0.041	0.010	0.003	0.008	0.026	0.000	0.037
			09/29/2002	0.016	0.056	0.007	0.041	0.001	0.002	0.009	0.015	0.006	0.039
			10/06/2002	0.016	0.055	0.009	0.038	0.008	0.004	0.007	0.017	0.001	0.034
			10/13/2002	0.021	0.081	0.019	0.043	0.002	0.002	0.002	0.038	0.017	0.041
			10/20/2002	0.022	0.088	0.008	0.032	0.001	0.005	0.014	0.056	0.007	0.027
			10/27/2002	0.019	0.174	0.007	0.039	0.011	0.003	0.012	0.135	0.000	0.036
			11/03/2002	0.019	0.072	0.009	0.028	0.010	0.008	0.010	0.044	0.000	0.020
			11/10/2002	0.028	0.038	0.011	0.034	0.011	0.003	0.017	0.004	0.000	0.031
			11/17/2002	0.014	0.060	0.005	0.034	0.001	0.003	0.009	0.026	0.004	0.031
			11/24/2002	0.014	0.029	0.006	0.025	0.001	0.008	0.008	0.004	0.005	0.017
			12/01/2002	0.013	0.041	0.016	0.029	0.002	0.009	0.000	0.012	0.014	0.020
			12/08/2002	0.020	0.051	0.007	0.022	0.012	0.010	0.013	0.029	0.000	0.012
			12/15/2002	0.012	0.050	0.006	0.026	0.002	0.020	0.006	0.024	0.004	0.006
LIME-HIGH-B	SA-10	Weekly	08/25/2002	0.023	0.035	0.007	0.016	0.002	0.001	0.016	0.019	0.005	0.015
			09/01/2002	0.040	0.036	0.011	0.019	0.008	0.002	0.030	0.018	0.000	0.021
			09/08/2002	0.017	0.039	0.011	0.025	0.009	0.003	0.006	0.014	0.000	0.024
			09/15/2002	0.026	0.042	0.007	0.020	0.002	0.002	0.018	0.021	0.005	0.018
			09/22/2002	0.019	0.042	0.012	0.024	0.010	0.008	0.008	0.018	0.000	0.013
			09/29/2002	0.016	0.046	0.007	0.030	0.001	0.001	0.009	0.016	0.006	0.029
			10/06/2002	0.016	0.051	0.009	0.031	0.008	0.005	0.007	0.020	0.001	0.026
			10/13/2002	0.021	0.048	0.019	0.027	0.002	0.009	0.002	0.021	0.017	0.018
			10/20/2002	0.022	0.037	0.008	0.029	0.001	0.002	0.014	0.008	0.007	0.027
			10/27/2002	0.019	0.035	0.007	0.026	0.011	0.001	0.012	0.009	0.000	0.025
			11/03/2002	0.019	0.044	0.009	0.017	0.010	0.006	0.010	0.027	0.000	0.012
			11/10/2002	0.028	0.044	0.011	0.020	0.011	0.008	0.017	0.024	0.000	0.012
			11/17/2002	0.014	0.040	0.005	0.020	0.001	0.009	0.009	0.020	0.004	0.011
			11/24/2002	0.014	0.033	0.006	0.015	0.001	0.007	0.008	0.018	0.005	0.008
			12/01/2002	0.013	0.115	0.016	0.026	0.002	0.003	0.000	0.089	0.014	0.023
			12/08/2002	0.020	0.031	0.007	0.012	0.012	0.010	0.013	0.019	0.000	0.002
			12/15/2002	0.012	0.029	0.006	0.013	0.002	0.007	0.006	0.016	0.004	0.006

Appendix B-1
Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Tank Detail)
Tanks In Batch Mode until 10/22/02

				TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
LIME-LOW-A	SA-14	Weekly	08/25/2002	0.023	0.029	0.007	0.015	0.002	0.002	0.016	0.014	0.005	0.013
			09/01/2002	0.040	0.041	0.011	0.023	0.008	0.010	0.030	0.018	0.000	0.013
			09/08/2002	0.017	0.042	0.011	0.026	0.009	0.003	0.006	0.017	0.000	0.023
			09/15/2002	0.026	0.037	0.007	0.019	0.002	0.002	0.018	0.018	0.005	0.017
			09/22/2002	0.019	0.035	0.012	0.021	0.010	0.002	0.008	0.014	0.000	0.017
			09/29/2002	0.016	0.027	0.007	0.025	0.001	0.001	0.009	0.002	0.006	0.024
			10/06/2002	0.016	0.033	0.009	0.016	0.008	0.007	0.007	0.017	0.001	0.009
			10/13/2002	0.021	0.042	0.019	0.025	0.002	0.002	0.002	0.017	0.017	0.023
			10/20/2002	0.022	0.031	0.008	0.014	0.001	0.009	0.014	0.017	0.007	0.005
			10/27/2002	0.019	0.032	0.007	0.022	0.011	0.002	0.012	0.010	0.000	0.020
			11/03/2002	0.019	0.028	0.009	0.013	0.010	0.002	0.010	0.015	0.000	0.011
			11/10/2002	0.028	0.019	0.011	0.012	0.011	0.002	0.017	0.007	0.000	0.010
			11/17/2002	0.014	0.024	0.005	0.021	0.001	0.003	0.009	0.003	0.004	0.018
			11/24/2002	0.014	0.025	0.006	0.016	0.001	0.002	0.008	0.009	0.005	0.014
			12/01/2002	0.013	0.025	0.016	0.016	0.002	0.003	0.000	0.009	0.014	0.013
			12/08/2002	0.020	0.021	0.007	0.019	0.012	0.003	0.013	0.002	0.000	0.016
			12/15/2002	0.012	0.019	0.006	0.014	0.002	0.003	0.006	0.005	0.004	0.011
LIME-LOW-B	SA-7	Weekly	08/25/2002	0.023	0.048	0.007	0.020	0.002	0.002	0.016	0.028	0.005	0.018
			09/01/2002	0.040	0.048	0.011	0.019	0.008	0.003	0.030	0.029	0.000	0.024
			09/08/2002	0.017	0.045	0.011	0.025	0.009	0.003	0.006	0.021	0.000	0.024
			09/15/2002	0.026	0.052	0.007	0.020	0.002	0.002	0.018	0.035	0.005	0.018
			09/22/2002	0.019	0.055	0.012	0.022	0.010	0.007	0.008	0.033	0.000	0.012
			09/29/2002	0.016	0.048	0.007	0.018	0.001	0.006	0.009	0.030	0.006	0.012
			10/06/2002	0.016	0.050	0.009	0.018	0.008	0.005	0.007	0.032	0.001	0.013
			10/13/2002	0.021	0.060	0.019	0.026	0.002	0.002	0.002	0.034	0.017	0.024
			10/20/2002	0.022	0.057	0.008	0.015	0.001	0.009	0.014	0.042	0.007	0.006
			10/27/2002	0.019	0.046	0.007	0.016	0.011	0.008	0.012	0.030	0.000	0.008
			11/03/2002	0.019	0.041	0.009	0.014	0.010	0.009	0.010	0.027	0.000	0.005
			11/10/2002	0.028	0.024	0.011	0.015	0.011	0.006	0.017	0.009	0.000	0.009
			11/17/2002	0.014	0.033	0.005	0.012	0.001	0.009	0.009	0.021	0.004	0.003
			11/24/2002	0.014	0.022	0.006	0.010	0.001	0.008	0.008	0.012	0.005	0.002
			12/01/2002	0.013	0.024	0.016	0.017	0.002	0.002	0.000	0.007	0.014	0.015
			12/08/2002	0.020	0.025	0.007	0.009	0.012	0.009	0.013	0.016	0.000	0.000
			12/15/2002	0.012	0.024	0.006	0.015	0.002	0.006	0.006	0.009	0.004	0.009
PACL-HIGH-A	SA-1	Weekly	08/25/2002	0.023	0.027	0.007	0.011	0.002	0.001	0.016	0.016	0.005	0.010
			09/01/2002	0.040	0.022	0.011	0.008	0.008	0.007	0.030	0.014	0.000	0.000
			09/08/2002	0.017	0.022	0.011	0.010	0.009	0.004	0.006	0.012	0.000	0.005
			09/15/2002	0.026	0.026	0.007	0.008	0.002	0.001	0.018	0.024	0.005	0.007
			09/22/2002	0.019	0.022	0.012	0.011	0.010	0.009	0.008	0.011	0.000	0.000
			09/29/2002	0.016	0.023	0.007	0.008	0.001	0.008	0.009	0.015	0.006	0.000
			10/06/2002	0.016	0.022	0.009	0.010	0.008	0.006	0.007	0.012	0.001	0.004
			10/13/2002	0.021	0.039	0.019	0.011	0.002	0.005	0.002	0.029	0.017	0.006
			10/20/2002	0.022	0.033	0.008	0.015	0.001	0.002	0.014	0.019	0.007	0.013
			10/27/2002	0.019	0.036	0.007	0.020	0.011	0.002	0.012	0.016	0.000	0.018
			11/03/2002	0.019	0.043	0.009	0.022	0.010	0.016	0.010	0.021	0.000	0.006
			11/10/2002	0.028	0.021	0.011	0.021	0.011	0.004	0.017	0.000	0.000	0.017
			11/17/2002	0.014	0.025	0.005	0.023	0.001	0.003	0.009	0.002	0.004	0.020
			11/24/2002	0.014	0.024	0.006	0.012	0.001	0.005	0.008	0.012	0.005	0.007
			12/01/2002	0.013	0.024	0.016	0.019	0.002	0.003	0.000	0.005	0.014	0.016
			12/08/2002	0.020	0.024	0.007	0.011	0.012	0.013	0.013	0.013	0.000	0.000
			12/15/2002	0.012	0.024	0.006	0.013	0.002	0.002	0.006	0.011	0.004	0.011
PACL-HIGH-B	SA-3	Weekly	08/25/2002	0.023	0.052	0.007	0.009	0.002	0.001	0.016	0.043	0.005	0.008
			09/01/2002	0.040	0.017	0.011	0.012	0.008	0.002	0.030	0.005	0.000	0.010
			09/08/2002	0.017	0.030	0.011	0.016	0.009	0.003	0.006	0.014	0.000	0.013
			09/15/2002	0.026	0.040	0.007	0.011	0.002	0.001	0.018	0.027	0.005	0.010
			09/22/2002	0.019	0.027	0.012	0.017	0.010	0.001	0.008	0.010	0.000	0.016
			09/29/2002	0.016	0.021	0.007	0.019	0.001	0.002	0.009	0.002	0.006	0.017
			10/06/2002	0.016	0.023	0.009	0.011	0.008	0.005	0.007	0.012	0.001	0.006
			10/13/2002	0.021	0.027	0.019	0.022	0.002	0.002	0.002	0.005	0.017	0.020
			10/20/2002	0.022	0.025	0.008	0.019	0.001	0.002	0.014	0.006	0.007	0.017
			10/27/2002	0.019	0.028	0.007	0.009	0.011	0.009	0.012	0.019	0.000	0.000
			11/03/2002	0.019	0.021	0.009	0.011	0.010	0.008	0.010	0.010	0.000	0.003
			11/10/2002	0.028	0.025	0.011	0.020	0.011	0.003	0.017	0.005	0.000	0.017
			11/17/2002	0.014	0.030	0.005	0.020	0.001	0.004	0.009	0.010	0.004	0.016
			11/24/2002	0.014	0.020	0.006	0.016	0.001	0.002	0.008	0.004	0.005	0.014
			12/01/2002	0.013	0.030	0.016	0.019	0.002	0.003	0.000	0.011	0.014	0.016
			12/08/2002	0.020	0.028	0.007	0.020	0.012	0.003	0.013	0.008	0.000	0.017
			12/15/2002	0.012	0.023	0.006	0.015	0.002	0.006	0.006	0.008	0.004	0.009

Appendix B-1
Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Tank Detail)
Tanks In Batch Mode until 10/22/02

				TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	Cell	Frequency	Date	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
PACL-LOW-A	SA-5	Weekly	08/25/2002	0.023	0.031	0.007	0.010	0.002	0.003	0.016	0.021	0.005	0.007
			09/01/2002	0.040	0.028	0.011	0.012	0.008	0.002	0.030	0.016	0.000	0.006
			09/08/2002	0.017	0.025	0.011	0.011	0.009	0.003	0.006	0.015	0.000	0.006
			09/15/2002	0.026	0.035	0.007	0.013	0.002	0.002	0.018	0.029	0.005	0.011
			09/22/2002	0.019	0.030	0.012	0.015	0.010	0.007	0.008	0.015	0.000	0.005
			09/29/2002	0.016	0.028	0.007	0.017	0.001	0.001	0.009	0.011	0.006	0.016
			10/06/2002	0.016	0.024	0.009	0.012	0.008	0.005	0.007	0.012	0.001	0.007
			10/13/2002	0.021	0.029	0.019	0.014	0.002	0.008	0.002	0.015	0.017	0.006
			10/20/2002	0.022	0.031	0.008	0.015	0.001	0.011	0.014	0.016	0.007	0.004
			10/27/2002	0.019	0.072	0.007	0.029	0.011	0.004	0.012	0.043	0.000	0.025
			11/03/2002	0.019	0.041	0.009	0.018	0.010	0.011	0.010	0.023	0.000	0.007
			11/10/2002	0.028	0.043	0.011	0.026	0.011	0.005	0.017	0.017	0.000	0.021
			11/17/2002	0.014	0.036	0.005	0.016	0.001	0.010	0.009	0.020	0.004	0.006
			11/24/2002	0.014	0.038	0.006	0.022	0.001	0.014	0.008	0.016	0.005	0.008
			12/01/2002	0.013	0.043	0.016	0.027	0.002	0.015	0.000	0.016	0.014	0.012
			12/08/2002	0.020	0.030	0.007	0.019	0.012	0.006	0.013	0.011	0.000	0.013
			12/15/2002	0.012	0.022	0.006	0.016	0.002	0.009	0.006	0.006	0.004	0.007
PACL-LOW-B	SA-12	Weekly	08/25/2002	0.023	0.026	0.007	0.010	0.002	0.002	0.016	0.016	0.005	0.008
			09/01/2002	0.040	0.019	0.011	0.010	0.008	0.007	0.030	0.009	0.000	0.000
			09/08/2002	0.017	0.021	0.011	0.014	0.009	0.002	0.006	0.007	0.000	0.013
			09/15/2002	0.026	0.023	0.007	0.010	0.002	0.001	0.018	0.015	0.005	0.009
			09/22/2002	0.019	0.021	0.012	0.013	0.010	0.003	0.008	0.008	0.000	0.011
			09/29/2002	0.016	0.017	0.007	0.021	0.001	0.001	0.009	0.000	0.006	0.020
			10/06/2002	0.016	0.019	0.009	0.010	0.008	0.003	0.007	0.009	0.001	0.007
			10/13/2002	0.021	0.020	0.019	0.019	0.002	0.001	0.002	0.001	0.017	0.018
			10/20/2002	0.022	0.021	0.008	0.018	0.001	0.002	0.014	0.003	0.007	0.016
			10/27/2002	0.019	0.052	0.007	0.018	0.011	0.010	0.012	0.034	0.000	0.008
			11/03/2002	0.019	0.031	0.009	0.014	0.010	0.008	0.010	0.017	0.000	0.006
			11/10/2002	0.028	0.027	0.011	0.019	0.011	0.002	0.017	0.008	0.000	0.017
			11/17/2002	0.014	0.023	0.005	0.049	0.001	0.033	0.009	0.000	0.004	0.016
			11/24/2002	0.014	0.027	0.006	0.011	0.001	0.005	0.008	0.016	0.005	0.006
			12/01/2002	0.013	0.023	0.016	0.019	0.002	0.005	0.000	0.004	0.014	0.014
			12/08/2002	0.020	0.018	0.007	0.009	0.012	0.002	0.013	0.009	0.000	0.007
			12/15/2002	0.012	0.012	0.006	0.008	0.002	0.008	0.006	0.004	0.004	0.000
CONTROL A	SA-6	Monthly	Aug-02	0.023	0.032	0.007	0.011	0.002	0.003	0.016	0.021	0.005	0.008
			Sep-02	0.025	0.030	0.010	0.013	0.007	0.004	0.015	0.017	0.001	0.008
			Oct-02	0.019	0.057	0.010	0.018	0.005	0.004	0.009	0.039	0.006	0.014
			Nov-02	0.019	0.035	0.008	0.018	0.006	0.008	0.011	0.017	0.002	0.010
			Dec-02	0.015	0.027	0.010	0.017	0.005	0.003	0.006	0.010	0.006	0.014
CONTROL B	SA-11	Monthly	Aug-02	0.023	0.028	0.007	0.010	0.002	0.003	0.016	0.018	0.005	0.007
			Sep-02	0.025	0.023	0.010	0.014	0.007	0.003	0.015	0.009	0.001	0.011
			Oct-02	0.019	0.029	0.010	0.013	0.005	0.005	0.009	0.016	0.006	0.008
			Nov-02	0.019	0.030	0.008	0.019	0.006	0.005	0.011	0.011	0.002	0.014
			Dec-02	0.015	0.040	0.010	0.009	0.005	0.008	0.006	0.031	0.006	0.002
FECL3-HIGH-A	SA-2	Monthly	Aug-02	0.023	0.029	0.007	0.009	0.002	0.001	0.016	0.020	0.005	0.008
			Sep-02	0.025	0.021	0.010	0.012	0.007	0.003	0.015	0.010	0.001	0.007
			Oct-02	0.019	0.032	0.010	0.017	0.005	0.002	0.009	0.015	0.006	0.014
			Nov-02	0.019	0.032	0.008	0.022	0.006	0.007	0.011	0.010	0.002	0.015
			Dec-02	0.015	0.024	0.010	0.017	0.005	0.005	0.006	0.007	0.006	0.013
FECL3-HIGH-B	SA-9	Monthly	Aug-02	0.023	0.025	0.007	0.010	0.002	0.002	0.016	0.015	0.005	0.008
			Sep-02	0.025	0.024	0.010	0.012	0.007	0.001	0.015	0.013	0.001	0.011
			Oct-02	0.019	0.032	0.010	0.017	0.005	0.005	0.009	0.015	0.006	0.012
			Nov-02	0.019	0.029	0.008	0.018	0.006	0.006	0.011	0.012	0.002	0.012
			Dec-02	0.015	0.026	0.010	0.016	0.005	0.005	0.006	0.010	0.006	0.011
FECL3-LOW-A	SA-8	Monthly	Aug-02	0.023	0.028	0.007	0.009	0.002	0.002	0.016	0.019	0.005	0.007
			Sep-02	0.025	0.024	0.010	0.011	0.007	0.003	0.015	0.012	0.001	0.006
			Oct-02	0.019	0.028	0.010	0.016	0.005	0.004	0.009	0.013	0.006	0.012
			Nov-02	0.019	0.020	0.008	0.015	0.006	0.004	0.011	0.006	0.002	0.010
			Dec-02	0.015	0.020	0.010	0.011	0.005	0.005	0.006	0.010	0.006	0.006
FECL3-LOW-B	SA-13	Monthly	Aug-02	0.023	0.033	0.007	0.010	0.002	0.001	0.016	0.023	0.005	0.009
			Sep-02	0.025	0.031	0.010	0.014	0.007	0.003	0.015	0.016	0.001	0.010
			Oct-02	0.019	0.034	0.010	0.020	0.005	0.006	0.009	0.014	0.006	0.014
			Nov-02	0.019	0.026	0.008	0.014	0.006	0.006	0.011	0.013	0.002	0.008
			Dec-02	0.015	0.023	0.010	0.016	0.005	0.004	0.006	0.007	0.006	0.012
LIME-HIGH-A	SA-4	Monthly	Aug-02	0.023	0.036	0.007	0.015	0.002	0.003	0.016	0.021	0.005	0.013
			Sep-02	0.025	0.060	0.010	0.035	0.007	0.004	0.015	0.023	0.001	0.032
			Oct-02	0.019	0.091	0.010	0.039	0.005	0.003	0.009	0.052	0.006	0.035
			Nov-02	0.019	0.050	0.008	0.030	0.006	0.006	0.011	0.020	0.002	0.025
			Dec-02	0.015	0.047	0.010	0.026	0.005	0.013	0.006	0.022	0.006	0.013
LIME-HIGH-B	SA-10	Monthly	Aug-02	0.023	0.035	0.007	0.016	0.002	0.001	0.016	0.019	0.005	0.015
			Sep-02	0.025	0.039	0.010	0.022	0.007	0.004	0.015	0.017	0.001	0.019
			Oct-02	0.019	0.043	0.010	0.029	0.005	0.004	0.009	0.015	0.006	0.025
			Nov-02	0.019	0.040	0.008	0.018	0.006	0.007	0.011	0.022	0.002	0.011
			Dec-02	0.015	0.058	0.010	0.017	0.005	0.007	0.006	0.041	0.006	0.010

Appendix B-1
Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Tank Detail)
Tanks In Batch Mode until 10/22/02

				TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
LIME-LOW-A	SA-14	Monthly	Aug-02	0.023	0.029	0.007	0.015	0.002	0.002	0.016	0.014	0.005	0.013
			Sep-02	0.025	0.039	0.010	0.023	0.007	0.004	0.015	0.016	0.001	0.018
			Oct-02	0.019	0.033	0.010	0.020	0.005	0.004	0.009	0.013	0.006	0.016
			Nov-02	0.019	0.024	0.008	0.016	0.006	0.002	0.011	0.009	0.002	0.013
			Dec-02	0.015	0.022	0.010	0.016	0.005	0.003	0.006	0.005	0.006	0.013
LIME-LOW-B	SA-7	Monthly	Aug-02	0.023	0.048	0.007	0.020	0.002	0.002	0.016	0.028	0.005	0.018
			Sep-02	0.025	0.050	0.010	0.021	0.007	0.004	0.015	0.029	0.001	0.020
			Oct-02	0.019	0.052	0.010	0.019	0.005	0.006	0.009	0.034	0.006	0.013
			Nov-02	0.019	0.030	0.008	0.013	0.006	0.008	0.011	0.017	0.002	0.005
			Dec-02	0.015	0.024	0.010	0.014	0.005	0.006	0.006	0.011	0.006	0.008
PACL-HIGH-A	SA-1	Monthly	Aug-02	0.023	0.027	0.007	0.011	0.002	0.001	0.016	0.016	0.005	0.010
			Sep-02	0.025	0.023	0.010	0.009	0.007	0.005	0.015	0.014	0.001	0.003
			Oct-02	0.019	0.031	0.010	0.013	0.005	0.005	0.009	0.018	0.006	0.008
			Nov-02	0.019	0.028	0.008	0.020	0.006	0.007	0.011	0.009	0.002	0.013
			Dec-02	0.015	0.024	0.010	0.014	0.005	0.006	0.006	0.010	0.006	0.009
PACL-HIGH-B	SA-3	Monthly	Aug-02	0.023	0.052	0.007	0.009	0.002	0.001	0.016	0.043	0.005	0.008
			Sep-02	0.025	0.028	0.010	0.014	0.007	0.002	0.015	0.012	0.001	0.012
			Oct-02	0.019	0.025	0.010	0.016	0.005	0.004	0.009	0.009	0.006	0.012
			Nov-02	0.019	0.024	0.008	0.017	0.006	0.004	0.011	0.007	0.002	0.013
			Dec-02	0.015	0.027	0.010	0.018	0.005	0.004	0.006	0.009	0.006	0.014
PACL-LOW-A	SA-5	Monthly	Aug-02	0.023	0.031	0.007	0.010	0.002	0.003	0.016	0.021	0.005	0.007
			Sep-02	0.025	0.029	0.010	0.012	0.007	0.004	0.015	0.017	0.001	0.007
			Oct-02	0.019	0.037	0.010	0.017	0.005	0.006	0.009	0.019	0.006	0.012
			Nov-02	0.019	0.040	0.008	0.021	0.006	0.010	0.011	0.019	0.002	0.011
			Dec-02	0.015	0.032	0.010	0.021	0.005	0.010	0.006	0.011	0.006	0.011
PACL-LOW-B	SA-12	Monthly	Aug-02	0.023	0.026	0.007	0.010	0.002	0.002	0.016	0.016	0.005	0.008
			Sep-02	0.025	0.021	0.010	0.012	0.007	0.003	0.015	0.009	0.001	0.008
			Oct-02	0.019	0.026	0.010	0.017	0.005	0.003	0.009	0.009	0.006	0.014
			Nov-02	0.019	0.027	0.008	0.023	0.006	0.012	0.011	0.010	0.002	0.011
			Dec-02	0.015	0.018	0.010	0.012	0.005	0.005	0.006	0.006	0.006	0.007
CONTROL A	SA-6	Quarterly	2002-3	0.025	0.030	0.010	0.013	0.006	0.004	0.015	0.018	0.002	0.008
			2002-4	0.018	0.042	0.009	0.018	0.005	0.005	0.009	0.025	0.005	0.013
CONTROL B	SA-11	Quarterly	2002-3	0.025	0.023	0.010	0.013	0.006	0.003	0.015	0.010	0.002	0.010
			2002-4	0.018	0.032	0.009	0.014	0.005	0.005	0.009	0.018	0.005	0.009
FECL3-HIGH-A	SA-2	Quarterly	2002-3	0.025	0.022	0.010	0.011	0.006	0.003	0.015	0.011	0.002	0.007
				0.018	0.030	0.009	0.019	0.005	0.005	0.009	0.012	0.005	0.014
FECL3-HIGH-B	SA-9	Quarterly	2002-3	0.025	0.024	0.010	0.012	0.006	0.001	0.015	0.013	0.002	0.010
			2002-4	0.018	0.030	0.009	0.017	0.005	0.005	0.009	0.013	0.005	0.011
FECL3-LOW-A	SA-8	Quarterly	2002-3	0.025	0.024	0.010	0.011	0.006	0.003	0.015	0.013	0.002	0.006
			2002-4	0.018	0.024	0.009	0.014	0.005	0.004	0.009	0.009	0.005	0.010
FECL3-LOW-B	SA-13	Quarterly	2002-3	0.025	0.031	0.010	0.014	0.006	0.003	0.015	0.017	0.002	0.010
			2002-4	0.018	0.029	0.009	0.017	0.005	0.005	0.009	0.012	0.005	0.012
LIME-HIGH-A	SA-4	Quarterly	2002-3	0.025	0.057	0.010	0.033	0.006	0.003	0.015	0.023	0.002	0.028
			2002-4	0.018	0.066	0.009	0.033	0.005	0.006	0.009	0.034	0.005	0.026
LIME-HIGH-B	SA-10	Quarterly	2002-3	0.025	0.039	0.010	0.021	0.006	0.003	0.015	0.017	0.002	0.018
			2002-4	0.018	0.046	0.009	0.022	0.005	0.006	0.009	0.024	0.005	0.017
LIME-LOW-A	SA-14	Quarterly	2002-3	0.025	0.037	0.010	0.022	0.006	0.004	0.015	0.016	0.002	0.017
			2002-4	0.018	0.027	0.009	0.018	0.005	0.003	0.009	0.009	0.005	0.015
LIME-LOW-B	SA-7	Quarterly	2002-3	0.025	0.050	0.010	0.021	0.006	0.003	0.015	0.029	0.002	0.019
			2002-4	0.018	0.038	0.009	0.015	0.005	0.007	0.009	0.022	0.005	0.009
PACL-HIGH-A	SA-1	Quarterly	2002-3	0.025	0.023	0.010	0.010	0.006	0.004	0.015	0.014	0.002	0.004
			2002-4	0.018	0.028	0.009	0.015	0.005	0.006	0.009	0.013	0.005	0.010
PACL-HIGH-B	SA-3	Quarterly	2002-3	0.025	0.031	0.010	0.014	0.006	0.002	0.015	0.016	0.002	0.011
			2002-4	0.018	0.025	0.009	0.017	0.005	0.004	0.009	0.008	0.005	0.013
PACL-LOW-A	SA-5	Quarterly	2002-3	0.025	0.029	0.010	0.012	0.006	0.003	0.015	0.018	0.002	0.007
			2002-4	0.018	0.036	0.009	0.019	0.005	0.008	0.009	0.017	0.005	0.011
PACL-LOW-B	SA-12	Quarterly	2002-3	0.025	0.022	0.010	0.012	0.006	0.003	0.015	0.010	0.002	0.008
			2002-4	0.018	0.024	0.009	0.018	0.005	0.007	0.009	0.009	0.005	0.011
CONTROL A	SA-6	LongTerm	POR	0.021	0.037	0.009	0.016	0.005	0.005	0.011	0.022	0.004	0.011
CONTROL B	SA-11	LongTerm	POR	0.021	0.028	0.009	0.014	0.005	0.005	0.011	0.015	0.004	0.009
FECL3-HIGH-A	SA-2	LongTerm	POR	0.021	0.027	0.009	0.016	0.005	0.004	0.011	0.011	0.004	0.012
FECL3-HIGH-B	SA-9	LongTerm	POR	0.021	0.027	0.009	0.015	0.005	0.004	0.011	0.013	0.004	0.011
FECL3-LOW-A	SA-8	LongTerm	POR	0.021	0.024	0.009	0.013	0.005	0.004	0.011	0.011	0.004	0.009
FECL3-LOW-B	SA-13	LongTerm	POR	0.021	0.030	0.009	0.015	0.005	0.004	0.011	0.014	0.004	0.011
LIME-HIGH-A	SA-4	LongTerm	POR	0.021	0.062	0.009	0.033	0.005	0.006	0.011	0.029	0.004	0.027
LIME-HIGH-B	SA-10	LongTerm	POR	0.021	0.043	0.009	0.022	0.005	0.005	0.011	0.021	0.004	0.017
LIME-LOW-A	SA-14	LongTerm	POR	0.021	0.032	0.009	0.019	0.005	0.003	0.011	0.012	0.004	0.015
LIME-LOW-B	SA-7	LongTerm	POR	0.021	0.043	0.009	0.018	0.005	0.006	0.011	0.025	0.004	0.012
PACL-HIGH-A	SA-1	LongTerm	POR	0.021	0.026	0.009	0.013	0.005	0.005	0.011	0.013	0.004	0.008
PACL-HIGH-B	SA-3	LongTerm	POR	0.021	0.028	0.009	0.016	0.005	0.003	0.011	0.011	0.004	0.012
PACL-LOW-A	SA-5	LongTerm	POR	0.021	0.033	0.009	0.016	0.005	0.007	0.011	0.017	0.004	0.010
PACL-LOW-B	SA-12	LongTerm	POR	0.021	0.023	0.009	0.015	0.005	0.006	0.011	0.009	0.004	0.010

Appendix B-2

Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

Tanks In Batch Mode until 10/22/02

			TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL	Weekly	08/25/2002	0.023	0.030	0.007	0.011	0.002	0.003	0.016	0.020	0.005	0.008
		09/01/2002	0.040	0.025	0.011	0.014	0.008	0.006	0.030	0.011	0.000	0.005
		09/08/2002	0.017	0.026	0.011	0.013	0.009	0.002	0.006	0.013	0.000	0.013
		09/15/2002	0.026	0.028	0.007	0.010	0.002	0.002	0.018	0.020	0.005	0.009
		09/22/2002	0.019	0.028	0.012	0.016	0.010	0.004	0.008	0.012	0.000	0.010
		09/29/2002	0.016	0.026	0.007	0.018	0.001	0.002	0.009	0.009	0.006	0.016
		10/06/2002	0.016	0.035	0.009	0.012	0.008	0.004	0.007	0.023	0.001	0.008
		10/13/2002	0.021	0.055	0.019	0.017	0.002	0.006	0.002	0.039	0.017	0.011
		10/20/2002	0.022	0.046	0.008	0.014	0.001	0.009	0.014	0.032	0.007	0.006
		10/27/2002	0.019	0.054	0.007	0.017	0.011	0.002	0.012	0.037	0.000	0.016
		11/03/2002	0.019	0.052	0.009	0.017	0.010	0.011	0.010	0.035	0.000	0.006
		11/10/2002	0.028	0.025	0.011	0.022	0.011	0.003	0.017	0.003	0.000	0.019
		11/17/2002	0.014	0.029	0.005	0.020	0.001	0.007	0.009	0.009	0.004	0.013
		11/24/2002	0.014	0.024	0.006	0.015	0.001	0.005	0.008	0.009	0.005	0.011
		12/01/2002	0.013	0.060	0.016	0.018	0.002	0.007	0.000	0.043	0.014	0.011
		12/08/2002	0.020	0.022	0.007	0.012	0.012	0.005	0.013	0.011	0.000	0.007
		12/15/2002	0.012	0.018	0.006	0.011	0.002	0.006	0.006	0.008	0.004	0.006
FECL3-HIGH	Weekly	08/25/2002	0.023	0.027	0.007	0.010	0.002	0.002	0.016	0.018	0.005	0.008
		09/01/2002	0.040	0.023	0.011	0.012	0.008	0.002	0.030	0.011	0.000	0.008
		09/08/2002	0.017	0.026	0.011	0.011	0.009	0.003	0.006	0.015	0.000	0.008
		09/15/2002	0.026	0.022	0.007	0.009	0.002	0.001	0.018	0.014	0.005	0.008
		09/22/2002	0.019	0.021	0.012	0.014	0.010	0.003	0.008	0.008	0.000	0.012
		09/29/2002	0.016	0.018	0.007	0.012	0.001	0.001	0.009	0.007	0.006	0.011
		10/06/2002	0.016	0.022	0.009	0.013	0.008	0.006	0.007	0.009	0.001	0.008
		10/13/2002	0.021	0.033	0.019	0.021	0.002	0.001	0.002	0.012	0.017	0.020
		10/20/2002	0.022	0.037	0.008	0.018	0.001	0.003	0.014	0.019	0.007	0.016
		10/27/2002	0.019	0.051	0.007	0.020	0.011	0.009	0.012	0.031	0.000	0.011
		11/03/2002	0.019	0.044	0.009	0.022	0.010	0.010	0.010	0.022	0.000	0.013
		11/10/2002	0.028	0.023	0.011	0.019	0.011	0.005	0.017	0.004	0.000	0.015
		11/17/2002	0.014	0.032	0.005	0.021	0.001	0.009	0.009	0.012	0.004	0.012
		11/24/2002	0.014	0.024	0.006	0.017	0.001	0.004	0.008	0.007	0.005	0.013
		12/01/2002	0.013	0.028	0.016	0.023	0.002	0.002	0.000	0.006	0.014	0.020
		12/08/2002	0.020	0.024	0.007	0.013	0.012	0.010	0.013	0.011	0.000	0.003
		12/15/2002	0.012	0.024	0.006	0.014	0.002	0.002	0.006	0.010	0.004	0.013
FECL3-LOW	Weekly	08/25/2002	0.023	0.031	0.007	0.010	0.002	0.002	0.016	0.021	0.005	0.008
		09/01/2002	0.040	0.027	0.011	0.012	0.008	0.005	0.030	0.016	0.000	0.004
		09/08/2002	0.017	0.026	0.011	0.012	0.009	0.004	0.006	0.015	0.000	0.008
		09/15/2002	0.026	0.030	0.007	0.012	0.002	0.002	0.018	0.019	0.005	0.010
		09/22/2002	0.019	0.025	0.012	0.015	0.010	0.003	0.008	0.010	0.000	0.010
		09/29/2002	0.016	0.025	0.007	0.018	0.001	0.002	0.009	0.006	0.006	0.016
		10/06/2002	0.016	0.028	0.009	0.012	0.008	0.006	0.007	0.016	0.001	0.007
		10/13/2002	0.021	0.033	0.019	0.022	0.002	0.002	0.002	0.011	0.017	0.020
		10/20/2002	0.022	0.043	0.008	0.018	0.001	0.012	0.014	0.025	0.007	0.006
		10/27/2002	0.019	0.028	0.007	0.019	0.011	0.002	0.012	0.009	0.000	0.017
		11/03/2002	0.019	0.022	0.009	0.012	0.010	0.007	0.010	0.010	0.000	0.006
		11/10/2002	0.028	0.030	0.011	0.018	0.011	0.005	0.017	0.012	0.000	0.013
		11/17/2002	0.014	0.022	0.005	0.015	0.001	0.003	0.009	0.006	0.004	0.012
		11/24/2002	0.014	0.020	0.006	0.012	0.001	0.005	0.008	0.009	0.005	0.007
		12/01/2002	0.013	0.019	0.016	0.014	0.002	0.005	0.000	0.005	0.014	0.010
		12/08/2002	0.020	0.023	0.007	0.014	0.012	0.007	0.013	0.009	0.000	0.009
		12/15/2002	0.012	0.024	0.006	0.012	0.002	0.003	0.006	0.012	0.004	0.010
LIME-HIGH	Weekly	08/25/2002	0.023	0.035	0.007	0.016	0.002	0.002	0.016	0.020	0.005	0.014
		09/01/2002	0.040	0.043	0.011	0.023	0.008	0.003	0.030	0.020	0.000	0.022
		09/08/2002	0.017	0.047	0.011	0.031	0.009	0.004	0.006	0.016	0.000	0.029
		09/15/2002	0.026	0.055	0.007	0.028	0.002	0.002	0.018	0.026	0.005	0.026
		09/22/2002	0.019	0.054	0.012	0.032	0.010	0.006	0.008	0.022	0.000	0.025
		09/29/2002	0.016	0.051	0.007	0.036	0.001	0.002	0.009	0.016	0.006	0.034
		10/06/2002	0.016	0.053	0.009	0.035	0.008	0.005	0.007	0.019	0.001	0.030
		10/13/2002	0.021	0.065	0.019	0.035	0.002	0.006	0.002	0.030	0.017	0.030
		10/20/2002	0.022	0.063	0.008	0.031	0.001	0.004	0.014	0.032	0.007	0.027
		10/27/2002	0.019	0.105	0.007	0.033	0.011	0.002	0.012	0.072	0.000	0.031
		11/03/2002	0.019	0.058	0.009	0.023	0.010	0.007	0.010	0.035	0.000	0.016
		11/10/2002	0.028	0.041	0.011	0.027	0.011	0.006	0.017	0.014	0.000	0.022
		11/17/2002	0.014	0.050	0.005	0.027	0.001	0.006	0.009	0.023	0.004	0.021
		11/24/2002	0.014	0.031	0.006	0.020	0.001	0.008	0.008	0.011	0.005	0.013
		12/01/2002	0.013	0.078	0.016	0.028	0.002	0.006	0.000	0.051	0.014	0.022
		12/08/2002	0.020	0.041	0.007	0.017	0.012	0.010	0.013	0.024	0.000	0.007
		12/15/2002	0.012	0.040	0.006	0.020	0.002	0.014	0.006	0.020	0.004	0.006

Appendix B-2

Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

Tanks In Batch Mode until 10/22/02

			TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
LIME-LOW	Weekly	08/25/2002	0.023	0.039	0.007	0.018	0.002	0.002	0.016	0.021	0.005	0.016
		09/01/2002	0.040	0.044	0.011	0.021	0.008	0.007	0.030	0.023	0.000	0.019
		09/08/2002	0.017	0.044	0.011	0.025	0.009	0.003	0.006	0.019	0.000	0.024
		09/15/2002	0.026	0.044	0.007	0.020	0.002	0.002	0.018	0.027	0.005	0.018
		09/22/2002	0.019	0.045	0.012	0.022	0.010	0.005	0.008	0.023	0.000	0.015
		09/29/2002	0.016	0.038	0.007	0.022	0.001	0.004	0.009	0.016	0.006	0.018
		10/06/2002	0.016	0.042	0.009	0.017	0.008	0.006	0.007	0.025	0.001	0.011
		10/13/2002	0.021	0.051	0.019	0.026	0.002	0.002	0.002	0.026	0.017	0.024
		10/20/2002	0.022	0.044	0.008	0.015	0.001	0.009	0.014	0.030	0.007	0.006
		10/27/2002	0.019	0.039	0.007	0.019	0.011	0.005	0.012	0.020	0.000	0.014
		11/03/2002	0.019	0.035	0.009	0.014	0.010	0.006	0.010	0.021	0.000	0.008
		11/10/2002	0.028	0.021	0.011	0.013	0.011	0.004	0.017	0.008	0.000	0.009
		11/17/2002	0.014	0.029	0.005	0.017	0.001	0.006	0.009	0.012	0.004	0.011
		11/24/2002	0.014	0.024	0.006	0.013	0.001	0.005	0.008	0.011	0.005	0.008
		12/01/2002	0.013	0.025	0.016	0.017	0.002	0.003	0.000	0.008	0.014	0.014
		12/08/2002	0.020	0.023	0.007	0.014	0.012	0.006	0.013	0.009	0.000	0.008
		12/15/2002	0.012	0.022	0.006	0.015	0.002	0.005	0.006	0.007	0.004	0.010
PACL-HIGH	Weekly	08/25/2002	0.023	0.040	0.007	0.010	0.002	0.001	0.016	0.030	0.005	0.009
		09/01/2002	0.040	0.019	0.011	0.010	0.008	0.005	0.030	0.010	0.000	0.005
		09/08/2002	0.017	0.026	0.011	0.013	0.009	0.004	0.006	0.013	0.000	0.009
		09/15/2002	0.026	0.033	0.007	0.010	0.002	0.001	0.018	0.026	0.005	0.009
		09/22/2002	0.019	0.024	0.012	0.014	0.010	0.005	0.008	0.010	0.000	0.008
		09/29/2002	0.016	0.022	0.007	0.014	0.001	0.005	0.009	0.009	0.006	0.009
		10/06/2002	0.016	0.023	0.009	0.011	0.008	0.006	0.007	0.012	0.001	0.005
		10/13/2002	0.021	0.033	0.019	0.016	0.002	0.003	0.002	0.017	0.017	0.013
		10/20/2002	0.022	0.029	0.008	0.017	0.001	0.002	0.014	0.012	0.007	0.015
		10/27/2002	0.019	0.032	0.007	0.015	0.011	0.006	0.012	0.018	0.000	0.009
		11/03/2002	0.019	0.032	0.009	0.017	0.010	0.012	0.010	0.016	0.000	0.005
		11/10/2002	0.028	0.023	0.011	0.021	0.011	0.004	0.017	0.003	0.000	0.017
		11/17/2002	0.014	0.028	0.005	0.022	0.001	0.004	0.009	0.006	0.004	0.018
		11/24/2002	0.014	0.022	0.006	0.014	0.001	0.004	0.008	0.008	0.005	0.011
		12/01/2002	0.013	0.027	0.016	0.019	0.002	0.003	0.000	0.008	0.014	0.016
		12/08/2002	0.020	0.026	0.007	0.016	0.012	0.008	0.013	0.011	0.000	0.009
		12/15/2002	0.012	0.024	0.006	0.014	0.002	0.004	0.006	0.010	0.004	0.010
PACL-LOW	Weekly	08/25/2002	0.023	0.029	0.007	0.010	0.002	0.003	0.016	0.019	0.005	0.008
		09/01/2002	0.040	0.023	0.011	0.011	0.008	0.005	0.030	0.013	0.000	0.003
		09/08/2002	0.017	0.023	0.011	0.012	0.009	0.003	0.006	0.011	0.000	0.010
		09/15/2002	0.026	0.029	0.007	0.012	0.002	0.002	0.018	0.022	0.005	0.010
		09/22/2002	0.019	0.025	0.012	0.014	0.010	0.005	0.008	0.011	0.000	0.008
		09/29/2002	0.016	0.023	0.007	0.019	0.001	0.001	0.009	0.006	0.006	0.018
		10/06/2002	0.016	0.021	0.009	0.011	0.008	0.004	0.007	0.010	0.001	0.007
		10/13/2002	0.021	0.025	0.019	0.017	0.002	0.005	0.002	0.008	0.017	0.012
		10/20/2002	0.022	0.026	0.008	0.017	0.001	0.007	0.014	0.010	0.007	0.010
		10/27/2002	0.019	0.062	0.007	0.024	0.011	0.007	0.012	0.039	0.000	0.017
		11/03/2002	0.019	0.036	0.009	0.016	0.010	0.010	0.010	0.020	0.000	0.007
		11/10/2002	0.028	0.035	0.011	0.023	0.011	0.004	0.017	0.013	0.000	0.019
		11/17/2002	0.014	0.030	0.005	0.033	0.001	0.022	0.009	0.010	0.004	0.011
		11/24/2002	0.014	0.033	0.006	0.017	0.001	0.010	0.008	0.016	0.005	0.007
		12/01/2002	0.013	0.033	0.016	0.023	0.002	0.010	0.000	0.010	0.014	0.013
		12/08/2002	0.020	0.024	0.007	0.014	0.012	0.004	0.013	0.010	0.000	0.010
		12/15/2002	0.012	0.017	0.006	0.012	0.002	0.009	0.006	0.005	0.004	0.004
CONTROL	Monthly	Aug-02	0.023	0.030	0.007	0.011	0.002	0.003	0.016	0.020	0.005	0.008
		Sep-02	0.025	0.026	0.010	0.014	0.007	0.003	0.015	0.013	0.001	0.009
		Oct-02	0.019	0.043	0.010	0.015	0.005	0.004	0.009	0.028	0.006	0.011
		Nov-02	0.019	0.032	0.008	0.018	0.006	0.006	0.011	0.014	0.002	0.012
		Dec-02	0.015	0.033	0.010	0.013	0.005	0.006	0.006	0.020	0.006	0.008
FECL3-HIGH	Monthly	Aug-02	0.023	0.027	0.007	0.010	0.002	0.002	0.016	0.018	0.005	0.008
		Sep-02	0.025	0.023	0.010	0.012	0.007	0.002	0.015	0.011	0.001	0.009
		Oct-02	0.019	0.032	0.010	0.017	0.005	0.004	0.009	0.015	0.006	0.013
		Nov-02	0.019	0.031	0.008	0.020	0.006	0.007	0.011	0.011	0.002	0.013
		Dec-02	0.015	0.025	0.010	0.017	0.005	0.005	0.006	0.009	0.006	0.012

Appendix B-2

Summary of Phosphorus Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

Tanks In Batch Mode until 10/22/02

			TP (mg/L)		TDP (mg/L)		SRP (mg/L)		TPP (mg/L)		DOP (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
FECL3-LOW	Monthly	Aug-02	0.023	0.031	0.007	0.010	0.002	0.002	0.016	0.021	0.005	0.008
		Sep-02	0.025	0.027	0.010	0.013	0.007	0.003	0.015	0.014	0.001	0.008
		Oct-02	0.019	0.031	0.010	0.018	0.005	0.005	0.009	0.013	0.006	0.013
		Nov-02	0.019	0.023	0.008	0.014	0.006	0.005	0.011	0.009	0.002	0.009
		Dec-02	0.015	0.022	0.010	0.013	0.005	0.005	0.006	0.008	0.006	0.009
LIME-HIGH	Monthly	Aug-02	0.023	0.035	0.007	0.016	0.002	0.002	0.016	0.020	0.005	0.014
		Sep-02	0.025	0.050	0.010	0.029	0.007	0.004	0.015	0.020	0.001	0.025
		Oct-02	0.019	0.067	0.010	0.034	0.005	0.003	0.009	0.034	0.006	0.030
		Nov-02	0.019	0.045	0.008	0.024	0.006	0.006	0.011	0.021	0.002	0.018
		Dec-02	0.015	0.053	0.010	0.021	0.005	0.010	0.006	0.032	0.006	0.012
LIME-LOW	Monthly	Aug-02	0.023	0.039	0.007	0.018	0.002	0.002	0.016	0.021	0.005	0.016
		Sep-02	0.025	0.044	0.010	0.022	0.007	0.004	0.015	0.022	0.001	0.019
		Oct-02	0.019	0.043	0.010	0.020	0.005	0.005	0.009	0.023	0.006	0.014
		Nov-02	0.019	0.027	0.008	0.014	0.006	0.005	0.011	0.013	0.002	0.009
		Dec-02	0.015	0.023	0.010	0.015	0.005	0.004	0.006	0.008	0.006	0.011
PACL-HIGH	Monthly	Aug-02	0.023	0.040	0.007	0.010	0.002	0.001	0.016	0.030	0.005	0.009
		Sep-02	0.025	0.025	0.010	0.012	0.007	0.004	0.015	0.013	0.001	0.008
		Oct-02	0.019	0.028	0.010	0.014	0.005	0.004	0.009	0.013	0.006	0.010
		Nov-02	0.019	0.026	0.008	0.018	0.006	0.006	0.011	0.008	0.002	0.013
		Dec-02	0.015	0.026	0.010	0.016	0.005	0.005	0.006	0.009	0.006	0.012
PACL-LOW	Monthly	Aug-02	0.023	0.029	0.007	0.010	0.002	0.003	0.016	0.019	0.005	0.008
		Sep-02	0.025	0.025	0.010	0.012	0.007	0.003	0.015	0.013	0.001	0.008
		Oct-02	0.019	0.031	0.010	0.017	0.005	0.005	0.009	0.014	0.006	0.013
		Nov-02	0.019	0.033	0.008	0.022	0.006	0.011	0.011	0.015	0.002	0.011
		Dec-02	0.015	0.025	0.010	0.016	0.005	0.008	0.006	0.008	0.006	0.009
CONTROL	Quarterly	2002-3	0.025	0.027	0.010	0.013	0.006	0.003	0.015	0.014	0.002	0.009
		2002-4	0.018	0.037	0.009	0.016	0.005	0.005	0.009	0.021	0.005	0.011
FECL3-HIGH	Quarterly	2002-3	0.025	0.023	0.010	0.011	0.006	0.002	0.015	0.012	0.002	0.009
		2002-4	0.018	0.030	0.009	0.018	0.005	0.005	0.009	0.012	0.005	0.013
FECL3-LOW	Quarterly	2002-3	0.025	0.028	0.010	0.012	0.006	0.003	0.015	0.015	0.002	0.008
		2002-4	0.018	0.026	0.009	0.015	0.005	0.005	0.009	0.011	0.005	0.011
LIME-HIGH	Quarterly	2002-3	0.025	0.048	0.010	0.027	0.006	0.003	0.015	0.020	0.002	0.023
		2002-4	0.018	0.056	0.009	0.027	0.005	0.006	0.009	0.029	0.005	0.021
LIME-LOW	Quarterly	2002-3	0.025	0.044	0.010	0.021	0.006	0.004	0.015	0.022	0.002	0.018
		2002-4	0.018	0.032	0.009	0.017	0.005	0.005	0.009	0.016	0.005	0.012
PACL-HIGH	Quarterly	2002-3	0.025	0.027	0.010	0.012	0.006	0.003	0.015	0.015	0.002	0.008
		2002-4	0.018	0.027	0.009	0.016	0.005	0.005	0.009	0.011	0.005	0.011
PACL-LOW	Quarterly	2002-3	0.025	0.026	0.010	0.012	0.006	0.003	0.015	0.014	0.002	0.008
		2002-4	0.018	0.030	0.009	0.019	0.005	0.007	0.009	0.013	0.005	0.011
CONTROL	LongTerm	POR	0.021	0.033	0.009	0.015	0.005	0.005	0.011	0.018	0.004	0.010
FECL3-HIGH	LongTerm	POR	0.021	0.027	0.009	0.015	0.005	0.004	0.011	0.012	0.004	0.012
FECL3-LOW	LongTerm	POR	0.021	0.027	0.009	0.014	0.005	0.004	0.011	0.012	0.004	0.010
LIME-HIGH	LongTerm	POR	0.021	0.053	0.009	0.027	0.005	0.005	0.011	0.025	0.004	0.022
LIME-LOW	LongTerm	POR	0.021	0.037	0.009	0.019	0.005	0.005	0.011	0.018	0.004	0.013
PACL-HIGH	LongTerm	POR	0.021	0.027	0.009	0.014	0.005	0.004	0.011	0.012	0.004	0.010
PACL-LOW	LongTerm	POR	0.021	0.028	0.009	0.016	0.005	0.006	0.011	0.013	0.004	0.010

Appendix B-3

Summary of Nitrogen Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TN (mg/L)		TKN (mg/L)		NO_2NO_3 (mg/L)		NH_3 (mg/L)		OrgN (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL A	SA-6	Monthly	Aug-02	2.46	2.70	2.46	2.70	0.10	0.10	0.05	0.05	2.41	2.65
			Sep-02	2.15	2.33	2.13	2.29	0.10	0.10	0.15	0.05	1.98	2.24
			Oct-02	1.64	3.61	1.61	3.60	0.10	0.10	0.11	0.09	1.50	3.51
			Nov-02	1.28	2.37	1.25	2.35	0.10	0.10	0.14	0.14	1.11	2.21
			Dec-02	1.21	1.65	1.18	1.62	0.10	0.10	0.17	0.16	1.01	1.46
CONTROL B	SA-11	Monthly	Aug-02	2.46	3.25	2.46	2.70	0.10	0.56	0.05	0.05	2.41	2.65
			Sep-02	2.15	2.21	2.13	2.19	0.10	0.10	0.15	0.10	1.98	2.09
			Oct-02	1.64	3.13	1.61	3.09	0.10	0.10	0.11	0.10	1.50	2.99
			Nov-02	1.28	1.98	1.25	1.95	0.10	0.10	0.14	0.21	1.11	1.74
			Dec-02	1.21	1.53	1.18	1.53	0.10	0.10	0.17	0.13	1.01	1.40
FECL3-HIGH-A	SA-2	Monthly	Aug-02	2.46	3.30	2.46	3.25	0.10	0.10	0.05	0.05	2.41	3.20
			Sep-02	2.15	1.77	2.13	7.15	0.10	0.10	0.15	0.11	1.98	7.05
			Oct-02	1.64	2.69	1.61	2.66	0.10	0.10	0.11	0.09	1.50	2.57
			Nov-02	1.28	2.56	1.25	2.53	0.10	0.10	0.14	0.17	1.11	2.36
			Dec-02	1.21	2.05	1.18	2.03	0.10	0.10	0.17	0.19	1.01	1.84
FECL3-HIGH-B	SA-9	Monthly	Aug-02	2.46	2.28	2.46	2.28	0.10	0.10	0.05	0.05	2.41	2.23
			Sep-02	2.15	1.83	2.13	1.81	0.10	0.10	0.15	0.05	1.98	1.76
			Oct-02	1.64	2.37	1.61	2.32	0.10	0.10	0.11	0.10	1.50	2.23
			Nov-02	1.28	1.88	1.25	1.86	0.10	0.10	0.14	0.18	1.11	1.69
			Dec-02	1.21	2.25	1.18	2.23	0.10	0.10	0.17	0.13	1.01	2.10
FECL3-LOW-A	SA-8	Monthly	Aug-02	2.46	3.32	2.46	3.04	0.10	0.28	0.05	0.05	2.41	2.99
			Sep-02	2.15	1.90	2.13	1.89	0.10	0.10	0.15	0.10	1.98	1.79
			Oct-02	1.64	2.76	1.61	2.74	0.10	0.10	0.11	0.09	1.50	2.65
			Nov-02	1.28	1.93	1.25	1.92	0.10	0.10	0.14	0.15	1.11	1.77
			Dec-02	1.21	1.70	1.18	1.68	0.10	0.10	0.17	0.15	1.01	1.54
FECL3-LOW-B	SA-13	Monthly	Aug-02	2.46	3.52	2.46	3.52	0.10	0.10	0.05	0.05	2.41	3.47
			Sep-02	2.15	2.11	2.13	2.09	0.10	0.10	0.15	0.05	1.98	2.04
			Oct-02	1.64	2.98	1.61	2.94	0.10	0.10	0.11	0.10	1.50	2.84
			Nov-02	1.28	2.24	1.25	2.22	0.10	0.10	0.14	0.17	1.11	2.05
			Dec-02	1.21	2.00	1.18	1.99	0.10	0.10	0.17	0.13	1.01	1.86
LIME-HIGH-A	SA-4	Monthly	Aug-02	2.46	4.31	2.46	4.27	0.10	0.10	0.05	0.80	2.41	3.47
			Sep-02	2.15	4.98	2.13	4.81	0.10	0.10	0.15	0.58	1.98	4.23
			Oct-02	1.64	7.40	1.61	7.37	0.10	0.10	0.11	0.22	1.50	7.15
			Nov-02	1.28	5.02	1.25	4.89	0.10	0.10	0.14	0.56	1.11	4.33
			Dec-02	1.21	3.91	1.18	3.88	0.10	0.10	0.17	0.14	1.01	3.74
LIME-HIGH-B	SA-10	Monthly	Aug-02	2.46	4.78	2.46	4.69	0.10	0.10	0.05	0.39	2.41	4.30
			Sep-02	2.15	3.60	2.13	3.46	0.10	0.10	0.15	0.16	1.98	3.30
			Oct-02	1.64	5.49	1.61	5.47	0.10	0.10	0.11	0.14	1.50	5.33
			Nov-02	1.28	3.33	1.25	3.18	0.10	0.10	0.14	0.27	1.11	2.91
			Dec-02	1.21	2.01	1.18	2.01	0.10	0.10	0.17	0.15	1.01	1.86
LIME-LOW-A	SA-14	Monthly	Aug-02	2.46	4.03	2.46	3.97	0.10	0.10	0.05	0.05	2.41	3.92
			Sep-02	2.15	2.85	2.13	2.84	0.10	0.10	0.15	0.11	1.98	2.73
			Oct-02	1.64	4.14	1.61	4.12	0.10	0.10	0.11	0.10	1.50	4.02
			Nov-02	1.28	2.54	1.25	2.52	0.10	0.10	0.14	0.15	1.11	2.37
			Dec-02	1.21	1.27	1.18	1.25	0.10	0.10	0.17	0.13	1.01	1.12
LIME-LOW-B	SA-7	Monthly	Aug-02	2.46	3.82	2.46	3.82	0.10	0.10	0.05	0.11	2.41	3.71
			Sep-02	2.15	2.95	2.13	2.85	0.10	0.10	0.15	0.12	1.98	2.74
			Oct-02	1.64	4.14	1.61	4.12	0.10	0.10	0.11	0.10	1.50	4.02
			Nov-02	1.28	2.16	1.25	1.97	0.10	0.10	0.14	0.16	1.11	1.81
			Dec-02	1.21	2.09	1.18	2.07	0.10	0.10	0.17	0.16	1.01	1.91
PACL-HIGH-A	SA-1	Monthly	Aug-02	2.46	4.00	2.46	3.68	0.10	0.32	0.05	0.14	2.41	3.54
			Sep-02	2.15	0.50	2.13	0.50	0.10	0.10	0.15	0.15	1.98	0.35
			Oct-02	1.64	2.55	1.61	2.53	0.10	0.10	0.11	0.09	1.50	2.44
			Nov-02	1.28	2.00	1.25	1.97	0.10	0.10	0.14	0.18	1.11	1.80
			Dec-02	1.21	2.06	1.18	2.04	0.10	0.10	0.17	0.16	1.01	1.88
PACL-HIGH-B	SA-3	Monthly	Aug-02	2.46	2.77	2.46	2.72	0.10	0.10	0.05	0.10	2.41	2.62
			Sep-02	2.15	2.17	2.13	2.13	0.10	0.10	0.15	0.11	1.98	2.03
			Oct-02	1.64	2.69	1.61	2.66	0.10	0.10	0.11	0.10	1.50	2.56
			Nov-02	1.28	1.83	1.25	1.81	0.10	0.10	0.14	0.17	1.11	1.64
			Dec-02	1.21	1.83	1.18	1.81	0.10	0.10	0.17	0.14	1.01	1.66

Appendix B-3

Summary of Nitrogen Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TN (mg/L)		TKN (mg/L)		NO_2NO_3 (mg/L)		NH_3 (mg/L)		OrgN (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
PACL-LOW-A	SA-5	Monthly	Aug-02	2.46	3.01	2.46	3.01	0.10	0.10	0.05	0.10	2.41	2.91
			Sep-02	2.15	2.63	2.13	2.60	0.10	0.10	0.15	0.12	1.98	2.48
			Oct-02	1.64	3.49	1.61	3.46	0.10	0.10	0.11	0.10	1.50	3.36
			Nov-02	1.28	2.27	1.25	2.24	0.10	0.10	0.14	0.19	1.11	2.05
			Dec-02	1.21	1.82	1.18	1.80	0.10	0.10	0.17	0.17	1.01	1.63
PACL-LOW-B	SA-12	Monthly	Aug-02	2.46	3.23	2.46	3.01	0.10	0.22	0.05	0.05	2.41	2.96
			Sep-02	2.15	1.86	2.13	1.81	0.10	0.10	0.15	0.10	1.98	1.71
			Oct-02	1.64	2.18	1.61	2.16	0.10	0.10	0.11	0.10	1.50	2.06
			Nov-02	1.28	2.61	1.25	2.59	0.10	0.10	0.14	0.15	1.11	2.44
			Dec-02	1.21	1.44	1.18	1.42	0.10	0.10	0.17	0.14	1.01	1.29
CONTROL A	SA-6	Quarterly	2002-3	2.31	2.52	2.30	2.50	0.10	0.10	0.10	0.05	2.20	2.45
			2002-4	1.38	2.54	1.35	2.52	0.10	0.10	0.14	0.13	1.21	2.39
CONTROL B	SA-11	Quarterly	2002-3	2.31	2.73	2.30	2.45	0.10	0.33	0.10	0.08	2.20	2.37
			2002-4	1.38	2.21	1.35	2.19	0.10	0.10	0.14	0.15	1.21	2.04
FECL3-HIGH-A	SA-2	Quarterly	2002-3	2.31	2.54	2.30	5.20	0.10	0.10	0.10	0.08	2.20	5.12
			2002-4	1.38	2.43	1.35	2.41	0.10	0.10	0.14	0.15	1.21	2.26
FECL3-HIGH-B	SA-9	Quarterly	2002-3	2.31	2.06	2.30	2.05	0.10	0.10	0.10	0.05	2.20	2.00
			2002-4	1.38	2.17	1.35	2.14	0.10	0.10	0.14	0.13	1.21	2.00
FECL3-LOW-A	SA-8	Quarterly	2002-3	2.31	2.61	2.30	2.47	0.10	0.19	0.10	0.08	2.20	2.39
			2002-4	1.38	2.13	1.35	2.11	0.10	0.10	0.14	0.13	1.21	1.98
FECL3-LOW-B	SA-13	Quarterly	2002-3	2.31	2.81	2.30	2.80	0.10	0.10	0.10	0.05	2.20	2.75
			2002-4	1.38	2.41	1.35	2.38	0.10	0.10	0.14	0.13	1.21	2.25
LIME-HIGH-A	SA-4	Quarterly	2002-3	2.31	4.65	2.30	4.54	0.10	0.10	0.10	0.69	2.20	3.85
			2002-4	1.38	5.44	1.35	5.38	0.10	0.10	0.14	0.31	1.21	5.07
LIME-HIGH-B	SA-10	Quarterly	2002-3	2.31	4.19	2.30	4.08	0.10	0.10	0.10	0.27	2.20	3.80
			2002-4	1.38	3.61	1.35	3.55	0.10	0.10	0.14	0.19	1.21	3.36
LIME-LOW-A	SA-14	Quarterly	2002-3	2.31	3.44	2.30	3.41	0.10	0.10	0.10	0.08	2.20	3.33
			2002-4	1.38	2.65	1.35	2.63	0.10	0.10	0.14	0.13	1.21	2.50
LIME-LOW-B	SA-7	Quarterly	2002-3	2.31	3.39	2.30	3.34	0.10	0.10	0.10	0.11	2.20	3.22
			2002-4	1.38	2.80	1.35	2.72	0.10	0.10	0.14	0.14	1.21	2.58
PACL-HIGH-A	SA-1	Quarterly	2002-3	2.31	2.25	2.30	2.09	0.10	0.21	0.10	0.15	2.20	1.95
			2002-4	1.38	2.20	1.35	2.18	0.10	0.10	0.14	0.14	1.21	2.04
PACL-HIGH-B	SA-3	Quarterly	2002-3	2.31	2.47	2.30	2.43	0.10	0.10	0.10	0.10	2.20	2.32
			2002-4	1.38	2.12	1.35	2.09	0.10	0.10	0.14	0.14	1.21	1.95
PACL-LOW-A	SA-5	Quarterly	2002-3	2.31	2.82	2.30	2.81	0.10	0.10	0.10	0.11	2.20	2.69
			2002-4	1.38	2.53	1.35	2.50	0.10	0.10	0.14	0.16	1.21	2.35
PACL-LOW-B	SA-12	Quarterly	2002-3	2.31	2.55	2.30	2.41	0.10	0.16	0.10	0.08	2.20	2.33
			2002-4	1.38	2.08	1.35	2.06	0.10	0.10	0.14	0.13	1.21	1.93
CONTROL A	SA-6	LongTerm	POR	1.75	2.53	1.73	2.51	0.10	0.10	0.12	0.10	1.60	2.41
CONTROL B	SA-11	LongTerm	POR	1.75	2.42	1.73	2.29	0.10	0.19	0.12	0.12	1.60	2.17
FECL3-HIGH-A	SA-2	LongTerm	POR	1.75	2.47	1.73	3.52	0.10	0.10	0.12	0.12	1.60	3.40
FECL3-HIGH-B	SA-9	LongTerm	POR	1.75	2.12	1.73	2.10	0.10	0.10	0.12	0.10	1.60	2.00
FECL3-LOW-A	SA-8	LongTerm	POR	1.75	2.32	1.73	2.25	0.10	0.14	0.12	0.11	1.60	2.15
FECL3-LOW-B	SA-13	LongTerm	POR	1.75	2.57	1.73	2.55	0.10	0.10	0.12	0.10	1.60	2.45
LIME-HIGH-A	SA-4	LongTerm	POR	1.75	5.12	1.73	5.04	0.10	0.10	0.12	0.46	1.60	4.58
LIME-HIGH-B	SA-10	LongTerm	POR	1.75	3.84	1.73	3.76	0.10	0.10	0.12	0.22	1.60	3.54
LIME-LOW-A	SA-14	LongTerm	POR	1.75	2.97	1.73	2.94	0.10	0.10	0.12	0.11	1.60	2.83
LIME-LOW-B	SA-7	LongTerm	POR	1.75	3.03	1.73	2.97	0.10	0.10	0.12	0.13	1.60	2.84
PACL-HIGH-A	SA-1	LongTerm	POR	1.75	2.22	1.73	2.14	0.10	0.14	0.12	0.14	1.60	2.00
PACL-HIGH-B	SA-3	LongTerm	POR	1.75	2.26	1.73	2.23	0.10	0.10	0.12	0.12	1.60	2.10
PACL-LOW-A	SA-5	LongTerm	POR	1.75	2.64	1.73	2.62	0.10	0.10	0.12	0.14	1.60	2.48
PACL-LOW-B	SA-12	LongTerm	POR	1.75	2.26	1.73	2.20	0.10	0.12	0.12	0.11	1.60	2.09

Appendix B-4

Summary of Nitrogen Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

Tanks in Batch Mode until 10/22/02

			TN (mg/L)		TKN (mg/L)		NO_2NO_3 (mg/L)		NH_3 (mg/L)		OrgN (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL	Monthly	Aug-02	2.46	2.98	2.46	2.70	0.10	0.33	0.05	0.05	2.41	2.65
		Sep-02	2.15	2.27	2.13	2.24	0.10	0.10	0.15	0.08	1.98	2.16
		Oct-02	1.64	3.37	1.61	3.35	0.10	0.10	0.11	0.09	1.50	3.25
		Nov-02	1.28	2.18	1.25	2.15	0.10	0.10	0.14	0.18	1.11	1.97
		Dec-02	1.21	1.59	1.18	1.58	0.10	0.10	0.17	0.15	1.01	1.43
FECL3-HIGH	Monthly	Aug-02	2.46	2.79	2.46	2.77	0.10	0.10	0.05	0.05	2.41	2.72
		Sep-02	2.15	1.80	2.13	4.48	0.10	0.10	0.15	0.08	1.98	4.40
		Oct-02	1.64	2.53	1.61	2.49	0.10	0.10	0.11	0.09	1.50	2.40
		Nov-02	1.28	2.22	1.25	2.20	0.10	0.10	0.14	0.17	1.11	2.02
		Dec-02	1.21	2.15	1.18	2.13	0.10	0.10	0.17	0.16	1.01	1.97
FECL3-LOW	Monthly	Aug-02	2.46	3.42	2.46	3.28	0.10	0.19	0.05	0.05	2.41	3.23
		Sep-02	2.15	2.00	2.13	1.99	0.10	0.10	0.15	0.08	1.98	1.91
		Oct-02	1.64	2.87	1.61	2.84	0.10	0.10	0.11	0.09	1.50	2.75
		Nov-02	1.28	2.09	1.25	2.07	0.10	0.10	0.14	0.16	1.11	1.91
		Dec-02	1.21	1.85	1.18	1.84	0.10	0.10	0.17	0.14	1.01	1.70
LIME-HIGH	Monthly	Aug-02	2.46	4.55	2.46	4.48	0.10	0.10	0.05	0.59	2.41	3.89
		Sep-02	2.15	4.29	2.13	4.14	0.10	0.10	0.15	0.37	1.98	3.77
		Oct-02	1.64	6.45	1.61	6.42	0.10	0.10	0.11	0.18	1.50	6.24
		Nov-02	1.28	4.18	1.25	4.04	0.10	0.10	0.14	0.42	1.11	3.62
		Dec-02	1.21	2.96	1.18	2.95	0.10	0.10	0.17	0.15	1.01	2.80
LIME-LOW	Monthly	Aug-02	2.46	3.93	2.46	3.90	0.10	0.10	0.05	0.08	2.41	3.81
		Sep-02	2.15	2.90	2.13	2.85	0.10	0.10	0.15	0.11	1.98	2.73
		Oct-02	1.64	4.14	1.61	4.12	0.10	0.10	0.11	0.10	1.50	4.02
		Nov-02	1.28	2.35	1.25	2.25	0.10	0.10	0.14	0.15	1.11	2.09
		Dec-02	1.21	1.68	1.18	1.66	0.10	0.10	0.17	0.14	1.01	1.52
PACL-HIGH	Monthly	Aug-02	2.46	3.39	2.46	3.20	0.10	0.21	0.05	0.12	2.41	3.08
		Sep-02	2.15	1.34	2.13	1.32	0.10	0.10	0.15	0.13	1.98	1.19
		Oct-02	1.64	2.62	1.61	2.59	0.10	0.10	0.11	0.09	1.50	2.50
		Nov-02	1.28	1.92	1.25	1.89	0.10	0.10	0.14	0.17	1.11	1.72
		Dec-02	1.21	1.94	1.18	1.92	0.10	0.10	0.17	0.15	1.01	1.77
PACL-LOW	Monthly	Aug-02	2.46	3.12	2.46	3.01	0.10	0.16	0.05	0.08	2.41	2.93
		Sep-02	2.15	2.25	2.13	2.21	0.10	0.10	0.15	0.11	1.98	2.09
		Oct-02	1.64	2.84	1.61	2.81	0.10	0.10	0.11	0.10	1.50	2.71
		Nov-02	1.28	2.44	1.25	2.42	0.10	0.10	0.14	0.17	1.11	2.24
		Dec-02	1.21	1.63	1.18	1.61	0.10	0.10	0.17	0.15	1.01	1.46
CONTROL	Quarterly	2002-3	2.31	2.62	2.30	2.47	0.10	0.22	0.10	0.06	2.20	2.41
		2002-4	1.38	2.38	1.35	2.36	0.10	0.10	0.14	0.14	1.21	2.22
FECL3-HIGH	Quarterly	2002-3	2.31	2.30	2.30	3.62	0.10	0.10	0.10	0.06	2.20	3.56
		2002-4	1.38	2.30	1.35	2.27	0.10	0.10	0.14	0.14	1.21	2.13
FECL3-LOW	Quarterly	2002-3	2.31	2.71	2.30	2.63	0.10	0.15	0.10	0.06	2.20	2.57
		2002-4	1.38	2.27	1.35	2.25	0.10	0.10	0.14	0.13	1.21	2.12
LIME-HIGH	Quarterly	2002-3	2.31	4.42	2.30	4.31	0.10	0.10	0.10	0.48	2.20	3.83
		2002-4	1.38	4.53	1.35	4.47	0.10	0.10	0.14	0.25	1.21	4.22
LIME-LOW	Quarterly	2002-3	2.31	3.41	2.30	3.37	0.10	0.10	0.10	0.10	2.20	3.27
		2002-4	1.38	2.72	1.35	2.68	0.10	0.10	0.14	0.13	1.21	2.54
PACL-HIGH	Quarterly	2002-3	2.31	2.36	2.30	2.26	0.10	0.15	0.10	0.12	2.20	2.13
		2002-4	1.38	2.16	1.35	2.14	0.10	0.10	0.14	0.14	1.21	2.00
PACL-LOW	Quarterly	2002-3	2.31	2.68	2.30	2.61	0.10	0.13	0.10	0.09	2.20	2.51
		2002-4	1.38	2.30	1.35	2.28	0.10	0.10	0.14	0.14	1.21	2.14
CONTROL	LongTerm	POR	1.75	2.48	1.73	2.40	0.10	0.15	0.12	0.11	1.60	2.29
FECL3-HIGH	LongTerm	POR	1.75	2.30	1.73	2.81	0.10	0.10	0.12	0.11	1.60	2.70
FECL3-LOW	LongTerm	POR	1.75	2.45	1.73	2.40	0.10	0.12	0.12	0.10	1.60	2.30
LIME-HIGH	LongTerm	POR	1.75	4.48	1.73	4.40	0.10	0.10	0.12	0.34	1.60	4.06
LIME-LOW	LongTerm	POR	1.75	3.00	1.73	2.95	0.10	0.10	0.12	0.12	1.60	2.83
PACL-HIGH	LongTerm	POR	1.75	2.24	1.73	2.18	0.10	0.12	0.12	0.13	1.60	2.05
PACL-LOW	LongTerm	POR	1.75	2.45	1.73	2.41	0.10	0.11	0.12	0.12	1.60	2.29

Appendix B-5

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL A	SA-6	Weekly	08/25/2002	2.50	2.50	103	126	320	315	331	273	0.113	0.111	0.050	0.156	1.080	1.340
			09/01/2002	1.00	2.75	88	95	327	288	186	165	0.489	0.267	0.489	0.322	0.256	0.300
			09/08/2002	2.50	2.50	81	112	325	340	199	199	0.025	0.025	0.025	0.156	0.211	0.333
			09/15/2002	1.00	5.00	53	125	290	348	165	174	0.025	0.025	0.025	3.220	0.178	0.489
			09/29/2002	1.00	6.67	34	90	205	325	182	165	0.025	0.025	0.025	0.025	0.133	0.300
			10/13/2002	2.50	24.00	63	95	320	275	211	223	0.025	0.025	0.156	0.133	0.133	0.289
			11/03/2002	5.50	3.00	90	62	245	155	223	285	0.025	0.025	0.025	0.144	0.133	0.133
			11/17/2002	2.50	2.00	70	49	250	138	199	236	0.025	0.100	0.025	0.111	0.200	0.156
			12/15/2002	1.00	1.00	92	35	288	153	165	215	0.250	0.025	0.025	0.025	0.278	0.122
			12/22/2002	1.00	6.00	73	42	258	168	182	240	0.025	0.025	0.025	0.025	0.200	0.167
CONTROL B	SA-11	Weekly	08/25/2002	2.50	2.50	103	130	320	320	331	273	0.113	0.050	0.050	0.050	1.080	1.320
			09/01/2002	1.00	1.00	88	101	327	273	186	174	0.489	0.244	0.489	0.522	0.256	0.267
			09/08/2002	2.50	2.50	81	117	325	320	199	165	0.025	0.056	0.025	0.444	0.211	0.444
			09/15/2002	1.00	3.00	53	115	290	335	165	186	0.025	0.025	0.025	0.089	0.178	0.378
			09/29/2002	1.00	2.25	34	98	205	308	182	223	0.025	0.025	0.025	0.025	0.133	0.222
			10/13/2002	2.50	5.33	63	107	320	308	211	261	0.025	0.025	0.156	0.025	0.133	0.244
			11/03/2002	5.50	4.75	90	110	245	233	223	285	0.025	0.067	0.025	0.267	0.133	0.222
			11/17/2002	2.50	4.50	70	80	250	193	199	248	0.025	0.025	0.025	0.056	0.200	0.222
			12/15/2002	1.00	1.00	92	32	288	200	165	190	0.250	0.025	0.025	0.025	0.278	0.100
			12/22/2002	1.00	17.50	73	--	258	218	182	248	0.025	0.025	0.025	--	0.200	--
FECL3-HIGH-A	SA-2	Weekly	08/25/2002	2.50	2.50	103	152	320	315	331	422	0.113	0.111	0.050	0.050	1.080	1.560
			09/01/2002	1.00	1.75	88	126	327	248	186	252	0.489	0.311	0.489	0.350	0.256	0.350
			09/08/2002	2.50	6.00	81	148	325	290	199	265	0.025	0.025	0.025	0.133	0.211	0.433
			09/15/2002	1.00	3.75	53	166	290	285	165	273	0.025	0.025	0.025	0.111	0.178	0.544
			09/29/2002	1.00	3.50	34	136	205	253	182	347	0.025	0.025	0.025	0.025	0.133	0.444
			10/13/2002	2.50	8.75	63	161	320	223	211	471	0.025	0.025	0.156	0.300	0.133	0.367
			11/03/2002	5.50	3.50	90	139	245	153	223	409	0.025	0.025	0.025	0.089	0.133	0.289
			11/17/2002	2.50	4.00	70	75	250	155	199	397	0.025	0.025	0.025	0.025	0.200	0.256
			12/15/2002	1.00	1.00	92	51	288	133	165	306	0.250	0.250	0.025	0.025	0.278	0.178
			12/22/2002	1.00	7.50	73	77	258	175	182	306	0.025	0.025	0.025	0.025	0.200	0.256
FECL3-HIGH-B	SA-9	Weekly	08/25/2002	2.50	2.50	103	147	320	300	331	414	0.113	0.050	0.050	0.278	1.080	1.510
			09/01/2002	1.00	4.00	88	125	327	253	186	223	0.489	0.244	0.489	6.160	0.256	0.467
			09/08/2002	2.50	2.50	81	148	325	293	199	245	0.025	0.213	0.025	0.450	0.211	0.473
			09/15/2002	1.00	1.00	53	157	290	308	165	285	0.025	0.025	0.025	0.089	0.178	0.478
			09/29/2002	1.00	2.75	34	126	205	245	182	339	0.025	0.311	0.025	0.322	0.133	0.389
			10/13/2002	2.50	5.00	63	166	320	233	211	385	0.025	0.025	0.156	0.025	0.133	0.367
			11/03/2002	5.50	5.25	90	143	245	178	223	323	0.025	0.067	0.025	0.167	0.133	0.300
			11/17/2002	2.50	9.50	70	118	250	168	199	347	0.025	0.025	0.025	0.056	0.200	0.344
			12/15/2002	1.00	1.00	92	70	288	205	165	306	0.250	0.025	0.025	0.025	0.278	0.233
			12/22/2002	1.00	3.00	73	93	258	200	182	248	0.025	0.025	0.025	0.025	0.200	0.289
FECL3-LOW-A	SA-8	Weekly	08/25/2002	2.50	2.50	103	133	320	310	331	265	0.113	0.500	0.050	1.560	1.080	1.420
			09/01/2002	1.00	1.00	88	106	327	263	186	215	0.489	0.256	0.489	0.278	0.256	0.344
			09/08/2002	2.50	2.50	81	120	325	330	199	215	0.025	0.122	0.025	0.122	0.211	0.367
			09/15/2002	1.00	3.25	53	136	290	315	165	223	0.025	0.025	0.025	0.233	0.178	0.456
			09/29/2002	1.00	7.78	34	114	205	299	182	224	0.025	0.578	0.025	1.122	0.133	0.367
			10/13/2002	2.50	7.25	63	115	320	275	211	285	0.025	0.025	0.156	0.025	0.133	0.267
			11/03/2002	5.50	3.25	90	62	245	168	223	248	0.025	0.025	0.025	0.211	0.133	0.144
			11/17/2002	2.50	17.30	70	51	250	148	199	273	0.025	0.025	0.025	0.056	0.200	0.167
			12/15/2002	1.00	1.00	92	30	288	160	165	174	0.250	0.025	0.025	0.025	0.278	0.100
			12/22/2002	1.00	11.50	73	41	258	185	182	240	0.025	0.025	0.025	0.025	0.200	0.156
FECL3-LOW-B	SA-13	Weekly	08/25/2002	2.50	2.50	103	142	320	310	331	306	0.113	0.050	0.050	0.467	1.080	1.570
			09/01/2002	1.00	2.50	88	98	327	255	186	199	0.489	0.244	0.489	2.780	0.256	0.311
			09/08/2002	2.50	2.50	81	109	325	280	199	240	0.025	0.025	0.025	0.189	0.211	0.322
			09/15/2002	1.00	3.75	53	126	290	289	165	230	0.025	0.057	0.025	0.434	0.178	0.444
			09/29/2002	1.00	4.00	34	114	205	285	182	265	0.025	0.025	0.025	0.222	0.133	0.311
			10/13/2002	2.50	2.50	63	95	320	203	211	298	0.025	0.025	0.156	0.025	0.133	0.289
			11/03/2002	5.50	6.50	90	77	245	163	223	298	0.025	0.025	0.025	0.100	0.133	0.156
			11/17/2002	2.50	3.63	70	48	250	109	199	249	0.025	0.038	0.025	0.025	0.200	0.133
			12/15/2002	1.00	1.00	92	30	288	123	165	248	0.250	0.025	0.025	0.078	0.278	0.111
			12/22/2002	1.00	3.00	73	47	258	130	182	273	0.025	0.025	0.025	0.025	0.200	0.211
LIME-HIGH-A	SA-4	Weekly	08/25/2002	2.50	2.50	103	105	320	257	331	257	0.113	0.050	0.050	0.050	1.080	1.105
			09/01/2002	1.00	1.00	88	62	327	150	186	141	0.489	0.244	0.489	0.289	0.256	0.244
			09/08/2002	2.50	2.50	81	69	325	158	199	182	0.025	0.144	0.025	0.267	0.211	0.278
			09/15/2002	1.00	6.00	53	71	290	163	165	174	0.025	0.025	0.025	0.167	0.178	0.322
			09/29/2002	1.00	16.00	34	59	205	153	182	207	0.025	0.025	0.025	0.025	0.133	0.256
			10/13/2002	2.50	11.50	63	75	320	163	211	248	0.025	0.025	0.156	0.025	0.133	0.222
			11/03/2002	5.50	15.50	90	145	245	240	223	298	0.025	0.233	0.025	0.356	0.133	0.356
			11/17/2002	2.50	9.00	70	105	250	223	199	223	0.025	0.122	0.025	0.311	0.200	0.411
			12/15/2002	1.00	1.00	92	65	288	193	165	215	0.250	0.250	0.025	0.056	0.278	0.256
			12/22/2002	1.00	5.00	73	90	258	235	182	240	0.025	0.025	0.025	0.025	0.200	0.333

Appendix B-5

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
LIME-HIGH-B	SA-10	Weekly	08/25/2002	2.50	2.50	103	124	320	305	331	256	0.113	0.050	0.050	0.050	1.080	1.280
			09/01/2002	1.00	1.00	88	86	327	208	186	174	0.489	0.200	0.489	1.960	0.256	0.367
			09/08/2002	2.50	2.50	81	92	325	248	199	165	0.025	0.025	0.025	0.722	0.211	0.289
			09/15/2002	1.00	3.00	53	94	290	218	165	186	0.025	0.025	0.025	0.078	0.178	0.344
			09/29/2002	1.00	1.00	34	60	205	168	182	215	0.025	0.025	0.025	0.025	0.133	0.233
			10/13/2002	2.50	2.50	63	90	320	210	211	248	0.025	0.025	0.156	0.025	0.133	0.233
			11/03/2002	5.50	4.63	90	120	245	249	223	261	0.025	0.025	0.025	0.067	0.133	0.228
			11/17/2002	2.50	6.00	70	105	250	230	199	248	0.025	0.025	0.025	0.056	0.200	0.311
			12/15/2002	1.00	1.00	92	44	288	248	165	199	0.250	0.025	0.025	0.025	0.278	0.144
			12/22/2002	1.00	4.50	73	95	258	245	182	240	0.025	0.025	0.025	0.211	0.200	0.478
LIME-LOW-A	SA-14	Weekly	08/25/2002	2.50	2.50	103	136	320	315	331	273	0.113	0.050	0.050	0.050	1.080	1.520
			09/01/2002	1.00	1.00	88	107	327	270	186	165	0.489	0.200	0.489	0.311	0.256	0.322
			09/08/2002	2.50	2.50	81	119	325	350	199	182	0.025	0.025	0.025	0.211	0.211	0.367
			09/15/2002	1.00	3.25	53	124	290	298	165	211	0.025	0.025	0.025	0.933	0.178	0.456
			09/29/2002	1.00	3.50	34	98	205	265	182	223	0.025	0.025	0.025	0.089	0.133	0.244
			10/13/2002	2.50	6.67	63	86	320	233	211	261	0.025	0.025	0.156	0.089	0.133	0.278
			11/03/2002	5.50	5.00	90	72	245	208	223	236	0.025	0.025	0.025	0.178	0.133	0.156
			11/17/2002	2.50	3.25	70	37	250	133	199	236	0.025	0.122	0.025	0.389	0.200	0.144
			12/15/2002	1.00	1.00	92	90	288	160	165	207	0.250	0.025	0.025	0.025	0.278	0.122
			12/22/2002	1.00	2.50	73	83	258	168	182	223	0.025	0.025	0.025	0.025	0.200	0.211
LIME-LOW-B	SA-7	Weekly	08/25/2002	2.50	6.50	103	135	320	310	331	314	0.113	0.050	0.050	0.311	1.080	1.480
			09/01/2002	1.00	2.75	88	97	327	258	186	174	0.489	0.278	0.489	0.556	0.256	0.311
			09/08/2002	2.50	2.50	81	114	325	310	199	182	0.025	0.025	0.025	0.144	0.211	0.333
			09/15/2002	1.00	5.00	53	124	290	298	165	199	0.025	0.025	0.025	0.678	0.178	0.444
			09/29/2002	1.00	5.50	34	82	205	268	182	199	0.025	0.025	0.025	0.122	0.133	0.311
			10/13/2002	2.50	13.00	63	103	320	290	211	273	0.025	0.025	0.156	0.078	0.133	0.278
			11/03/2002	5.50	10.50	90	156	245	318	223	273	0.025	0.356	0.025	0.978	0.133	0.522
			11/17/2002	2.50	10.00	70	115	250	278	199	248	0.025	0.178	0.025	0.422	0.200	0.433
			12/15/2002	1.00	1.00	92	71	288	260	165	223	0.250	0.025	0.025	0.078	0.278	0.311
			12/22/2002	1.00	2.50	73	91	258	300	182	248	0.025	0.025	0.025	0.025	0.200	0.300
PACL-HIGH-A	SA-1	Weekly	08/25/2002	2.50	2.50	103	138	320	323	331	414	0.113	0.050	0.050	0.050	1.080	1.390
			09/01/2002	1.00	1.00	88	109	327	258	186	215	0.489	0.511	0.489	0.511	0.256	0.344
			09/08/2002	2.50	2.50	81	129	325	323	199	240	0.025	0.025	0.025	0.444	0.211	0.367
			09/15/2002	1.00	10.00	53	119	290	280	165	248	0.025	0.278	0.025	0.389	0.178	0.367
			09/29/2002	1.00	5.00	34	108	205	258	182	281	0.025	0.178	0.025	0.267	0.133	0.344
			10/13/2002	2.50	6.25	63	132	320	219	211	329	0.025	0.046	0.156	1.596	0.133	0.384
			11/03/2002	5.50	4.75	90	102	245	148	223	323	0.025	0.433	0.025	0.489	0.133	0.211
			11/17/2002	2.50	3.25	70	75	250	140	199	285	0.025	0.244	0.025	0.256	0.200	0.200
			12/15/2002	1.00	1.00	92	50	288	143	165	215	0.250	0.250	0.025	0.156	0.278	0.167
			12/22/2002	1.00	1.00	73	71	258	163	182	314	0.025	0.025	0.025	0.056	0.200	0.211
PACL-HIGH-B	SA-3	Weekly	08/25/2002	2.50	2.50	103	140	320	330	331	323	0.113	0.050	0.050	0.278	1.080	1.390
			09/01/2002	1.00	1.00	88	108	327	265	186	199	0.489	0.489	0.489	0.489	0.256	0.300
			09/08/2002	2.50	5.00	81	130	325	305	199	273	0.025	0.025	0.025	0.467	0.211	0.389
			09/15/2002	1.00	5.25	53	141	290	310	165	248	0.025	0.222	0.025	0.456	0.178	0.467
			09/29/2002	1.00	7.50	34	109	205	272	182	290	0.025	0.122	0.025	0.333	0.133	0.367
			10/13/2002	2.50	5.00	63	119	320	228	211	310	0.025	0.025	0.156	0.156	0.133	0.289
			11/03/2002	5.50	2.50	90	56	245	168	223	273	0.025	0.067	0.025	0.189	0.133	0.111
			11/17/2002	2.50	3.75	70	25	250	120	199	248	0.025	0.025	0.025	0.025	0.200	0.133
			12/15/2002	1.00	1.00	92	65	288	132	165	225	0.250	0.138	0.025	0.096	0.278	0.139
			12/22/2002	1.00	1.00	73	42	258	138	182	256	0.025	0.025	0.025	0.025	0.200	0.167
PACL-LOW-A	SA-5	Weekly	08/25/2002	2.50	5.50	103	130	320	305	331	314	0.113	0.050	0.050	0.189	1.080	1.360
			09/01/2002	1.00	1.00	88	98	327	260	186	165	0.489	0.333	0.489	0.411	0.256	0.311
			09/08/2002	2.50	2.50	81	115	325	340	199	223	0.025	0.222	0.025	0.278	0.211	0.344
			09/15/2002	1.00	6.00	53	123	290	333	165	186	0.025	0.122	0.025	0.267	0.178	0.433
			09/29/2002	1.00	2.75	34	91	205	283	182	240	0.025	0.025	0.025	0.167	0.133	0.311
			10/13/2002	2.50	2.50	63	113	320	290	211	285	0.025	0.025	0.156	0.089	0.133	0.278
			11/03/2002	5.50	8.67	90	128	245	225	223	273	0.025	0.122	0.025	0.378	0.133	0.322
			11/17/2002	2.50	4.75	70	75	250	188	199	273	0.025	0.178	0.025	0.211	0.200	0.256
			12/15/2002	1.00	1.00	92	48	288	203	165	215	0.250	0.250	0.025	0.025	0.278	0.144
			12/22/2002	1.00	3.00	73	75	258	213	182	248	0.025	0.025	0.025	0.025	0.200	0.267
PACL-LOW-B	SA-12	Weekly	08/25/2002	2.50	2.50	103	135	320	328	331	356	0.113	0.050	0.050	0.244	1.080	1.480
			09/01/2002	1.00	1.00	88	106	327	268	186	174	0.489	0.433	0.489	0.433	0.256	0.300
			09/08/2002	2.50	2.50	81	118	325	313	199	215	0.025	0.222	0.025	0.456	0.211	0.356
			09/15/2002	1.00	3.50	53	123	290	330	165	199	0.025	0.111	0.025	0.233	0.178	0.422
			09/29/2002	1.00	2.00	34	111	205	315	182	223	0.025	0.025	0.025	0.211	0.133	0.244
			10/13/2002	2.50	2.50	63	109	320	288	211	273	0.025	0.025	0.156	0.025	0.133	0.244
			11/03/2002	5.50	3.50	90	80	245	175	223	236	0.025	0.100	0.025	0.189	0.133	0.167
			11/17/2002	2.50	5.00	70	57	250	123	199	261	0.025	0.267	0.025	0.700	0.200	0.178
			12/15/2002	1.00	1.00	92	31	288	150	165	207	0.250	0.025	0.025	0.278	0.278	0.122
			12/22/2002	1.00	1.00	73	32	258	158	182	248	0.025	0.025	0.025	0.025	0.200	0.133

Appendix B-5

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL A	SA-6	Monthly	Aug-02	2.50	2.50	103	126	320	315	331	273	0.113	0.111	0.050	0.156	1.080	1.340
			Sep-02	1.50	3.42	74	111	314	325	183	179	0.180	0.106	0.180	1.233	0.215	0.374
			Oct-02	1.75	15.34	49	93	263	300	197	194	0.025	0.025	0.091	0.079	0.133	0.295
			Nov-02	4.00	2.50	80	56	248	147	211	261	0.025	0.063	0.025	0.128	0.167	0.145
			Dec-02	1.00	3.50	83	39	273	161	174	228	0.138	0.025	0.025	0.025	0.239	0.145
CONTROL B	SA-11	Monthly	Aug-02	2.50	2.50	103	130	320	320	331	273	0.113	0.050	0.050	0.050	1.080	1.320
			Sep-02	1.50	2.17	74	111	314	309	183	175	0.180	0.108	0.180	0.352	0.215	0.363
			Oct-02	1.75	3.79	49	102	263	308	197	242	0.025	0.025	0.091	0.025	0.133	0.233
			Nov-02	4.00	4.63	80	95	248	213	211	267	0.025	0.046	0.025	0.162	0.167	0.222
			Dec-02	1.00	9.25	83	32	273	209	174	219	0.138	0.025	0.025	0.025	0.239	0.100
FECL3-HIGH-A	SA-2	Monthly	Aug-02	2.50	2.50	103	152	320	315	331	422	0.113	0.111	0.050	0.050	1.080	1.560
			Sep-02	1.50	3.83	74	147	314	274	183	263	0.180	0.120	0.180	0.198	0.215	0.442
			Oct-02	1.75	6.13	49	149	263	238	197	409	0.025	0.025	0.091	0.163	0.133	0.406
			Nov-02	4.00	3.75	80	107	248	154	211	403	0.025	0.025	0.025	0.057	0.167	0.273
			Dec-02	1.00	4.25	83	64	273	154	174	306	0.138	0.138	0.025	0.025	0.239	0.217
FECL3-HIGH-B	SA-9	Monthly	Aug-02	2.50	2.50	103	147	320	300	331	414	0.113	0.050	0.050	0.278	1.080	1.510
			Sep-02	1.50	2.50	74	143	314	285	183	251	0.180	0.161	0.180	2.233	0.215	0.473
			Oct-02	1.75	3.88	49	146	263	239	197	362	0.025	0.168	0.091	0.174	0.133	0.378
			Nov-02	4.00	7.38	80	131	248	173	211	335	0.025	0.046	0.025	0.112	0.167	0.322
			Dec-02	1.00	2.00	83	82	273	203	174	277	0.138	0.025	0.025	0.025	0.239	0.261
FECL3-LOW-A	SA-8	Monthly	Aug-02	2.50	2.50	103	133	320	310	331	265	0.113	0.500	0.050	1.560	1.080	1.420
			Sep-02	1.50	2.25	74	121	314	303	183	218	0.180	0.134	0.180	0.211	0.215	0.389
			Oct-02	1.75	7.51	49	114	263	287	197	254	0.025	0.301	0.091	0.573	0.133	0.317
			Nov-02	4.00	10.28	80	56	248	158	211	261	0.025	0.025	0.025	0.134	0.167	0.156
			Dec-02	1.00	6.25	83	35	273	173	174	207	0.138	0.025	0.025	0.025	0.239	0.128
FECL3-LOW-B	SA-13	Monthly	Aug-02	2.50	2.50	103	142	320	310	331	306	0.113	0.050	0.050	0.467	1.080	1.570
			Sep-02	1.50	2.92	74	111	314	275	183	223	0.180	0.109	0.180	1.134	0.215	0.359
			Oct-02	1.75	3.25	49	104	263	244	197	282	0.025	0.025	0.091	0.124	0.133	0.300
			Nov-02	4.00	5.06	80	63	248	136	211	273	0.025	0.031	0.025	0.063	0.167	0.145
			Dec-02	1.00	2.00	83	39	273	127	174	261	0.138	0.025	0.025	0.052	0.239	0.161
LIME-HIGH-A	SA-4	Monthly	Aug-02	2.50	2.50	103	105	320	257	331	257	0.113	0.050	0.050	0.050	1.080	1.105
			Sep-02	1.50	3.17	74	67	314	157	183	166	0.180	0.138	0.180	0.241	0.215	0.281
			Oct-02	1.75	13.75	49	67	263	158	197	228	0.025	0.025	0.091	0.025	0.133	0.239
			Nov-02	4.00	12.25	80	125	248	232	211	261	0.025	0.178	0.025	0.334	0.167	0.384
			Dec-02	1.00	3.00	83	78	273	214	174	228	0.138	0.138	0.025	0.041	0.239	0.295
LIME-HIGH-B	SA-10	Monthly	Aug-02	2.50	2.50	103	124	320	305	331	256	0.113	0.050	0.050	0.050	1.080	1.280
			Sep-02	1.50	2.17	74	90	314	225	183	175	0.180	0.083	0.180	0.920	0.215	0.333
			Oct-02	1.75	1.75	49	75	263	189	197	232	0.025	0.025	0.091	0.025	0.133	0.233
			Nov-02	4.00	5.31	80	112	248	240	211	255	0.025	0.025	0.025	0.062	0.167	0.269
			Dec-02	1.00	2.75	83	70	273	247	174	220	0.138	0.025	0.025	0.118	0.239	0.311
LIME-LOW-A	SA-14	Monthly	Aug-02	2.50	2.50	103	136	320	315	331	273	0.113	0.050	0.050	0.050	1.080	1.520
			Sep-02	1.50	2.25	74	117	314	306	183	186	0.180	0.083	0.180	0.485	0.215	0.382
			Oct-02	1.75	5.09	49	92	263	249	197	242	0.025	0.025	0.091	0.089	0.133	0.261
			Nov-02	4.00	4.13	80	55	248	171	211	236	0.025	0.074	0.025	0.284	0.167	0.150
			Dec-02	1.00	1.75	83	87	273	164	174	215	0.138	0.025	0.025	0.025	0.239	0.167
LIME-LOW-B	SA-7	Monthly	Aug-02	2.50	6.50	103	135	320	310	331	314	0.113	0.050	0.050	0.311	1.080	1.480
			Sep-02	1.50	3.42	74	112	314	289	183	185	0.180	0.109	0.180	0.459	0.215	0.363
			Oct-02	1.75	9.25	49	92	263	279	197	236	0.025	0.025	0.091	0.100	0.133	0.295
			Nov-02	4.00	10.25	80	136	248	298	211	261	0.025	0.267	0.025	0.700	0.167	0.478
			Dec-02	1.00	1.75	83	81	273	280	174	236	0.138	0.025	0.025	0.052	0.239	0.306
PACL-HIGH-A	SA-1	Monthly	Aug-02	2.50	2.50	103	138	320	323	331	414	0.113	0.050	0.050	0.050	1.080	1.390
			Sep-02	1.50	4.50	74	119	314	287	183	234	0.180	0.271	0.180	0.448	0.215	0.359
			Oct-02	1.75	5.63	49	120	263	239	197	305	0.025	0.112	0.091	0.931	0.133	0.364
			Nov-02	4.00	4.00	80	88	248	144	211	304	0.025	0.339	0.025	0.373	0.167	0.206
			Dec-02	1.00	1.00	83	60	273	153	174	265	0.138	0.138	0.025	0.106	0.239	0.189
PACL-HIGH-B	SA-3	Monthly	Aug-02	2.50	2.50	103	140	320	330	331	323	0.113	0.050	0.050	0.278	1.080	1.390
			Sep-02	1.50	3.75	74	126	314	293	183	240	0.180	0.245	0.180	0.471	0.215	0.385
			Oct-02	1.75	6.25	49	114	263	250	197	300	0.025	0.074	0.091	0.245	0.133	0.328
			Nov-02	4.00	3.13	80	40	248	144	211	261	0.025	0.046	0.025	0.107	0.167	0.122
			Dec-02	1.00	1.00	83	54	273	135	174	241	0.138	0.081	0.025	0.061	0.239	0.153
PACL-LOW-A	SA-5	Monthly	Aug-02	2.50	5.50	103	130	320	305	331	314	0.113	0.050	0.050	0.189	1.080	1.360
			Sep-02	1.50	3.17	74	112	314	311	183	191	0.180	0.226	0.180	0.319	0.215	0.363
			Oct-02	1.75	2.63	49	102	263	287	197	263	0.025	0.025	0.091	0.128	0.133	0.295
			Nov-02	4.00	6.71	80	102	248	207	211	273	0.025	0.150	0.025	0.295	0.167	0.289
			Dec-02	1.00	2.00	83	62	273	208	174	232	0.138	0.138	0.025	0.025	0.239	0.206
PACL-LOW-B	SA-12	Monthly	Aug-02	2.50	2.50	103	135	320	328	331	356	0.113	0.050	0.050	0.244	1.080	1.480
			Sep-02	1.50	2.33	74	116	314	304	183	196	0.180	0.255	0.180	0.374	0.215	0.359
			Oct-02	1.75	2.25	49	110	263	302	197	248	0.025	0.025	0.091	0.118	0.133	0.244
			Nov-02	4.00	4.25	80	69	248	149	211	249	0.025	0.184	0.025	0.445	0.167	0.173
			Dec-02	1.00	1.00	83	31	273	154	174	228	0.138	0.025	0.025	0.152	0.239	0.128

Appendix B-5

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Cell Detail)

Tanks in Batch Mode until 10/22/02

				TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Cell**	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL A	SA-6	Quarterly	2002-3	1.75	3.19	81	115	316	323	220	203	0.163	0.107	0.147	0.964	0.431	0.616
			2002-4	2.25	7.11	70	62	261	202	194	227	0.063	0.038	0.047	0.077	0.180	0.195
CONTROL B	SA-11	Quarterly	2002-3	1.75	2.25	81	116	316	312	220	200	0.163	0.094	0.147	0.276	0.431	0.602
			2002-4	2.25	5.89	70	85	261	243	194	243	0.063	0.032	0.047	0.080	0.180	0.202
FECL3-HIGH-A	SA-2	Quarterly	2002-3	1.75	3.50	81	148	316	285	220	303	0.163	0.118	0.147	0.161	0.431	0.722
			2002-4	2.25	4.71	70	106	261	182	194	373	0.063	0.063	0.047	0.082	0.180	0.298
FECL3-HIGH-B	SA-9	Quarterly	2002-3	1.75	2.50	81	144	316	288	220	292	0.163	0.133	0.147	1.744	0.431	0.732
			2002-4	2.25	4.42	70	119	261	205	194	325	0.063	0.080	0.047	0.103	0.180	0.320
FECL3-LOW-A	SA-8	Quarterly	2002-3	1.75	2.31	81	124	316	305	220	230	0.163	0.226	0.147	0.548	0.431	0.647
			2002-4	2.25	8.01	70	69	261	206	194	241	0.063	0.117	0.047	0.244	0.180	0.200
FECL3-LOW-B	SA-13	Quarterly	2002-3	1.75	2.81	81	119	316	283	220	244	0.163	0.094	0.147	0.967	0.431	0.662
			2002-4	2.25	3.44	70	69	261	169	194	272	0.063	0.027	0.047	0.079	0.180	0.202
LIME-HIGH-A	SA-4	Quarterly	2002-3	1.75	3.00	81	77	316	182	220	188	0.163	0.116	0.147	0.193	0.431	0.487
			2002-4	2.25	9.67	70	90	261	201	194	239	0.063	0.113	0.047	0.133	0.180	0.306
LIME-HIGH-B	SA-10	Quarterly	2002-3	1.75	2.25	81	99	316	245	220	195	0.163	0.075	0.147	0.703	0.431	0.570
			2002-4	2.25	3.27	70	86	261	225	194	235	0.063	0.025	0.047	0.068	0.180	0.271
LIME-LOW-A	SA-14	Quarterly	2002-3	1.75	2.31	81	122	316	308	220	208	0.163	0.075	0.147	0.376	0.431	0.666
			2002-4	2.25	3.65	70	78	261	195	194	231	0.063	0.041	0.047	0.133	0.180	0.193
LIME-LOW-B	SA-7	Quarterly	2002-3	1.75	4.19	81	118	316	294	220	217	0.163	0.095	0.147	0.422	0.431	0.642
			2002-4	2.25	7.08	70	103	261	286	194	244	0.063	0.106	0.047	0.284	0.180	0.359
PACL-HIGH-A	SA-1	Quarterly	2002-3	1.75	4.00	81	124	316	296	220	279	0.163	0.216	0.147	0.349	0.431	0.617
			2002-4	2.25	3.54	70	90	261	179	194	291	0.063	0.196	0.047	0.470	0.180	0.253
PACL-HIGH-B	SA-3	Quarterly	2002-3	1.75	3.44	81	130	316	303	220	261	0.163	0.197	0.147	0.423	0.431	0.637
			2002-4	2.25	3.46	70	69	261	176	194	267	0.063	0.067	0.047	0.137	0.180	0.201
PACL-LOW-A	SA-5	Quarterly	2002-3	1.75	3.75	81	116	316	310	220	222	0.163	0.182	0.147	0.286	0.431	0.612
			2002-4	2.25	3.78	70	88	261	234	194	256	0.063	0.104	0.047	0.149	0.180	0.263
PACL-LOW-B	SA-12	Quarterly	2002-3	1.75	2.38	81	121	316	310	220	236	0.163	0.204	0.147	0.342	0.431	0.640
			2002-4	2.25	2.50	70	70	261	202	194	241	0.063	0.078	0.047	0.238	0.180	0.181
CONTROL A	SA-6	LongTerm	POR	2.05	5.54	75	83	283	251	204	218	0.103	0.065	0.087	0.432	0.280	0.363
CONTROL B	SA-11	LongTerm	POR	2.05	4.43	75	99	283	271	204	225	0.103	0.057	0.087	0.167	0.280	0.380
FECL3-HIGH-A	SA-2	LongTerm	POR	2.05	4.23	75	123	283	223	204	345	0.103	0.085	0.087	0.113	0.280	0.468
FECL3-HIGH-B	SA-9	LongTerm	POR	2.05	3.65	75	129	283	238	204	311	0.103	0.101	0.087	0.760	0.280	0.485
FECL3-LOW-A	SA-8	LongTerm	POR	2.05	5.73	75	91	283	245	204	236	0.103	0.161	0.087	0.366	0.280	0.379
FECL3-LOW-B	SA-13	LongTerm	POR	2.05	3.19	75	89	283	215	204	261	0.103	0.054	0.087	0.434	0.280	0.386
LIME-HIGH-A	SA-4	LongTerm	POR	2.05	7.00	75	85	283	193	204	218	0.103	0.114	0.087	0.157	0.280	0.378
LIME-HIGH-B	SA-10	LongTerm	POR	2.05	2.86	75	91	283	233	204	219	0.103	0.045	0.087	0.322	0.280	0.391
LIME-LOW-A	SA-14	LongTerm	POR	2.05	3.12	75	95	283	240	204	222	0.103	0.055	0.087	0.230	0.280	0.382
LIME-LOW-B	SA-7	LongTerm	POR	2.05	5.93	75	109	283	289	204	233	0.103	0.101	0.087	0.339	0.280	0.472
PACL-HIGH-A	SA-1	LongTerm	POR	2.05	3.73	75	103	283	226	204	286	0.103	0.204	0.087	0.421	0.280	0.398
PACL-HIGH-B	SA-3	LongTerm	POR	2.05	3.45	75	94	283	227	204	265	0.103	0.119	0.087	0.251	0.280	0.375
PACL-LOW-A	SA-5	LongTerm	POR	2.05	3.77	75	100	283	264	204	242	0.103	0.135	0.087	0.204	0.280	0.403
PACL-LOW-B	SA-12	LongTerm	POR	2.05	2.45	75	90	283	245	204	239	0.103	0.128	0.087	0.279	0.280	0.365

Appendix B-6

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

Tanks in Batch Mode until 10/22/02

			TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
CONTROL	Weekly	08/25/2002	2.50	2.50	103	128	320	318	331	273	0.113	0.081	0.050	0.103	1.080	1.330
		09/01/2002	1.00	1.88	88	98	327	281	186	170	0.489	0.256	0.489	0.422	0.256	0.284
		09/08/2002	2.50	2.50	81	115	325	330	199	182	0.025	0.041	0.025	0.300	0.211	0.389
		09/15/2002	1.00	4.00	53	120	290	342	165	180	0.025	0.025	0.025	1.655	0.178	0.434
		09/29/2002	1.00	4.46	34	94	205	317	182	194	0.025	0.025	0.025	0.025	0.133	0.261
		10/13/2002	2.50	14.67	63	101	320	292	211	242	0.025	0.025	0.156	0.079	0.133	0.267
		11/03/2002	5.50	3.88	90	86	245	194	223	285	0.025	0.046	0.025	0.206	0.133	0.178
		11/17/2002	2.50	3.25	70	65	250	166	199	242	0.025	0.063	0.025	0.084	0.200	0.189
		12/15/2002	1.00	1.00	92	33	288	177	165	203	0.250	0.025	0.025	0.025	0.278	0.111
		12/22/2002	1.00	11.75	73	42	258	193	182	244	0.025	0.025	0.025	0.025	0.200	0.167
		08/25/2002	2.50	2.50	103	150	320	308	331	418	0.113	0.081	0.050	0.164	1.080	1.535
FECL3-HIGH	Weekly	09/01/2002	1.00	2.88	88	126	327	251	186	238	0.489	0.278	0.489	3.255	0.256	0.409
		09/08/2002	2.50	4.25	81	148	325	291	199	255	0.025	0.119	0.025	0.292	0.211	0.453
		09/15/2002	1.00	2.38	53	162	290	297	165	279	0.025	0.025	0.025	0.100	0.178	0.511
		09/29/2002	1.00	3.13	34	131	205	249	182	343	0.025	0.168	0.025	0.174	0.133	0.417
		10/13/2002	2.50	6.88	63	164	320	228	211	428	0.025	0.025	0.156	0.163	0.133	0.367
		11/03/2002	5.50	4.38	90	141	245	166	223	366	0.025	0.046	0.025	0.128	0.133	0.295
		11/17/2002	2.50	6.75	70	96	250	162	199	372	0.025	0.025	0.025	0.041	0.200	0.300
		12/15/2002	1.00	1.00	92	61	288	169	165	306	0.250	0.138	0.025	0.025	0.278	0.206
		12/22/2002	1.00	5.25	73	85	258	188	182	277	0.025	0.025	0.025	0.025	0.200	0.273
FECL3-LOW	Weekly	08/25/2002	2.50	2.50	103	138	320	310	331	286	0.113	0.275	0.050	1.014	1.080	1.495
		09/01/2002	1.00	1.75	88	102	327	259	186	207	0.489	0.250	0.489	1.529	0.256	0.328
		09/08/2002	2.50	2.50	81	115	325	305	199	228	0.025	0.074	0.025	0.156	0.211	0.345
		09/15/2002	1.00	3.50	53	131	290	302	165	226	0.025	0.041	0.025	0.333	0.178	0.450
		09/29/2002	1.00	5.89	34	114	205	292	182	244	0.025	0.301	0.025	0.672	0.133	0.339
		10/13/2002	2.50	4.88	63	105	320	239	211	292	0.025	0.025	0.156	0.025	0.133	0.278
		11/03/2002	5.50	4.88	90	70	245	166	223	273	0.025	0.025	0.025	0.156	0.133	0.150
		11/17/2002	2.50	10.46	70	49	250	129	199	261	0.025	0.031	0.025	0.041	0.200	0.150
		12/15/2002	1.00	1.00	92	30	288	142	165	211	0.250	0.025	0.025	0.052	0.278	0.106
		12/22/2002	1.00	7.25	73	44	258	158	182	257	0.025	0.025	0.025	0.025	0.200	0.184
LIME-HIGH	Weekly	08/25/2002	2.50	2.50	103	115	320	281	331	256	0.113	0.050	0.050	0.050	1.080	1.193
		09/01/2002	1.00	1.00	88	74	327	179	186	158	0.489	0.222	0.489	1.125	0.256	0.306
		09/08/2002	2.50	2.50	81	80	325	203	199	174	0.025	0.085	0.025	0.495	0.211	0.284
		09/15/2002	1.00	4.50	53	82	290	191	165	180	0.025	0.025	0.025	0.123	0.178	0.333
		09/29/2002	1.00	8.50	34	60	205	161	182	211	0.025	0.025	0.025	0.025	0.133	0.245
		10/13/2002	2.50	7.00	63	83	320	187	211	248	0.025	0.025	0.156	0.025	0.133	0.228
		11/03/2002	5.50	10.06	90	132	245	245	223	280	0.025	0.129	0.025	0.212	0.133	0.292
		11/17/2002	2.50	7.50	70	105	250	227	199	236	0.025	0.074	0.025	0.184	0.200	0.361
		12/15/2002	1.00	1.00	92	55	288	221	165	207	0.250	0.138	0.025	0.041	0.278	0.200
		12/22/2002	1.00	4.75	73	93	258	240	182	240	0.025	0.025	0.025	0.118	0.200	0.406
LIME-LOW	Weekly	08/25/2002	2.50	4.50	103	136	320	313	331	294	0.113	0.050	0.050	0.181	1.080	1.500
		09/01/2002	1.00	1.88	88	102	327	264	186	170	0.489	0.239	0.489	0.434	0.256	0.317
		09/08/2002	2.50	2.50	81	117	325	330	199	182	0.025	0.025	0.025	0.178	0.211	0.350
		09/15/2002	1.00	4.13	53	124	290	298	165	205	0.025	0.025	0.025	0.806	0.178	0.450
		09/29/2002	1.00	4.50	34	90	205	267	182	211	0.025	0.025	0.025	0.106	0.133	0.278
		10/13/2002	2.50	9.84	63	95	320	262	211	267	0.025	0.025	0.156	0.084	0.133	0.278
		11/03/2002	5.50	7.75	90	114	245	263	223	255	0.025	0.191	0.025	0.578	0.133	0.339
		11/17/2002	2.50	6.63	70	76	250	206	199	242	0.025	0.150	0.025	0.406	0.200	0.289
		12/15/2002	1.00	1.00	92	81	288	210	165	215	0.250	0.025	0.025	0.052	0.278	0.217
		12/22/2002	1.00	2.50	73	87	258	234	182	236	0.025	0.025	0.025	0.025	0.200	0.256
PACL-HIGH	Weekly	08/25/2002	2.50	2.50	103	139	320	327	331	369	0.113	0.050	0.050	0.164	1.080	1.390
		09/01/2002	1.00	1.00	88	109	327	262	186	207	0.489	0.500	0.489	0.500	0.256	0.322
		09/08/2002	2.50	3.75	81	130	325	314	199	257	0.025	0.025	0.025	0.456	0.211	0.378
		09/15/2002	1.00	7.63	53	130	290	295	165	248	0.025	0.250	0.025	0.423	0.178	0.417
		09/29/2002	1.00	6.25	34	109	205	265	182	286	0.025	0.150	0.025	0.300	0.133	0.356
		10/13/2002	2.50	5.63	63	125	320	224	211	320	0.025	0.036	0.156	0.876	0.133	0.336
		11/03/2002	5.50	3.63	90	79	245	158	223	298	0.025	0.250	0.025	0.339	0.133	0.161
		11/17/2002	2.50	3.50	70	50	250	130	199	267	0.025	0.135	0.025	0.141	0.200	0.167
		12/15/2002	1.00	1.00	92	58	288	137	165	220	0.250	0.194	0.025	0.126	0.278	0.153
		12/22/2002	1.00	1.00	73	56	258	151	182	285	0.025	0.025	0.025	0.041	0.200	0.189

Appendix B-6

Summary of Other Water Quality Data Collected at the Soil Amendment Tanks (Treatment Detail)

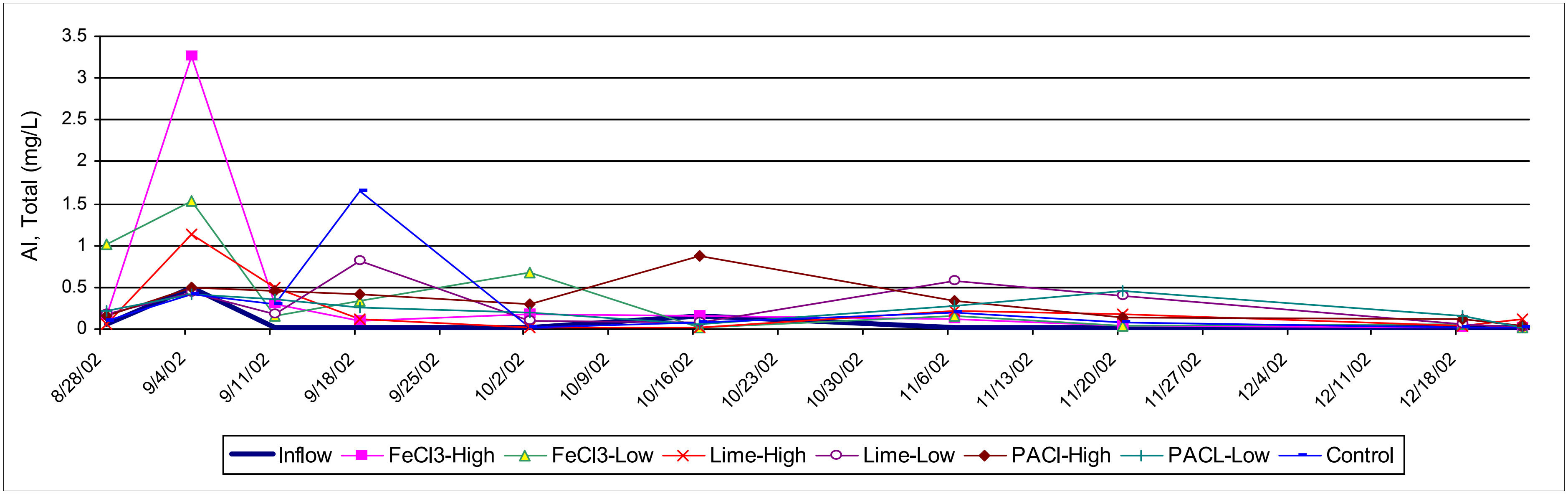
Tanks in Batch Mode until 10/22/02

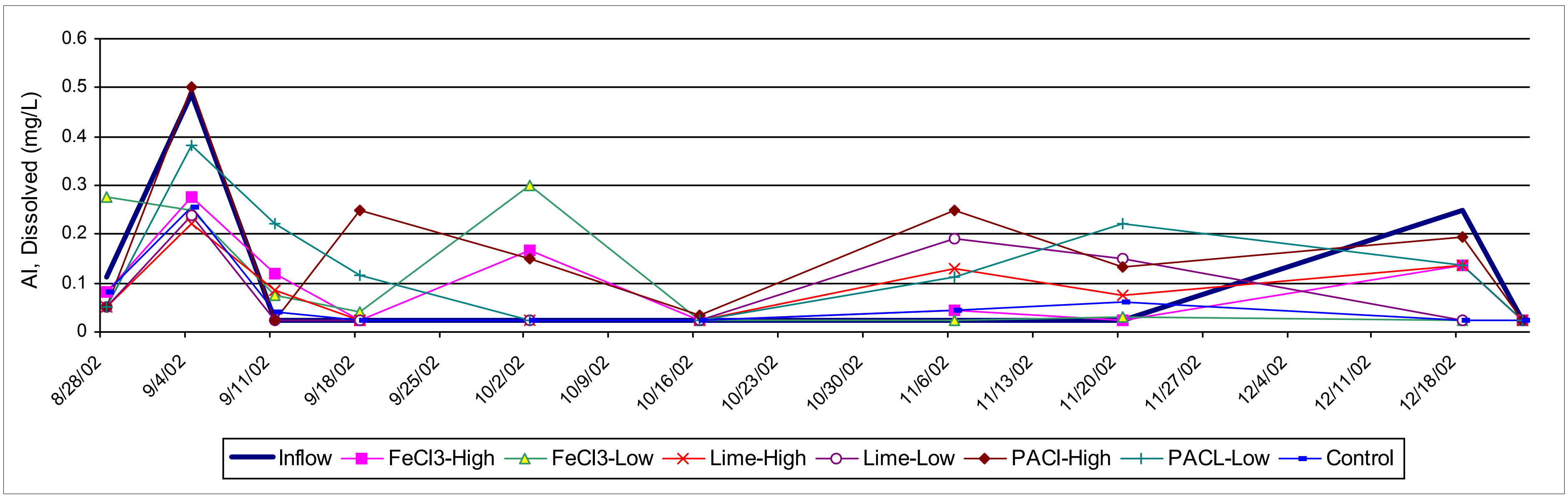
			TSS (mg/L)		Ca (mg/L)		Alkalinity (mg/L)		Cloride (mg/L)		Al diss. (mg/L)		Al total (mg/L)		Fe total (mg/L)	
Treatment	**Frequency**	**Date**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
PACL-LOW	Weekly	08/25/2002	2.50	4.00	103	133	320	317	331	335	0.113	0.050	0.050	0.217	1.080	1.420
		09/01/2002	1.00	1.00	88	102	327	264	186	170	0.489	0.383	0.489	0.422	0.256	0.306
		09/08/2002	2.50	2.50	81	117	325	327	199	219	0.025	0.222	0.025	0.367	0.211	0.350
		09/15/2002	1.00	4.75	53	123	290	332	165	193	0.025	0.117	0.025	0.250	0.178	0.428
		09/29/2002	1.00	2.38	34	101	205	299	182	232	0.025	0.025	0.025	0.189	0.133	0.278
		10/13/2002	2.50	2.50	63	111	320	289	211	279	0.025	0.025	0.156	0.057	0.133	0.261
		11/03/2002	5.50	6.09	90	104	245	200	223	255	0.025	0.111	0.025	0.284	0.133	0.245
		11/17/2002	2.50	4.88	70	66	250	156	199	267	0.025	0.223	0.025	0.456	0.200	0.217
		12/15/2002	1.00	1.00	92	40	288	177	165	211	0.250	0.138	0.025	0.152	0.278	0.133
		12/22/2002	1.00	2.00	73	53	258	186	182	248	0.025	0.025	0.025	0.025	0.200	0.200
CONTROL	Monthly	Aug-02	2.50	2.50	103	128	320	318	331	273	0.113	0.081	0.050	0.103	1.080	1.330
		Sep-02	1.50	2.79	74	111	314	317	183	177	0.180	0.107	0.180	0.792	0.215	0.369
		Oct-02	1.75	9.56	49	98	263	304	197	218	0.025	0.025	0.091	0.052	0.133	0.264
		Nov-02	4.00	3.56	80	75	248	180	211	264	0.025	0.054	0.025	0.145	0.167	0.183
		Dec-02	1.00	6.38	83	36	273	185	174	223	0.138	0.025	0.025	0.025	0.239	0.130
FECL3-HIGH	Monthly	Aug-02	2.50	2.50	103	150	320	308	331	418	0.113	0.081	0.050	0.164	1.080	1.535
		Sep-02	1.50	3.17	74	145	314	279	183	257	0.180	0.140	0.180	1.216	0.215	0.457
		Oct-02	1.75	5.00	49	147	263	239	197	386	0.025	0.097	0.091	0.168	0.133	0.392
		Nov-02	4.00	5.56	80	119	248	164	211	369	0.025	0.036	0.025	0.084	0.167	0.297
		Dec-02	1.00	3.13	83	73	273	178	174	292	0.138	0.081	0.025	0.025	0.239	0.239
FECL3-LOW	Monthly	Aug-02	2.50	2.50	103	138	320	310	331	286	0.113	0.275	0.050	1.014	1.080	1.495
		Sep-02	1.50	2.58	74	116	314	289	183	220	0.180	0.122	0.180	0.673	0.215	0.374
		Oct-02	1.75	5.38	49	109	263	266	197	268	0.025	0.163	0.091	0.348	0.133	0.308
		Nov-02	4.00	7.67	80	59	248	147	211	267	0.025	0.028	0.025	0.098	0.167	0.150
		Dec-02	1.00	4.13	83	37	273	150	174	234	0.138	0.025	0.025	0.038	0.239	0.145
LIME-HIGH	Monthly	Aug-02	2.50	2.50	103	115	320	281	331	256	0.113	0.050	0.050	0.050	1.080	1.193
		Sep-02	1.50	2.67	74	79	314	191	183	170	0.180	0.111	0.180	0.581	0.215	0.307
		Oct-02	1.75	7.75	49	71	263	174	197	230	0.025	0.025	0.091	0.025	0.133	0.236
		Nov-02	4.00	8.78	80	119	248	236	211	258	0.025	0.101	0.025	0.198	0.167	0.326
		Dec-02	1.00	2.88	83	74	273	230	174	224	0.138	0.081	0.025	0.079	0.239	0.303
LIME-LOW	Monthly	Aug-02	2.50	4.50	103	136	320	313	331	294	0.113	0.050	0.050	0.181	1.080	1.500
		Sep-02	1.50	2.83	74	114	314	297	183	186	0.180	0.096	0.180	0.472	0.215	0.372
		Oct-02	1.75	7.17	49	92	263	264	197	239	0.025	0.025	0.091	0.095	0.133	0.278
		Nov-02	4.00	7.19	80	95	248	234	211	248	0.025	0.170	0.025	0.492	0.167	0.314
		Dec-02	1.00	1.75	83	84	273	222	174	225	0.138	0.025	0.025	0.038	0.239	0.236
PACL-HIGH	Monthly	Aug-02	2.50	2.50	103	139	320	327	331	369	0.113	0.050	0.050	0.164	1.080	1.390
		Sep-02	1.50	4.13	74	123	314	290	183	237	0.180	0.258	0.180	0.459	0.215	0.372
		Oct-02	1.75	5.94	49	117	263	244	197	303	0.025	0.093	0.091	0.588	0.133	0.346
		Nov-02	4.00	3.56	80	64	248	144	211	282	0.025	0.192	0.025	0.240	0.167	0.164
		Dec-02	1.00	1.00	83	57	273	144	174	253	0.138	0.109	0.025	0.083	0.239	0.171
PACL-LOW	Monthly	Aug-02	2.50	4.00	103	133	320	317	331	335	0.113	0.050	0.050	0.217	1.080	1.420
		Sep-02	1.50	2.75	74	114	314	307	183	194	0.180	0.241	0.180	0.346	0.215	0.361
		Oct-02	1.75	2.44	49	106	263	294	197	255	0.025	0.025	0.091	0.123	0.133	0.269
		Nov-02	4.00	5.48	80	85	248	178	211	261	0.025	0.167	0.025	0.370	0.167	0.231
		Dec-02	1.00	1.50	83	47	273	181	174	230	0.138	0.081	0.025	0.088	0.239	0.167
CONTROL	Quarterly	2002-3	1.75	2.72	81	115	316	317	220	201	0.163	0.100	0.147	0.620	0.431	0.609
		2002-4	2.25	6.50	70	73	261	223	194	235	0.063	0.035	0.047	0.078	0.180	0.198
FECL3-HIGH	Quarterly	2002-3	1.75	3.00	81	146	316	286	220	297	0.163	0.125	0.147	0.953	0.431	0.727
		2002-4	2.25	4.56	70	113	261	193	194	349	0.063	0.071	0.047	0.092	0.180	0.309
FECL3-LOW	Quarterly	2002-3	1.75	2.56	81	121	316	294	220	237	0.163	0.160	0.147	0.758	0.431	0.654
		2002-4	2.25	5.73	70	69	261	187	194	256	0.063	0.072	0.047	0.162	0.180	0.201
LIME-HIGH	Quarterly	2002-3	1.75	2.63	81	88	316	213	220	192	0.163	0.095	0.147	0.448	0.431	0.529
		2002-4	2.25	6.47	70	88	261	213	194	237	0.063	0.069	0.047	0.101	0.180	0.288
LIME-LOW	Quarterly	2002-3	1.75	3.25	81	120	316	301	220	213	0.163	0.085	0.147	0.399	0.431	0.654
		2002-4	2.25	5.37	70	90	261	240	194	238	0.063	0.073	0.047	0.208	0.180	0.276
PACL-HIGH	Quarterly	2002-3	1.75	3.72	81	127	316	299	220	270	0.163	0.206	0.147	0.386	0.431	0.627
		2002-4	2.25	3.50	70	79	261	177	194	279	0.063	0.131	0.047	0.304	0.180	0.227
PACL-LOW	Quarterly	2002-3	1.75	3.06	81	118	316	310	220	229	0.163	0.193	0.147	0.314	0.431	0.626
		2002-4	2.25	3.14	70	79	261	218	194	249	0.063	0.091	0.047	0.194	0.180	0.222
CONTROL	LongTerm	POR	2.05	4.99	75	91	283	261	204	221	0.103	0.061	0.087	0.306	0.280	0.371
FECL3-HIGH	LongTerm	POR	2.05	3.94	75	126	283	231	204	328	0.103	0.093	0.087	0.437	0.280	0.476
FECL3-LOW	LongTerm	POR	2.05	4.46	75	90	283	230	204	248	0.103	0.107	0.087	0.400	0.280	0.382
LIME-HIGH	LongTerm	POR	2.05	4.93	75	88	283	213	204	219	0.103	0.080	0.087	0.240	0.280	0.384
LIME-LOW	LongTerm	POR	2.05	4.52	75	102	283	265	204	228	0.103	0.078	0.087	0.285	0.280	0.427
PACL-HIGH	LongTerm	POR	2.05	3.59	75	98	283	226	204	275	0.103	0.161	0.087	0.336	0.280	0.387
PACL-LOW	LongTerm	POR	2.05	3.11	75	95	283	254	204	241	0.103	0.132	0.087	0.242	0.280	0.384

Appendix C
Soil Amendment Study Detailed Data Charts

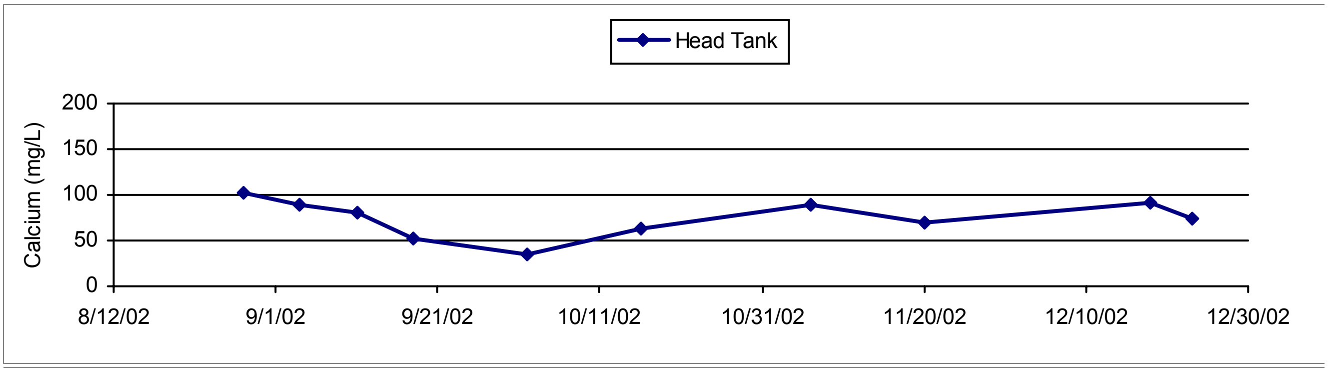
PSTA Field Scale Phase 3 - Soil Amendment Study

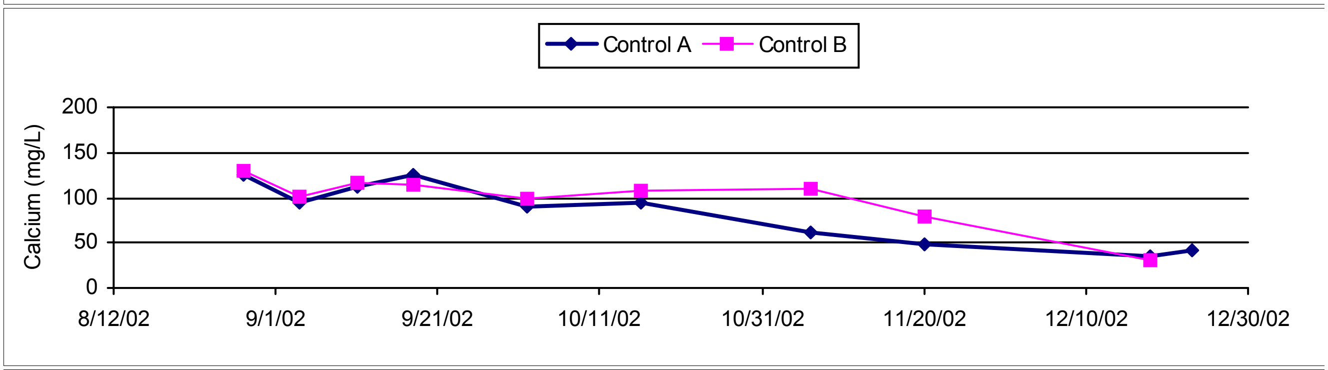
Total and Dissolved Aluminum - Surface Water

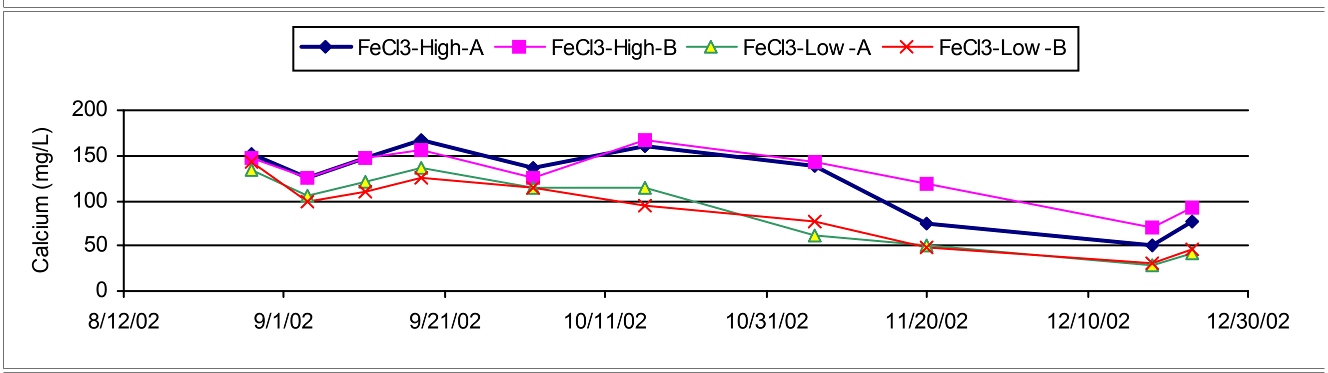


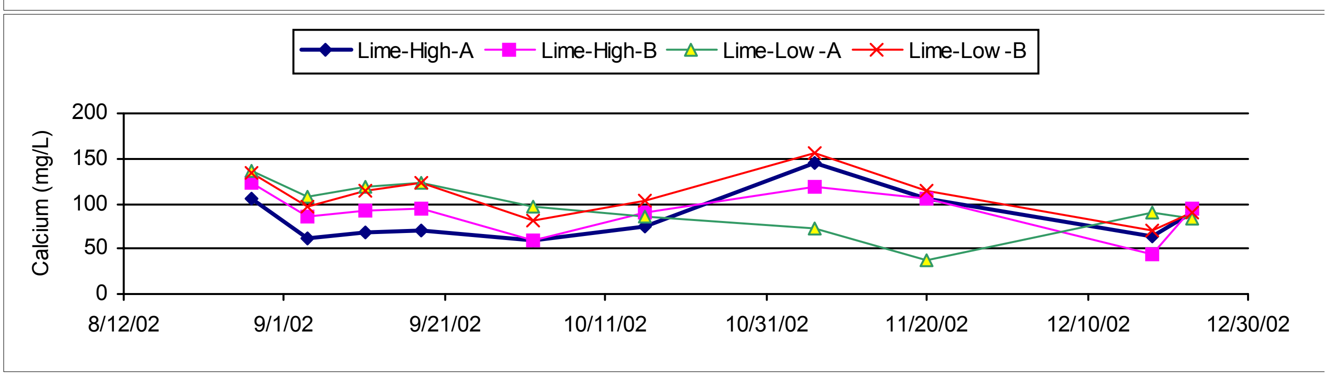


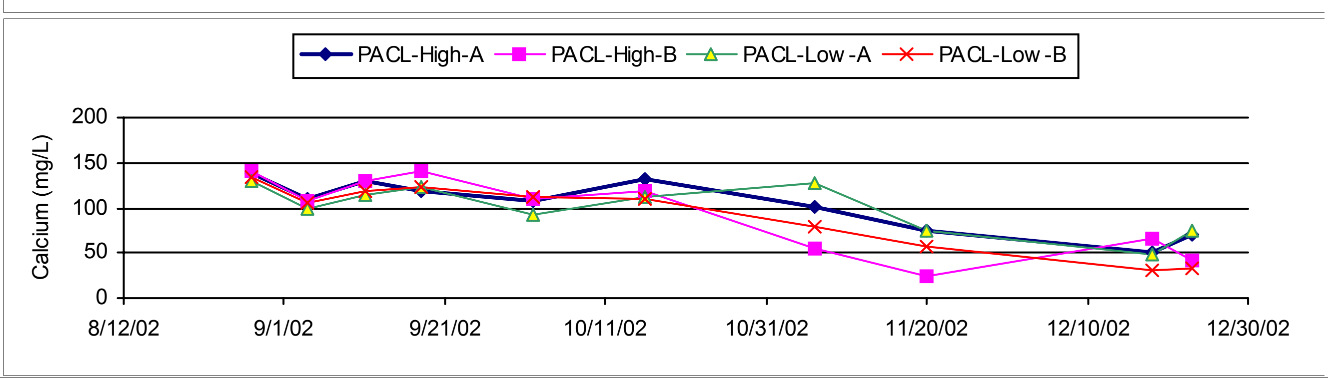
PSTA Field Scale Phase 3 - Soil Amendment Study
Calcium - Surface Water





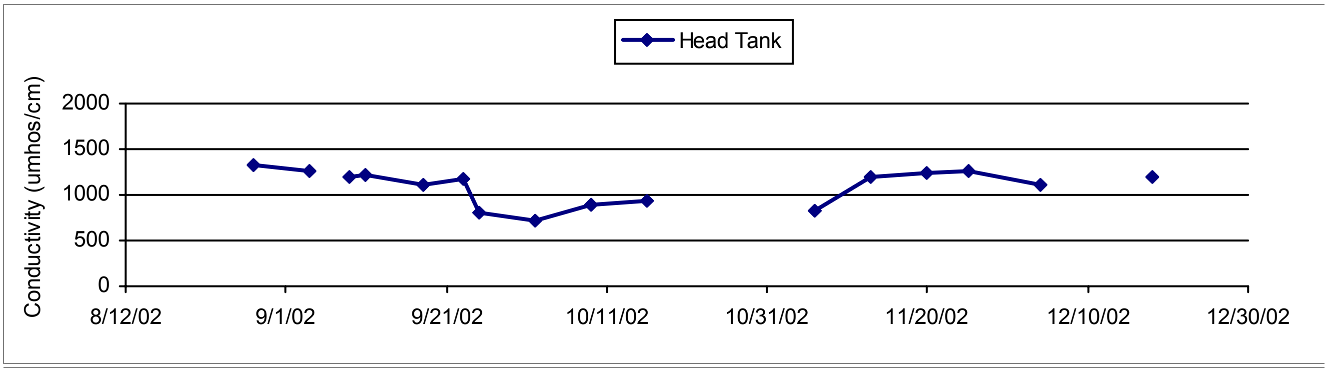


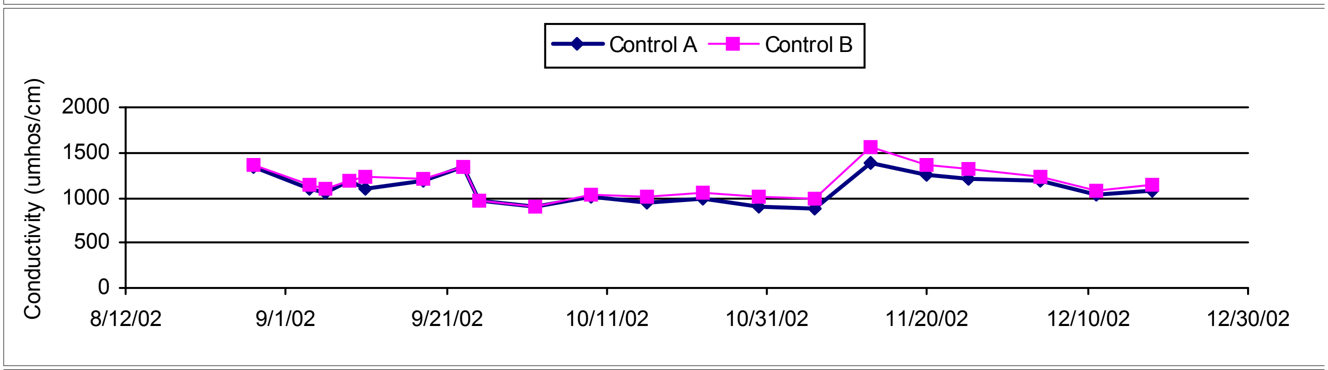


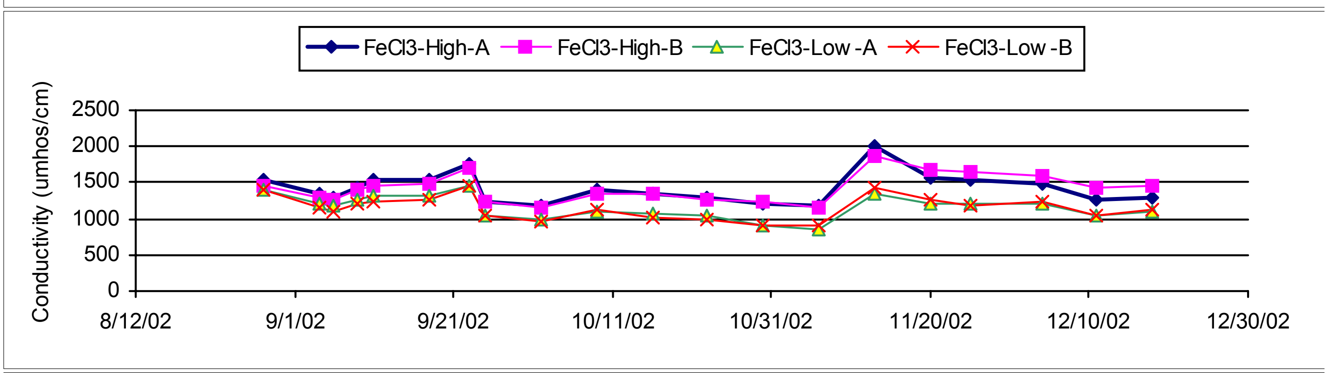


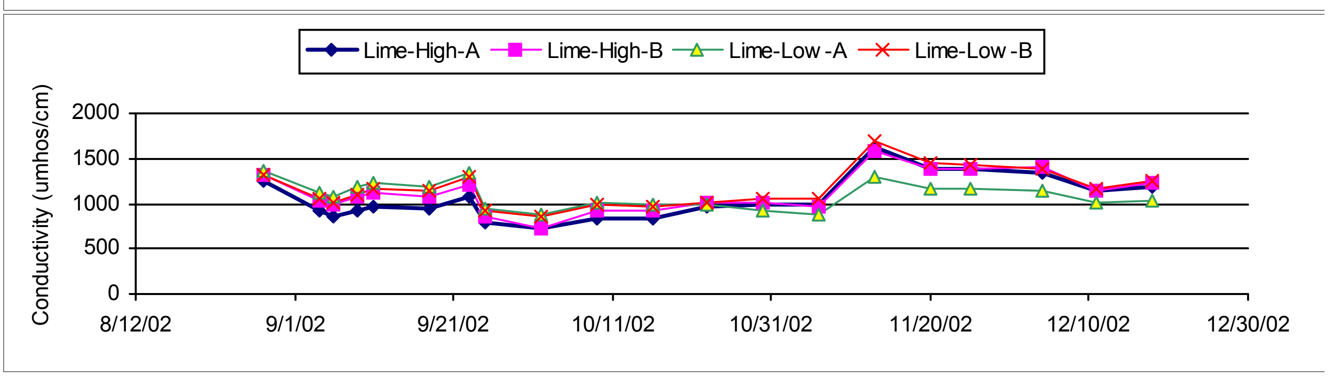
PSTA Field Scale Phase 3 - Soil Amendment Study

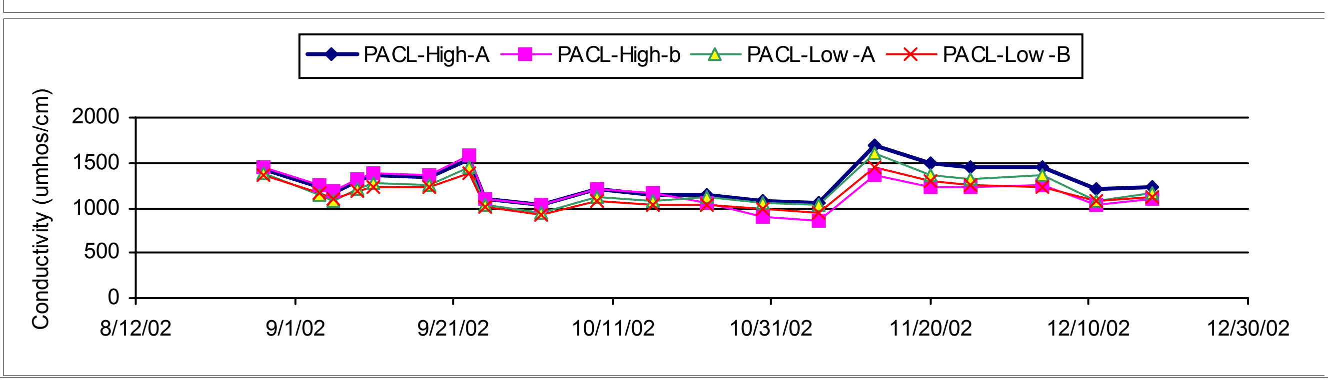
Conductivity - Surface Water





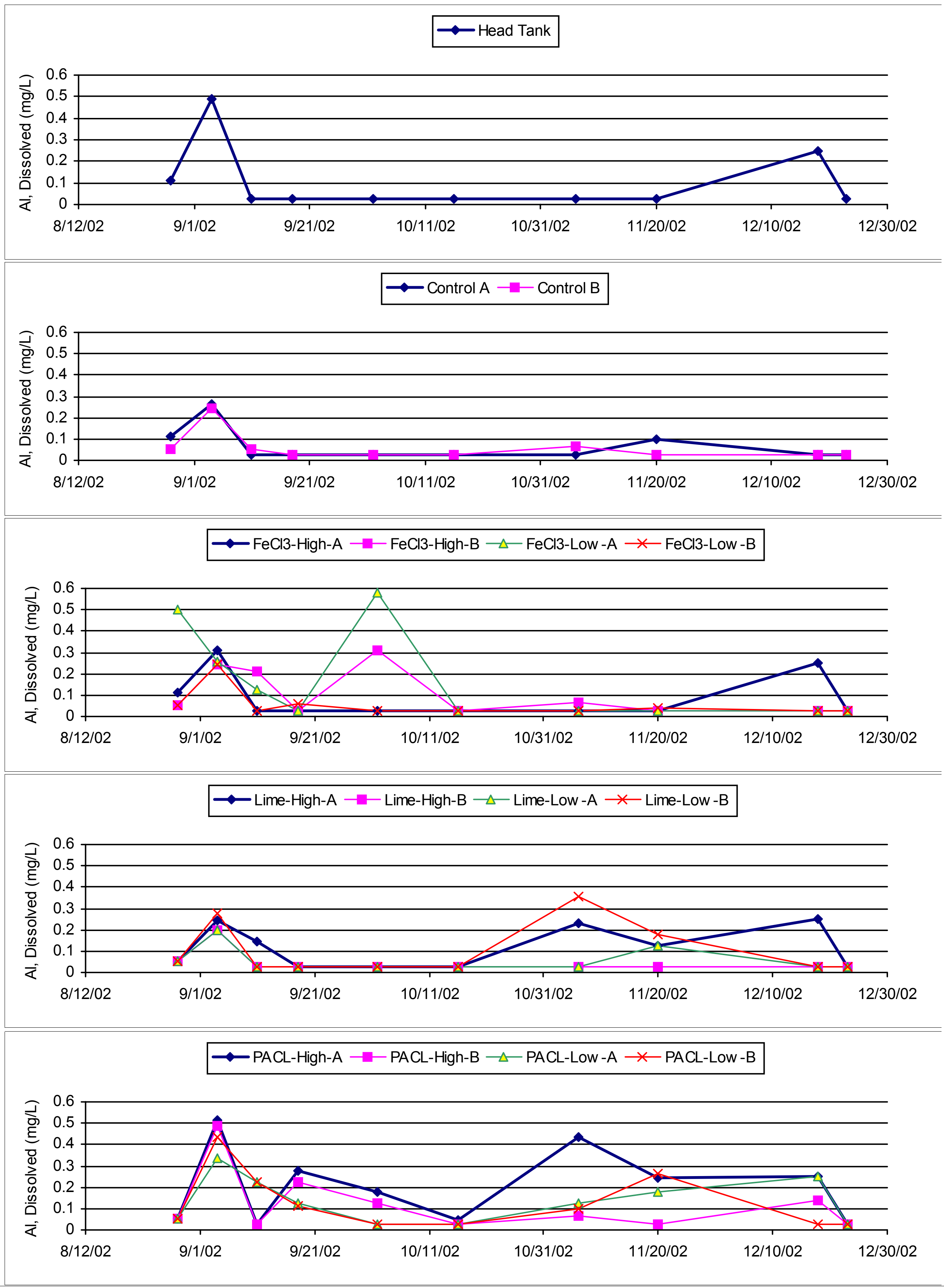




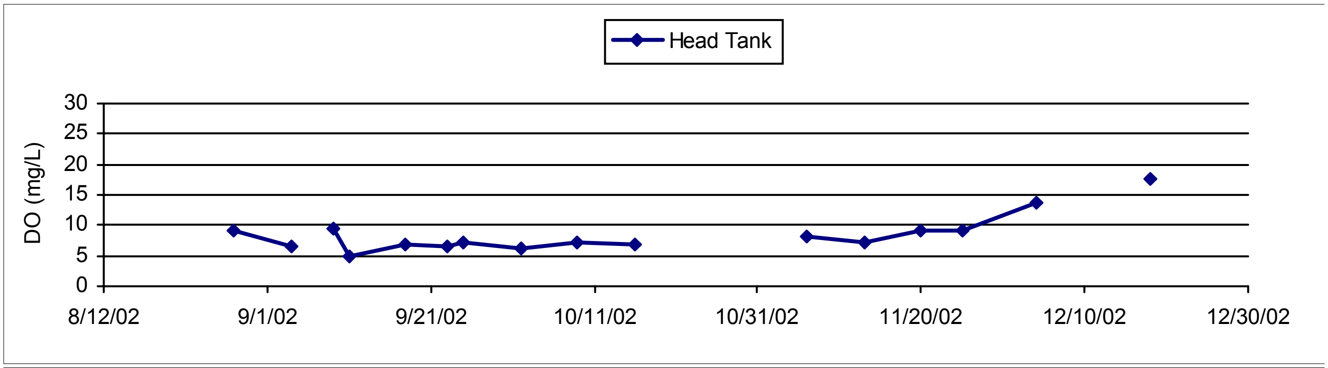


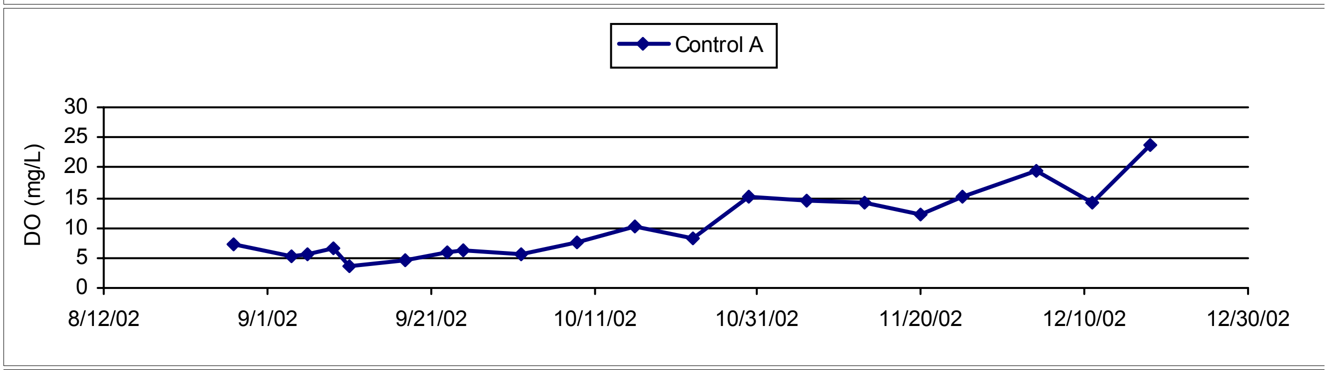
PSTA Field Scale Phase 3 - Soil Amendment Study

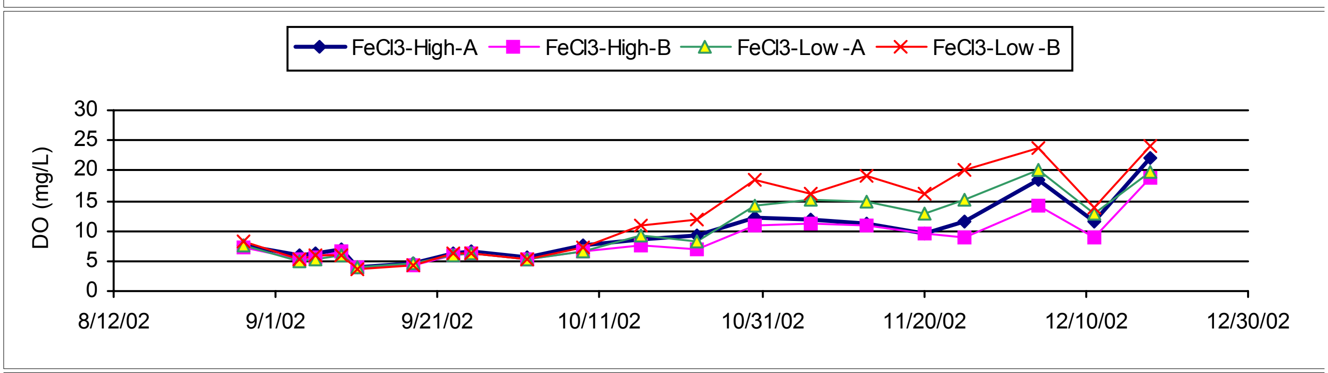
Dissolved Aluminum - Surface Water

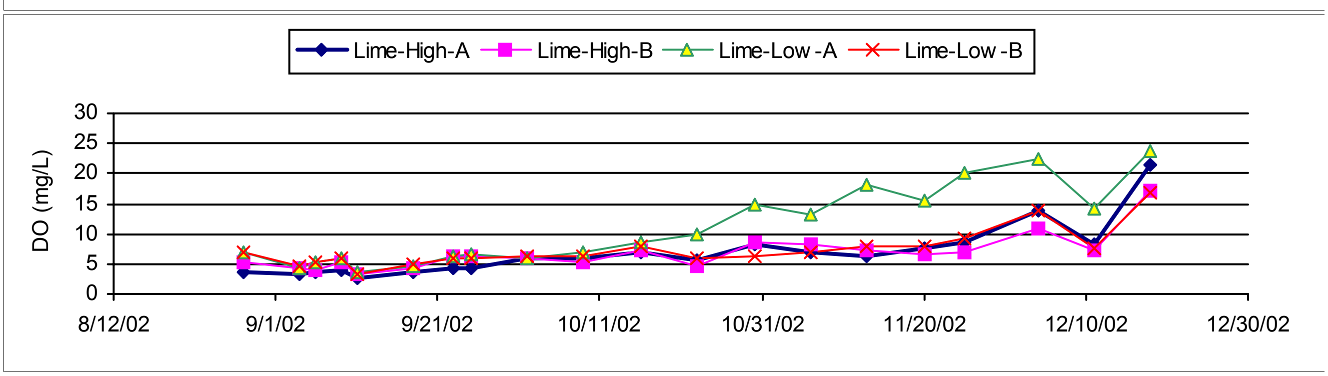


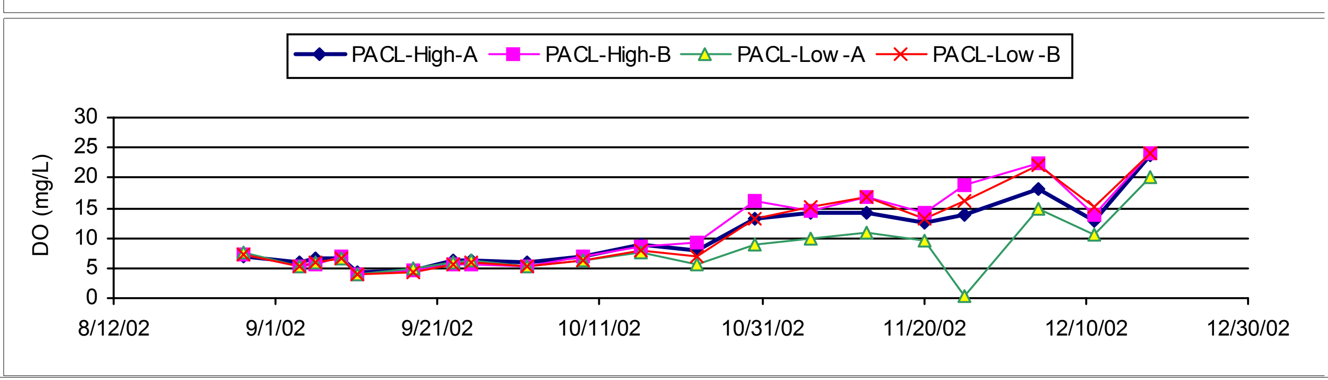
PSTA Field Scale Phase 3 - Soil Amendment Study
Dissolved Oxygen - Surface Water



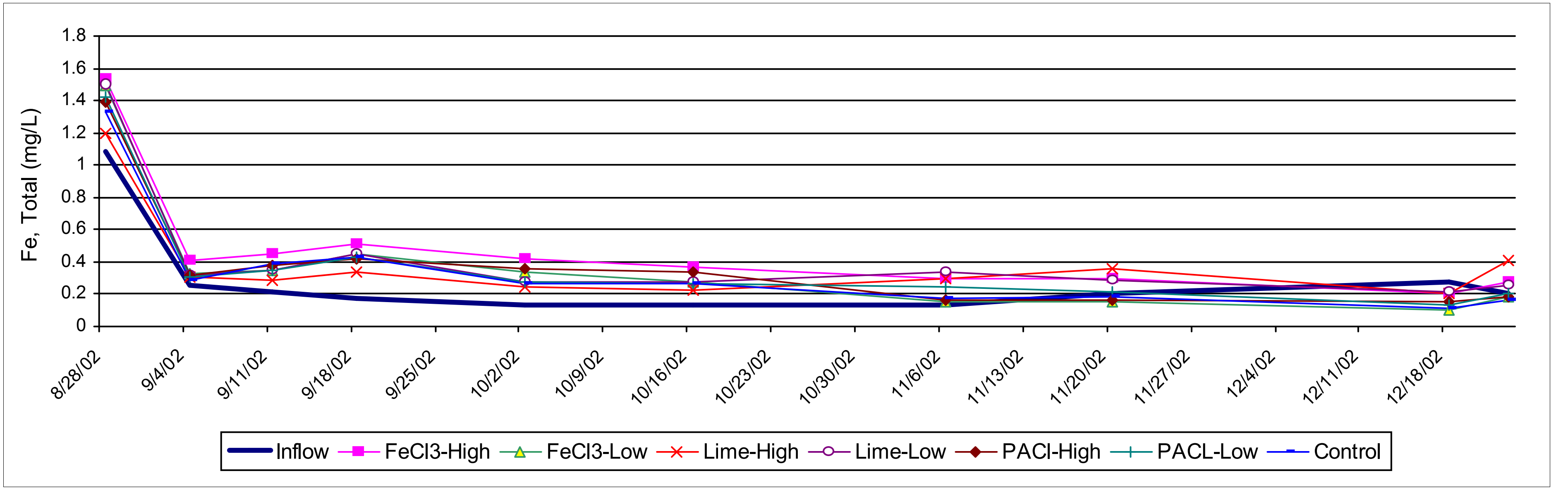


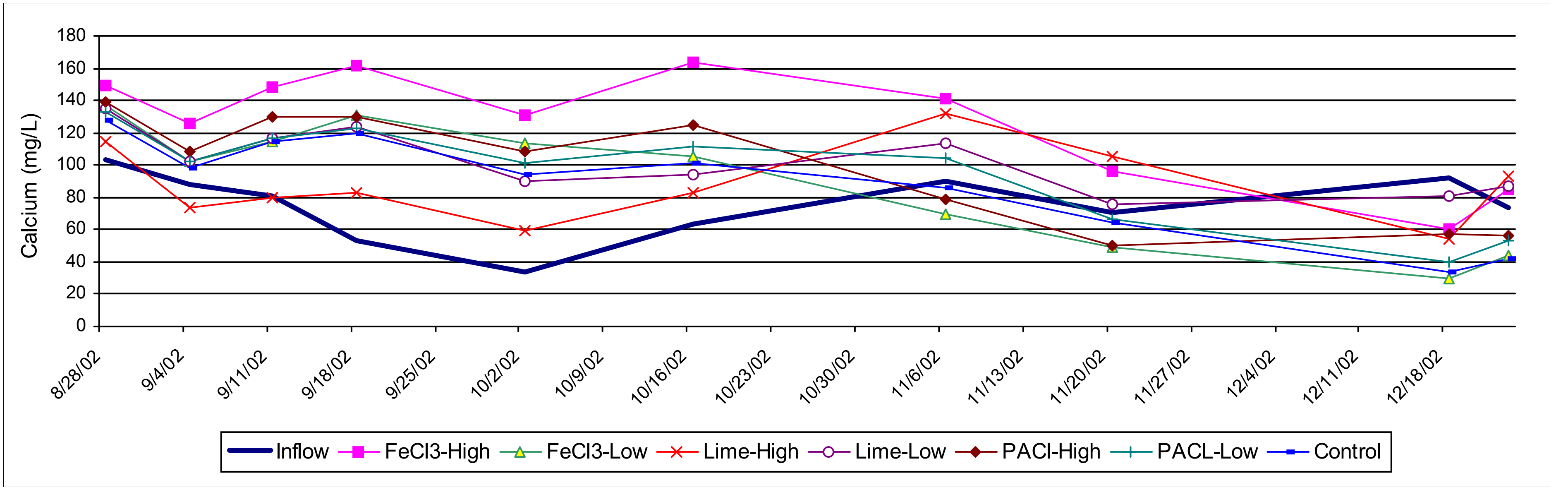




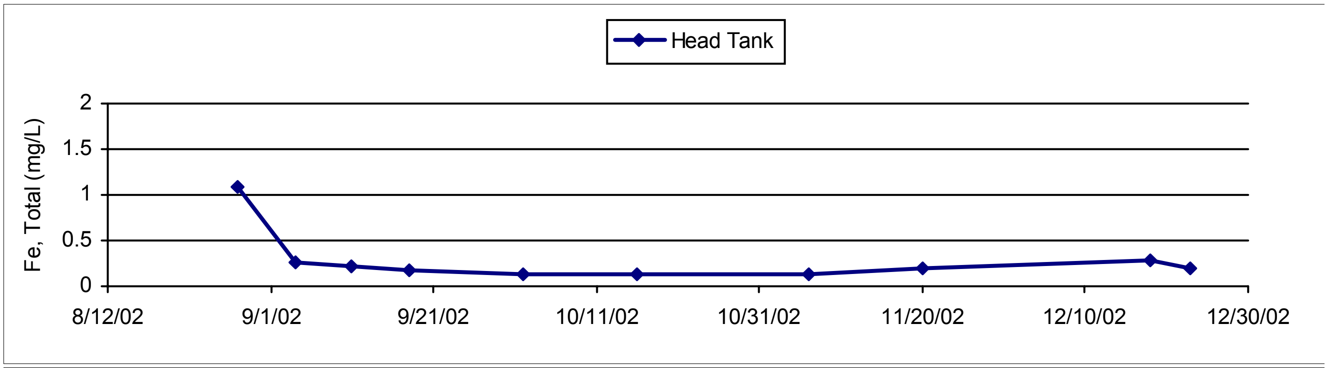


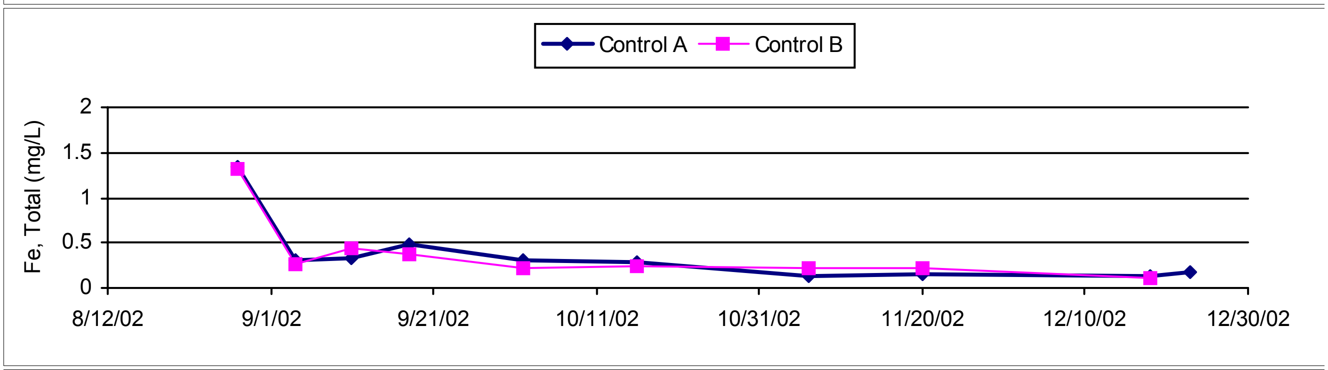
PSTA Field Scale Phase 3 - Soil Amendment Study
Total Iron and Calcium - Surface Water

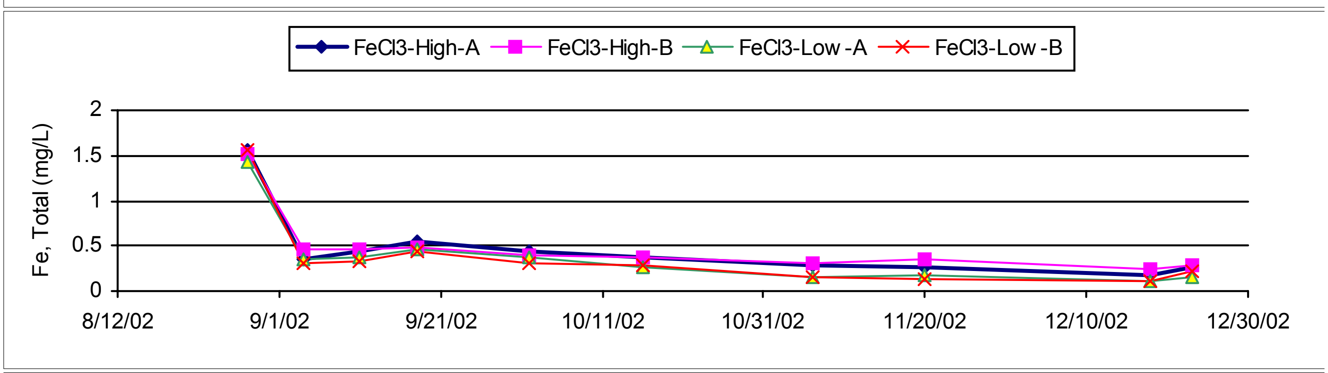


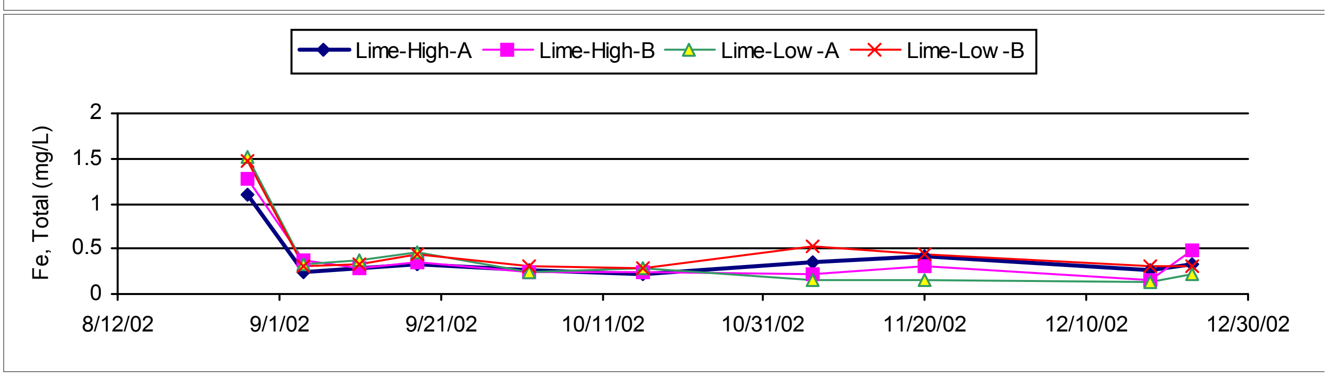


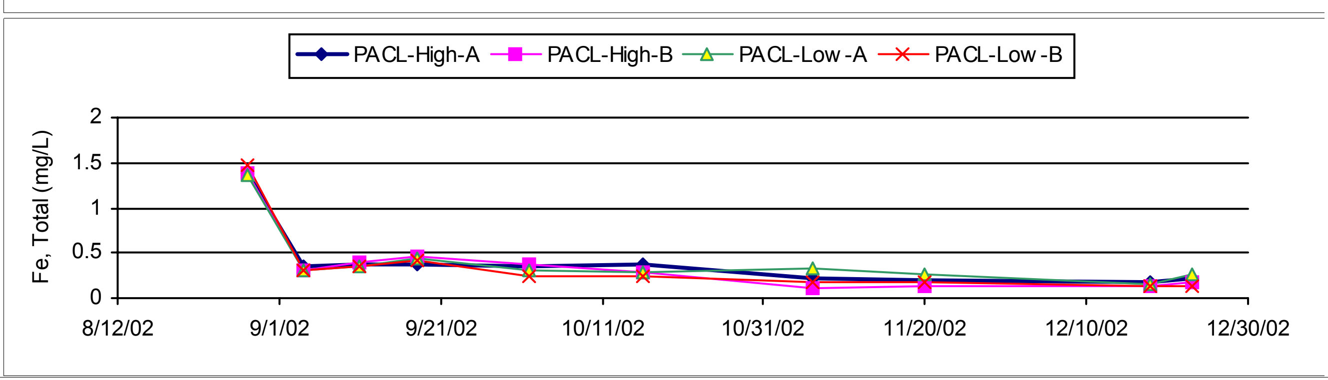
PSTA Field Scale Phase 3 - Soil Amendment Study
Total Iron - Surface Water





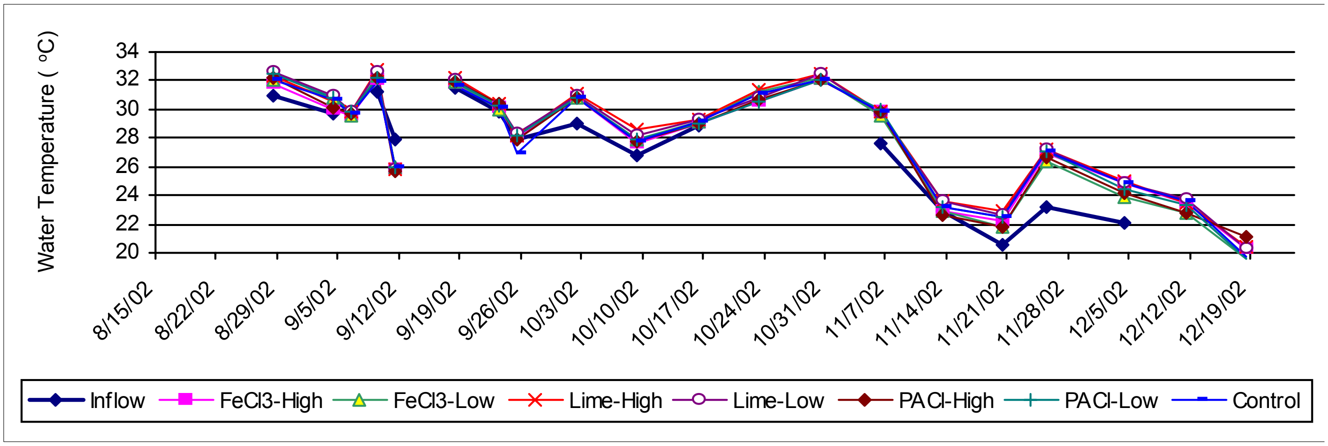


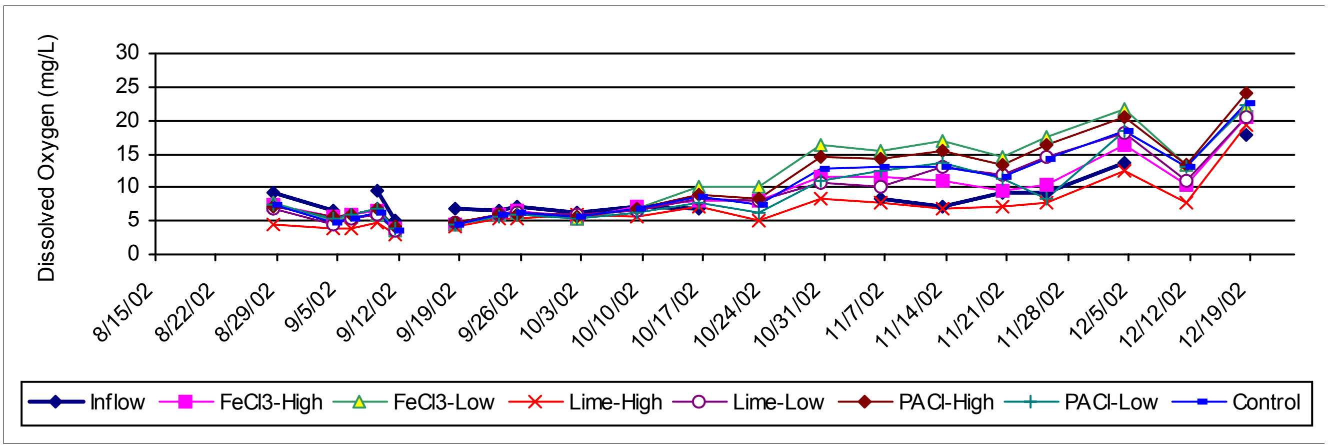


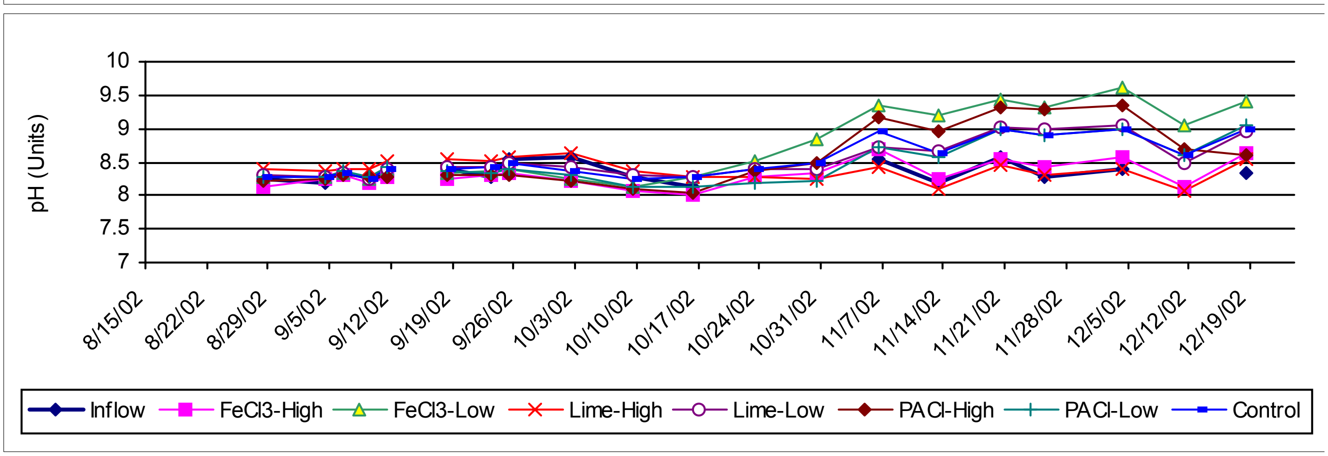


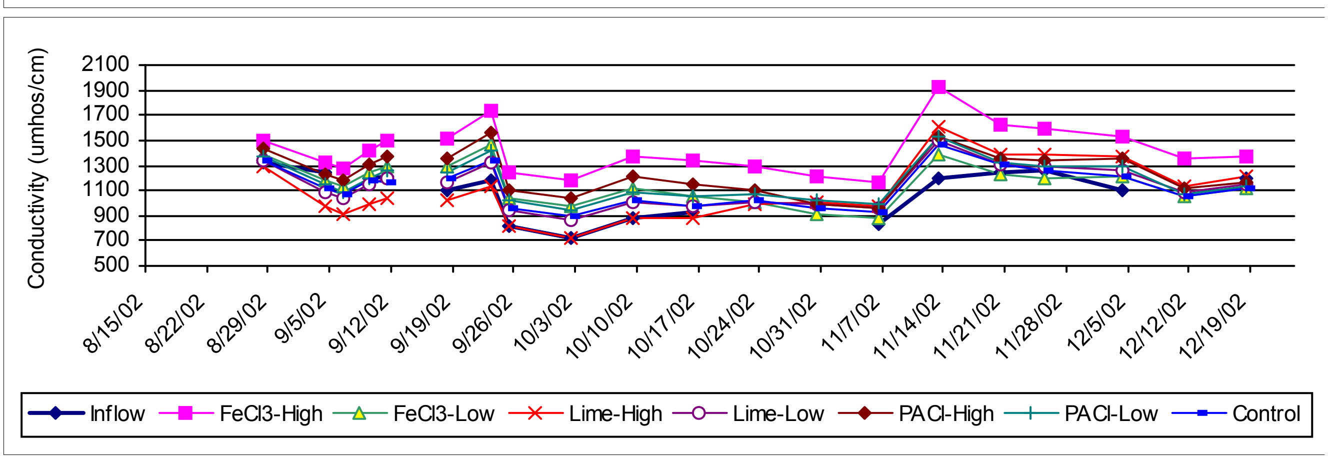
PSTA Field Scale Phase 3 - Soil Amendment Study

Field Parameters - Surface Water



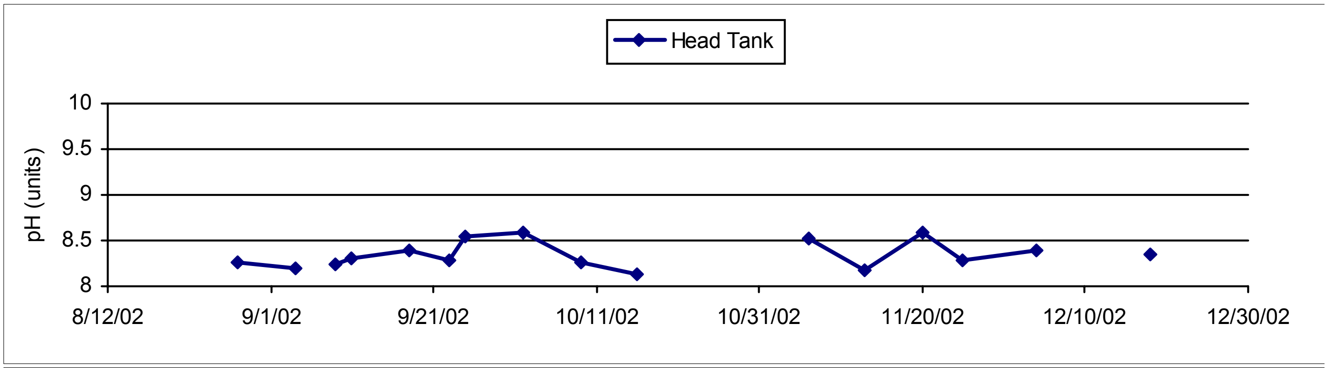


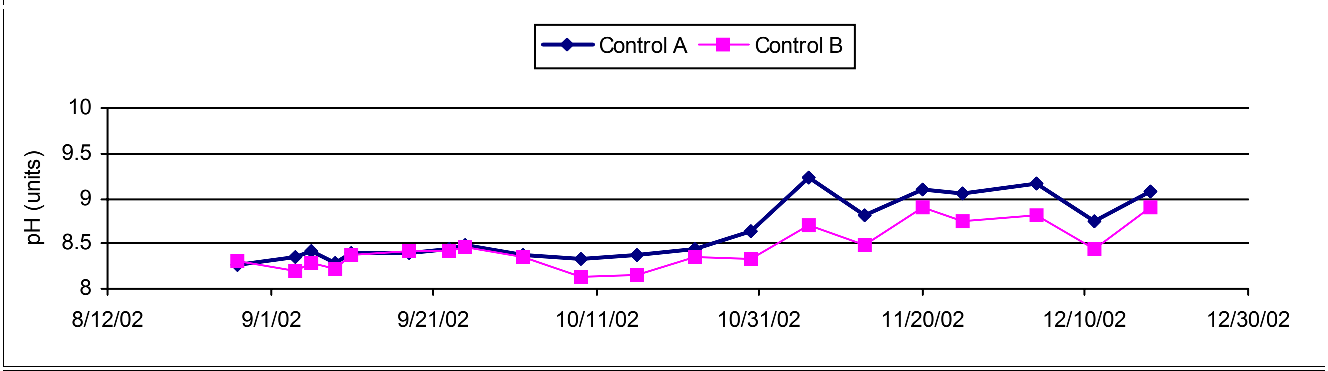


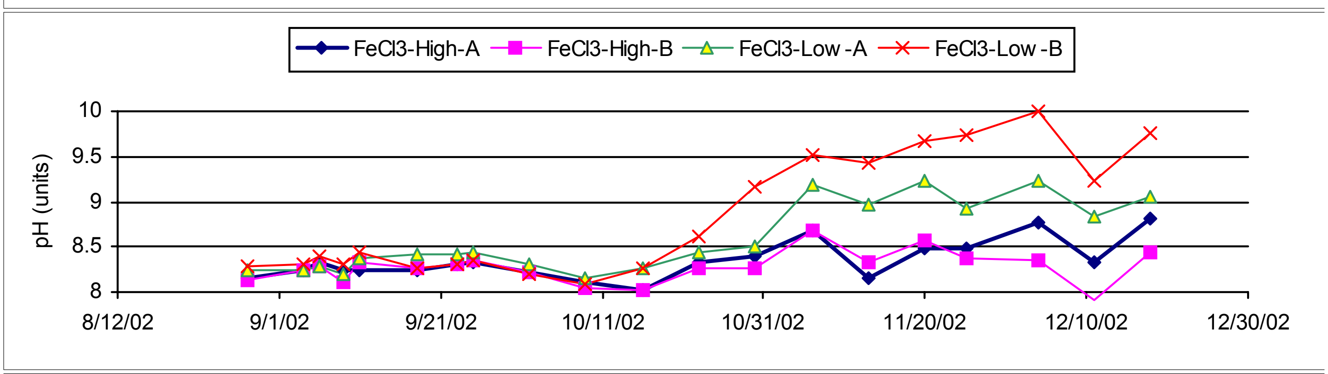


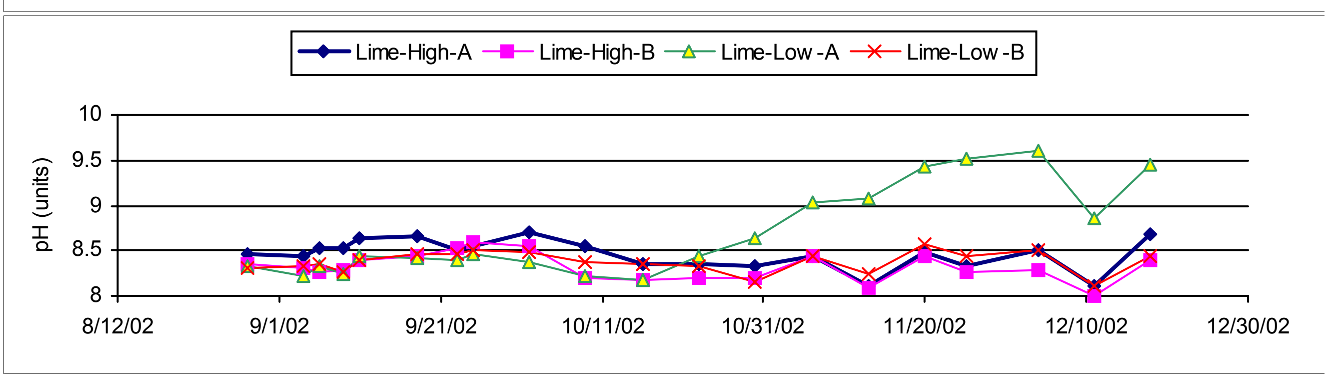
PSTA Field Scale Phase 3 - Soil Amendment Study

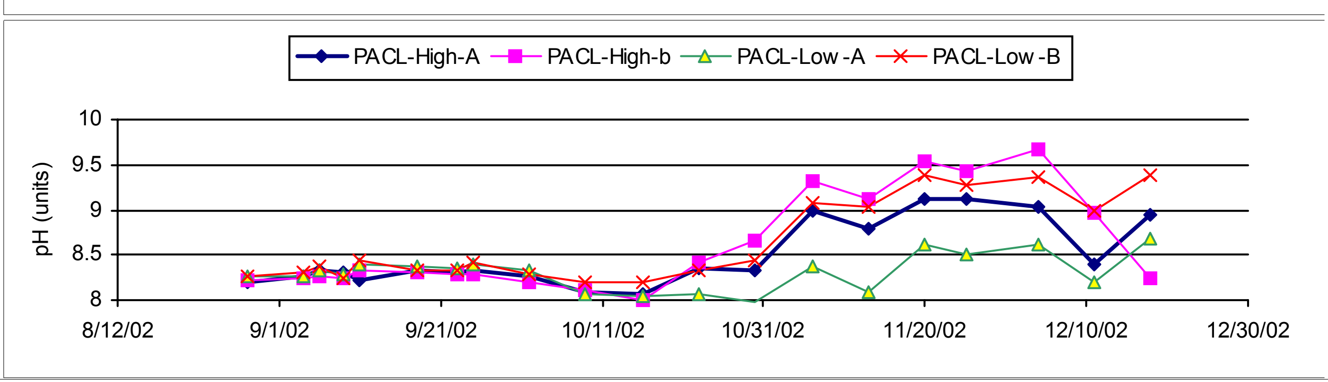
pH - Surface Water





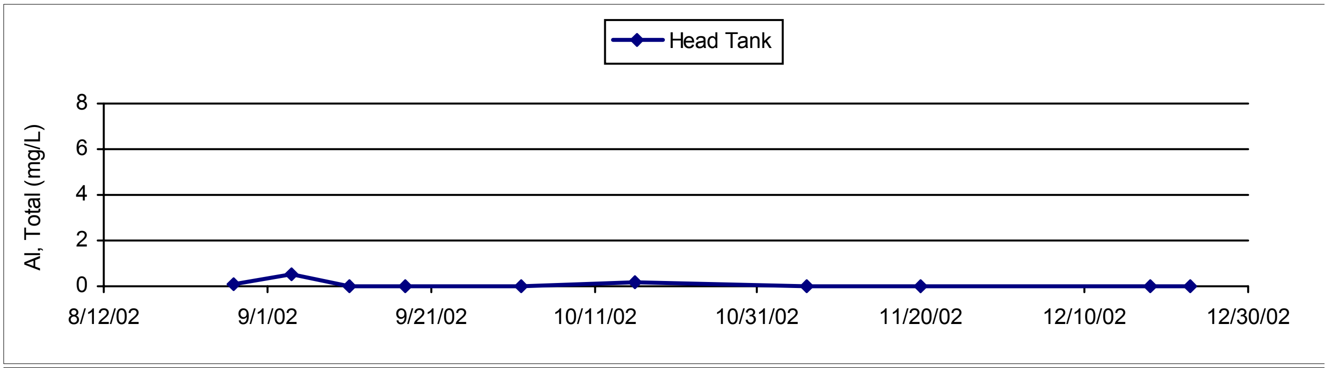


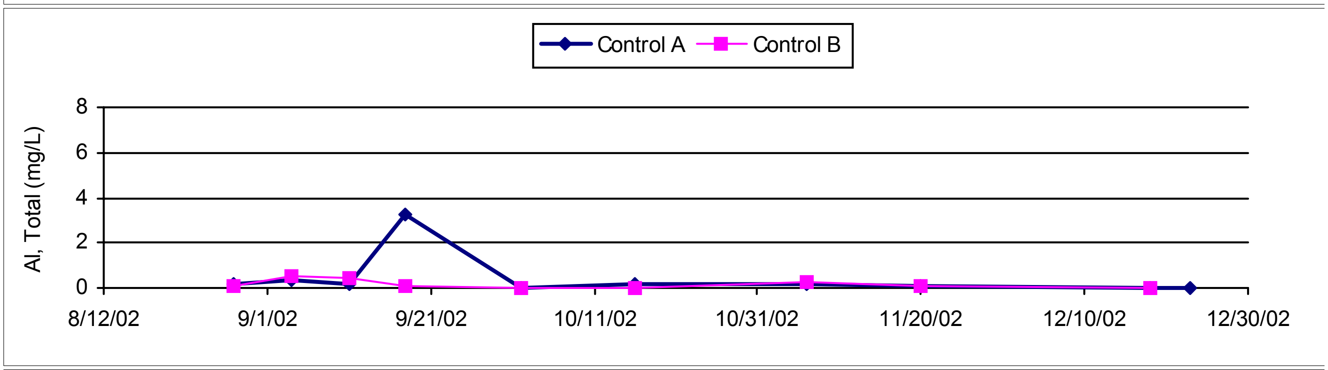


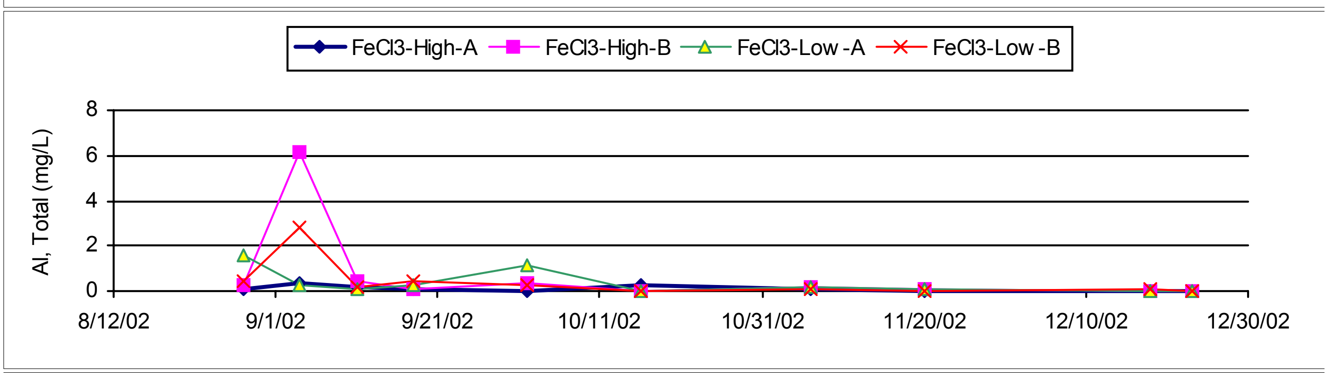


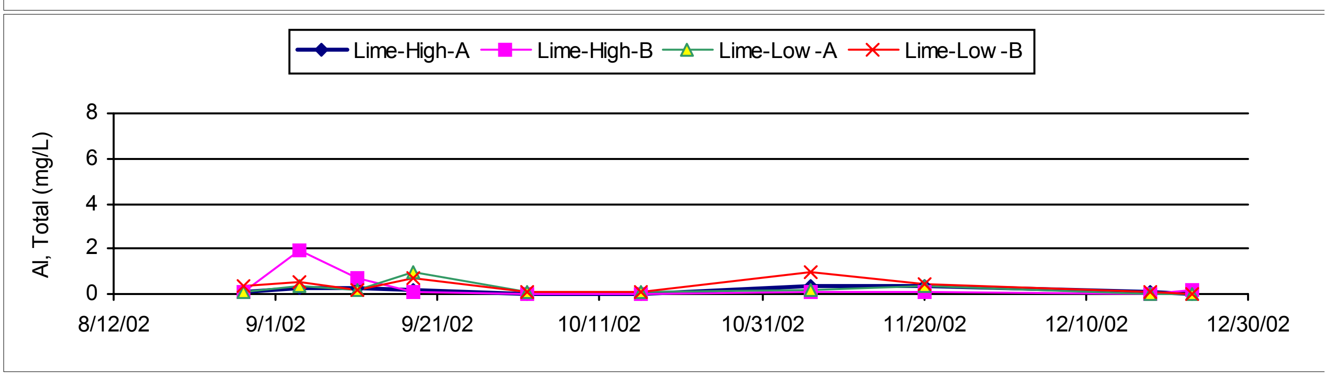
PSTA Field Scale Phase 3 - Soil Amendment Study

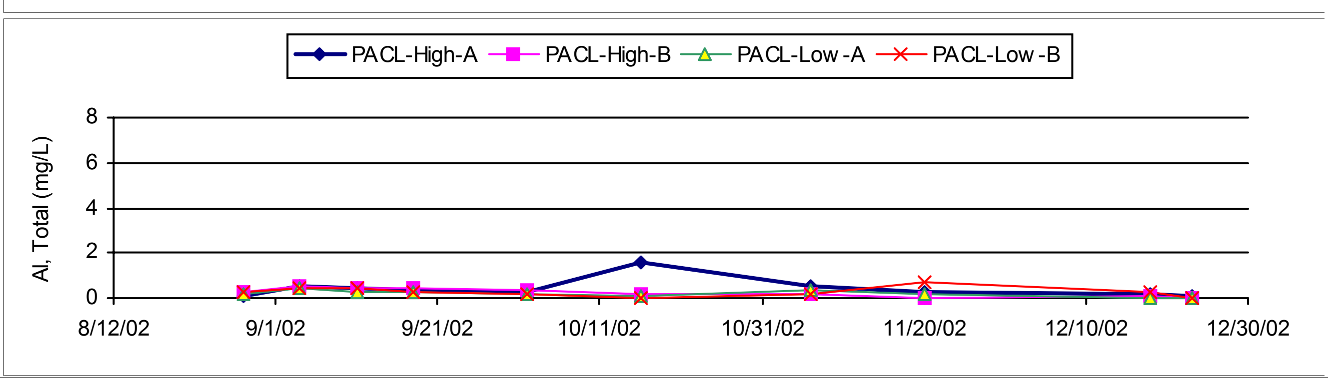
Total Aluminum - Surface Water



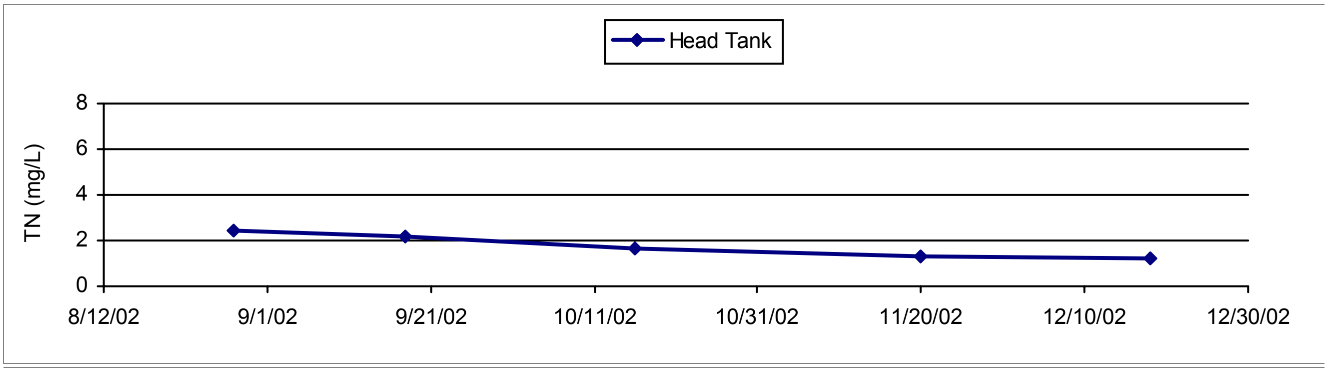


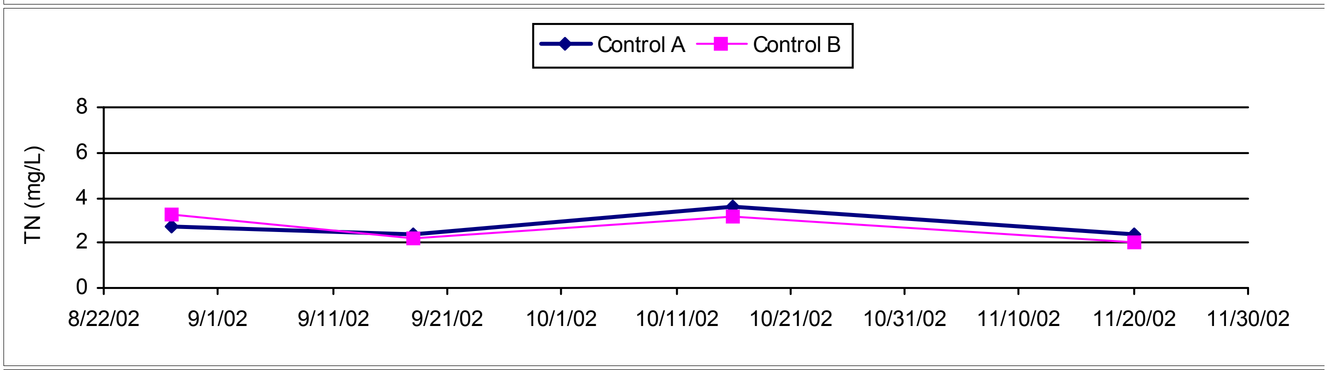


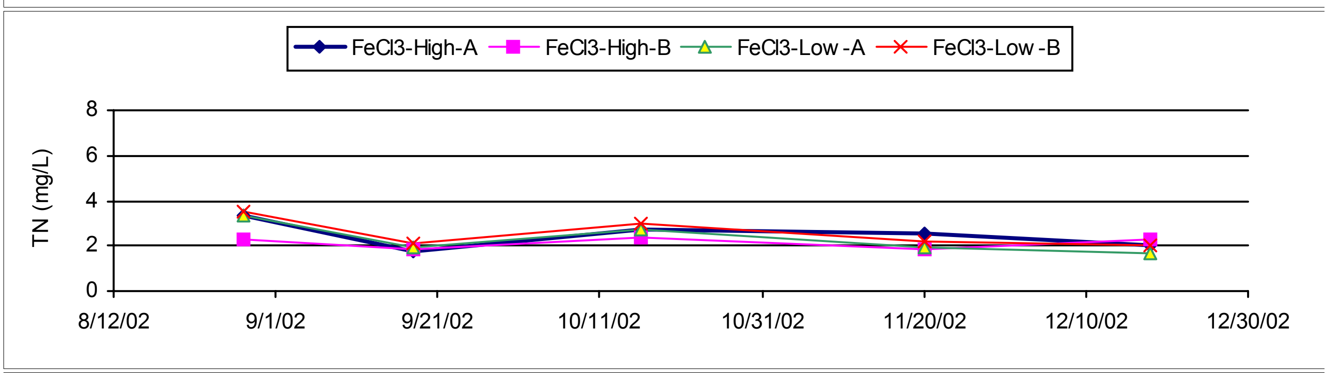


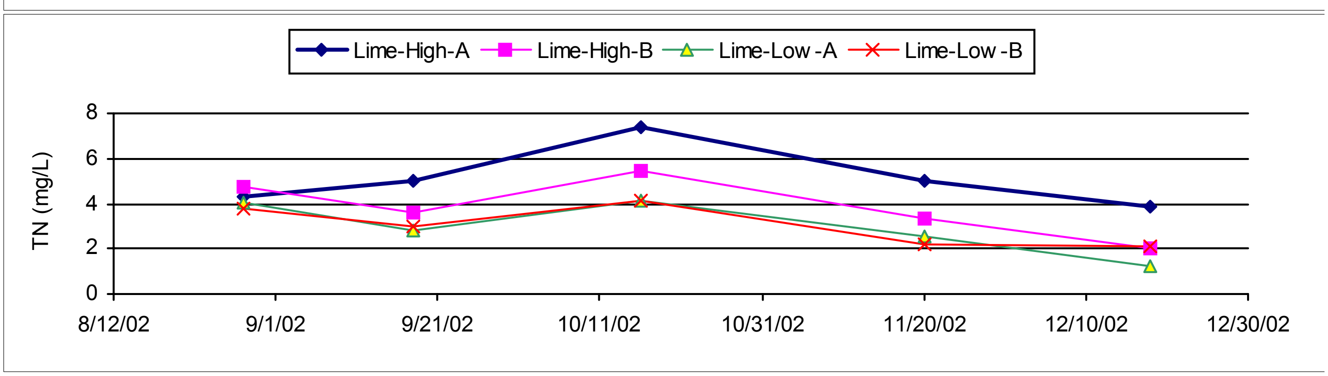


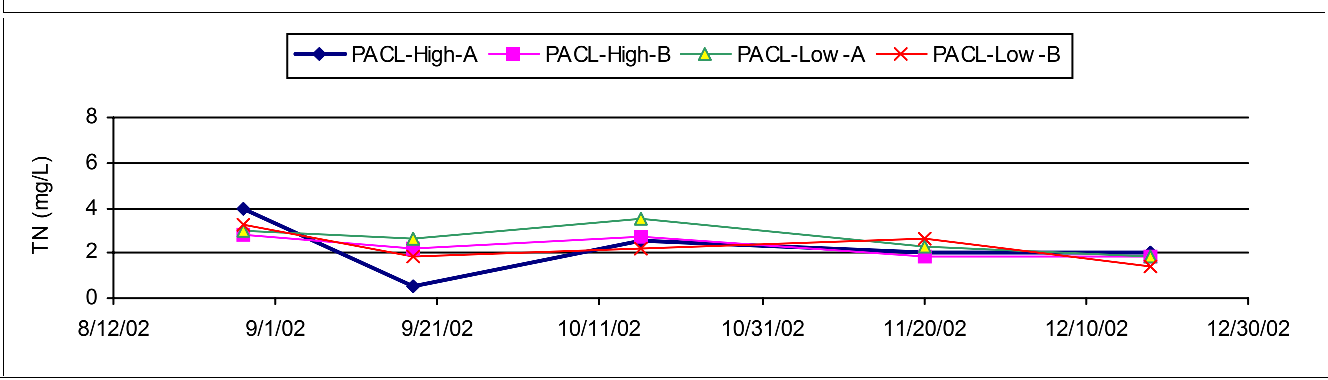
PSTA Field Scale Phase 3 - Soil Amendment Study
Total Nitrogen - Surface Water



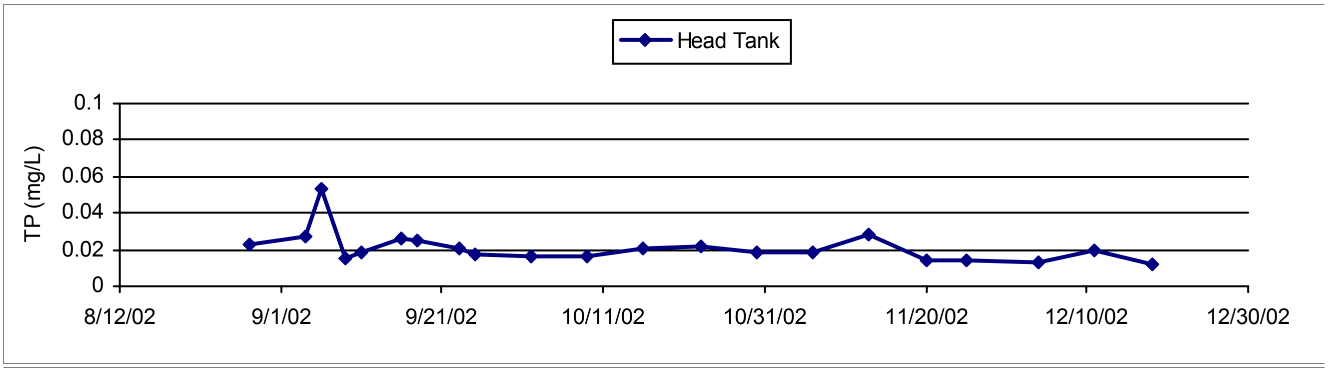


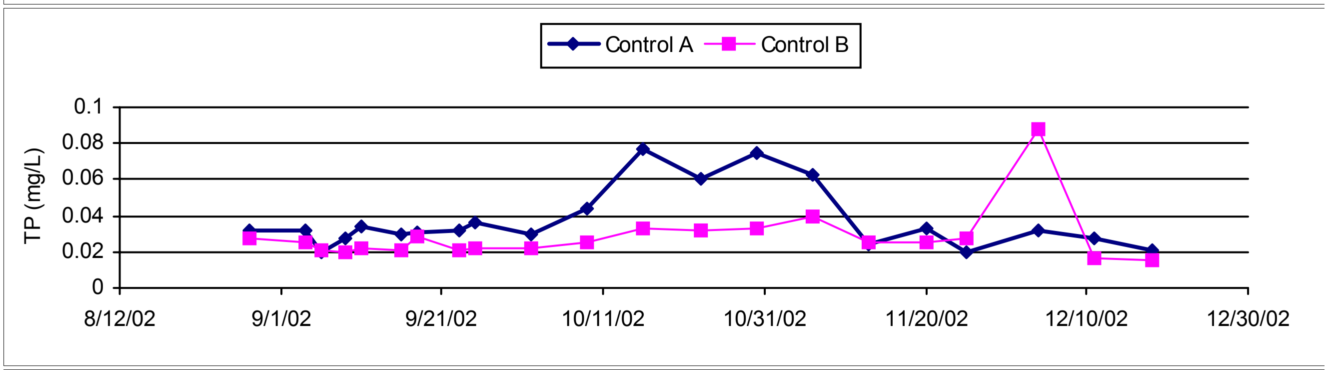


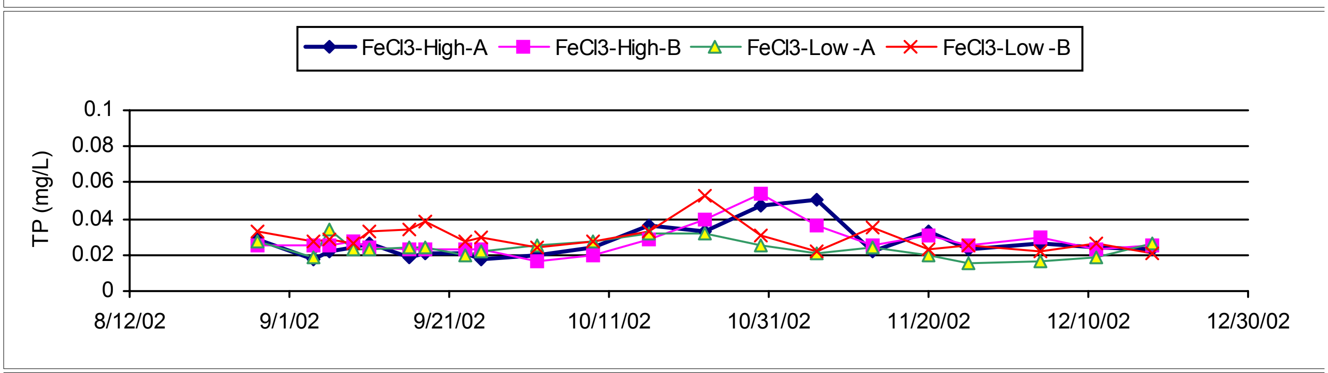


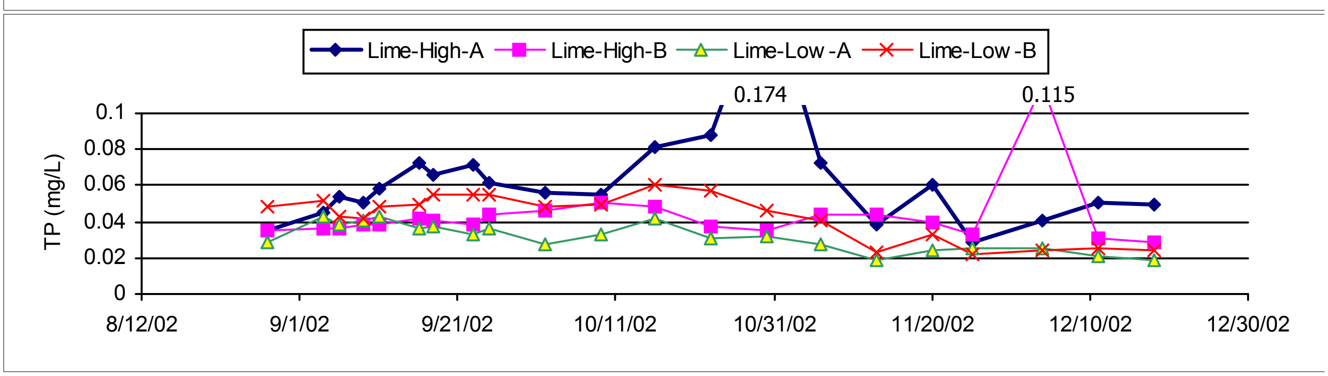


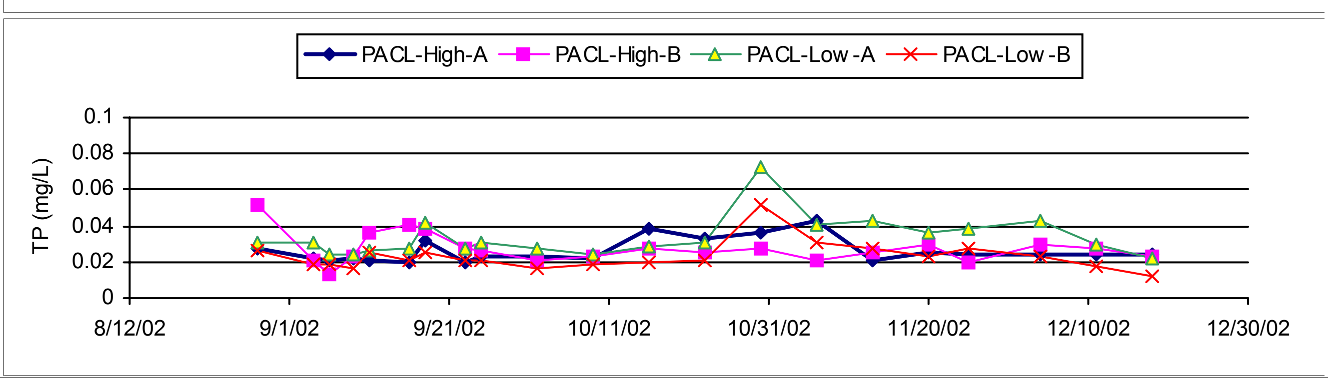
PSTA Field Scale Phase 3 - Soil Amendment Study
Total Phosphorus - Surface Water



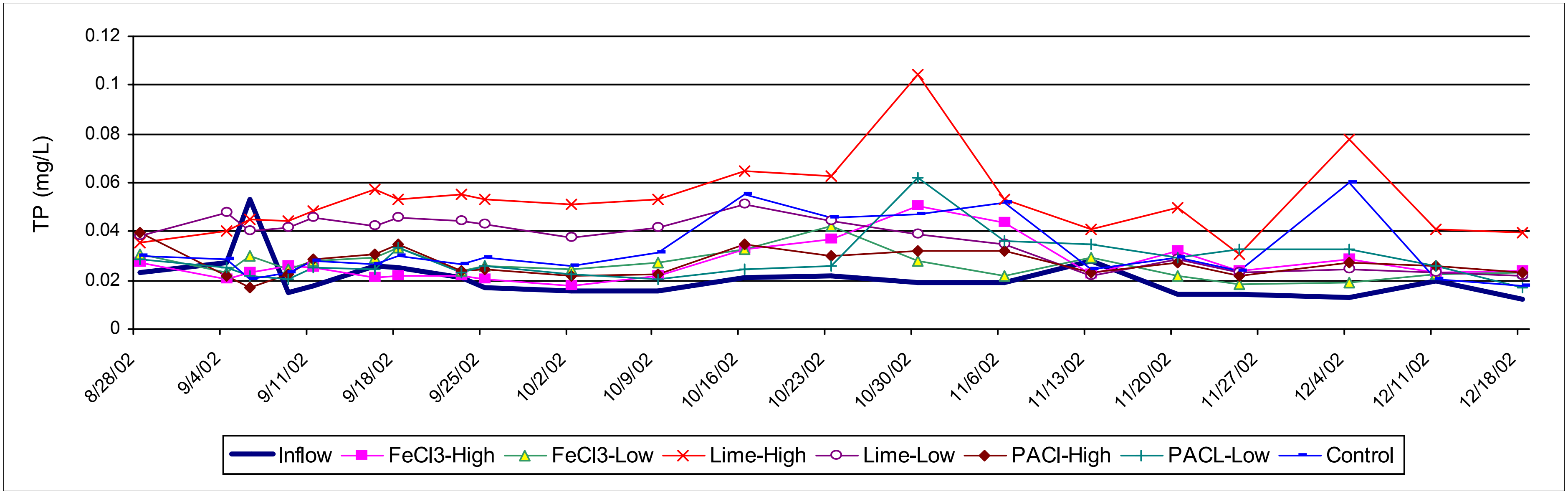


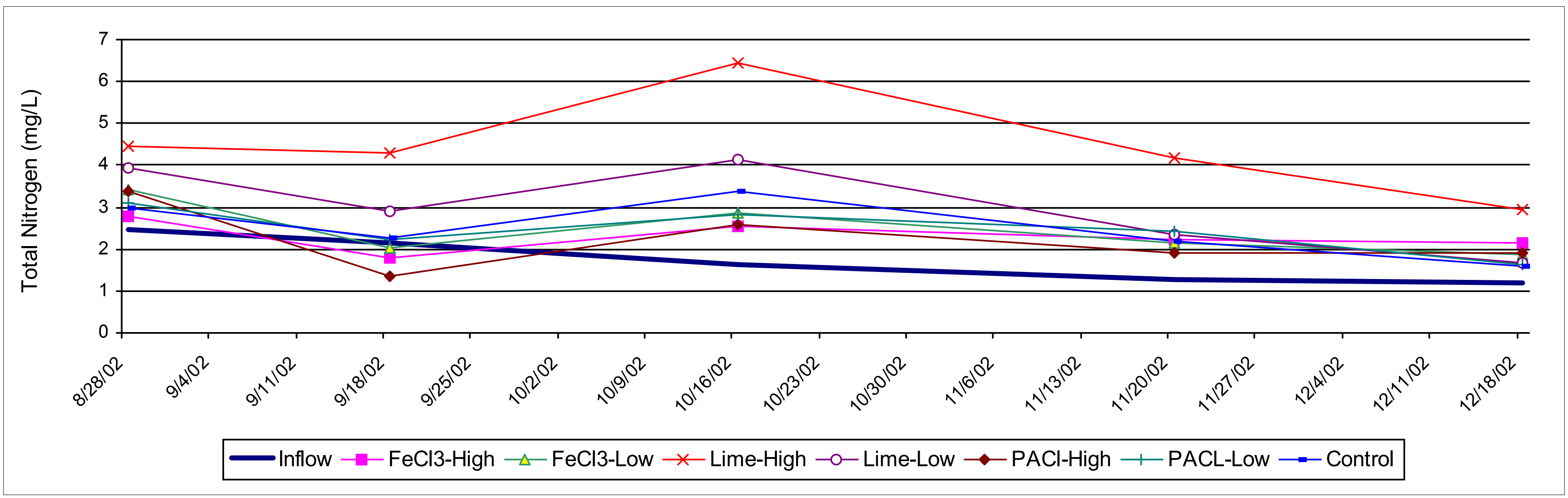


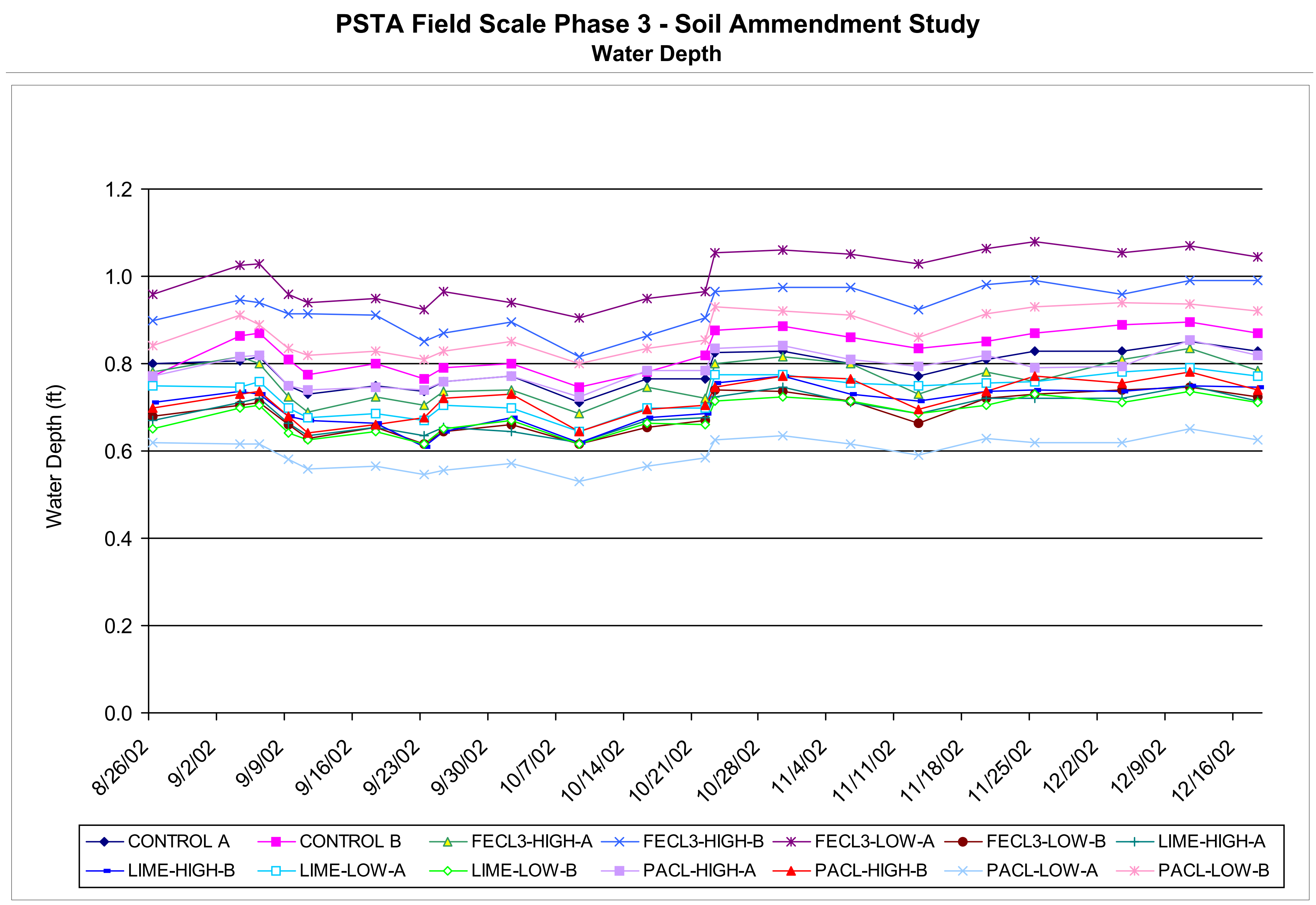




PSTA Field Scale Phase 3 - Soil Amendment Study
Total Phosphorus and Total Nitrogen - Surface Water







PSTA Field Scale Phase 3 - Soil Ammendment Study
Water Depth
Water Depth (ft)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/26/02
9/2/02
9/9/02
9/16/02
9/23/02
9/30/02
10/7/02
10/14/02
10/21/02
10/28/02
11/4/02
11/11/02
11/18/02
11/25/02
12/2/02
12/9/02
12/16/02
CONTROL A
CONTROL B
FECL3-HIGH-A
FECL3-HIGH-B
FECL3-LOW-A
FECL3-LOW-B
LIME-HIGH-A
LIME-HIGH-B
LIME-LOW-A
LIME-LOW-B
PACL-HIGH-A
PACL-HIGH-B
PACL-LOW-A
PACL-LOW-B

Appendix D
Soil Amendment Study Detailed Soils Data

Appendix D-1

Summary of Sediment Data Collected at the Soil Amendment Tanks

Tanks in Batch Mode until 10/22/02

Treatment	Cell	Date	Total Al (mg/kg)	Calcium (mg/kg)	Dry weight (g)	Total Fe (mg/kg)	Total Mg (mg/kg)	TP (mg/kg)
CONTROL A	SA-6	8/15/02	12,095	57,667	---	8,071	6,807	---
		11/13/02	17,797	52,079	53.7	10,522	8,683	514.9
CONTROL B	SA-11	8/15/02	13,985	67,132	---	8,774	7,678	---
		11/13/02	16,925	60,025	58.8	10,375	8,695	570.0
FECL3-HIGH-A	SA-2	8/15/02	12,120	60,000	---	9,440	7,664	---
		11/13/02	13,720	67,391	72.2	10,809	8,802	573.6
FECL3-HIGH-B	SA-9	8/15/02	13,020	57,797	---	10,760	7,111	---
		11/13/02	16,850	51,125	59.7	13,075	7,833	561.0
FECL3-LOW-A	SA-8	8/15/02	11,857	64,422	---	8,384	7,048	---
		11/13/02	13,679	76,061	53.5	9,535	7,941	573.4
FECL3-LOW-B	SA-13	8/15/02	12,433	59,876	---	11,871	6,950	---
		11/13/02	17,328	77,377	105.4	10,787	9,583	540.4
LIME-HIGH-A	SA-4	8/15/02	11,569	74,746	---	7,566	7,124	---
		11/13/02	13,525	95,525	55.7	8,868	9,993	593.0
LIME-HIGH-B	SA-10	8/15/02	13,654	80,986	---	8,875	7,873	---
		11/13/02	18,902	72,383	77.4	11,752	9,710	520.1
LIME-LOW-A	SA-14	8/15/02	11,557	64,211	---	7,864	7,624	---
		11/13/02	17,118	59,680	45.2	10,200	8,313	534.2
LIME-LOW-B	SA-7	8/15/02	12,440	59,522	---	8,074	6,897	---
		11/13/02	15,366	70,293	53.7	9,771	10,520	573.8
PACL-HIGH-A	SA-1	8/15/02	12,805	60,707	---	8,224	7,066	---
		11/13/02	15,317	77,143	94.8	9,257	9,632	552.9
PACL-HIGH-B	SA-3	8/15/02	13,164	58,188	---	8,411	7,336	---
		11/13/02	20,392	59,926	85.4	12,221	10,113	509.7
PACL-LOW-A	SA-5	8/15/02	12,660	57,365	---	8,276	7,034	---
		11/13/02	15,311	68,876	69.4	9,538	8,902	588.5
PACL-LOW-B	SA-12	8/15/02	14,423	60,192	---	8,962	7,803	---
		11/13/02	15,915	59,413	61.3	10,523	10,099	860.9
CONTROL	---	8/15/02	13,040	62,400	---	8,423	7,243	---
		11/13/02	17,361	56,052	56.3	10,449	8,689	542.4
FECL3-HIGH	---	8/15/02	12,570	58,899	---	10,100	7,388	---
		11/13/02	15,285	59,258	66.0	11,942	8,318	567.3
FECL3-LOW	---	8/15/02	12,145	62,149	---	10,128	6,999	---
		11/13/02	15,504	76,719	79.5	10,161	8,762	556.9
LIME-HIGH	---	8/15/02	12,612	77,866	---	8,221	7,499	---
		11/13/02	16,214	83,954	66.6	10,310	9,852	556.5
LIME-LOW	---	8/15/02	11,999	61,867	---	7,969	7,261	---
		11/13/02	16,242	64,987	49.5	9,986	9,417	554.0
PACL-HIGH	---	8/15/02	12,985	59,448	---	8,318	7,201	---
		11/13/02	17,855	68,535	90.1	10,739	9,873	531.3
PACL-LOW	---	8/15/02	13,542	58,779	---	8,619	7,419	---
		11/13/02	15,613	64,145	65.4	10,031	9,501	724.7

APPENDIX J

Post STA-2 STSOC Cost Estimates

APPENDIX J-1
PSTA Standards of Comparison (STSOC) Post-STA-2 Design Criteria Summary

Design Criteria	No by-pass, 20 ppb P	10% By-pass, 20 ppb P	20% By-pass, 20 ppb P	No by-pass, 12 ppb P	10% By-pass, 12 ppb P	20% By-pass, 12 ppb P
Total Treatment Area, acres	6603	5639	5006	15316	13241	11791
No. of Treatment Cells	3	3	3	3	3	3
Treatment Cell Area, acres	2201	1880	1669	5105	4414	3930
Average Water Depth, ft.	1.14	1.14	1.13	1.18	1.17	1.15
Maximum Water Depth, ft	3.35	2.97	2.86	3.02	2.71	2.64
Total Land Required, acres	6885	5888	5237	15727	13607	12134
Inflow Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Inflow Canal Bottom Width, ft.	20	20	20	20	20	20
Inflow Canal Side Slope, H:V	2	2	2	2	2	2
Inflow Canal Depth, ft.	22	19.75	19	22	19.75	19
No. of Inflow Control Structures per Cell	4	4	4	4	4	4
Type of Inflow Control Structures	Gated Weir	Gated Weir	Gated Weir	Gated Weir	Gated Weir	Gated Weir
Size of Inflow Control Structures, ft.	50	50	50	50	50	50
Inflow Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Inflow Levee Top Width, ft.	10	10	10	10	10	10
Inflow Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Inflow Levee Height, ft.	9.75	9.25	9	9.5	9	9
Inflow Levee Top Elevation, ft.	9.75	9.25	9	9.5	9	9
No. of Small Inflow Pumps	4	3	3	4	3	3
Size of Small Inflow Pumps, cfs	75	100	100	75	100	100
No. of Large Inflow Pumps	5	5	4	5	5	4
Size of Large Inflow Pumps, cfs	650	500	600	650	500	600
Outflow Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Outflow Canal Bottom Width, ft.	20	20	20	20	20	20
Outflow Canal Side Slope, H:V	2	2	2	2	2	2
Outflow Canal Depth, ft.	21.5	19.25	18.5	19.5	17.5	17.25
No. of Outflow Control Structures per Cell	2	2	2	2	2	2
Type of Outflow Control Structures	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert	Gated Box Culvert
Height of Outflow Control Structures, ft.	5	5	5	5	5	5
Width of Outflow Control Structures, ft.	20	25	25	20	20	20
Outflow Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Outflow Levee Top Width, ft.	10	10	10	10	10	10
Outflow Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Outflow Levee Height, ft.	8.5	8	8	8.25	7.75	7.75
Outflow Levee Top Elevation, ft.	8.5	8	8	8.25	7.75	7.75
No. of Small Outflow Pumps	4	3	3	4	3	3
Size of Small Outflow Pumps, cfs	75	100	100	75	100	100
No. of Large Outflow Pumps	5	4	5	4	4	4
Size of Large Outflow Pumps, cfs	600	625	425	650	500	475
Interior Levee Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50
Interior Levee Top Width, ft.	6	6	6	6	6	6
Interior Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Interior Levee Height, ft.	8.5	8	8	8.25	7.75	7.75
Interior Levee Top Elevation, ft.	10.5	10	10	10.25	9.75	9.75
Side Levee Length, mi.	2.62	NA	NA	3.99	NA	NA

APPENDIX J-1
PSTA Standards of Comparison (STSOC) Post-STA-2 Design Criteria Summary

Design Criteria	No by-pass, 20 ppb P	10% By-pass, 20 ppb P	20% By-pass, 20 ppb P	No by-pass, 12 ppb P	10% By-pass, 12 ppb P	20% By-pass, 12 ppb P
Side Levee Top Width, ft.	10	NA	NA	10	NA	NA
Side Levee Side Slope, H:V	2.5	NA	NA	2.5	NA	NA
Side Levee Height, ft.	8.5	NA	NA	8.25	NA	NA
Side Levee Top Elevation, ft.	8.5	NA	NA	8.25	NA	NA
By-Pass Canal Length, mi.	NA	2.42	2.28	NA	3.71	3.50
By-Pass Canal Bottom Width, ft.	NA	6	6	NA	5	5
By-Pass Canal Side Slope, H:V	NA	2	2	NA	2	2
By-Pass Canal Depth, ft.	NA	3.25	4.25	NA	4.25	5.25
No. of By-Pass Control Structures	0	1	1	0	1	1
Type of By-Pass Control Structures	NA	Flow Splitter Box w/ Weir	Flow Splitter Box w/ Weir	NA	Flow Splitter Box w/ Weir	Flow Splitter Box w/ Weir
Size of By-Pass Control Structures, ft.	0	5	5	0	5	5
By-Pass Levee Length, mi.	NA	2.42	2.28	NA	3.71	3.50
By-Pass Levee Top Width, ft.	NA	6	6	NA	6	6
By-Pass Levee Side Slope, H:V	NA	2.5	2.5	NA	2.5	2.5
By-Pass Levee Height, ft.	NA	8	8	NA	7.75	7.75
By-Pass Levee Top Elevation, ft.	NA	8	8	NA	7.75	7.75
No. of Small By-Pass Pumps	NA	2	2	NA	2	2
Size of Small By-Pass Pumps, cfs	NA	25	50	NA	25	50
No. of Large By-Pass Pumps	NA	8	9	NA	8	9
Size of Large By-Pass Pumps, cfs	NA	100	100	NA	100	100
Seepage Canal Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Seepage Canal Bottom Width, ft.	6	6	6	6	6	6
Seepage Canal Side Slope, H:V	2	2	2	2	2	2
Seepage Canal Depth, ft.	3.25	3	3	4.25	4	3.75
Seepage Levee Length, mi.	3.93	3.64	3.43	5.99	5.57	5.26
Seepage Levee Top Width, ft.	6	6	6	6	6	6
Seepage Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Seepage Levee Height, ft.	7	7	7	7	7	7
Seepage Levee Top Elevation, ft.	7	7	7	7	7	7
Side Seepage Canal Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50
Side Seepage Canal Bottom Width, ft.	2	2	2	3	3	3
Side Seepage Canal Side Slope, H:V	2	2	2	2	2	2
Side Seepage Canal Depth, ft.	2.5	2.25	2.25	3.25	3.25	3
Side Seepage Levee Length, mi.	2.62	2.42	2.28	3.99	3.71	3.50
Side Seepage Levee Top Width, ft.	6	6	6	6	6	6
Side Seepage Levee Side Slope, H:V	2.5	2.5	2.5	2.5	2.5	2.5
Side Seepage Levee Height, ft.	7	7	7	7	7	7
Side Seepage Levee Top Elevation, ft.	7	7	7	7	7	7
No. of Small Seepage Pumps	2	2	2	2	2	3
Size of Small Seepage Pumps, cfs	5	10	10	5	15	15
No. of Large Seepage Pumps	2	2	2	3	3	NA
Size of Large Seepage Pumps, cfs	20	15	15	20	20	NA

APPENDIX J-2

STSOC Cost Estimate - Target 20 ppb w/No Bypass

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment	Lump sum			$0		Not applicable, passive treatment system
1.1.2	Residuals management	Lump sum			$0		Not applicable, no residuals produced
1	Freight	Lump sum			$0		Not applicable
1	Installation	Lump sum			$0		Not applicable
1	Instrumentation	Lump sum			$0		Not applicable
2	**Electrical controls**						
1.5.1	Electrical controls	Lump sum			$0		Not applicable
1.5.2	Electrical power distribution	$/mile	$80,000	10.48	$838,400	$838,400	For powering gated water control structures and pumping stations
2	**Civil Work- water control structures**						
1.6.5	50' inflow weir with control gate	per structure	$110,000	12.00	$1,320,000	$1,320,000	
1.6.6	5' X 20' outflow box culvert with gate	per structure	$119,000	6.00	$714,000	$714,000	
1.6.9	By-pass structure	per structure	$5,270	0.00	$0		No by-pass
1.6.10	5' wide by-pass weir without gate	per structure	$5,000	0.00	$0		No by-pass
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$4		$0		Not applicable
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$3	2,334,633.00	$5,836,583	$5,836,583	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$5	2,123,073.33	$9,553,830	$9,553,830	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$4		$0		
2	**Levees (no blasting)**						
1.8.1.4	Internal-8' 6" (4.5' SWD) - 6' top width	$/mile	$313,000	5.24	$1,640,120	$1,640,120	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$398,000	6.55	$2,606,900	$2,606,900	
1.8.2.5	External- 8' 6" (4.5' SWD)	$/mile	$523,500	13.10	$6,857,850	$6,857,850	
1.9.1	**Pumping stations - Influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$7,500	3,000.00	$22,500,000	[redacted]	
1.9.1.2	Additional influent pumping station 500-3000 cfs	$/cfs	$7,500		$0		
1.9.1.3	Additional influent pumping station >3000 cfs	$/cfs	$7,950		$0		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$7,500	3,000.00	$22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$7,500		$0	$0	
1.9.2.3	Additional effluent pumping station >3000 cfs	$/cfs	$7,950	3,300.00	$26,235,000	$26,235,000	
1.9.3	**Pumping stations - Seepage**						
1.9.3.1	0-40 cfs	$/cfs	$7,600		$0		
1.9.3.2	41-60 cfs	$/cfs	$9,500	50.00	$475,000	$475,000	
1.9.3.3	60-500 cfs	$/cfs	$9,900	500.00	$4,950,000		
1.9.4	**Pumping stations - By-pass**					[redacted]	Not applicable
1.9.4.1	0-40 cfs	$/cfs	$7,600		$0	$0	
1.9.4.2	41-60 cfs	$/cfs	$9,500		$0	$0	
1.9.4.2	60-500 cfs	$/cfs	$9,900		$0	$0	
1.9.4.4	500-3000 cfs	$/cfs	$7,500		$0	$0	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump sum			$22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$31,000	6,603.00	$204,693,000	$204,693,000	
Subtotal Capital Costs					$332,720,683	$260,770,683	
Construction Contingencies					$52,154,137	$52,154,137	20% of Capital Costs
Subtotal Construction Costs					$384,874,819	$312,924,819	

APPENDIX J-2

STSOC Cost Estimate - Target 20 ppb w/No Bypass

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
Engineering and Design Costs					$46,938,723	$46,938,723	15% of construction costs
1	**Land**						
1.11.1	STA-2	$/acre	$4,655	6,430.00	$29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$4,655	6,885.28	$32,050,978	$32,050,978	
1	6" gravel access roads (12 ft wide road)	$/linear ft	$150	110,668.80	$16,600,320	$16,600,320	Assumes gravel roads around the PSTA
TOTAL CAPITAL COSTS					$510,396,490	$408,514,840	
PRESENT WORTH - CAPITAL COSTS					$510,396,490	$408,514,840	
2	**OPERATING COSTS (per year)**						
2	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$50,000	0.23	$11,538	$11,538	Assumes one person at a rate of 5 days per month
2.2.1.1	Mechanical maintenance (lubrication, spare parts, etc.)- 500-3,000 cfs pumps	per unit	$23,000	11.00	$253,000	$230,000	
2.2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$10,000	12.00	$120,000	$120,000	
2.2.2	Maintenance (water control structures)	each	$12,000	18.00	$216,000	$216,000	
2.2.4	Maintenance (levees)	$/mile	$1,530	50.75	$77,648	$50,108	
2.2.5	Maintenance (vegetation control)	$/acre	$22	6,603.00	$145,266	$145,266	
2.2.6	Maintenance (canals)	$/acre	$500	105.28	$52,638	$52,638	
3	**Energy**						
2.5.1	Electricity	KW/hr	$0	6,728,499.00	$538,280	$538,280	
2.5.2.1	Fuel consumption - STA2	acre-feet	$1	117,950.00	$58,975	[redacted]	0.55 gal/acre-foot @ $0.9/gallon
2.4.2	Additional fuel consumption	acre-feet	$1	7,849.22	$3,925	$3,925	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					$1,477,270	$1,367,755	
PRESENT WORTH - OPERATING COSTS					$31,736,189	$29,383,479	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition Costs - STA2	Lump sum	$9,990,000	1.00	$9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump sum	$5,342,000	1.00	$5,342,000	$5,342,000	For demolition of outflow and seepage pump stations
3.2.1	Restoration of Levees - STA2	$/yard	$3	156,790.00	$470,370	[redacted]	
3	Restoration of Levees	$/yard	$3	57,640.00	$172,920	$172,920	
3	Clearing and grubbing						
	Light foliage	$/acre	$300	6,885.28	$2,065,584	$2,065,584	
	Forest/heavy brushes	$/acre	$1,500		$0		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
4	Replacement items						
3.5.2	Seepage pumping stations	Lump sum	$237,500	1.00	$237,500	$237,500	Assumes 50% replacement once at 25 years
3.5.3.1	STA-2 pumping stations	Lump sum	$24,975,000	1.00	$24,975,000	[redacted]	Assumes 50% replacement once at 25 years
3.5.3.2	Other pumping stations	Lump sum	$13,117,500	1.00	$13,117,500	$13,117,500	Assumes 50% replacement once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					$56,370,874	$20,935,504	
PRESENT WORTH DEMOLITION/REP. COSTS					$56,370,874	$20,935,504	
4	**Salvage Costs**						
4	Land - STA2	$/acre	$4,655	6,430.00	-$29,931,650	[redacted]	
4.1.1	Land - Additional land	$/acre	$4,655	6,885.28	-$32,050,978	-$32,050,978	
TOTAL SALVAGE COSTS					-$61,982,628	-$32,050,978	
PRESENT WORTH OF SALVAGE COSTS					-$8,714,757	-$4,506,367	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
5	**Lump sump/ Contingency Items**						
5	Telemetry						
5.1.1	Pump stations	$/unit	$50,000	2.00	$100,000	$100,000	
5.1.2	Water control structure	$/unit	$25,000	18.00	$450,000	$450,000	
5	FPL improvements	Lump sum	$211,200	1.00	$211,200	$211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					$761,200	$761,200	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					$761,200	$761,200	
50-YEAR PRESENT WORTH							
	CAPITAL COSTS				$510,396,490	$408,514,840	
	OPERATING COSTS				$31,736,189	$29,383,479	
	DEMOLITION/REPLACEMENT COSTS				$56,370,874	$20,935,504	
	SALVAGE COST				-$8,714,757	-$4,506,367	
	LUMP SUM COST				$761,200	$761,200	
	TOTAL COSTS				$590,549,996	$455,088,655	
	Kg TP REMOVED BY TECHNOLOGY (50 years)				$295,205	$295,205	
	POUND TP REMOVED BY TECHNOLOGY (50 years)				$650,927	$650,927	
	$/KG TP REMOVED BY TECHNOLOGY				$2,000	$1,542	
	$/POUND TP REMOVED BY TECHNOLOGY				$907	$699	
	1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				$2,559,777,878	$2,559,777,878	
	$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				$0.23	$0.18	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment				$ -		Not applicable, passive treatment system
1.1.2	Residuals management				$ -		Not applicable, no residuals produced
1.2	Freight				$ -		Not applicable
1.3	Installation				$ -		Not applicable
1.4	Instrumentation				$ -		Not applicable
1.5	**Electrical controls**						
1.5.1	Electrical controls				$ -		Not applicable
1.5.2	Electrical power distribution	$/mile	$ 80,000	9.70	$ 776,000	$ 776,000	For powering gated water control structures and pumping stations
1.6	**Civil Work- water control structures**						
1.6.5	50' inflow weir with control gate	per structure	$ 110,000	12.00	$ 1,320,000	$ 1,320,000	
1.6.7	5' X 25' outflow box culvert with gate	per structure	$ 148,000	6.00	$ 888,000	$ 888,000	
1.6.9	By-pass structure	per structure	$ 5,270	1.00	$ 5,270	$ 5,270	
1.6.10	5' wide by-pass weir without gate	per structure	$ 5,000	1.00	$ 5,000	$ 5,000	Assumes 10 cy concrete@ $500/cy
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$ 3.50		$ -		
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$ 2.50	2128323.60	$ 5,320,809	$ 5,320,809	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$ 4.50	1638080.89	$ 7,371,364	$ 7,371,364	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$ 3.50		$ -		
1.8	**Levees (no blasting)**						
1.8.1.3	Internal-8' (4.5' SWD) - 6' top width	$/mile	$ 281,000	4.84	$ 1,360,040	$ 1,360,040	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$ 398,000	6.06	$ 2,411,880	$ 2,411,880	
1.8.2.2	External- 8' (4.5' SWD)	$/mile	$ 485,000	12.12	$ 5,878,200	$ 5,878,200	
1.9.1	**Pumping stations - influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.1.2	Additional influent pumping station 500-3000 cfs	$/cfs	$ 7,500		$ -		
1.9.1.3	Additional influent pumping station >3000 cfs	$/cfs	$ 7,950		$ -		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$ 7,500	2800.00	$ 21,000,000	$ 21,000,000	
1.9.2.3	Additional effluent pumping station >3000 cfs	$/cfs	$ 7,950		$ -		
1.9.3	**Pumping stations - Seepage**						
1.9.1	0-40 cfs	$/cfs	$ 7,600		$ -		
1.9.2	41-60 cfs	$/cfs	$ 9,500	50.00	$ 475,000	$ 475,000	
1.9.3	60-500 cfs	$/cfs	$ 9,900	500.00	$ 4,950,000	[redacted]	
1.9.4	**Pumping stations - By-pass**						
1.9.4.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.4.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.4.2	60-500 cfs	$/cfs	$ 9,900		$ -	$ -	
1.9.4.4	500-3000 cfs	$/cfs	$ 7,500	850.00	$ 6,375,000	$ 6,375,000	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump sum			$ 22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$ 31,000	5639.00	$ 174,809,000	$ 174,809,000	
Subtotal Capital Costs					$ 299,945,563	$ 227,995,563	
Construction Contingencies					$ 45,599,113	$ 45,599,113	20% of Capital Costs
Subtotal Construction Costs					$ 345,544,676	$ 273,594,676	
Engineering and Design Costs					$ 41,039,201	$ 41,039,201	15% of construction costs

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1.11	**Land**						
1.11.1	STA-2	$/acre	$ 4,655	6430.00	$ 29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$ 4,655	5887.79	$ 27,407,667	$ 27,407,667	
1.12	6" gravel access roads (12 ft wide road)	$/linear ft	$ 150	102432.00	$ 15,364,800	$ 15,364,800	Assumes gravel roads around the PSTA and on each interior levee
TOTAL CAPITAL COSTS					**$ 459,287,994**	**$ 357,406,344**	
PRESENT WORTH - CAPITAL COSTS					**$ 459,287,994**	**$ 357,406,344**	
2	**OPERATING COSTS (per year)**						
2.1	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$ 50,000	0.23	$ 11,538	$ 11,538	Assumes one person at a rate of 5 days per month
2.2.1.1	Mechanical maintenance (lubrication, spare parts, etc.)- 500- 3,000 cfs pumps	per unit	$ 23,000	10.00	$ 230,000	$ 207,000	
2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$ 10,000	12.00	$ 120,000	$ 120,000	
2.2.2	Maintenance (water control structures)	each	$ 12,000	18.00	$ 216,000	$ 216,000	
2.2.4	Maintenance (levees)	$/mile	$ 1,530	45.88	$ 70,196	$ 42,656	
2.2.5	Maintenance (vegetation control)	$/acre	$ 22	5639.00	$ 124,058	$ 124,058	
2.2.6	Maintenance (canals)	$/acre	$ 500	92.53	$ 46,266	$ 46,266	
2.5	**Energy**						
2.5.1	Electricity	KW/hr	$ 0.08	6518055.00	$ 521,444	$ 521,444	
2.5.2.1	Fuel consumption - STA2	acre-feet	$ 0.50	117950.00	$ 58,975	[redacted]	
2.4.2	Fuel consumption	acre-feet	$ 0.50	6428.46	$ 3,214	$ 3,214	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					**$ 1,401,693**	**$ 1,292,178**	
PRESENT WORTH - OPERATING COSTS					**$ 30,112,561**	**$ 27,759,850**	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition costs - STA2				$ 9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump sum	$ 4,295,000	1.00	$ 4,295,000	$ 4,295,000	For demolition of outflow, seepage, and by-pass pump stations
3.2.1	Restoration of levees - STA2	$/yard	$ 3	156790.00	$ 470,370	[redacted]	
3.2.2	Restoration of Levees	$/yard	$ 3	57587.20	$ 172,762	$ 172,762	
3.4	Clearing and grubbing						
	Light foliage	$/acre	$ 300	5887.79	$ 1,766,337	$ 1,766,337	
	Forest/heavy brushes	$/acre	$ 1,500		$ -		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
3.5	Replacement items						
3.5.2	Seepage pump stations	Lump sum	$ 237,500	1.00	$ 237,500	$ 237,500	Assumes 50% replacement once at 25 years
3.5.3.1	STA-2 Pumping stations	Lump sum	$ 24,975,000	1.00	$ 24,975,000	[redacted]	
3.5.3.2	Other pumping stations	Lump sum	$ 10,500,000	1.00	$ 10,500,000	$ 10,500,000	Assumes 50% replacement of by-pass and outflow stations once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					**$ 52,406,969**	**$ 16,971,599**	
PRESENT WORTH DEMOLITION/REP. COSTS					**$ 52,406,969**	**$ 16,971,599**	
4	**Salvage Costs**						
4.1	Land - STA2	$/acre	$ 4,655	6430.00	$ (29,931,650)	[redacted]	
4.1.1	Land - Additional land	$/acre	$ 4,655	5887.79	$ (27,407,667)	$ (27,407,667)	
TOTAL SALVAGE COSTS					$ (57,339,317)	$ (27,407,667)	
PRESENT WORTH OF SALVAGE COSTS					**$ (8,061,907)**	**$ (3,853,518)**	
5	**Lump Sum/Contingency Items**						
5.1	Telemetry						

APPENDIX J-3
STSOC Cost Estimate - Target 20 ppb w/ 10 Percent Bypass

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
5.1.1	Pump stations	$/unit	$ 50,000	3.00	$ 150,000	$ 150,000	
5.1.2	Water control structure	$/unit	$ 25,000	18.00	$ 450,000	$ 450,000	
5.2	FPL improvements	Lump sum	$ 211,200	1.00	$ 211,200	$ 211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					**$ 811,200**	**$ 811,200**	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					**$ 811,200**	**$ 811,200**	

50-YEAR PRESENT WORTH

CAPITAL COSTS	$ 459,287,994	$ 357,406,344
OPERATING COSTS	$ 30,112,561	$ 27,759,850
DEMOLITION/REPLACEMENT COSTS	$ 52,406,969	$ 16,971,599
SALVAGE COST	$ (8,061,907)	$ (3,853,518)
LUMP SUM COST	$ 811,200	$ 811,200
TOTAL COSTS	$ 534,556,817	$ 399,095,476
Kg TP REMOVED BY TECHNOLOGY (50 years)	256790	256790
POUND TP REMOVED BY TECHNOLOGY (50 years)	566221.95	566221.95
$/KG TP REMOVED BY TECHNOLOGY	$ 2,082	$ 1,554
$/POUND TP REMOVED BY TECHNOLOGY	$ 944	$ 705
1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)	2282277932	2282277932
$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)	$ 0.23	$ 0.17

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment				$ -		Not applicable, passive treatment system
1.1.2	Residuals management				$ -		Not applicable, no residuals produced
1.2	Freight				$ -		Not applicable
1.3	Installation				$ -		Not applicable
1.4	Instrumentation				$ -		Not applicable
1.5	**Electrical controls**						
1.5.1	Electrical controls				$ -		Not applicable
1.5.2	Electrical power distribution	$/mile	$ 80,000	9.14	$ 731,200	$ 731,200	For powering gated water control structures and pumping stations
1.6	**Civil Work- water control structures**						
1.6.5	50' inflow weir with gate	per structure	$ 110,000	12.00	$ 1,320,000	$ 1,320,000	
1.6.7	5' X 25' outflow box culvert with gate	per structure	$ 148,000	6.00	$ 888,000	$ 888,000	
1.6.9	By-pass structure	per structure	$ 5,270	1.00	$ 5,270	$ 5,270	
1.6.10	5' wide by-pass weir without gate	per structure	$ 5,000	1.00	$ 5,000	$ 5,000	Assumes 10 cy concrete @ $500/cy
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$ 3.50		$ -		Not applicable
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$ 2.50	2077596.00	$ 5,193,990	$ 5,193,990	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$ 4.50	1446484.36	$ 6,509,180	$ 6,509,180	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$ 3.50		$ -		
1.8	**Levees (no blasting)**						
1.8.1.3	Internal-8' (4.5' SWD) - 6' top width	$/mile	$ 281,000	4.56	$ 1,281,360	$ 1,281,360	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$ 398,000	5.71	$ 2,272,580	$ 2,272,580	
1.8.2.2	External- 8' (4.5' SWD)	$/mile	$ 485,000	11.42	$ 5,538,700	$ 5,538,700	
1.9.1	**Pumping stations - influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.1.2	Additional Influent pumping station 500-3000 cfs	$/cfs	$ 7,500		$ -		
1.9.1.3	Additional influent pumping station > 3000 cfs	$/cfs	$ 7,950		$ -		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$ 7,500	2425.00	$ 18,187,500	$ 18,187,500	
1.9.2.3	Additional effluent pumping station > 3000 cfs	$/cfs	$ 7,950		$ -		
1.9.3	**Pumping stations - Seepage**						
1.9.1	0-40 cfs	$/cfs	$ 7,600		$ -		
1.9.2	41-60 cfs	$/cfs	$ 9,500	50.00	$ 475,000	$ 475,000	
1.9.3	60-500 cfs	$/cfs	$ 9,900	500.00	$ 4,950,000	[redacted]	
1.9.4	**Pumping stations - By-pass**						
1.9.4.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.4.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.4.2	60-500 cfs	$/cfs	$ 9,900		$ -	$ -	
1.9.4.4	500-3000 cfs	$/cfs	$ 7,500	1000.00	$ 7,500,000	$ 7,500,000	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump Sum			$ 22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$ 31,000	5006.00	$ 155,186,000	$ 155,186,000	
Subtotal Capital Costs					$ 277,043,780	$ 205,093,780	
Construction Contingencies					$ 41,018,756	$ 41,018,756	20% of Capital Costs
Subtotal Construction Costs					$ 318,062,536	$ 246,112,536	
Engineering and Design Costs					$ 36,916,880	$ 36,916,880	15% of construction costs

Item/Task		Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
1.11	**Land**						
1.11.1	STA-2	$/acre	$ 4,655	6430.00	$ 29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$ 4,655	5237.13	$ 24,378,828	$ 24,378,828	
1.12	6" gravel access roads (12 ft wide road)	$/linear ft	$ 150	96518.40	$ 14,477,760	$ 14,477,760	Assumes gravel roads around the PSTA
TOTAL CAPITAL COSTS					**$ 423,767,654**	**$ 321,886,004**	
PRESENT WORTH - CAPITAL COSTS					**$ 423,767,654**	**$ 321,886,004**	
2	**OPERATING COSTS (per year)**						
2.1	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$ 50,000	0.23	$ 11,538	$ 11,538	Assumes one person at a rate of 5 days per month
	Mechanical maintenance (lubrication, spare parts, etc.)-						
2.2.1.1	500- 3,000 cfs pumps	per unit	$ 23,000	10.00	$ 230,000	$ 207,000	
2.2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$ 10,000	12.00	$ 120,000	$ 120,000	
2.2.2	Maintenance (water control structures)	each	$ 12,000	18.00	$ 216,000	$ 216,000	
2.2.4	Maintenance (Levees)	$/mile	$ 1,530	44.27	$ 67,733	$ 40,193	
2.2.5	Maintenance (Vegetation control)	$/acre	$ 22	5006.00	$ 110,132	$ 110,132	
2.2.6	Maintenance (Canals)	$/acre	$ 500	86.75	$ 43,373	$ 43,373	
2.5	**Energy**						
2.5.1	Electricity	KW/hr	$ 0.08	6299783.00	$ 503,983	$ 503,983	
2.5.2.1	Fuel consumption - STA2	acre-feet	$ 0.50	117950.00	$ 58,975	[redacted]	0.55 gal/acre-foot @ $0.9/gallon
2.5.2.2	Fuel consumption	acre-feet	$ 0.50	5656.78	$ 2,828	$ 2,828	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					**$ 1,364,563**	**$ 1,255,048**	
PRESENT WORTH - OPERATING COSTS					**$ 29,314,905**	**$ 26,962,195**	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition costs - STA2				$ 9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump Sum	$ 3,732,500	1.00	$ 3,732,500	$ 3,732,500	
3.2.1	Restoration of Levees - STA2	$/yard	$ 3	156790.00	$ 470,370	[redacted]	
3.2.2	Restoration of Levees	$/yard	$ 3	54260.80	$ 162,782	$ 162,782	
3.4	Clearing and grubbing						
	Light foliage	$/acre	$ 300	5237.13	$ 1,571,138	$ 1,571,138	
	Forest/heavy brushes	$/acre	$ 1,500		$ -		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
3.5	Replacement items						
3.5.2	Seepage pumping stations	Lump Sum	$ 237,500	1.00	$ 237,500	$ 237,500	50% of cost replaced once at 25 years
3.5.3.1	STA-2 pumping stations	Lump Sum	$ 24,975,000	1.00	$ 24,975,000	[redacted]	50% of cost replaced once at 25 years
3.5.3.2	Other pumping stations	Lump Sum	$ 9,093,750	1.00	$ 9,093,750	$ 9,093,750	50% of cost replaced once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					**$ 50,233,041**	**$ 14,797,671**	
PRESENT WORTH DEMOLITION/REP. COSTS					**$ 50,233,041**	**$ 14,797,671**	
4	**Salvage Costs**						
4.1	Land - STA2	$/acre	$ 4,655	6430.00	$ (29,931,650)	[redacted]	
4.1.1	Land - Additional land	$/acre	$ 4,655	5237.13	$ (24,378,828)	$ (24,378,828)	
TOTAL SALVAGE COSTS					$ (54,310,478)	$ (24,378,828)	
PRESENT WORTH OF SALVAGE COSTS					**$ (7,636,053)**	**$ (3,427,663)**	
5	**Lump sump/ Contingency Items**						
5.1	Telemetry						
5.1.1	Pump s[illegible]s	$/unit	$ 50,000	3.00	$ 150,000	$ 150,000	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
5.1.2	Water control structure	$/unit	$ 25,000	18.00	$ 450,000	$ 450,000	
5.2	FPL improvements	Lump sum	$ 211,200	1.00	$ 211,200	$ 211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					**$ 811,200**	**$ 811,200**	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					**$ 811,200**	**$ 811,200**	

		Total - Including STA2 Costs	Total - Excluding STA2 Costs
50-YEAR PRESENT WORTH			
	CAPITAL COSTS	$ 423,767,654	$ 321,886,004
	OPERATING COSTS	$ 29,314,905	$ 26,962,195
	DEMOLITION/REPLACEMENT COSTS	$ 50,233,041	$ 14,797,671
	SALVAGE COST	$ (7,636,053)	$ (3,427,663)
	LUMP SUM COST	$ 811,200	$ 811,200
	TOTAL COSTS	$ 496,490,747	$ 361,029,406
	Kg TP REMOVED BY TECHNOLOGY (50 years)	228028	228028
	POUND TP REMOVED BY TECHNOLOGY (50 years)	502801.74	502801.74
	$/KG TP REMOVED BY TECHNOLOGY	$ 2,177	$ 1,583
	$/POUND TP REMOVED BY TECHNOLOGY	$ 987	$ 718
	1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)	2021351033	2021351033
	$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)	$ 0.25	$ 0.18

APPENDIX J-5

STSOC Cost Estimate - Target 12 ppb w/ No Bypass

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment	Lump sum			$ -		Not applicable, passive treatment system
1.1.2	Residuals management	Lump sum			$ -		Not applicable, no residuals produced
1.2	Freight	Lump sum			$ -		Not applicable
1.3	Installation	Lump sum			$ -		Not applicable
1.4	Instrumentation	Lump sum			$ -		Not applicable
1.5	**Electrical controls**						
1.5.1	Electrical controls	Lump sum			$ -		Not applicable
1.5.2	Electrical power distribution	$/mile	$ 80,000	15.97	$ 1,277,600	$ 1,277,600	For powering gated water control structures and pumping stations
1.6	**Civil Work- water control structures**						
1.6.5	50' inflow weir with control gate	per structure	$ 110,000	12.00	$ 1,320,000	$ 1,320,000	
1.6.6	5' X 20' outflow box culvert with gate	per structure	$ 119,000	6.00	$ 714,000	$ 714,000	
1.6.9	By-pass structure	per structure	$ 5,270	0.00	$ -		No by-pass
1.6.10	5' wide by-pass weir without gate	per structure	$ 5,000	0.00	$ -		No by-pass
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$ 3.50		$ -		Not applicable
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$ 2.50	3849036.00	$ 9,622,590	$ 9,622,590	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$ 4.50	2996970.04	$ 13,486,365	$ 13,486,365	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$ 3.50		$ -		
1.8	**Levees (no blasting)**						
1.8.1.4	Internal-8' 3" (4.5' SWD) - 6' top width	$/mile	$ 297,000	7.98	$ 2,370,060	$ 2,370,060	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$ 398,000	9.98	$ 3,972,040	$ 3,972,040	
1.8.2.5	External- 8' 3" (4.5' SWD)	$/mile	$ 504,250	19.96	$ 10,064,830	$ 10,064,830	
1.9.1	**Pumping stations - influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.1.2	Additional influent pumping station 500-3000 cfs	$/cfs	$ 7,500		$ -		
1.9.1.3	Additional influent pumping station >3000 cfs	$/cfs	$ 7,950		$ -		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$ 7,500	2900.00	$ 21,750,000	$ 21,750,000	
1.9.2.3	Additional effluent pumping station >3000 cfs	$/cfs	$ 7,950		$ -	$ -	
1.9.3	**Pumping stations - Seepage**						
1.9.3.1	0-40 cfs	$/cfs	$ 7,600		$ -		
1.9.3.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.3.3	60-500 cfs	$/cfs	$ 9,900	570.00	$ 5,643,000	$ 693,000	
1.9.4	**Pumping stations - By-pass**						Not applicable
1.9.4.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.4.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.4.2	60-500 cfs	$/cfs	$ 9,900		$ -	$ -	
1.9.4.4	500-3000 cfs	$/cfs	$ 7,500		$ -	$ -	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump sum			$ 22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$ 31,000	15316.00	$ 474,796,000	$ 474,796,000	
Subtotal Capital Costs					$ 612,016,485	$ 540,066,485	
Construction Contingencies					$ 108,013,297	$ 108,013,297	20% of Capital Costs
Subtotal Construction Costs					$ 720,029,782	$ 648,079,782	
Engineering and Design Costs					$ 97,211,967	$ 97,211,967	15% of construction costs

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1.11	**Land**						
1.11.1	STA-2	$/acre	$ 4,655	6430.00	$ 29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$ 4,655	15727.25	$ 73,210,339	$ 73,210,339	
1.12	6" gravel access roads (12 ft wide road)	$/linear ft	$ 150	168643.20	$ 25,296,480	$ 25,296,480	Assumes gravel roads around the PSTA
TOTAL CAPITAL COSTS					**$ 945,680,219**	**$ 843,798,569**	
PRESENT WORTH - CAPITAL COSTS					**$ 945,680,219**	**$ 843,798,569**	
2	**OPERATING COSTS (per year)**						
2.1	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$ 50,000	0.23	$ 11,538	$ 11,538	Assumes one person at a rate of 5 days per month
2.2.1.1	Mechanical maintenance (lubrication, spare parts, etc.)- 500-3,000 cfs pumps	per unit	$ 23,000	10.00	$ 230,000	$ 207,000	
2.2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$ 10,000	13.00	$ 130,000	$ 130,000	
2.2.2	Maintenance (water control structures)	each	$ 12,000	18.00	$ 216,000	$ 216,000	
2.2.4	Maintenance (levees)	$/mile	$ 1,530	67.90	$ 103,887	$ 76,347	
2.2.5	Maintenance (vegetation control)	$/acre	$ 22	15316.00	$ 336,952	$ 336,952	
2.2.6	Maintenance (canals)	$/acre	$ 500	159.49	$ 79,743	$ 79,743	
2.5	**Energy**						
2.5.1	Electricity	KW/hr	$ 0.08	6437988.00	$ 515,039	$ 515,039	
2.5.2.1	Fuel consumption - STA2	acre-feet	$ 0.50	117950.00	$ 58,975	[redacted]	0.55 gal/acre-foot @ $0.9/gallon
2.4.2	Additional fuel consumption	acre-feet	$ 0.50	18558.15	$ 9,279	$ 9,279	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					**$ 1,691,413**	**$ 1,581,898**	
PRESENT WORTH - OPERATING COSTS					**$ 36,336,630**	**$ 33,983,920**	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition Costs - STA2	Lump sum	$ 9,990,000	1.00	$ 9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump sum	$ 4,488,600	1.00	$ 4,488,600	$ 4,488,600	For demolition of outflow and seepage pump stations
3.2.1	Restoration of Levees - STA2	$/yard	$ 3	156790.00	$ 470,370	[redacted]	
3.2	Restoration of Levees	$/yard	$ 3	87824.00	$ 263,472	$ 263,472	
3.4	Clearing and grubbing						
	Light foliage	$/acre	$ 300	15727.25	$ 4,718,174	$ 4,718,174	
	Forest/heavy brushes	$/acre	$ 1,500		$ -		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
3.5	Replacement items						
3.5.2	Seepage pumping stations	Lump sum	$ 346,500	1.00	$ 346,500	$ 346,500	Assumes 50% replacement once at 25 years
3.5.3.1	STA-2 pumping stations	Lump sum	$ 24,975,000	1.00	$ 24,975,000	[redacted]	Assumes 50% replacement once at 25 years
3.5.3.2	Other pumping stations	Lump sum	$ 10,875,000	1.00	$ 10,875,000	$ 10,875,000	Assumes 50% replacement once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					**$ 56,127,116**	**$ 20,691,746**	
PRESENT WORTH DEMOLITION/REP. COSTS					**$ 56,127,116**	**$ 20,691,746**	
4	**Salvage Costs**						
4.1	Land - STA2	$/acre	$ 4,655	6430.00	$ (29,931,650)	[redacted]	
4.1.1	Land - Additional land	$/acre	$ 4,655	15727.25	$ (73,210,339)	$ (73,210,339)	
TOTAL SALVAGE COSTS					**$ (103,141,989)**	**$ (73,210,339)**	
PRESENT WORTH OF SALVAGE COSTS					**$ (14,501,763)**	**$ (10,293,373)**	
5	**Lump sump/ Contingency Items**						
5.1	Telemetry						
5.1.1	Pump stations	$/unit	$ 50,000	2.00	$ 100,000	$ 100,000	
5.1.2	Water control structure	$/unit	$ 25,000	18.00	$ 450,000	$ 450,000	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
5.2	FPL improvements	Lump sum	$ 211,200	1.00	$ 211,200	$ 211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					**$ 761,200**	**$ 761,200**	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					$ 761,200	$ 761,200	
50-YEAR PRESENT WORTH							
	CAPITAL COSTS				$ 945,680,219	$ 843,798,569	
	OPERATING COSTS				$ 36,336,630	$ 33,983,920	
	DEMOLITION/REPLACEMENT COSTS				$ 56,127,116	$ 20,691,746	
	SALVAGE COST				$ (14,501,763)	$ (10,293,373)	
	LUMP SUM COST				$ 761,200	$ 761,200	
	TOTAL COSTS				$ 1,024,403,403	$ 888,942,062	
	Kg TP REMOVED BY TECHNOLOGY (50 years)				374678	374678	
	POUND TP REMOVED BY TECHNOLOGY (50 years)				826164.99	826164.99	
	$/KG TP REMOVED BY TECHNOLOGY				$ 2,734	$ 2,373	
	$/POUND TP REMOVED BY TECHNOLOGY				$ 1,240	$ 1,076	
	1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				2559777878	2559777878	
	$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				$ 0.40	$ 0.35	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment				$ -		Not applicable, passive treatment system
1.1.2	Residuals management				$ -		Not applicable, no residuals produced
1.2	Freight				$ -		Not applicable
1.3	Installation				$ -		Not applicable
1.4	Instrumentation				$ -		Not applicable
1.5	**Electrical controls**						
1.5.1	Electrical controls				$ -		Not applicable
1.5.2	Electrical power distribution	$/mile	$ 80,000	14.85	$ 1,188,000	$ 1,188,000	For powering gated water control structures and pumping stations
1.6	**Civil Work- water control structures**						
1.6.5	50' inflow weir with control gate	per structure	$ 110,000	12.00	$ 1,320,000	$ 1,320,000	
1.6.7	5' X 20' outflow box culvert with gate	per structure	$ 119,000	6.00	$ 714,000	$ 714,000	
1.6.9	By-pass structure	per structure	$ 5,270	1.00	$ 5,270	$ 5,270	
1.6.10	5' wide by-pass weir without gate	per structure	$ 5,000	1.00	$ 5,000	$ 5,000	Assumes 10 cy concrete @ $500/cy
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$ 3.50		$ -		
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$ 2.50	3501301.80	$ 8,753,255	$ 8,753,255	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$ 4.50	2328396.16	$ 10,477,783	$ 10,477,783	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$ 3.50		$ -		
1.8	**Levees (no blasting)**						
1.8.1.3	Internal-7' 9" (4.5' SWD) - 6' top width	$/mile	$ 266,000	7.42	$ 1,973,720	$ 1,973,720	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$ 398,000	9.28	$ 3,693,440	$ 3,693,440	
1.8.2.2	External- 7' 9" (4.5' SWD)	$/mile	$ 463,250	18.56	$ 8,597,920	$ 8,597,920	
1.9.1	**Pumping stations - influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.1.2	Additional influent pumping station 500-3000 cfs	$/cfs	$ 7,500		$ -		
1.9.1.3	Additional influent pumping station >3000 cfs	$/cfs	$ 7,950		$ -		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$ 7,500	2300.00	$ 17,250,000	$ 17,250,000	
1.9.2.3	Additional effluent pumping station >3000 cfs	$/cfs	$ 7,950		$ -		
1.9.3	**Pumping stations - Seepage**						
1.9.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.3	60-500 cfs	$/cfs	$ 9,900	590.00	$ 5,841,000	$ 891,000	
1.9.4	**Pumping stations - By-pass**						
1.9.4.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.4.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.4.2	60-500 cfs	$/cfs	$ 9,900		$ -	$ -	
1.9.4.4	500-3000 cfs	$/cfs	$ 7,500	850.00	$ 6,375,000	$ 6,375,000	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump sum			$ 22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$ 31,000	13241.00	$ 410,471,000	$ 410,471,000	
Subtotal Capital Costs					$ 543,665,387	$ 471,715,387	
Construction Contingencies					$ 94,343,077	$ 94,343,077	20% of Capital Costs
Subtotal Construction Costs					$ 638,008,465	$ 566,058,465	
Engineering and Design Costs					$ 84,908,770	$ 84,908,770	15% of construction costs

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
1.11	**Land**						
1.11.1	STA-2	$/acre	$ 4,655	6430.00	$ 29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$ 4,655	13607.48	$ 63,342,812	$ 63,342,812	
1.12	6" gravel access roads (12 ft wide road)	$/linear ft	$ 150	156816.00	$ 23,522,400	$ 23,522,400	Assumes gravel roads around the PSTA and on each interior levee
TOTAL CAPITAL COSTS					**$ 839,714,096**	**$ 737,832,446**	
PRESENT WORTH - CAPITAL COSTS					**$ 839,714,096**	**$ 737,832,446**	
2	**OPERATING COSTS (per year)**						
2.1	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$ 50,000	0.23	$ 11,538	$ 11,538	Assumes one person at a rate of 5 days per month
	Mechanical maintenance (lubrication, spare parts, etc.)-						
2.2.1.1	500- 3,000 cfs pumps	per unit	$ 23,000	10.00	$ 230,000	$ 207,000	
2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$ 10,000	13.00	$ 130,000	$ 130,000	
2.2.2	Maintenance (water control structures)	each	$ 12,000	18.00	$ 216,000	$ 216,000	
2.2.4	Maintenance (levees)	$/mile	$ 1,530	60.69	$ 92,856	$ 65,316	
2.2.5	Maintenance (vegetation control)	$/acre	$ 22	13241.00	$ 291,302	$ 291,302	
2.2.6	Maintenance (canals)	$/acre	$ 500	119.82	$ 59,912	$ 59,912	
2.5	**Energy**						
2.5.1	Electricity	KW/hr	$ 0.08	6182921.00	$ 494,634	$ 494,634	
2.5.2.1	Fuel consumption - STA2	acre-feet	$ 0.50	117950.00	$ 58,975	[redacted]	
2.4.2	Fuel consumption	acre-feet	$ 0.50	15491.97	$ 7,746	$ 7,746	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					**$ 1,592,963**	**$ 1,483,448**	
PRESENT WORTH - OPERATING COSTS					**$ 34,221,623**	**$ 31,868,912**	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition costs - STA2				$ 9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump sum	$ 3,450,000	1.00	$ 3,450,000	$ 3,450,000	For demolition of outflow, seepage, and by-pass pump stations
3.2.1	Restoration of levees - STA2	$/yard	$ 3	156790.00	$ 470,370	[redacted]	
3.2.2	Restoration of Levees	$/yard	$ 3	88193.60	$ 264,581	$ 264,581	
3.4	Clearing and grubbing						
	Light foliage	$/acre	$ 300	13607.48	$ 4,082,244	$ 4,082,244	
	Forest/heavy brushes	$/acre	$ 1,500		$ -		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
3.5	Replacement items						
3.5.2	Seepage pump stations	Lump sum	$ 445,500	1.00	$ 445,500	$ 445,500	Assumes 50% replacement once at 25 years
3.5.3.1	STA-2 Pumping stations	Lump sum	$ 24,975,000	1.00	$ 24,975,000	[redacted]	
3.5.3.2	Other pumping stations	Lump sum	$ 8,625,000	1.00	$ 8,625,000	$ 8,625,000	Assumes 50% replacement of by-pass and outflow stations once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					**$ 52,302,694**	**$ 16,867,324**	
PRESENT WORTH DEMOLITION/REP. COSTS					**$ 52,302,694**	**$ 16,867,324**	
4	**Salvage Costs**						
4.1	Land - STA2	$/acre	$ 4,655	6430.00	$ (29,931,650)	[redacted]	
4.1.1	Land - Additional land	$/acre	$ 4,655	13607.48	$ (63,342,812)	$ (63,342,812)	
TOTAL SALVAGE COSTS					$ (93,274,462)	$ (63,342,812)	
PRESENT WORTH OF SALVAGE COSTS					**$ (13,114,389)**	**$ (8,905,999)**	
5	**Lump Sum/Contingency Items**						
5.1	Telem						

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA 2 Costs	Total - Excluding STA 2 Costs	Comments/Explanation
5.1.1	Pump stations	$/unit	$ 50,000	3.00	$ 150,000	$ 150,000	
5.1.2	Water control structure	$/unit	$ 25,000	18.00	$ 450,000	$ 450,000	
5.2	FPL improvements	Lump sum	$ 211,200	1.00	$ 211,200	$ 211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					**$ 811,200**	**$ 811,200**	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					**$ 811,200**	**$ 811,200**	
50-YEAR PRESENT WORTH							
	CAPITAL COSTS				$ 839,714,096	$ 737,832,446	
	OPERATING COSTS				$ 34,221,623	$ 31,868,912	
	DEMOLITION/REPLACEMENT COSTS				$ 52,302,694	$ 16,867,324	
	SALVAGE COST				$ (13,114,389)	$ (8,905,999)	
	LUMP SUM COST				$ 811,200	$ 811,200	
	TOTAL COSTS				$ 913,935,225	$ 778,473,884	
	Kg TP REMOVED BY TECHNOLOGY (50 years)				327618	327618	
	POUND TP REMOVED BY TECHNOLOGY (50 years)				722397.69	722397.69	
	$/KG TP REMOVED BY TECHNOLOGY				$ 2,790	$ 2,376	
	$/POUND TP REMOVED BY TECHNOLOGY				$ 1,265	$ 1,078	
	1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				2282277932	2282277932	
	$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				$ 0.40	$ 0.34	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
1	**Capital costs**						
1.1.1	Equipment				$ -		Not applicable, passive treatment system
1.1.2	Residuals management				$ -		Not applicable, no residuals produced
1.2	Freight				$ -		Not applicable
1.3	Installation				$ -		Not applicable
1.4	Instrumentation				$ -		Not applicable
1.5	**Electrical controls**						
1.5.1	Electrical controls				$ -		Not applicable
1.5.2	Electrical power distribution	$/mile	$ 80,000	14.02	$ 1,121,600	$ 1,121,600	For powering gated water control structures and pumping stations
1.6	**Civil Work- water control structures**						
1.6.5	50' inflow weir with gate	per structure	$ 110,000	12.00	$ 1,320,000	$ 1,320,000	
1.6.7	5' X 20' outflow box culvert with gate	per structure	$ 119,000	6.00	$ 714,000	$ 714,000	
1.6.9	By-pass structure	per structure	$ 5,270	1.00	$ 5,270	$ 5,270	
1.6.10	5' wide by-pass weir without gate	per structure	$ 5,000	1.00	$ 5,000	$ 5,000	Assumes 10 cy concrete @ $500/cy
1.7.1	**Canals (digging - no blasting)**						
1.7.1.1	Canals- Deep excavation	$/cubic yard	$ 3.50		$ -		Not applicable
1.7.1.2	Canals- Shallow excavation	$/cubic yard	$ 2.50	3154518.00	$ 7,886,295	$ 7,886,295	For deep zones within the treatment cells and seepage canals
1.7.2	**Canals (including blasting)**						
1.7.2.1	Canals- Deep excavation	$/cubic yard	$ 4.50	2100575.16	$ 9,452,588	$ 9,452,588	Assumes canal depth > 10 feet
1.7.2.2	Canals- Shallow excavation	$/cubic yard	$ 3.50		$ -		
1.8	**Levees (no blasting)**						
1.8.1.3	Internal-7' 9" (4.5' SWD) - 6' top width	$/mile	$ 266,000	7.00	$ 1,862,000	$ 1,862,000	
1.8.2.1	External- 7' (4.5' SWD)	$/mile	$ 398,000	8.76	$ 3,486,480	$ 3,486,480	
1.8.2.2	External- 7' 9" (4.5' SWD)	$/mile	$ 463,250	17.52	$ 8,116,140	$ 8,116,140	
1.9.1	**Pumping stations - Influent**						
1.9.1.1	STA-2 Influent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.1.2	Additional Influent pumping station 500-3000 cfs	$/cfs	$ 7,500		$ -		
1.9.1.3	Additional influent pumping station > 3000 cfs	$/cfs	$ 7,950		$ -		
1.9.2	**Pumping Stations - Effluent**						
1.9.2.1	STA-2 effluent pumping station	$/cfs	$ 7,500	3000.00	$ 22,500,000	[redacted]	
1.9.2.2	Additional effluent pumping station 500-3000 cfs	$/cfs	$ 7,500	2200.00	$ 16,500,000	$ 16,500,000	
1.9.2.3	Additional effluent pumping station > 3000 cfs	$/cfs	$ 7,950		$ -		
1.9.3	**Pumping stations - Seepage**						
1.9.1	0-40 cfs	$/cfs	$ 7,600		$ -		
1.9.2	41-60 cfs	$/cfs	$ 9,500	45.00	$ 427,500	$ 427,500	
1.9.3	60-500 cfs	$/cfs	$ 9,900	500.00	$ 4,950,000	[redacted]	
1.9.4	**Pumping stations - By-pass**						
1.9.4.1	0-40 cfs	$/cfs	$ 7,600		$ -	$ -	
1.9.4.2	41-60 cfs	$/cfs	$ 9,500		$ -	$ -	
1.9.4.2	60-500 cfs	$/cfs	$ 9,900		$ -	$ -	
1.9.4.4	500-3000 cfs	$/cfs	$ 7,500	1000.00	$ 7,500,000	$ 7,500,000	
1.10	**Earthwork**						
1.10.1	Interior land preparation - Earthwork	Lump Sum			$ 22,000,000	[redacted]	
1.10.4	Limerock base of 2' - Labor + materials	$/acre	$ 31,000	11791.00	$ 365,521,000	$ 365,521,000	
Subtotal Capital Costs					$ 495,867,873	$ 423,917,873	
Construction Contingencies					$ 84,783,575	$ 84,783,575	20% of Capital Costs
Subtotal Construction Costs					$ 580,651,448	$ 508,701,448	
Engineering and Design Costs					$ 76,305,217	$ 76,305,217	15% of construction costs

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
1.11	**Land**						
1.11.1	STA-2	$/acre	$ 4,655	6430.00	$ 29,931,650	[redacted]	
1.11.2	Additional land required						
1.11.2.2	Treatment	$/acre	$ 4,655	12133.92	$ 56,483,392	$ 56,483,392	
1.12	6" gravel access roads (12 ft wide road)	$/linear ft	$ 150	148051.20	$ 22,207,680	$ 22,207,680	Assumes gravel roads around the PSTA
TOTAL CAPITAL COSTS					**$ 765,579,387**	**$ 663,697,737**	
PRESENT WORTH - CAPITAL COSTS					**$ 765,579,387**	**$ 663,697,737**	
2	**OPERATING COSTS (per year)**						
2.1	**Labor**						
2.1.1	Engine operator/Maintenance mechanic	each	$ 50,000	0.23	$ 11,538	$ 11,538	Assumes one person at a rate of 5 days per month
	Mechanical maintenance (lubrication, spare parts, etc.)-						
2.2.1.1	500- 3,000 cfs pumps	per unit	$ 23,000	9.00	$ 207,000	$ 184,000	
2.2.1.2	Mechanical maintenance- 0-500 cfs pumps	per unit	$ 10,000	11.00	$ 110,000	$ 110,000	
2.2.2	Maintenance (water control structures)	each	$ 12,000	18.00	$ 216,000	$ 216,000	
2.2.4	Maintenance (Levees)	$/mile	$ 1,530	58.30	$ 89,199	$ 61,659	
2.2.5	Maintenance (Vegetation control)	$/acre	$ 22	11791.00	$ 259,402	$ 259,402	
2.2.6	Maintenance (Canals)	$/acre	$ 500	113.47	$ 56,733	$ 56,733	
2.5	**Energy**						
2.5.1	Electricity	KW/hr	$ 0.08	6393510.00	$ 511,481	$ 511,481	
2.5.2.1	Fuel consumption - STA2	acre-feet	$ 0.50	117950.00	$ 58,975	[redacted]	0.55 gal/acre-foot @ $0.9/gallon
2.5.2.2	Fuel consumption	acre-feet	$ 0.50	13559.65	$ 6,780	$ 6,780	0.55 gal/acre-foot @ $0.9/gallon, calculated based upon average water depth
TOTAL OPERATING COSTS:					**$ 1,527,108**	**$ 1,417,593**	
PRESENT WORTH - OPERATING COSTS					**$ 32,806,857**	**$ 30,454,146**	
3	**Demolition/Replacement Costs**						
3.1.1	Demolition costs - STA2				$ 9,990,000	[redacted]	
3.1.2	Other demolition costs	Lump Sum	$ 3,385,500	1.00	$ 3,385,500	$ 3,385,500	
3.2.1	Restoration of Levees - STA2	$/yard	$ 3	156790.00	$ 470,370	[redacted]	
3.2.2	Restoration of Levees	$/yard	$ 3	83248.00	$ 249,744	$ 249,744	
3.4	Clearing and grubbing						
	Light foliage	$/acre	$ 300	12133.92	$ 3,640,176	$ 3,640,176	
	Forest/heavy brushes	$/acre	$ 1,500		$ -		Not applicable; assumes construction of technology in an area with land coverage similar to that of STA 2
3.5	Replacement items						
3.5.2	Seepage pumping stations	Lump Sum	$ 213,750	1.00	$ 213,750	$ 213,750	50% of cost replaced once at 25 years
3.5.3.1	STA-2 pumping stations	Lump Sum	$ 24,975,000	1.00	$ 24,975,000	[redacted]	50% of cost replaced once at 25 years
3.5.3.2	Other pumping stations	Lump Sum	$ 8,250,000	1.00	$ 8,250,000	$ 8,250,000	50% of cost replaced once at 25 years
TOTAL DEMOLITION/REPLACEMENT COSTS					**$ 51,174,540**	**$ 15,739,170**	
PRESENT WORTH DEMOLITION/REP. COSTS					**$ 51,174,540**	**$ 15,739,170**	
4	**Salvage Costs**						
4.1	Land - STA2	$/acre	$ 4,655	6430.00	$ (29,931,650)	[redacted]	
4.1.1	Land - Additional land	$/acre	$ 4,655	12133.92	$ (56,483,392)	$ (56,483,392)	
TOTAL SALVAGE COSTS					$ (86,415,042)	$ (56,483,392)	
PRESENT WORTH OF SALVAGE COSTS					**$ (12,149,954)**	**$ (7,941,564)**	
5	**Lump sump/ Contingency Items**						
5.1	Telemetry						
5.1.1	Pump stations	$/unit	$ 50,000	3.00	$ 150,000	$ 150,000	

	Item/Task	Unit	Unit cost	Quantity	Total - Including STA2 Costs	Total - Excluding STA2 Costs	Comments/Explanation
5.1.2	Water control structure	$/unit	$ 25,000	18.00	$ 450,000	$ 450,000	
5.2	FPL improvements	Lump sum	$ 211,200	1.00	$ 211,200	$ 211,200	Assumes providing improvements over 2 miles
TOTAL LUMP SUMP ITEMS					**$ 811,200**	**$ 811,200**	
PRESENT WORTH OF LUMP SUM/CONTINGENCY ITEMS					**$ 811,200**	**$ 811,200**	
50-YEAR PRESENT WORTH							
	CAPITAL COSTS				$ 765,579,387	$ 663,697,737	
	OPERATING COSTS				$ 32,806,857	$ 30,454,146	
	DEMOLITION/REPLACEMENT COSTS				$ 51,174,540	$ 15,739,170	
	SALVAGE COST				$ (12,149,954)	$ (7,941,564)	
	LUMP SUM COST				$ 811,200	$ 811,200	
	TOTAL COSTS				$ 838,222,030	$ 702,760,689	
	Kg TP REMOVED BY TECHNOLOGY (50 years)				290763	290763	
	POUND TP REMOVED BY TECHNOLOGY (50 years)				641132.415	641132.415	
	$/KG TP REMOVED BY TECHNOLOGY				$ 2,883	$ 2,417	
	$/POUND TP REMOVED BY TECHNOLOGY				$ 1,307	$ 1,096	
	1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				2021351033	2021351033	
	$/1000 GALLONS TREATED BY TECHNOLOGY (AT AVE. FLOW)				$ 0.41	$ 0.35	

Item/Task	Unit	Unit cost	Comments/Explanation
50' inflow weir with gate	per structure	$ 110,000	20 cy concrete @ $500/cy for concrete, forms, and rebar & electric slide gates (50'W x 5' H) @ $400/sf installed
5' X 20' outflow box culvert with gate	per structure	$ 119,000	Assumes 4-5' x 5' precast concrete structures ganged together @ $250/LF of structure (approximately 55'); labor and equipment @ $500/hr with 50' of box culvert being installed/day; electric slide gates (5'W x 5'H) @ $400/sf installed; mobilization, bonds, insurance, overhead, etc.
5' X 25' outflow box culvert with gate	per structure	$ 148,000	Assumes 5-5' x 5' precast concrete structures ganged together @ $250/LF of structure (approximately 55'); labor and equipment @ $500/hr with 50' of box culvert being installed/day; electric slide gates (5'W x 5'H) @ $400/sf installed; mobilization, bonds, insurance, overhead, etc.
5' X 35' outflow box culvert with gate	per structure	$ 207,000	Assumes 7-5' x 5' precast concrete structures ganged together @ $250/LF of structure (approximately 55'); labor and equipment @ $500/hr with 50' of box culvert being installed/day; electric slide gates (5'W x 5'H) @ $400/sf installed; mobilization, bonds, insurance, overhead, etc.
By-pass structure	per structure	$ 5,270	Earthen dam with concrete sill (20' wide) and paved side slopes, concrete @ $50/sy and earthwork @ @22/cy
5' wide by-pass weir without gate	per structure	$ 5,000	10 cy concrete @ $500/cy
Levees - Internal-7.5' (4.5' SWD)	$/mile	$ 251,000	Assumes a top width of 6' and side slopes of 2.5:1; material available onsite from canal construction @ approximately $6.90/cy of material
Levees - Internal-7.75' (4.5' SWD)	$/mile	$ 266,000	Assumes a top width of 6' and side slopes of 2.5:1; material available onsite from canal construction @ approximately $6.90/cy of material
Levees - Internal- 8' (4.5' SWD)	$/mile	$ 281,000	Assumes a top width of 6' and side slopes of 2.5:1; material available onsite from canal construction @ approximately $6.90/cy of material
Levees - Internal-8.5' (4.5' SWD)	$/mile	$ 313,000	Assumes a top width of 6' and side slopes of 2.5:1; material available onsite from canal construction @ approximately $6.90/cy of material
Levees - External- 7' (4.5' SWD)	$/mile	$ 398,000	Extrapolated from SFWMD costs provided for external levees with heights of 8', 9', and 10'
Levees - External- 7.75' (4.5' SWD)	$/mile	$ 457,000	Extrapolated from SFWMD costs provided for external levees with heights of 8', 9', and 10'
Levees External- 8.5' (4.5' SWD)	$/mile	$ 525,000	Interpolated from SFWMD costs provided for external levees with heights of 8' and 9'
Laying rock base	$/acre	$ 31,000	Assumes 2-ft fill based on about $10/cubic yard - provided by District
Pump Stations>3,000 cfs	$/cfs	$ 7,950	Developed using standard 6/10 rule of cost estimating with the considered ratio being the pump station size required (3300 cfs) to the maximum pump station size in the next lowest range (3000 cfs)
Canals - Maintenance	$/acre	$ 500	Developed from TM Basis for Cost estimates of Full Scale Alternative Treatment (Supplemental) Technology Facilities
Demolition Costs	Lump sum		Assumed to be 20% of capital cost (excluding contingency) per TM Basis for Cost estimates of Full Scale Alternative Treatment (Supplemental) Technology Facilities; will vary by scenario
Replacement Items	Lump sum		Assumes 50% of costs for outflow, seepage, and by-pass pump stations replaced once at 25 years per TM Basis for Cost estimates of Full Scale Alternative Treatment (Supplemental) Technology Facilities; will vary by scenario
Salvage of Land	Lump sum		Assumed to equal the price paid for the land (today's dollars); will vary by scenario
FPL Improvements	Lump sum	$ 211,200	Assumes providing improvements over 2 miles

APPENDIX K

Reviewer Comments

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
General		Many table titles are in fonts to small – need to be enlarged throughout the report.
III	Table of Contents	1.2.1 Just call it "Periphyton Ecology"
IV	Table of Contents	3.3.3 Mass Removals – Remove the "s" to read Mass Removal
IV	Table of Contents	3.5.5 Groundwater Phosphorus – add the word "losses" to the end of the title.
IV	Table of Contents	3.6 Summary of PSTA Effectiveness actually begins on Pg 3-61.
V	Table of Contents	5.7 Capitalize the U in under.
VI	Table of Contents	ES-7 Remove the words "Photograph of"
VII	Table of Contents	Bottom of the Page from 2-5 through 2-9 numbers miss-ordered or titles miss-labeled.
VII	Table of Contents	2-7 Spelling Fiels- scale cells. Add the d to field.
X	Table of Contents	3-44 – "k1" subscript the number 1.
XIII	ENR	Change ENR to ENRP for Everglades Nutrient Removal Project. Suggest that this change be made globally throughout the document.
ES-1	Title	If this needs to be an Executive Summary then limit to intro material and results, drop the methods. You could change the title to Project Summary. An executive summary should be shorter than 3 pages.
ES-1	1st Para	(SFWMD, 2000) not in the references cited.
ES-1	2cd Para	PSTAs "are one of the Advanced Treatment Technologies (ATTs) being researched" Change researched to considered.
ES-2	2cd Para	Remove the comma between larger and field-scale.

Page	Paragraph or Exhibit	Comment
ES-2	2cd bullet	Put () around 2000 in SFWMD 2000.
ES-3	2cd bullet	Remove the comma between four and 5. "…monitoring of four 5 acre Field-Scale PSTA cells…"
ES-4	4th Para	Change "… while hydraulic loading was only varied…" to "… while hydraulic loading was varied only …"
ES-4	4th Para	(*Eleocharis*) Please provide the full species name.
ES-4	7th bullet	"Limerock substrate similar to material used by other researchers" – Who and for what?
ES-6	1st bullet	Change "… from a local, unflooded, and former agricultural lands area" to "… from a local unflooded former agricultural area"
ES-6	5th bullet	Change rage to range.
ES-7	1st Para	Change "Native peat soils with no amendments or other pre-treatments comprise the floor of Cell 4." to "The floor of Cell 4 consists of native peat soils with no amendments or other pre-treatments comprise."
ES-7	1st Para	Change "…specific information regarding constructability issues…" to "…specific information regarding construction issues…"
ES-8	Ex ES-6	Insert the last sentence between " (left side of photo)." and "FSC-1 is on the left side…"
ES-8	1st Para	The periphyton communities that became established within the PSTA test systems attained biomass levels and replicated normal periphyton algal species assemblages typical of low-P Everglades waters…" – All of the PSTA test systems or only most?
ES-8	1st Para	Please provide a reference for the last sentence and remove the 2 commas in the sentence.
ES-8	2cd Para	"…were observed to occupy the front end of the PSTA cells…" – Were measurements made in the inflow area or do you mean at the 1/3 station?
ES-8	3rd Para	"(typically between 100 and 1,000 grams per square meter in all test systems)" in which systems? Change "…within 4 to 5 months from startup." to "…within 4 to 5 months of startup."

Page	Paragraph or Exhibit	Comment
ES-9	1st 2 Para	The first 2 paragraphs seem to contradict each other. In the first you state 4 to 5 months for the biomass to achieve sustainable levels, but in the 2cd paragraph that after 2 years of colonization macrophytes had reduced the periphyton community in the peat-based systems. Need to clarify specifically.
ES-9	Ex ES-7	Remove the words "Photograph of"
ES-10	1st Para	FYI – The current TP concentration from STA-1W, cell 4 is 37.6ug/L
ES-10	1st Para	Replace the words "2 optimal years" with " a two year period with optimal performance.
ES-10	1st Para	DBEL, 2000 citation. Is that a, b, or c?
ES-10	2cd Para	"The minimum TP values recorded during this research…" Does this refer to the DB experiments?
ES-10	3rd Para	First occurrence of the term k_1. Please define it.
ES-10	4th Para	Define DRP.
ES-10	5th Para	Define k-C* model.
ES-11	Ex ES-8	Define k_{20PFR} and k_{20TIS}.
ES-12	General	Please provide ranges and numbers for the facts in bullets on this page.
ES-12	2cd Para	"The following conclusions concerning P removal effectiveness were drawn from these PSTA research data:" – From which systems?
ES-12	3rd bullet	Over what time period was the TP concentration averaged? Weekly, daily, monthly? Was it flow weighted, grab samples?
ES-12	4th bullet	What method was used in the tracer tests? Explain plug-flow and why it matters here.
ES-12	5th bullet	"There were no consistent effects of water depth…" – Was this statistically significant? "…but the TP removal rate was slightly higher…" – How much?
ES-13	Ex ES-9	What is the x-axis? Julian dates? If so change to normal dates.
ES-13	Ex ES-9	Change "Monthly Average k_{1TP} Values" to "Monthly Average TP k_1 Values

Page	Paragraph or Exhibit	Comment
ES-14	Ex ES-10	Define PP and the other treatment abbreviations. Is it the same as the pp in the abbreviations list?
ES-14	1st Para	Change "Inorganic dissolved reactive forms of P were initially released from these soils." to "Inorganic dissolved reactive forms of P were released initially from these soils."
ES-14	2cd Para	"Leakance" – Is this a real word? I could not find it in the dictionary. Why not "Leakage"? remove the hyphen in "un-lined"
ES-15	1st Para	", with full recognition of the substantive levels of uncertainty associated with applying the model" Change the second with to when to read ", with full recognition of the substantive levels of uncertainty associated when applying the model"
ES-15	3rd Para	"Because PSTA is a solar-powered system," – SAV and emergent systems are also solar powered and operate at deeper depths, thereby requiring less land.
ES-15	Last Para And Ex ES-11	Actual inflow concentrations averaged less than 25ppb but the model was run for inflows from 25 to 50 ppb. But you cannot do this because its outside the range for which the model was designed. Their biology may not ever allow for dealing with those concentrations – aren't they only found in low TP concentration waters?
ES-17	3rd bullet	How deep are the deep zones?
ES-17	10th and 11th bullets	Why plan a seepage canal if the seepage is primarily out the bottom as stated earlier?
ES-20	2cd Para	"… if an effective soil amendment could be used…" – without harm to the periphyton community.
ES-21	2cd Para	Reference citations – Kadlec, 1999 which one a or b. Payne et al., 2001 is not cited in the references.
ES-21	First 3 bullets	1st bullet – add "especially over 20ppb." 2cd bullet – add "especially at higher TP concentrations." 3rd bullet – add "and effects on the periphyton community."
ES-22	1st bullet	Change bullet to read "Benefits / liabilities of high current water velocities and wind on PSTAs"
ES-22	2cd Para	Last sentence regarding the PSTA design is premature. However this is the best information we have to date. Need to identify what information is needed for detailed design – this begs the question what is left to do?

Page	Paragraph or Exhibit	Comment
ES-22	3rd Para	Data is plural. Change "this data has" to "these data have"
ES-22	4th Para	Remove the hyphen in "Results to-date…" Change "…TP outflow concentrations than emergent macrophyte STAs and wetlands dominated by SAV…" to "…TP outflow concentrations than either emergent macrophyte STAs or wetlands dominated by SAV…"

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
1-1	1st Para	"were one of the advanced treatment technologies researched by the District". Replace the word researched with investigated. "were one of the advanced treatment technologies investigated by the District".
1-1	2cd Para	Change "help achieve compliance with the anticipated target total phosphorus (TP) concentration of 10 parts per billion (ppb)." To read "help achieve compliance with the target total phosphorus (TP) concentration which may be as low as 10 parts per billion (ppb)."
1-1	2cd Para	"Prior to the initiation of the District research project in July 1998, detailed research…" Had any research been conducted, detailed or otherwise? Remove the word detailed.
1-1	3rd Para	Change " In concept, the periphyton complex is hypothesized as being capable…" to "In concept, the periphyton complex is hypothesized to be capable…"
1-2	3rd bullet	Remove the hyphen. "…related to un-lined cells…"
1-3	1st Para	Change "(February 1999 – September 2002)." to "(February 1999 – September 2002)." Change "…data generated by other studies, and also provides an overview…" to ""…data generated by other studies and provides an overview…"
1-4	2cd Para	"Low P results in dominance…while high P results in…" – What ranges represent low and high P?
1-6	1st Para	Browder, 1995 is not in the works cited
1-6	1st Para	How is significant defined in this case? "…periphyton contribute a significant portion of the total primary productivity."
1-6	2cd Para	Change reference Grimshaw et al., 1996 to 1997.
1-6	Last Para	David, 1996 is not in the references cited.
1-6	Last Para	"…found that average substrate depths in WCA 3A…" Is this the peat depth or the depth to the peat? Unclear.
1-6	Last Para	Change "was between 43 and 48 centimeters (cm)." to "were between 43 and 48 centimeters (cm)."
1-7	1st Para	Last sentence is too long and is unclear. Please break it up.

Page	Paragraph or Exhibit	Comment
1-7	3rd Para	None of the 3 references cited are in the works cited.
1-7	4th Para	Simmons 2001 is not referenced.
1-7	4th Para	Define HLR first time used.
1-8	1st Para	Put in degree notation for both values when citing a range.
1-8	1st Para	Incorrect reference. McCormick et al., 1997 – Is it 1996 or 1998? 1997 is not in the works cited.
1-8	4th and 5th Para	David, 1996 and Browder et al., 1997 are not in the works cited
1-8	Last Para	Get rid of the dashes in the following words re-flooding, re-wetting, re-vitalization, re-colonize, and water-bourne. And check the spelling for the word dessicated.
1-9	Top of Pg	Who hypothesized?
1-9	1st Para	Specifically what P concentrations are considered high in the Everglades?
1-9	2cd Para	Duke Wetland Center, 1997 is not in the works cited.
1-9	3rd Para	Remove the commas between Nutrients, such Macrophytes, such (Typha spp.), may
1-9	4th Para	Move the words "submerged aquatic vegetation / limerock" before the first occurrence of SAV/LR
1-9	4th Para	Add extremely shallow following "The" in "The low-velocity periphyton mesocosms were able to provide…"
1-10	2cd Para	Remove the word back in "reduced back to 11 cm/day" Add the words "to range " between the words continued and between to read "continued to range between"
1-10	3rd Para	Define the first occurrence of k-C* model and C*
1-10	3rd Para	Chara – Please capitalize and put into italics
1-11	2cd Para	Remove the dash between Flow and Path.
1-11	3rd Para	No. 1 crushed limerock – For the lay reader please describe how big/ and other relevant qualities.
1-11	1st Para	Why mention other studies in this report?

Page	Paragraph or Exhibit	Comment
1-12		I like the fact that other studies are mentioned so the reader is made aware of other studies available. However, maybe these summaries should be put into an appendix or with the future work.
1-12	1st Para	From ex 1-3 the mass removal % is 52% and –8% respectively. Doesn't this contradict the 1st sentence here?
1-12	1st Para	"Outflow concentrations have been generally declining…" Unclear – Do you mean lower concentrations or less efficient removal?
1-13	Hyp 3	Insert the word "the" between the words affects and PSTA to read "affects the PSTA"
1-13	Hyp 6	Insert the word "the" between the words times and annual to read "times the annual"
1-13	Hyp 10	Change "TP settling rate" to TP settling rates.
1-14	1st Para	Define first use of FSCs
1-14	2cd Para	Change "…Porta-PSTA mesocosms were constructed offsite of fiberglass…" to "…fiberglass Porta-PSTA mesocosms were constructed offsite …"
1-14	2cd Para	HLRs were already defined earlier
1-14	Bullet bottom of pg.	Define surcharge
1-16	bullets	Unbold 1st bullet. Change 1st bullet to read "Test Cells 3 and 8…" and remove the second bullet.
1-16	2cd Para	"The effects of three treatments…" – Was there replication?
1-18	1st Para	Add the following "and ranged between __ and ___" to the end of each of the below statements "…are summarized in Exhibit 1-14" "…are provided in Exhibit 1-15"
1-18	2cd Para	Change "Native peat soils with no amendments or other pretreatments comprise the floor of FSC-4." to "Native peat soils, without amendments or other pretreatments, comprise the floor of FSC-4."
1-18	2cd Para	Were the native peat soils there or were they imported?

Page	Paragraph or Exhibit	Comment
Ex 1-10 Ex 1-15	Legends	The notation is unclear please define. PP-1/13?
Ex 1-11		Instead of outfall station change to outflow station.
1-23	2cd Para	Check use of present vs past tense. "boardwalks are installed" and "wells are arranged"
1-29	1st Para	Should add temperature to environmental forcing functions – drives physiological processes
1-29	1.5.2	How did you estimate ET? The equations make a big difference. What data did you use?
1-29	1.6	Change "PSTA test systems were water-filled, aquatic ecosystems. As such, detailed knowledge…" to "PSTA test systems were aquatic ecosystems, detailed knowledge…"
1-32	2cd Para	Change "…water mass balances were fairly accurate." to "…water mass balances were fairly reasonable."
1-32	5th Para	May want to consider changing the word leakance to leakage.

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
2-1	Section 2.1	May want to add low inflow TP concentrations (or they won't survive) to the viability characteristics.
2-2	2cd Para	CH2M Hill, Inc., April 2001 is not in the works cited.
2-2 to 2-4	1st Para on 2-4	"… ,taxa were fairly evenly distributed between diatoms (35 to 37 percent) were diatoms…" – remove the words "were diatoms".
2-4	3rd Para	You state that less species were identified in the scrape-down cell compared to the caprock over peat systems. Do you have any possible explanation? Possibly, leaching of the nutrients from the sediments?
2-6	Ex 2-4	Define legends a little better – STC 2/5?
2-14	1st Para	CH2M Hill, 2000 – Which one?
2-19	Ex 2-12	Make figure heading font larger, easier to read. Bottom graph – X bar is TKN. Generally sediments are TN, is TKN correct?
2-21	2cd Para	Change "The TKN content of the Field-scale periphyton fell from 8,000 to 11,000 mg/kg…" to "The TKN content of the Field-scale periphyton fell from a range of 8,000 to 11,000 mg/kg…"
2-21	Bottom Para	"It is less likely that macrophyte invasion and dominance will be a significant issue for PSTA operation and management…" – Not sure I agree, based on the field-scale.
2-22	Ex 2-14 Ex 2-15 Ex 2-16 Ex 2-17 Ex 2-19 Ex 2-21 Ex 2-22 Ex 2-23 Ex 2-24	Can you increase the font size on the figure heading?
2-23	2cd Para & 3rd Para	Please describe the method for determining cover. Isn't 100% the max you can have, but 124% is reported here.
2-23	3rd Para	Change "field-Scale" to "field-scale"

Page	Paragraph or Exhibit	Comment
2-25	3rd Para	Regarding the stem densities – were there any dead in the counts? What would be considered optimal?
2-25	4th Para	Change "It only took approximately 3 to 4 months…both of these were nearly completely colonized by SAV…" to "It took only 3 to 4 months…both of these were colonized nearly completely by SAV…"
2-25	4th & 5th Para	Capitalize and italicize the word chara. You may want to do a global search and replace.
2-29	1st Para	Regarding rapid colonization by cattails from the seed bank – Are you sure this was a live seed bank? Not new seeds or rhizomes in the soil?
2-31	2cd Para	CH2M Hill, 2000– Which one? CH2M Hill, 2001a is not in the works cited
2-32	1st Para	Change " It is important to note that CM estimates…" to "It is important in this study to note that CM estimates…"
2-32	2cd Para	Change "Exhibit 2-20 summarizes the ecosystem metabolism estimates for all of the PSTA treatments for the POR." to "Exhibit 2-20 summarizes the ecosystem metabolism estimates in the submerged portions of the ecosystem for all of the PSTA treatments during the POR."
2-34	4th Para	Regarding the DWC, 1995 report of GPP rates in WCA-2A – Were they only from below the waters surface?
2-34	4th Para	Change the reference Duke, 1995 to DWC, 1995

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
3-2	3rd Para	Change "The increases in TDP was less than DOP because of…" to "The increases in TDP was less than the increases in DOP because of…"
3-2	3rd Para	Regarding the averaging of the source water TP with the PSTA cell inflow concentrations – Any idea if this made a difference in the calculated performance estimates?
3-6	Ex 3-4	These are confusing. Is there any better way to plot these or perhaps provide a detailed explanation of their interpretation. Move Y-axis labels over some. What are the units in the legends?
3-8	Top of Pg	Change "PSTA performance estimates for the POR offer a very conservative…" to "PSTA performance estimates for the POR present a very conservative…"
3-8	3.3.3 Heading	Change Mass Removals to Mass Removal
	Ex 3-7 Pg 4 of 4	Note the formatting errors for DOP and the fact that the numbers extend beyond the table in this case.
3-19	1st Para	Remove hyphen from un-lined (2 occurrences in the paragraph)
3-19	2cd Para	Regarding 3 to 12 % of the TP budget delivered in rain – 3 to 12 % +/- 6% can be quite a significant portion of TP, should include these in the budgets.
3-19	3rd Para	References Put the comma in Kadlec and Knight, 1996 CH2M Hill, 2000 – Which one?
3-20	1st Para	References Kadlec, 2001 – Which one? Chimney et al., 2000 is not in the works cited.
3-20	1st Para	Regarding the fact that k_1 is highly correlated with loading – Of course it is : $k_1=\ln(c_1/c_2)*q$
3-20	1st Para	Remove the word "sake" in "For comparisons sake, the global average k_1…"

Page	Paragraph or Exhibit	Comment
3-21	2cd Para	"It is important to note that because this is a 2 parameter model, values for k_{PFR} and k_{TIS} cannot be compared between treatments except in the light of the C* estimate." Not clear, inclusion of this parameter in exhibit 3-9 would suggest that you are comparing them.
3-22	Top of pg	Add the word "than" – "…increases at water temperatures less **than** 20 degrees…"
3-25	2cd Para	Change the word "are" to "is" – "The same type of…PSTA test cells **are** presented"
3-25	3rd Para	Change "Treatments PP-11 (shellrock) and PP-12 (peat) were identical in terms of water depth and their POR…" to "Treatments PP-11 (shellrock) and PP-12 (peat) were operated under the same water depths and for the same time period…"
3-25	4th Para	Change the word "rising" to "increasing" in "…all had rising TP removal rates…" Change the word "if" to the word "whether" in "…would help clarify if this process"
3-33	3rd Para	"Also, average PSTA outflow TP measurements of 11 and 12 ug/L may not be statistically different…" – and if you go by the PQL it is not different from 16 ug/L. Not sure that statement is relevant, really only need the last statement to make the point.
3-34	Ex 3-26	Change the word "Average" to the word "Mean" and provide a column with "n", the number of samples used in the mean.
3-35	Bullet	Change "Aquamat (synthetic substrate)" to "Synthetic Substrate (Aquamat®)"
3-37	2cd Para	Regarding the disturbance in the test cell lime addition by foot traffic versus the undisturbed porta-PSTA. What about other possible explanations – Different peat sources?
3-37	2cd Para	Remove the word "be" in "…minimize soil disturbance be conducted under flooded conditions."
3-37	Last Para	Were there controls in this study? Please define low and high levels for the different chemical amendments. Explain what is meant by "left in batch mode"
3-38	1st Para	Based on these incomplete results…" – Could this be just natural variability or sample sizes too small?

Page	Paragraph or Exhibit	Comment
3-38	2cd Para	Regarding the discussion on k and loading – Of course they are, since k_1 is calculated from loading rates: $k_1=\ln(c_1/c_2)*q$
3-39	Ex 29 Ex 30	Rather poor r^2
3-41	3.4.4	Define Batch Operation
3-41	Last Para	How were these systems replicated?
	Ex 3-32 & 3-33	Increase font on figure headings
	Ex 3-42 & 3-43	Increase font on figure headings
3-47	3.5.1	How do the reported soil TP values compare to the original baseline values?
3-49	1st Para	Remove the word "only" in "…and that the sand soils had only approximately half as much…"
3-49	2cd Para	Define EPC0 in its first occurrence and it is not in the list of abbreviations
3-55	3.5.2 1st Para	Change "Overall periphyton TP treatment averages ranged…" to "Overall average periphyton TP treatment ranged…"
3-59	1st Para	Any ideas why the sediment accretion rates were different for the different systems?
3-62	1st bullet	We are not commenting on limits. Please remove the last sentence of the bullet.

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
4-1	2cd and 3rd Para	References Change CH2M Hill, 2002 to CH2M Hill, July 2002 Kadlec, 2001 – Which one a, b, or c?
4-3	1st bullet	May need to include temperature as the external forcing function.
4-3	2cd bullet	Move the word "only" – "…Level 2 model to only include predictions…" to "…Level 2 model to include only predictions…"
4-3	Last Para	What data were used to develop the model?
4-4	Last Para	Kadlec, 2000 is not in the works cited.
4-4	Last word	Enhancement split onto 2 pages, but is not hyphenated.
4-7	Ex 4-2	Where's k_{net}? Check to assure that all model variables have been included.
4-8	Section 4.2.3.2	Any idea of loss through seepage?
4-8	General	Please provide equations or else cite the table with them in it?
4-9	Last sentence	"Only shellrock treatment data were reviewed for this range-finding effort?" – Why?
4-10	1st Para	Correlation is not causation.
4-10	3rd Para	"…regression line provides an initial value for k_g of 0.0178 d_{-1}." What's the r^2 for this regression?
4-12	3rd Para	"…reasonably well simulated…" – Based on what criteria?
4-13	Ex 4-3	Change R^2 to r^2. I am assuming these r^2 are predicted versus measured. Please clarify what these values signify. Very poor r^2.
4-14	Ex 4-4	Legend disagrees with notation in Ex 4-1. TP_{out}=P_{out} not P_w
4-15 4-16	Ex 4-5 Ex 4-6	In the TP_{out} graph – Check legend notation P_{out}=TP_{out} In the k_{TP} graph legend – k_{net} –Where is this in Table 4-1?
4-18	1st Para	"…data were copied to provide a synthetic 5 year dataset." – Why copied? Why not use other methods that may be more appropriate.

Page	Paragraph or Exhibit	Comment
4-18	Section 4.2.7.3	Did you simulate harvesting? Please be clear.
4-21	Section 4.2.7.5	If data to back up periphyton responses is up to 50ppb seems to be way outside the normal range for the preferred periphyton; it's outside the model boundaries – not appropriate test of the model, may not be meaningful.
4-21		How much confidence do you have that these simulations mimic real world behavior?
4-23	1st Para	"The DMSTA model already provides a workable, Excel platform…" – remove the comma.
4-23	1st Para	"It is recommended that any additional PSTA modeling efforts build on the DMSTA platform." – Why?
4-23	2cd Para	1st sentence – Add the word "The" in "PSTA conceptual design is based…" to read "The PSTA conceptual design is based…"
4-24	3rd Para	Change "…and flows from STA-2 (post-STA), as provided by the District." to "…and flows from STA-2 (post-STA) that was provided by the District."
4-24	4th Para	I am glad to see these qualifications. Add these words "and may not be valid." To the end of the following "…is subject to greater error in estimated performance."
4-25	1st Para	CH2M Hill, 1999, 2000, 2001. For 2000 and 2001 which ones
4-28	Ex 4-13	Reference the previous table for the meaning of the Parameter Groups.
4-30	Ex 4-15	Label locations were confusing for Phase 2 and the OPP. It may help to refer to the 2 lines instead or maybe use background shading.
4-31	2cd Para	"…and concentrations of several other water quality parameters." – Please specify.
4-31	Last Para	SFWMD, 2001 is not in the works cited.
4-32 4-34 4-43 4-58 4-66 4-68	Ex 4-16 Ex 4-19 Ex 4-23 Ex 4-38 Ex 4-44 Ex 4-45	Larger font for the figure heading. Larger font for the figure heading.

Page	Paragraph or Exhibit	Comment
4-37	2cd bullet	Remove the comma – “Size and layout of engineering works, including…”
4-40 4-41	Ex 4-21 Ex 4-22	Larger font for the figure heading and legends.
4-48	3rd Para	May want to rewrite sentence to either shorten or reorganize so the word bypass is not used so much. “Bypass flows of these magnitudes account for 87 percent of the bypassed flows encountered during 10 percent of the bypassing…”
4-49	1st Para	Add the comma to this reference Burns and McDonnell, December, 1999.
4-50	3rd Para	Meyers and Ewel, 1990 is not in the works cited.
4-52	Ex 4-31	May want to define which levees are which in the PSTA system.
4-53	3rd Para	Number the points in the following sentence to read “It was requested…assumptions that (1) a full-scale PSTA system would receive post-STA-2 inflow, (2) that the system would, in all likelihood, be constructed as an add-on to STA-2, and (3) that the PSTA system would utilize…”
4-53	Last Para	How does the hydrated lime soil amendment work? Is it indefinite in its effectiveness?
4-59	5th Para	TP mass removal efficiency positively correlated with inflow concentration. – Not a very strong correlation.
4-59 4-63 4-64 4-65	Last 2 Para Ex 4-41 Ex 4-42 Ex 4-43	Weak r^2’s. – 0.29, 0.35, 0.40
4-69	2cd Para	Referencing natural ecosystems as existing full-scale systems.
4-69	2cd Para	References not in the works cited Kadlec, 1999 and Payne et al., 2001
4-70	3rd Para	Last sentence. Remove the words “the concept of” in “However, the concept of periphyton growing…”
4-70	Last Para	Move the word “only” to read “Engineered PSTAs have been studied only during…”
4-70	Last Para	Units are mixed, both English and metric, so give both when you use one.

Page	Paragraph or Exhibit	Comment
4-71	4th Para	Good, glad you have qualified the results on peat soils.
4-72	Top of pg	Remove hyphen in stand-alone
4-72	3rd Para	"Assuming a conservative accretion rate of 2.5 cm/yr…" – Seems awfully high, where did you get this number from?

SFWMD comments on the "PSTA Research and Demonstration Project Phase 1, 2, and 3 Summary Report"

Page	Paragraph or Exhibit	Comment
5-3	5th bullet	Testing various forms and methods of soil amendments. I thought we did this in the mesocosm study at the field-scale. Maybe this could be rephrased to state that further research in this area may be warranted.
5-4	Section 5.5	Cells in Series – You already know that more cells in series enhance performance and the funds were redirected by FDEP.
5-4	Section 5.6	Correct reference from Addy et al., 1993 to Adey et al., 1993
5-4	Section 5.7	Kadlec, 2000 is not in the works cited.
5-5	1st Para	Change "All of these locations have been operational…" to "All of these locations existed…"
	Section 6	These references are not in the text. Are they in the appendix perhaps? CH2M Hill. January 2000 CH2M Hill. February 2000 Drenner, et al., 1997 Kadlec, 1996b Kadlec, 2001b Kadlec, 2001c Knight, 1980 McCormick and O'Dell, 1996 PEER Consultants/ Brown and Caldwell, 1996 Van der Valk and Crumpton, 1996 Vymazal, 1988 Wetzel, 1996
6-2	Section 6	The CH2M Hill references need to be reordered by date.
6-3	Section 6	Add a comma – Hydromentia, Inc. 2000.
6-4	Section 6	Kadlec, R.H. 1998. Unpublished. Is missing the title.
6-5	Section 6	Van der Valk and Crumpton, 1996 – van should be lower case.
6-5	Section 6	Move Walker, 2001 above Walker and Kadlec, 2000.