5th Quarterly Report (August - October 1999)

Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project

Prepared for

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Acronyms and Abbreviations

°C	degree(s) Celsius
µg/L	microgram(s) per liter
µmhos/cm	micromhos per centimeter
afdw/m^2/d	ash-free dry weight per square meter per day
cm	centimeter
CM	community metabolism
CR	community respiration
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
E/M^2/d	Einstein per square meter per day
EAA	Everglades Agricultural Area
ENR	Everglades Nutrient Removal
ET	evapotranspiration
ft	foot (feet)
g/cm^3	gram(s) per cubic centimeter
g/L	gram(s) per liter
g/m^2/y	gram(s) per square meter per year
GPP	gross primary production
HLR	hydraulic loading rate
HRT	hydraulic residence time
LiCl	lithium chloride
m^3/d	cubic meter(s) per day
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mg/m^2	milligram(s) per square meter
MJ/M^2/d	megajoules per square meter per day
mL	milliliter(s)
mm/d	millimeter(s) per day
NaBr	sodium bromide
nm	nanometer
NPP	net primary production
NRP	non-reactive phosphorus
O_2/m^2/hr	oxygen per square meter per hour
PAR	photosynthetically active radiation
ppt	parts per thousand
PSTA	Periphyton-based Stormwater Treatment Area
QC	quality control
SRP	Scientific Review Panel
STA	Stormwater Treatment Area

STRC	Supplemental Technologies Research Compound
SU	standard units
SWDI	Shannon-Weaver Diversity Index
TDP	total dissolved phosphorus
TDS	total dissolved solids
TIP	total inorganic phosphorus
TIS	tanks-in-series
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TPP	total particulate phosphorus
TSS	total suspended solids

Executive Summary

The South Florida Water Management District (District) is conducting research focused on potential advanced treatment technologies to support reduction of phosphorus loads in surface waters entering the remaining Everglades. Periphyton-based stormwater treatment areas (PSTAs) are one of the advanced treatment technologies being researched by the District. Prior to initiation of the District's PSTA project in July 1998, detailed research to evaluate treatment performance issues and the long-term viability of the PSTA approach to phosphorus reduction in Everglades Agricultural Area surface waters had not been performed.

Studies are being conducted in three of the south ENR Test Cells (PSTA Test Cells) and in 24 portable PSTA mesocosms (Porta-PSTAs). A second phase of research is planned under which PSTA feasibility will be evaluated further in larger-scale test systems (Field-Scale PSTAs). This document is an interim report of the PSTA study program contract held by CH2M HILL. It provides a brief summary of progress on the PSTA Research Project, with the primary focus on new information generated during the 5th project quarter (August through October 1999). The purpose of this document is primarily to transmit the new quarterly data. Preliminary mass loading and nutrient removal analyses are presented to introduce the anticipated final analytical approach.

PSTA research activities during the first two quarters of the project were focused on development of a peer-reviewed, scientifically valid research plan and implementation of that plan through mesocosm design, construction, and testing. The operational startup of the three ENR PSTA Test Cells and the Porta-PSTA mesocosms occurred during the third quarter. The ENR PSTA Test Cells were filled to their operational levels, and inflows were adjusted to operational hydraulic loading rates (HLRs) on February 15, 1999. All Test Cell modifications were complete at that time. Operational monitoring of the PSTA Test Cells began on February 23, 1999. The Porta-PSTAs were adjusted to operational levels, and inflows and routine monitoring began on April 12, 1999.

Preliminary findings from the District's PSTA research are summarized as follows. Key results to-date from the three PSTA Test Cells include:

- Period-of-record (POR) HLRs to the three PSTA Test Cells have averaged between 4.4 and 4.6 centimeters per day (cm/d).
- Preliminary analysis of tracer tests in the PSTA Test Cells indicated that the effective volume and hydraulic residence time in Treatment 1 (Test Cell 13 – peat soil) is 55 percent higher than expected and almost twice as high as Treatment 2 (Test Cell 8 – shellrock soil). Test Cell 8 was well mixed while Test Cells 3 (Treatment 3 – shellrock soil) and 13 were intermediate between well mixed and plug flow.
- Dissolved oxygen percent saturation increased with travel through all of the PSTA Test Cells, with the greatest increases during the 5th quarter consistently observed in the shellrock soil treatments.

- Inflow total phosphorus (TP) concentrations have been approximately one-half of anticipated levels and have ranged from 0.017 to 0.035 milligrams per liter (mg/L) on a monthly average basis.
- Average TP outflow concentrations were higher than inflow levels for the first 3 to 4 months of operation but have generally been below inflow levels during the last 5 months. Outflow TP averages for June through October were 0.016 mg/L in Treatment 2 and 0.021 mg/L in Treatments 1 and 3. The lowest monthly average TP outflow concentration was 0.013 mg/L in Treatment 1.
- Preliminary statistical analysis indicates that the shellrock soils yield a significantly lower TP minimum than peat soils and that a constant deep-water regime resulted in lower TP than variable hydraulic loading.
- Outflow dissolved (soluble) reactive phosphorus (DRP) concentrations averaged between 0.001 and 0.003 mg/L in all three PSTA Test Cell treatments during the period from June through October. The remaining TP in the Test Cell outflows is comprised of variable fractions of particulate and dissolved organic phosphorus forms.
- TP removal efficiencies averaged 38, 45, and 26 percent in Treatments 1, 2, and 3, respectively, during the 5th quarter.
- Average quarterly TP net mass removal rate constants have steadily increased since startup in Treatments 2 and 3. The highest quarterly average is 10.3 meters per year (m/y) in Treatment 2.
- Average total nitrogen (TN) concentrations have typically decreased with passage through the test cells. Average monthly outflow TN concentrations ranged between 0.63 and 1.74 mg/L in Treatment 1, 0.65 and 1.70 mg/L in Treatment 2, and 0.57 and 1.60 mg/L in Treatment 3.
- Influent concentrations of calcium and alkalinity generally decreased with passage through the PSTA Test Cells.
- The peat soils in Treatment 1 are highly organic and exhibit relatively low bulk densities, averaging 0.48 grams per cubic centimeter (g/cm^3), as compared to the shellrock soils of Treatments 2 and 3, which averaged 1.43 and 1.38 g/cm^3, respectively, during the period-of-record.
- The estimated TP stored in the top 10 cm of soil in Treatment 1 was relatively constant, ranging from approximately 12 to 18 grams per square meter (g/m^2) since startup. The monthly average TP estimated in the top 10 cm of the shellrock soils was 115 g/m^2 in Treatment 2 and 121 g/m^2 in Treatment 3.
- Soil TP inventory has shown both positive and negative changes with no consistent trends. Very slight percentage TP losses from Test Cell soils could be contributing a significant fraction of the TP measured in water outflows.
- Plant cover in the PSTA Test Cells has increased throughout the operational period. This plant cover is dominated by macrophytes in all three treatments.

- At the end of the 5th quarter, Treatment 1 had an estimated total plant cover of 198 percent, with individual contributions of 96, 71, and 31 percent by submerged aquatic plants, algal mat, and emergent macrophytes, respectively. Blue-green-dominated algal mats covered approximately 69 percent of this cell in October. Periphyton ash-free dry weights averaged between 256 and 833 g/m^2 for the period from June through October. Periphyton TP averaged 0.65 g/m^2, and corrected chlorophyll *a* averaged 213 mg/m^2 during this period.

- The shellrock-based cells have a lower plant cover by all plant species. At the end of the 5th quarter, Treatment 2 had an estimated total plant cover of 92 percent, with individual contributions of 64, 22, and 4 percent by submerged aquatic plants, emergent macrophytes, and algal mat, respectively. Treatment 3 had an estimated total plant cover of 61 percent, with individual contributions of 28, 20, and 10 percent by submerged aquatic plants, emergent macrophytes, and algal mat, respectively. Periphyton ash-free dry weights averaged 190 and 262 g/m^2 in Treatments 2 and 3 in October. Periphyton TP averaged 0.29 g/m^2 in Treatment 2 and 0.18 g/m^2 in Treatment 3 during the period-of-record. Chlorophyll *a*, cell counts, and algal biovolume were much lower in the shellrock treatments than in the peat treatment.

- POR community metabolism estimates in Treatments 1, 2, and 3 were 3.4, 3.0, and 2.3 g $O_2/m^2/d$, respectively. This gross primary production is balanced by relatively high community respiration estimates of 3.2, 2.8, and 2.5 g $O_2/m^2/d$, respectively, for this period. Resulting average estimated net primary production in all three cells is relatively low.

- A diel study conducted on October 5 and 6, 1999, indicated that outflow concentrations of TP were slightly higher during the night than during the day. Outflow concentrations of total suspended solids (TSS) and algal populations indicated an opposite diel pattern, with higher levels during the day than at night. No trend in outflow concentrations of total particulate phosphorus (TPP) were evident.

Key results to-date from the 24 Porta-PSTA mesocosms include:

- Long-term average inlet HLRs ranged from 5.8 to 6.7 cm/d in the 6 cm/d treatments and 11.2 cm/d in the 12 cm/d treatment. HLRs to the Porta-PSTAs were increased during the operational period to eliminate plugging problems in the inlet valves.

- Inflow TP concentrations have been variable and have ranged from approximately 0.013 to 0.045 mg/L on a monthly average basis.

- Outflow TP concentrations have generally decreased each month in all treatments since startup. Outflow concentrations in October averaged from 0.013 to 0.017 mg/L.

- Preliminary statistical analysis indicates that the shellrock soils in the Porta-PSTA mesocosms yield a significantly lower TP minimum than peat soils and that a constant deep-water regime resulted in lower TP than variable hydraulic loading. A comparison between the Porta-PSTA mesocosms and the Test Cells indicated that outflow TP was statistically lower at the smaller experimental scale.

- Monthly average outflow dissolved reactive phosphorus concentrations averaged between 0.001 and 0.005 mg/L in all Porta-PSTA treatments since startup.
- The highest monthly average TP removal rate constant was 19 m/y measured in October in Treatment 5 (deep shellrock with high hydraulic loading). The highest quarterly average TP removal rate constant was 8.8 m/y measured in Treatment 7 (shallow sand control). The highest period-of-record TP removal rate constant was 5.3 m/y in Treatment 9 (peat Aquashade control).
- Influent total nitrogen (TN) concentrations were variable during the operational period with monthly averages generally ranging from 0.61 to 2.42 mg/L. Long-term average outflow TN concentrations were between 0.95 and 1.2 mg/L in all treatments.
- Monthly average concentrations of calcium and alkalinity generally decreased with passage through the Porta-PSTA mesocosms.
- Soil TP averaged between 5.4 and 6.2 g/m^2 in the top 10 cm of the peat soil mesocosms. Soil TP averaged between 120 and 140 g/m^2 in the top 10 cm of the shellrock soil mesocosms. Soil TP averaged between 2.7 and 3.3 g/m^2 in the top 10 cm of the sand treatments. Soil TP inventory has shown both positive and negative changes with no consistent trends. Very slight percentage TP losses from mesocosm soils could be contributing a significant fraction of the TP measured in water outflows.
- Plant cover in the Porta-PSTA mesocosms has generally increased throughout the operational period in most treatments. This plant cover is dominated by planted macrophytes in the peat-based treatments and by floating blue-green periphytic mats in the other treatments. Macrophytes and periphyton mats are growing faster in shallow than in deeper mesocosms.
- Total periphyton biomass in peat-based mesocosms was estimated as between 220 and 836 grams ash-free dry weight per square meter (g $AFDW/m^2$) in the 5th quarter. Chlorophyll *a* ranged from 39 to 73 milligrams per square meter (mg/m^2). Algal biovolumes were dominated by blue-green periphyton species.
- Total periphyton biomass in shellrock treatments was estimated between 140 and 260 g $AFDW/m^2$ in the 5th quarter. Chlorophyll *a* ranged from 10 to 80 mg/m^2. Algal biovolumes were dominated by blue-green periphyton species.
- Community metabolism estimates in the Porta-PSTA treatments averaged between 1.14 and 3.24 g $O_2/m^2/d$ during the period-of-record. Community metabolism in the Aquashade controls was much lower (0.30 to 0.32 g $O_2/m^2/d$).
- Estimates of net primary productivity in peat-based treatments were typically negative, in spite of evident plant community development. This observation indicates that there may be a relatively high sediment oxygen demand in these peat-based systems.

Phase 1 operation and monitoring of the PSTA mesocosms past October 1999 is scheduled to continue for approximately 4 more months for the Test Cells and 6 more months in the Porta-PSTAs. Results through the first three operational quarters have helped to characterize the growth and ecology of periphyton and macrophytes on differing antecedent soils, and have identified initial lower outflow TP concentrations and effective TP net removal

rate constants. Very low phosphorus loadings have provided insight into system operation under unusual conditions. Continued monitoring of the PSTA experimental systems and detailed data analysis is necessary to fully document the effects of seasonal variability, ecosystem maturity, and response to higher TP loadings.

SECTION 1

Introduction

1.1 Background

The South Florida Water Management District (District) is conducting research focused on potential advanced treatment technologies to support reduction of phosphorus loads in surface waters entering the remaining Everglades. Particular focus is being placed on the treatment of excess 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) are one of the advanced treatment technologies being researched by the District. The PSTA concept was proposed for phosphorus removal from EAA waters by Doren and Jones (1996) and further described and evaluated by Kadlec (1996, 1998) and Kadlec and Walker (1996). Prior to initiation of the District's PSTA project in July 1998, detailed research to evaluate treatment performance issues and the long-term viability of the PSTA approach to phosphorus reduction in EAA surface waters had not been performed.

The two phases of the PSTA research and demonstration project are described in detail in the *Experimental Research Plan* (CH2M HILL 1999). In brief, the first phase of the study is to provide basic research data needed to better understand whether the PSTA concept should continue to be investigated as a part of the solution for Everglades restoration. Phase 1 research is being performed through field-based mesocosm experiments located within the District's Everglades Nutrient Removal (ENR) Project. Studies are being conducted in 24 portable PSTA mesocosms (Porta-PSTAs), and in three of the south ENR Test Cells (see Section 1.2). A second phase of research is planned under which PSTA feasibility will be evaluated further in larger-scale mesocosms. Although preliminary research plan concepts for Phase 2 have been outlined in the *Experimental Research Plan*, they remain dynamic in light of the high level of interest in expediting the overall schedule for evaluating and integrating advanced treatment technologies into the Stormwater Treatment Area (STA) system design for the EAA.

This document is an interim report prepared under Task 9 of the PSTA study program contract held by CH2M HILL. It provides a brief summary of progress on the PSTA Research Project, with the primary focus on new information generated during the fifth quarter (August through October 1999). However, it should be noted that the data summaries presented are cumulative to provide a clear overview of all data generated under the field program to date. While this approach varies somewhat from that specified under Task 9 in the project scope of work, this comprehensive overview approach was considered likely to be more useful as the District tracks the growing database available and makes decisions relevant to the potential acceleration of Phase 2 of the PSTA research program. The cumulative data summaries are viewed as products that would have been needed for

preparation of the anticipated Phase 1 final report and, therefore, are considered an early implementation of the work authorized under the contract as Task 10.

It should be clearly understood that while the cumulative data are being presented, the purpose of this document remains primarily to transmit the new quarterly data. Preliminary mass loading and nutrient removal analyses are presented to introduce the anticipated final analytical approach. However, detailed data interpretation is being deferred until the complete Phase 1 data sets are available to support objective, technically defensible conclusions. Completion of the 1-year field studies anticipated under Phase 1 will provide the District with a clearer picture on how seasonality affects PSTA "functionality". Therefore, the interim data presented in this report merely serve to document the continuation of monitoring efforts and are not yet appropriate for supporting final conclusions regarding PSTA viability.

Lastly, it should be noted that the information contained in this document remains preliminary and draft. Complete quality control (QC) review of all data sets has not been conducted on all of the information being transmitted. Any data identified during our QC reviews that should be flagged or qualified will be documented in the remaining Phase 1 quarterly reports or a final Phase 1 report, as applicable.

1.2 Summary of Experimental Design

This section provides some key information related to the experimental systems being used in Phase 1.

1.2.1 South ENR Test Cells

The District assigned three South ENR Test Cells to the PSTA Research 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:

- **Test Cell 13–**2.5 feet (ft) of sand surcharge 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)
- **Test Cell 8–**3.5 ft of sand surcharge plus 1.0 ft of shellrock (locally mined)
- **Test Cell 3–**3.5 ft of sand surcharge plus 1.0 ft of shellrock (locally mined)

Exhibit 1-1 provides a plan view of a typical PSTA Test Cell showing sampling locations and walkways. Exhibit 1-2 provides a summary of detailed design criteria for the PSTA Test Cells. Exhibits 1-3a, b, and c are aerial photographs of Test Cells 13, 8, and 3, respectively, taken on September 29, 1999.

1.2.2 Porta-PSTA Mesocosms

Twenty-four Porta-PSTA mesocosm units were fabricated of fiberglass offsite and delivered to the South ENR STRC. Twenty-two of the fiberglass tanks are 6 meters long by 1 meter wide by 1 meter deep. The remaining two tanks are 3 meters wide to allow assessment of mesocosm configuration effects.

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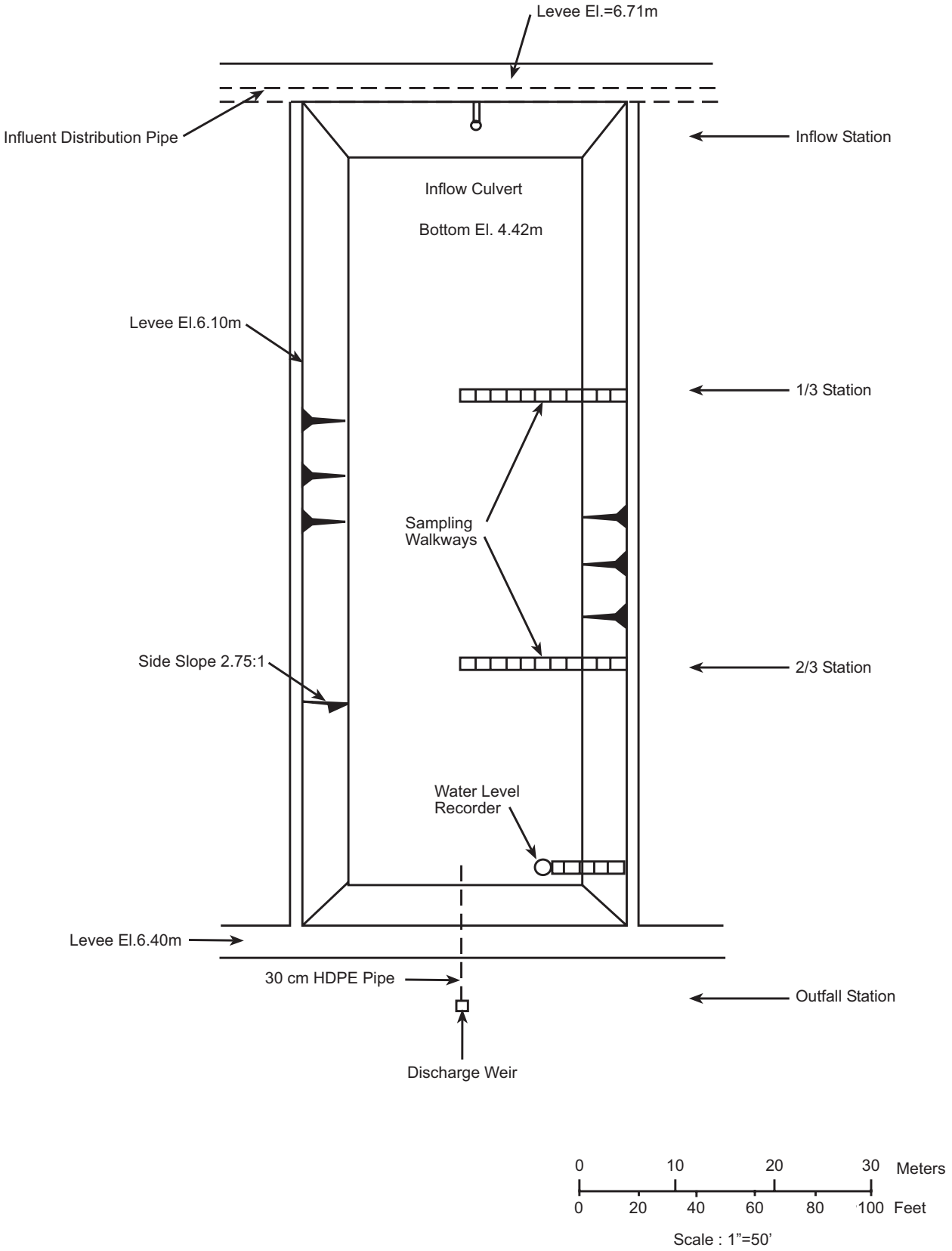

Exhibit 1-1. Plan View of Typical ENR PSTA Test Cell Showing Sampling Locations

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Exhibit 1-2

Summary of Detailed Design Criteria for ENR PSTA Test Cells

Design Parameter	Treatment 1 Cell 13	Treatment 2 Cell 8	Treatment 3 Cell 3	Combined System
No. Cells	1	1	1	1
Flow (m^3/d)				
Average	134	134	134	269
Maximum	134	134	269	403
Minimum	134	134	1	135
Cell Length (m)	80.0	80.0	80.0	80.0
Cell Width (m)	28.0	28.0	28.0	28.0
Aspect Ratio	2.9	2.9	2.9	2.9
Area (m^2)				
Horizontal surface area	2240.0	2240.0	2240.0	4480
Wall Area (@ design depth)	129.6	129.6	64.8	194
Operational Water Depth (m)				
Average	0.60	0.60	0.30	0.45
Maximum	0.60	0.60	1.00	0.80
Minimum	0.60	0.60	0.01	0.31
Operational Water Volume (m^3)				
Average	1344.0	1344.0	672.0	2016
Maximum	1344.0	1344.0	2240.0	3584
Minimum	1344.0	1344.0	22.4	1366
Nominal Hydraulic Residence Time (d)				
@ average flow and depth	10.00	10.00	5.00	7.50
@ maximum flow and minimum depth	10.00	10.00	0.08	3.39
@minimum flow and maximum depth	10.00	10.00	2240.00	26.47
Hydraulic Loading Rate (cm/d)				
@ average flow and depth	6.0	6.0	6.0	6.0
@ maximum flow	6.0	6.0	12.0	9.0
@minimum flow	6.0	6.0	0.0	3.0
Nominal Linear Velocity (m/d)				
@ average flow and depth	8.00	8.00	16.00	21.33
@ maximum flow and minimum depth	8.0	8.0	960.0	47.2
@minimum flow and maximum depth	8.00	8.00	0.04	6.04
Substrate				
Surface	Peat	Shellrock	Shellrock	Peat/Shellrock
Bottom	Shellrock	Shellrock	Shellrock	Shellrock
Construction Material	Earth	Earth	Earth	Earth
Liner (Yes/No)	Yes	Yes	Yes	Yes
Freeboard (m)				
@ average depth	1.38	1.38	1.68	1.53
Deep Zones				
Number per Cell	0	0	0	0
Depth Below Floor Elevation (m)	NA	NA	NA	NA
Plant Species (Yes/No)				
Periphyton	Yes	Yes	Yes	Yes
Macrophytes	Yes	Yes	Yes	Yes
None (Aquashade Control)	No	No	No	No
Design TP Influent Quality (µg/L)				
Average	40	40	40	40
Maximum	50	50	50	50
Minimum	30	30	30	30
Design TP Mass Loading ($g/m^2/y$)				
Average	0.88	0.88	0.88	0.88
Maximum	1.10	1.10	1.10	1.10
Minimum	0.66	0.66	0.66	0.66

Notes:

m = meters

m^3/d = cubic meter(s) per day

m^2 = square meter(s)

cm/d = centimeter(s) per day

$g/m^2/y$ = gram(s) per square meter per year

µg/L = microgram(s) per liter

EXHIBIT 1-3A
Aerial Photograph of South ENR Test Cell 13

EXHIBIT 1-3B
Aerial Photograph of South ENR Test Cell 8

EXHIBIT 1-3C
Aerial Photograph of South ENR Test Cell 3

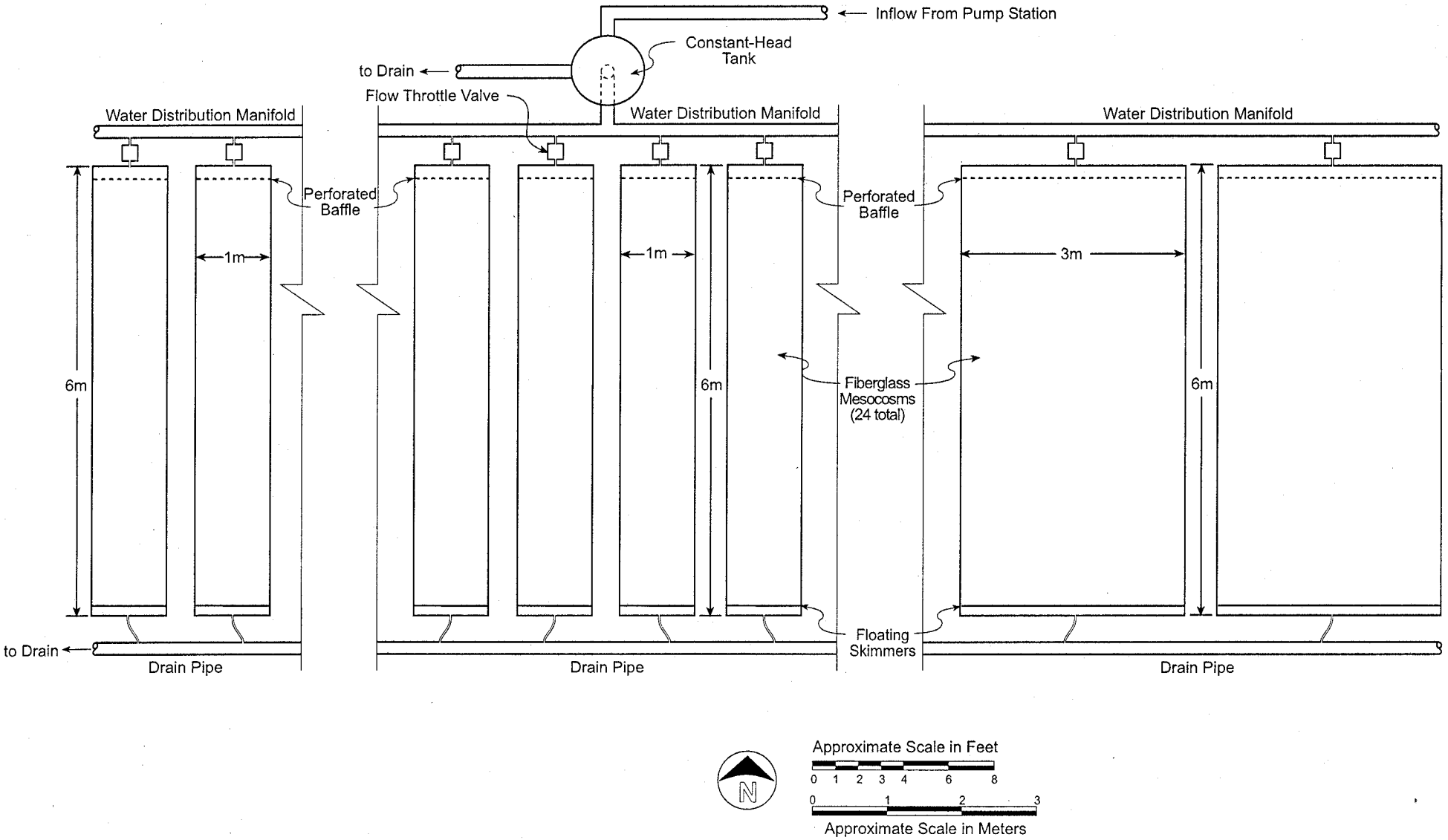

Exhibit 1-4. Porta-PSTA Experimental Mesocosm Site Plan

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Exhibit 1-5

Summary of Design Criteria for Porta-PSTA Experimental Mesocosms

Design Parameter	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12	Combined System
No. Cells	3	3	3	3	3	3	1	1	1	1	1	1	24
Flow (m^3/d)													
Average	0.36	0.36	0.36	0.36	0.72	0.36	0.36	0.36	0.36	0.36	1.08	1.08	11.16
Maximum	0.36	0.36	0.36	0.36	0.72	0.72	0.72	0.36	0.36	0.36	1.08	1.08	12.60
Minimum	0.36	0.36	0.36	0.36	0.72	0.05	0.05	0.36	0.36	0.36	1.08	1.08	9.92
Flow (mL/min)													
Average	250	250	250	250	500	250	250	250	250	250	750	750	7750
Maximum	250	250	250	250	500	500	500	250	250	250	750	750	8749
Minimum	250	250	250	250	500	35	35	250	250	250	750	750	6888
Cell Depth (m)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Cell Length (m)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Cell Width (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	3.00	1.33
Length:Width Ratio	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.0	2.0	4.5
Water Depth:Width Ratio	0.6	0.6	0.3	0.3	0.6	0.3	0.3	0.6	0.6	0.6	0.1	0.1	0.34
Area (m^2)													
Horizontal surface area	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	18.00	18.00	168.00
Wall Area (@ design depth)	8.40	8.40	4.20	4.20	8.40	4.20	4.20	8.40	8.40	8.40	5.40	5.40	153.60
Operational Water Depth (m)													
Average	0.60	0.60	0.30	0.30	0.60	0.30	0.30	0.60	0.60	0.60	0.30	0.30	0.45
Maximum	0.60	0.60	0.30	0.30	0.60	0.60	0.30	0.60	0.60	0.60	0.30	0.30	0.48
Minimum	0.60	0.60	0.30	0.30	0.60	0.01	0.30	0.60	0.60	0.60	0.30	0.30	0.43
Operational Water Volume (m^3)													
Average	3.60	3.60	1.80	1.80	3.60	1.80	1.80	3.60	3.60	3.60	5.40	5.40	72.00
Maximum	3.60	3.60	1.80	1.80	3.60	3.60	1.80	3.60	3.60	3.60	5.40	5.40	77.40
Minimum	3.60	3.60	1.80	1.80	3.60	0.06	1.80	3.60	3.60	3.60	5.40	5.40	66.78
Nominal Hydraulic Residence Time (d)													
@ average flow and depth	10.00	10.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	5.00	5.00	6.45
@ maximum flow and minimum depth	10.00	10.00	5.00	5.00	5.00	0.08	5.00	10.00	10.00	10.00	5.00	5.00	5.30
@minimum flow and maximum depth	10.00	10.00	5.00	5.00	5.00	72.00	5.00	10.00	10.00	10.00	5.00	5.00	7.80
Hydraulic Loading Rate (cm/d)													
@ average flow and depth	6.0	6.0	6.0	6.0	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.6
@ maximum flow	6.0	6.0	6.0	6.0	12.0	12.0	6.0	6.0	6.0	6.0	6.0	6.0	7.5
@minimum flow	6.0	6.0	6.0	6.0	12.0	0.8	6.0	6.0	6.0	6.0	6.0	6.0	5.9
Nominal Linear Velocity (m/d)													
@ average flow and depth	0.60	0.60	1.20	1.20	1.20	1.20	1.20	0.60	0.60	0.60	1.20	1.20	0.95
@ maximum flow and minimum depth	0.60	0.60	1.20	1.20	1.20	72.00	1.20	0.60	0.60	0.60	1.20	1.20	6.85
@minimum flow and maximum depth	0.60	0.60	1.20	1.20	1.20	0.08	1.20	0.60	0.60	0.60	1.20	1.20	0.86
Substrate Depth (m)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.20
Substrate Type	Peat	Shellrock	Peat	Shellrock	Shellrock	Shellrock	Sand	Sand	Peat	Shellrock	Shellrock	Shellrock	Peat/Shellrock
Construction Material	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass	Fiberglass
Liner (Yes/No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Freeboard (m)													
@ average depth	0.10	0.10	0.40	0.40	0.10	0.40	0.40	0.10	0.10	0.10	0.40	0.40	0.25
Plant Species (Yes/No)													
Periphyton	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes/No
Macrophytes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes/No
None (Aquashade Control)	No	No	No	No	No	No	No	No	Yes	Yes	No	No	Yes/No
Design TP Influent Quality (µg/L)													
Average	40	40	40	40	40	40	40	40	40	40	40	40	40
Maximum	50	50	50	50	50	50	50	50	50	50	50	50	50
Minimum	30	30	30	30	30	30	30	30	30	30	30	30	30
Design TP Mass Loading (g/m^2/y)													
Average	0.88	0.88	0.88	0.88	1.75	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.97
Maximum	1.10	1.10	1.10	1.10	2.19	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.21
Minimum	0.66	0.66	0.66	0.66	1.31	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.73

Notes:

m = meters

mL/min = milliliter(s) per minute

m^3/d = cubic meter(s) per day

m^2 = square meter(s)

cm/d = centimeter(s) per day

g/m^2/y = gram(s) per square meter per year

µg/L = microgram(s) per liter

Exhibit 1-4 provides a plan view of the Porta-PSTA experimental setup showing the layout of typical 1- and 3-meter-wide mesocosms in relation to the constant-head tank and inlet manifolds. Detailed design and operational criteria for the Porta-PSTAs are summarized in Exhibit 1-5.

1.3 Summary of Progress During Previous Quarters

PSTA research activities during the first two quarters of the project were focused on development of a peer-reviewed, scientifically valid research plan and implementation of that plan through mesocosm design, construction, and testing. The operational startup of the three ENR PSTA Test Cells and the Porta-PSTA mesocosms occurred during the third quarter. This section provides a bulletized summary of key activities during the first four quarters of project activity.

1.3.1 1st Project Quarter—July 1998 through October 1998

- Scientific Research Panel (SRP) members subcontracted and scheduled to review the PSTA Research Plan.
- Preliminary Draft PSTA Research Plan was prepared and submitted to District for review and comment.
- Draft PSTA Research Plan was revised and sent to SRP members prior to the review meeting.
- PSTA SRP review meeting was held at District headquarters in West Palm Beach.
- Oral and written comments on the PSTA Research Plan were received and incorporated in the revised Draft PSTA Research Plan dated October 1998.

1.3.2 2nd Project Quarter—November 1998 through January 1999

- Conducted design and contracting for Porta-PSTA construction
- Conducted design of modifications to ENR PSTA Test Cells and implementation of plant growth inhibition activities
- Developed Porta-PSTA layout at South ENR Supplemental Technologies Research Compound (STRC)
- Delivered and set up Porta-PSTAs including site plumbing, leak testing, sediment installation, macrophyte planting, and algae seeding
- Delivered and set up PSTA field trailer at South ENR STRC
- Modified ENR PSTA Test Cells to include inlet and outlet distribution enhancement, installation of monitoring walkways and horizon markers, and macrophyte planting
- Developed methods for water regime fluctuations, periphyton and sediment coring, percent cover estimates, light attenuation studies, and community metabolism studies

- Conducted analytical testing of PSTA sediments for phosphorus sorption/desorption characteristics and inclusion of sand-based controls in Porta-PSTA design

Several of the activities started during the second quarter continued into the third project quarter because of the need for Porta-PSTA mesocosm leak-proofing and repairs. While this delayed field research startup, this had the side benefit of providing additional time for establishment and growth of the *Eleocharis* sp. planted in both mesocosm types before raising water in the mesocosms to target water levels for operation. In addition, deferral of operational startup reduced the challenge of trying to get the periphyton system operational during the normally least-productive season for periphytic algal growth.

1.3.3 3rd Project Quarter—February 1999 through April 1999

- The ENR PSTA Test Cells were filled to their operational levels, and inflows were adjusted to operational hydraulic loading rates on February 15, 1999. All Test Cell modifications were complete at that time. Operational monitoring of the PSTA Test Cells began on February 23, 1999.
- The Porta-PSTAs were adjusted to operational levels, and inflows and routine monitoring began on April 12, 1999.
- Tracer study methodology was evaluated for the Porta-PSTA system.
- The first operational data summary covering results from the 3rd Project Quarter was issued in July 1999.

1.3.4 4th Project Quarter—May 1999 through July 1999

- The water supply pumps serving the South ENR STRC became nonfunctional on June 10, 1999. Because of the uncertainty related to repairs, CH2M HILL installed a temporary water delivery system to the Porta-PSTA mesocosms.
- A tracer study was conducted in selected Porta-PSTA mesocosms between April 19, 1999, and June 15, 1999. Both lithium and bromide were used as tracer elements.
- A lithium tracer study was initiated in the three PSTA Test Cells on July 29, 1999.
- Monitoring of all systems was maintained; efforts were directed toward improving consistency in hydraulic loading rates (HLRs).

1.4 PSTA Research Highlights during the 5th Project Quarter

Routine operation and monitoring of the PSTA Test Cells and the Porta-PSTA mesocosms was continued throughout the 5th project quarter from August through October 1999. Several operational events occurred during this period as summarized below:

- A teleconference was held with the PSTA SRP on August 5, 1999. Research progress through July 1999 was presented and discussed.
- A lithium tracer study was conducted within the ENR Test Cells between July 29, 1999, and September 30, 1999. Results of this study are included in this report.

- Increased volume of aquashade was used in control tanks (PP-21 and PP-22) to try to reduce the periphyton growth within these tanks.
- Completed hurricane preparations for the PSTA Test Cell and Porta-PSTA sites. The site endured two hurricanes during this hurricane season: Hurricane Floyd (September 14, 1999) and Hurricane Irene (October 15, 1999).
- Conducted a diel study within selected Porta-PSTA mesocosms. Preliminary results of this study are included in this report.
- Porta-PSTA inflow rates were increased through the individual mesocom inflow valves to all of the Porta-PSTA tanks (except the three mesocosms with variable flow) to compensate for intermittent valve clogging.
- Deployed and collected sediment traps from each of the Porta-PSTA mesocosms.

1.5 Report Organization

Section 2 provides an overview of meteorological conditions for the study period of record (POR). Sections 3 and 4 summarize the Test Cell and Porta-PSTA study results, respectively. Section 5 presents some initial statistical evaluations of the data available while Section 6 addresses progress made on the PSTA performance forecast model.

SECTION 2

Meteorological Data

2.1 Solar Radiation

Solar radiation is being continuously monitored by CH2M HILL at the South ENR STRC using a pyranometer and phostosynthetically active radiation (PAR) quantum sensor mounted above the constant-head water tank. Exhibits 2-1 and 2-2 illustrate total solar radiation and PAR, respectively, at this site for the study POR. PAR and total insolation monitored during the 3rd quarter averaged 39.16 Einstein per square meter per day ($E/m^2/d$) and 20.50 megajoules per square meter per day ($MJ/m^2/d$), respectively. In the 4th quarter, PAR and total insolation averaged 39.26 $E/m^2/d$ and 21.29 $MJ/m^2/d$, respectively. In the 5th quarter, PAR and total insolation averaged 27.99 $E/m^2/d$ and 16.31 $MJ/m^2/d$, respectively. Total insolation and PAR were lower during the 5th quarter than in the 3rd or 4th quarter in response to the seasonal pattern of declining day length and cloudy weather in September and October.

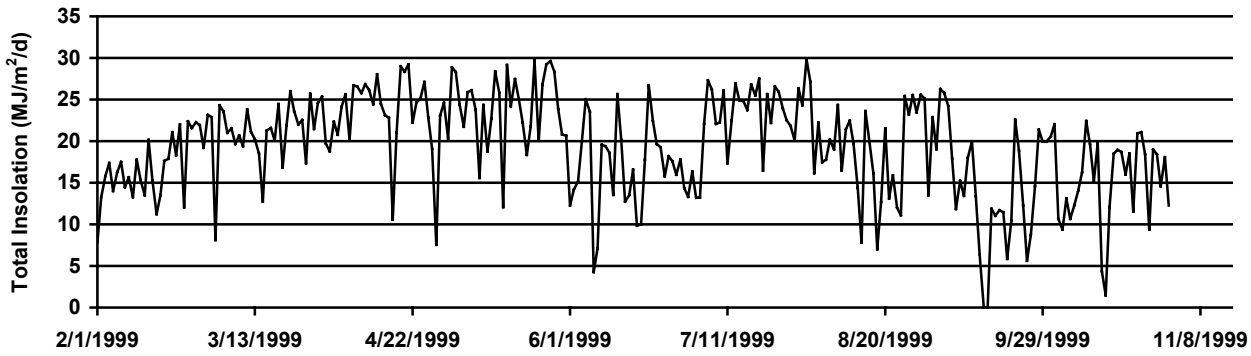


EXHIBIT 2-1
Total Solar Radiation Measured at the South ENR STRC

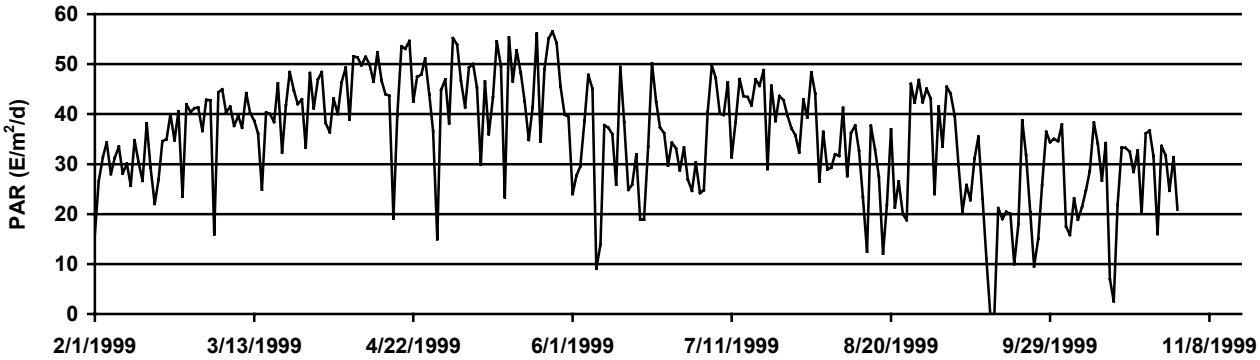


EXHIBIT 2-2
Photosynthetically Active Radiation Measured at the South ENR STRC

2.2 Air Temperature

On May 29, 1999, CH2M HILL initiated continuous monitoring of air temperature at the South ENR STRC. An air temperature probe is mounted above the constant-head water tank along with the solar radiation equipment. Air temperature averaged between 21.7 and 30.1 degrees Celsius (^{o}C) during the May through October study period. Exhibit 2-3 presents average air temperatures recorded at the South ENR STRC through the 5th quarter.

2.3 Rainfall

Daily rainfall data were provided by the District. Exhibit 2-4 illustrates daily total rainfall at the ENR Rainfall Station ENR301 for the February through October 1999 study period. Rainfall during the 3rd, 4th, and 5th quarters totaled 2.00 inches, 17.81 inches, and 29.91 inches, respectively. Rainfall in October was higher than in any other month since operational monitoring began in February. High rainfall during October and associated cloudy sky conditions explain the relatively low solar insolation and temperature averages observed for this month.

2.4 Evapotranspiration

Daily evapotranspiration (ET) data were provided by the District. Exhibit 2-5 illustrates daily total ET at the ENR Evapotranspiration Station ENRP for the February through September 1999 study period. Estimated ET during the 3rd and 4th quarters totaled 12.74 inches and 14.90 inches, respectively. Daily ET data for the last month of the 5th quarter (October 1999) are not yet available from the District. However, August and September 1999 ET totaled 8.88 inches.

SECTION 3

ENR PSTA Test Cells

3.1 PSTA Treatments at the ENR South Test Cells

Exhibit 3-1 provides a summary of the three experimental treatments being examined at the South ENR PSTA Test Cells.

EXHIBIT 3-1
Experimental Treatments in the ENR PSTA Test Cells

	Substrate	Periphyton	Macrophytes	Water Depth (cm)	HLR (cm/d)	# Replicates
Treatment						
1 (Cell 13)	Peat	Yes	Yes	60	6	1
2 (Cell 8)	Shellrock	Yes	Yes	60	6	1
3 (Cell 3)	Shellrock	Yes	Yes	0–60	6	1
					Total Cells =	**3**

3.2 Water Regime

The PSTA water regime includes the components of water depth fluctuations, HLR, and water mass balance. Continuous water level recorders were installed by the District at the upstream and downstream ends of each of the ENR Test Cells during the 4th quarter. Data summaries for those instruments were not available for this report. Exhibit 3-2 summarizes the PSTA Test Cell water depth and mass balance data for the 3rd, 4th, and 5th quarters. Water depth, inflow, outflow, and HLR trend charts by month are presented in Appendix A.

3.2.1 Water Depth

Water level measurements in the PSTA Test Cells were recorded at the District staff gauge near the outflow of each Test Cell. Water depth was directly measured along the internal boardwalks located at the one-third and two-third points in each cell. Staff gauge and water depth readings were generally collected at least twice each week.

Exhibit 3-2 summarizes the average water depths by month since test cell operation started in February 1999. Water depth in Test Cells 8 and 13 generally ranged from 0.61 to 0.68 m since March. Water depth in Test Cell 3 was intentionally varied to simulate a natural Everglades marsh water regime. Average monthly water depth in this cell has fluctuated from a low of 0.39 m in May to a maximum of 0.80 m in August 1999.

Exhibit 3-2
Water Balances for the South Test Cells

Treatment	Cell	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)
1	13	Feb-1999	0.51	4.67	122.90	3809.81	---	---	0.59	38.01	78.47	199.05	641.72	---	---
		Mar-1999	0.65	4.35	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	4.69	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	4.64	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	4.68	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	4.67	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	4.66	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	4.47	118.86	3684.53	102.66	3182.38	13.86	930.53	---	---	-40.28	---	---
2	8	Feb-1999	0.54	4.67	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	4.63	122.85	3808.50	161.46	5005.41	6.69	452.68	105.39	280.76	48.72	-1073.71	-25.20
		Oct-1999	0.66	4.46	118.78	3682.25	130.23	4037.19	13.86	933.72	---	---	-56.59	---	---
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	8.58	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	4.35	150.73	4672.52	113.95	3532.57	13.86	952.76	---	---	-123.74	---	---

3.2.2 Water Inflows and Outflows and Hydraulic Loading Rate

Water inflows to the PSTA Test Cells are estimated with an empirical equation (Equation 1) provided by the District that is based upon inlet orifice diameter and the water stage in the Head Cell feeding the three PSTA Test Cells:

$$Qin\ (cfs) = [stage\ (ft)*A] - B \qquad \text{Equation 1}$$

Where:

0.75-inch-diameter orifice: A = 0.004561, B = 0.07561
1.0-inch-diameter orifice: A = 0.008587, B = 0.14266

Outflows from the PSTA Test Cells were estimated by applying a standard flow equation for the 90-degree V-notch weirs at each outlet. The height at the water over the weir (H) is calculated by reading the staff gauge in the weir box and is used in Equation 2:

$$Q_{out}\ (cfs) = 2.50*H^{2.5} \qquad \text{Equation 2}$$

Where:

H = height of water over the V-notch (ft)

Exhibit 3-2 summarizes monthly average water inflows and outflows for the PSTA Test Cells for the period from February through October 1999. Inflows to Test Cells 8 and 13 remained relatively constant during this period, varying on a monthly average basis between 114 to 123 cubic meters per day (m^3/d). Estimated outflows were more variable than inflows. This is partially a result of rain events and infrequent outflow estimation (typically two times per week). Monthly average outflow in Test Cells 8 and 13 ranged from approximately 93 to 178 m^3/d.

Flows to Test Cell 3 were intentionally varied during this period to simulate fluctuating water regimes of the Everglades marsh communities. Monthly average inflows to Test Cell 3 varied between 68 and 220 m^3/d. Monthly average outflows varied between 102 to 277 m^3/d.

The HLR, q, is calculated using the following equation:

$$q\ (m/d) = Q/A \qquad \text{Equation 3}$$

Where:

Q = volumetric flow rate (m^3/d)

A = wetted area of the cell (m^2)

Inflow HLRs for the PSTA Test Cells are summarized by month in Exhibit 3-2. Monthly average HLRs for Test Cells 8 and 13 varied between approximately 4.3 and 4.7 cm/d, respectively. These HLRs are limited by the sizes of the inlet orifice plates for each Test Cell. The HLR for Test Cell 3 was intentionally varied during the course of this research with monthly averages ranging from approximately 3.0 to 8.6 cm/d.

3.2.3 Water Balance

The general balance between water storage, inflows, and outflows is shown in Equation 4:

$$\Delta V = V_{in} - V_{out} + P - ET - S \qquad \text{Equation 4}$$

Where:

ΔV = change in storage volume
V_{in} = inflow volume
V_{out} = outflow volume
P = precipitation
ET = evapotranspiration
S = seepage

Because the Test Cells are lined and seepage is assumed to be zero, the water balance equation can be re-arranged as shown in Equation 5:

$$V_{in} - V_{out} + P - ET - \Delta V = 0 \qquad \text{Equation 5}$$

If the net result of Equation 5 is non-zero, the residual term may be explained as the sum of the errors associated with measurements of the individual components of the water balance. As in all water balances, numerous sources of potential error exist that can affect the magnitude of the residual term. For this project, the estimates of inflow rate made using an empirical equation may be a source of error. Similarly, outflow measurement error may be tied to the use of the V-notch weir equation, but may more likely be attributable to the use of infrequent, discrete measurements that may not capture the full range of outflow variation. Potential errors associated with rainfall volumes may be attributed to spatial variation in rainfall patterns. The nearest District rain gauge is located at the ENR Outflow Pump Station, approximately 1.5 miles distant. ET data may also vary spatially. Finally, seepage losses, while unquantified, are assumed to be zero.

Exhibit 3-2 presents monthly average water balances for the period of record (February to October 1999). Inflow measurements were derived from District data as described above. Discrete outflow measurements were made approximately twice per week. Rainfall and ET data were provided by the District. The average daily ET rate was 3.5 millimeters per day (mm/d) for June, 4.4 mm/d for July, 3.9 mm/d for August, and 3.5 mm/d for September. ET data were not available for October. Change in storage was estimated as the product of the cell area and the change in water level between the beginning and end of each time increment.

Most of the water balance residuals shown in Exhibit 3-2 are less than 25 percent. This level of accuracy is consistent with normal expectations based on infrequent outlet stage measurements. A few higher monthly average residuals and the high percentage of negative residuals reflect the inaccuracies of outflow measurements and indicate that outflows are possibly being overestimated. Once District water level recorder data are available, it may be possible to provide more accurate estimates of outflows. Because of the uncertainty related to these outflow estimates, the mass balances presented in this section only rely on the inflow hydraulic loadings. For analysis, it is assumed that $q_{out} = q_{in}$.

3.3 Tracer Studies

3.3.1 Prior PSTA Mesocosm 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 Porta-PSTA 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 Porta-PSTA 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 mesocosm tanks. These tracer studies were conducted at the Porta-PSTA Mesocosm site during the period from April 19 through June 15, 1999.

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.

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 this larger-scale tracer test.

3.3.2 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 Cells 3 and 13 and 7.0 L for 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.

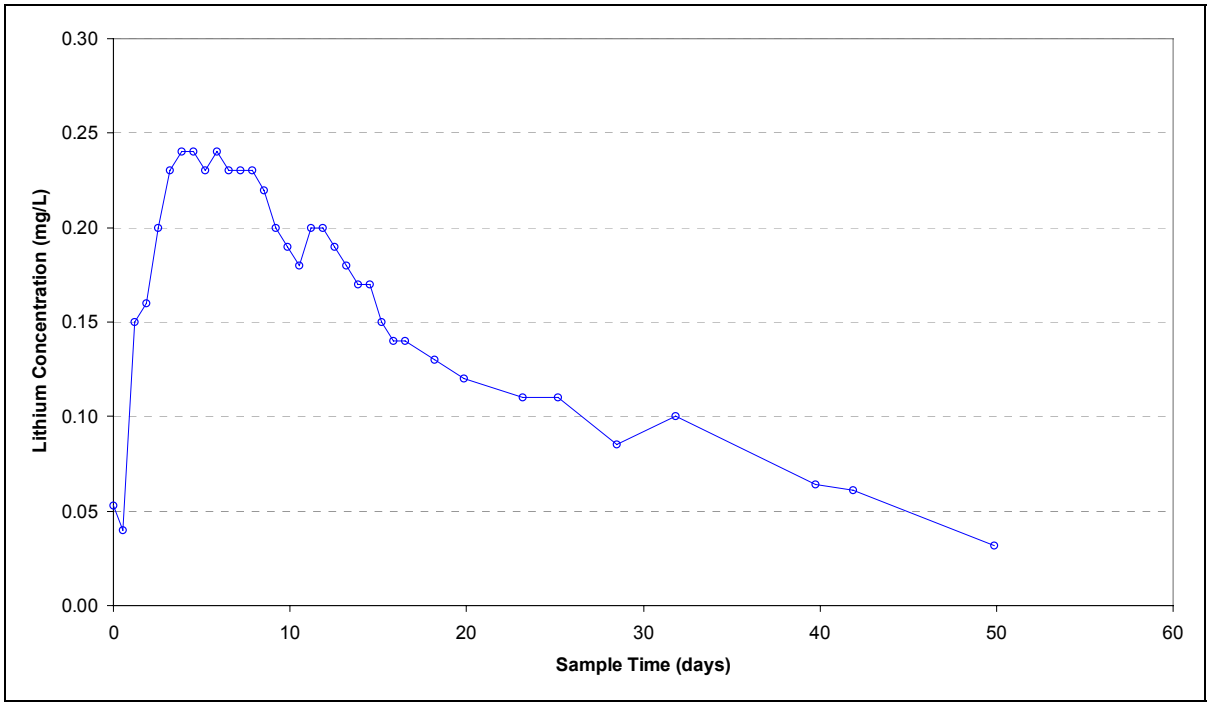
Outflows were calculated based on measurements of the V-notch weir elevations and the water level in the outflow structures just upstream from the weirs. Flows were measured in the same manner twice each week during the course of the experiments.

3.3.3 Test Cell Tracer Results

The PSTA Test Cell tracer study data were interpreted following the methods summarized by Kadlec and Knight (1996). Appendix B presents the data collected for each experiment. Flows corresponding with each sample were interpolated from the flow records described above.

Exhibits 3-3 through 3-5 show the tracer response curves (concentration versus time) for Test Cells 3, 8, and 13, respectively.

EXHIBIT 3-3
South ENR 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 3-6 summarizes the hydraulic characteristics of Test Cells 3, 8, and 13, as determined through this lithium tracer study.

EXHIBIT 3-4
South ENR Test Cell 8 Tracer Response Curve

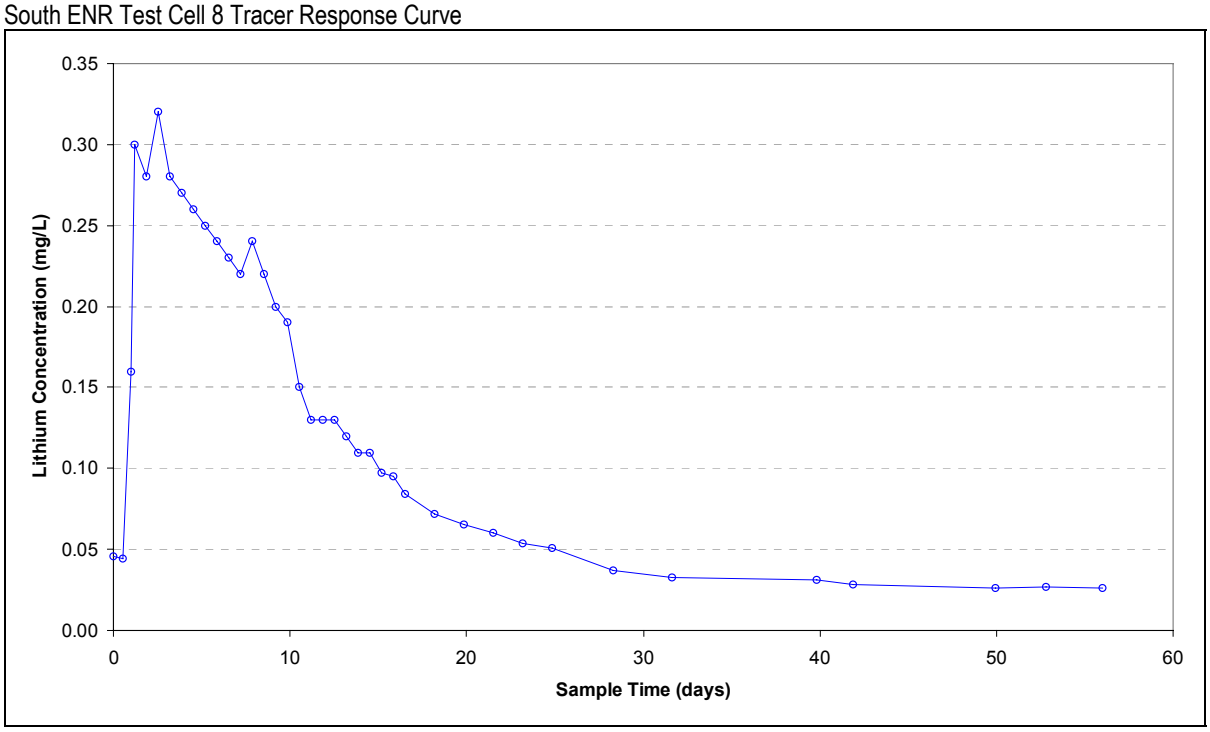


EXHIBIT 3-5
South ENR Test Cell 13 Tracer Response Curve

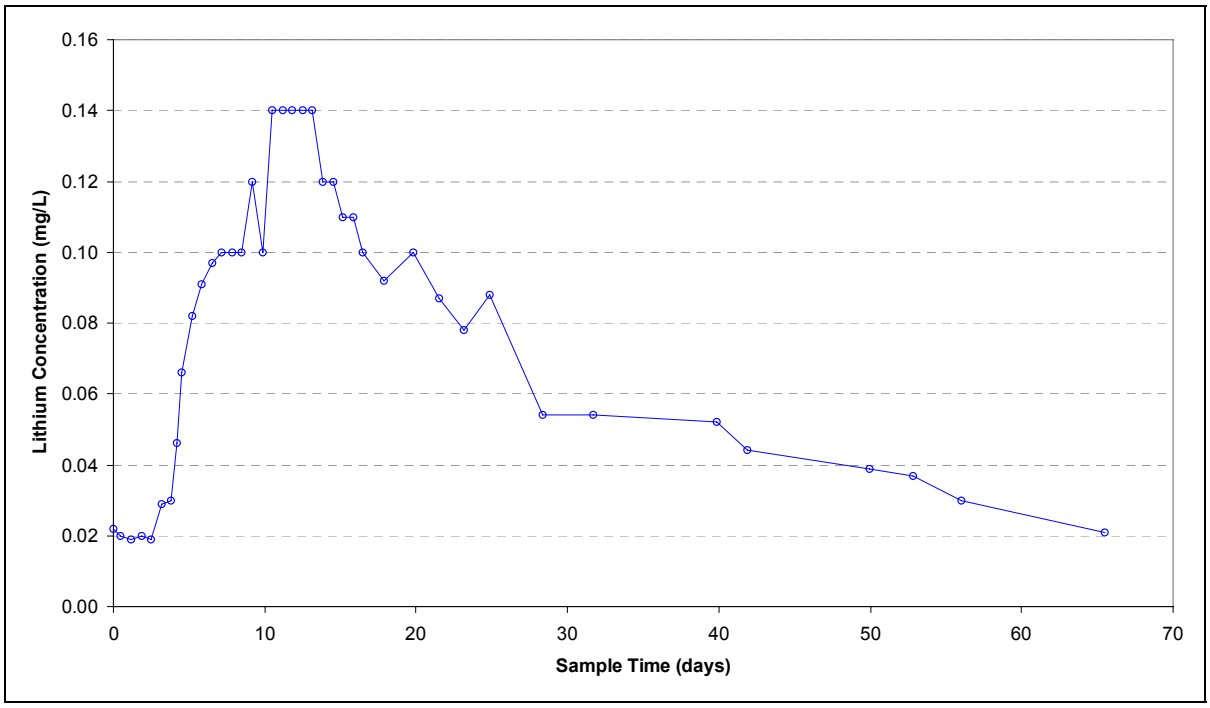


EXHIBIT 3-6
Summary of South ENR Test Cell Tracer Study Results

Parameter	Cell 13	Cell 8	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 3-7 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 3-7

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

3.4 Field Parameters

Field parameters (water temperature, pH, dissolved oxygen [DO], percent saturation, salinity, total dissolved solids [TDS], and specific conductance) were measured in the PSTA Test Cells weekly at the inflow and outflow, and monthly at two internal sampling points (one-third and two-third monitoring walkways). In addition, one recording data sonde unit, installed in the Head Cell on April 12, 1999, continuously documents inflow conditions, and two data sondes are deployed on a rotating basis at the monitoring walkways within the Test Cells.

Exhibit 3-8 summarizes the monthly averages for field parameter data during the first 9 months of operation. Appendix A provides monthly trend graphics for the key parameters measured at the Test Cells, as well as the Porta-PSTAs. A brief description of each of the field parameters is provided below.

3.4.1 Temperature

Average water temperatures in the Head Cell and the Test Cells followed a seasonal cycle with minimum average values recorded in February (between 17.8 and 19.2°C) and maximum average values recorded in the period from July through September (28.6 to 31.3°C).

3.4.2 pH

Consistent pH measurements were recorded during the study period for the Head Cell with monthly average values ranging from 7.2 to 7.9 Standard Units (SU). Monthly average pH measurements in Treatment 1 (Test Cell 13) were elevated compared to the Head Cell, ranging from 7.9 to 8.5 SU. Monthly average pH measurements in Treatment 2 (Test Cell 8) ranged from 8.2 to 8.6 SU. Monthly average pH measurements in Treatment 3 (Test Cell 3) were more variable than in other Test Cells, ranging from 7.6 to 9.0 SU.

3.4.3 Conductivity

Conductivity has been variable during the first 9 months of operation. Head Cell average monthly conductivity has ranged from a low of 800 micromhos per centimeter (µmhos/cm)

Exhibit No. 3-8
Monthly Averages of Field Measurements Collected from the ENR South Head Cell
and the ENR PSTA Test Cells, February to October 1999

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	26.44	27.38	26.34
	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	26.73	26.49	30.74	28.32
	Oct-99	24.98	24.86	27.60	24.26
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	7.21	7.84	8.38	7.88
	Oct-99	7.30	7.64	8.15	8.13
Conductivity (umhos/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	840
	Sep-99	1362	1064	980	1212
	Oct-99	1186	964	1170	952
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
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	0.872	0.681	0.627	0.775
	Oct-99	0.759	0.614	0.749	0.606
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	6.3	33.7	103.2	90.3
	Oct-99	15.8	32.6	110.2	101.4
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	5.69	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	0.51	2.69	7.64	6.98
	Oct-99	1.30	2.70	8.64	8.47

in June 1999 to higher values in March (1,245 µmhos/cm) and September (1,362 µmhos/cm). Conductivity in the PSTA Test Cells has been similar to the Head Cell averages.

3.4.4 Salinity

Salinity readings tracked the same seasonal trend observed with the conductivity measurements. Average monthly values ranged from 0.33 to 0.73 parts per thousand (ppt). Salinity was not recorded in the Head Cell during the study period.

3.4.5 Total Dissolved Solids

Monthly average TDS concentrations have varied between 0.512 and 0.872 grams per liter (g/L) in the Head Cell and from 0.406 to 0.881 in the three PSTA Test Cells. TDS readings tracked the same seasonal trend observed with the conductivity measurements.

3.4.6 Dissolved Oxygen

DO concentrations in the Head Cell have varied in response to temperature and biological activity in the ENR. Monthly average DO concentration and percent saturation peaked in March at 6.4 mg/L (72 percent saturation) and declined to 0.51 mg/L (6 percent saturation) in September. Average monthly DO concentrations were higher in the Test Cells than in the Head Cell. Treatment 1 (Test Cell 13) had monthly average DO concentration between 2.7 and 11.4 mg/L. Treatment 2 (Test Cell 8) had monthly average DO concentration between 7.6 and 9.1 mg/L. Treatment 3 (Test Cell 3) had monthly average DO concentration between 6.8 and 8.5 mg/L.

3.5 Water Quality Data

Water quality samples were collected at the Head Cell and at selected locations within each Test Cell at varying frequencies in accordance with the PSTA Research Plan. Phosphorus samples were collected at the highest frequency and were analyzed for a number of phosphorus forms. Head Cell samples (representing Test Cell inflows) and Test Cell outflow samples were collected weekly for analysis of total phosphorus (TP), total dissolved phosphorus (TDP), and dissolved reactive phosphorus (DRP). Individual cell inflows were monitored monthly, and internal stations were sampled quarterly for these parameters. From the collected phosphorus data, total particulate phosphorus (TPP) is estimated by the difference: TP - TDP, and dissolved organic phosphorus (DOP) is estimated by the difference: TDP - DRP.

Monthly and quarterly water quality samples were analyzed for total nitrogen (TN), major nitrogen (N) forms (total Kjeldahl N [TKN], total ammonia N [NH_3-N], and nitrate + nitrite N [NOx-N]), calcium, total suspended solids (TSS), alkalinity, and total organic carbon (TOC). Parameters were sampled monthly at the Head Cell and at the outflows of the three PSTA Test Cells; Test Cell inflow points and the internal stations were sampled quarterly for these parameters. From the collected nitrogen data, organic nitrogen is estimated by the difference: TKN - NH_3-N.

Monthly average values for water quality data collected from February 1999 to October 1999 at the Head Cell and the three Test Cells are presented in Exhibit 3-9, and are summarized

Exhibit 3-9

Monthly Average Values of Water Quality Data Collected at the
ENR South Head Cell and ENR Test Cells, February to October 1999

Parameter	Month	Treatment					
		1 (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
		Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
Total Phosphorus as P (mg/L)	Feb-99	0.019	0.086	0.021	0.025	0.019	0.035
	Mar-99	0.020	0.041	0.021	0.028	0.020	0.038
	Apr-99	0.025	0.035	0.025	0.031	0.026	0.037
	May-99	0.023	0.022	0.023	0.021	0.023	0.026
	Jun-99	0.019	0.018	0.020	0.020	0.022	0.025
	Jul-99	0.031	0.013	0.031	0.014	0.031	0.017
	Aug-99	0.035	0.036	0.033	0.017	0.032	0.021
	Sep-99	0.023	0.021	0.022	0.015	0.022	0.024
	Oct-99	0.017	0.019	0.019	0.016	0.019	0.019
Total Particulate Phosphorus (mg/L)	Feb-99	0.010	0.070	0.014	0.000	0.011	0.024
	Mar-99	0.010	0.029	0.011	0.016	0.010	0.027
	Apr-99	0.015	0.018	0.015	0.016	0.012	0.020
	May-99	0.006	0.004	0.001	0.004	0.006	0.009
	Jun-99	0.006	0.007	0.008	0.010	0.014	0.014
	Jul-99	0.017	0.005	0.018	0.001	0.018	0.009
	Aug-99	0.005	0.025	0.004	0.007	0.002	0.011
	Sep-99	0.010	0.011	0.008	0.006	0.008	0.014
	Oct-99	0.007	0.010	0.008	0.008	0.008	0.010
Total Dissolved Phosphorus (mg/L)	Feb-99	0.009	0.016	0.008	0.025	0.008	0.011
	Mar-99	0.010	0.011	0.010	0.013	0.010	0.011
	Apr-99	0.014	0.016	0.014	0.016	0.016	0.017
	May-99	0.017	0.017	0.022	0.017	0.016	0.017
	Jun-99	0.014	0.011	0.014	0.010	0.013	0.010
	Jul-99	0.014	0.008	0.013	0.013	0.012	0.008
	Aug-99	0.029	0.011	0.029	0.011	0.029	0.011
	Sep-99	0.013	0.011	0.014	0.009	0.014	0.010
	Oct-99	0.010	0.009	0.011	0.008	0.011	0.009
Soluable 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	0.011	0.007	0.011	0.006	0.010	0.008
	Jun-99	0.007	0.002	0.006	0.002	0.006	0.002
	Jul-99	0.005	0.002	0.003	0.003	0.003	0.002
	Aug-99	0.003	0.002	0.003	0.001	0.003	0.002
	Sep-99	0.004	0.002	0.002	0.002	0.003	0.002
	Oct-99	0.005	0.002	0.005	0.002	0.003	0.003
Dissolved Organic Phosphorus (mg/L)	Feb-99	0.000	0.011	0.002	0.022	0.003	0.009
	Mar-99	0.005	0.006	0.006	0.007	0.004	0.008
	Apr-99	0.009	0.012	0.010	0.013	0.010	0.014
	May-99	0.004	0.011	0.008	0.011	0.005	0.009
	Jun-99	0.009	0.009	0.009	0.007	0.009	0.008
	Jul-99	0.009	0.006	0.010	0.010	0.009	0.006
	Aug-99	0.027	0.009	0.027	0.010	0.027	0.009
	Sep-99	0.009	0.010	0.012	0.007	0.011	0.009
	Oct-99	0.005	0.006	0.006	0.005	0.008	0.006
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	0.95	1.76	0.86	1.80	1.09
	May-99	1.47	1.16	1.39	1.38	2.58	1.28
	Jun-99	1.25	0.84	1.25	1.00	1.25	0.93
	Jul-99	1.51	0.44	1.53	0.65	1.57	0.57
	Aug-99	2.24	1.60	2.32	1.70	2.24	1.60
	Sep-99	1.40	1.20	0.62	1.50	0.91	0.46
	Oct-99	0.98	0.86	0.98	1.20	0.98	0.93

Exhibit 3-9

Monthly Average Values of Water Quality Data Collected at the
ENR South Head Cell and ENR Test Cells, February to October 1999

Parameter	Month	Treatment					
		1 (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
		Inflow	Outflow	Inflow	Outflow	Inflow	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	0.95	1.68	1.06	1.73	1.43
	May-99	1.42	1.16	1.37	1.38	2.56	1.28
	Jun-99	1.24	0.84	1.24	1.00	1.24	0.93
	Jul-99	1.46	0.44	1.48	0.65	1.55	0.57
	Aug-99	2.23	1.60	2.31	1.70	2.23	1.60
	Sep-99	1.40	1.20	0.62	1.50	0.60	0.46
	Oct-99	0.90	0.86	0.90	1.20	0.90	0.93
Nitrate/Nitrite, as N (mg/L)	Feb-99	0.17	0.08	0.15	0.03	0.12	0.03
	Mar-99	0.17	0.03	0.18	0.01	0.15	0.02
	Apr-99	0.08	0.03	0.09	0.02	0.08	0.02
	May-99	0.05	0.03	0.03	0.03	0.03	0.03
	Jun-99	0.02	0.03	0.02	0.03	0.02	0.03
	Jul-99	0.05	0.03	0.05	0.03	0.04	0.03
	Aug-99	0.01	0.03	0.01	0.03	0.01	0.03
	Sep-99	0.03	0.03	0.03	0.03	0.31	0.03
	Oct-99	0.08	0.03	0.08	0.03	0.08	0.03
Ammonia, as NH_3 (mg/L)	Feb-99	0.15	0.02	0.15	0.02	0.15	0.02
	Mar-99	0.02	0.02	0.02	0.02	0.02	0.02
	Apr-99	0.02	0.02	0.02	0.02	0.02	0.02
	May-99	0.06	0.05	0.07	0.05	0.05	0.05
	Jun-99	0.02	0.02	0.02	0.02	0.02	0.02
	Jul-99	0.06	0.02	0.05	0.02	0.02	0.02
	Aug-99	0.21	0.02	0.22	0.02	0.18	0.02
	Sep-99	0.02	0.02	0.02	0.02	0.02	0.02
	Oct-99	0.07	0.02	0.07	0.07	0.07	0.02
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	0.93	1.07	1.04	1.29	1.41
	May-99	1.11	1.11	1.18	1.33	3.50	1.23
	Jun-99	0.94	0.82	0.94	0.98	0.94	0.91
	Jul-99	0.55	0.42	0.59	0.63	0.76	0.55
	Aug-99	1.79	1.58	2.18	1.68	1.82	1.58
	Sep-99	1.38	1.18	0.60	1.48	0.58	0.44
	Oct-99	0.83	0.84	0.83	1.13	0.83	0.91
TOC (mg/L)	Feb-99	31.00	32.70	31.00	32.50	31.00	33.00
	Mar-99	37.43	35.60	37.89	35.27	37.48	35.38
	Apr-99	39.45	38.50	38.95	37.74	38.80	37.64
	May-99	27.90	29.40	27.80	32.10	27.70	30.70
	Jun-99	25.95	20.70	25.95	23.20	25.95	21.50
	Jul-99	29.80	26.40	30.30	29.00	29.70	26.90
	Aug-99	34.49	28.00	33.71	29.20	33.59	29.20
	Sep-99	40.00	69.00	40.60	39.50	39.00	39.50
	Oct-99	34.00	30.00	34.00	30.00	34.00	32.00

Exhibit 3-9

Monthly Average Values of Water Quality Data Collected at the
ENR South Head Cell and ENR Test Cells, February to October 1999

Parameter	Month	Treatment					
		1 (Peat)		2 (Shellrock)		3 (Shellrock-Variable Stage)	
		Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
TSS (mg/L)	Feb-99	4.00	2.00	4.70	2.00	4.50	2.00
	Mar-99	1.67	6.00	1.67	4.75	1.67	2.25
	Apr-99	4.75	9.00	4.75	3.38	4.75	7.13
	May-99	2.75	4.00	1.75	4.00	2.75	10.00
	Jun-99	2.75	2.00	2.75	2.00	2.75	26.00
	Jul-99	3.33	2.00	6.33	2.00	3.33	2.00
	Aug-99	3.33	1.00	3.33	3.80	3.33	2.80
	Sep-99	1.75	3.75	1.25	1.75	0.63	7.75
	Oct-99	2.00	1.20	2.00	2.40	2.00	2.80
Calcium (mg/L)	Feb-99	76.00	70.90	76.00	72.00	77.00	77.70
	Mar-99	70.67	49.20	70.77	66.05	71.30	71.20
	Apr-99	56.85	45.50	56.93	56.03	57.73	63.20
	May-99	45.96	15.70	46.30	32.20	46.13	34.10
	Jun-99	51.85	22.00	51.85	30.00	51.85	30.00
	Jul-99	57.07	23.00	57.17	40.60	57.07	37.90
	Aug-99	61.99	29.00	61.19	40.00	61.59	38.00
	Sep-99	94.00	62.00	88.00	62.00	95.00	73.00
	Oct-99	69.00	54.00	69.00	53.00	69.00	60.00
Alkalinity (mg/L)	Feb-99	290.00	278.00	290.00	276.00	290.00	276.00
	Mar-99	304.40	258.00	303.67	278.35	304.30	283.15
	Apr-99	230.73	240.50	230.95	262.68	231.80	271.58
	May-99	178.27	105.00	179.50	161.00	182.07	163.00
	Jun-99	177.30	104.00	177.30	125.00	177.30	114.00
	Jul-99	230.17	126.00	233.67	183.00	200.67	230.00
	Aug-99	259.00	160.00	258.20	192.00	259.00	187.00
	Sep-99	300.00	238.00	310.00	248.00	305.00	288.00
	Oct-99	137.00	187.00	137.00	187.00	137.00	195.00

below. Appendix A provides monthly trend graphics for the key parameters measured at the Test Cells, as well as the Porta-PSTAs.

3.5.1 Phosphorus

Detailed monthly and weekly TP trend charts are provided in Appendices A and C, respectively. The time series plots shown in Exhibits C-1, C-2, and C-3 indicated that TP levels initially increased as water passed through each Test Cell because of increased levels of TPP during the startup period of February from April 1999. This finding is believed to be related to re-suspension of loosely consolidated sediments and export because of wind mixing after startup and prior to significant periphyton and macrophyte establishment.

Specific phosphorus parameters for the study period from May through October 1999 are presented below.

- TP - 13 out of 18 monthly average outflow concentrations were less than the corresponding inflow average. Monthly average inflow concentrations ranged from 0.017 mg/L to 0.035 mg/L for the three treatments. Average monthly outflow concentrations ranged from 0.013 to 0.036 mg/L in Treatment 1 (Test Cell 13), 0.014 to 0.021 mg/L in Treatment 2 (Test Cell 8), and 0.017 to 0.026 mg/L in Treatment 3 (Test Cell 3).
- TPP - Monthly average inflow concentrations ranged from 0.001 mg/L to 0.018 mg/L for the three treatments. Average monthly outflow concentrations ranged from 0.005 to 0.025 mg/L in Treatment 1 (Test Cell 13), 0.001 to 0.010 mg/L in Treatment 2 (Test Cell 8), and 0.009 to 0.014 mg/L in Treatment 3 (Test Cell 3).
- TDP - Monthly average inflow concentrations ranged from 0.010 mg/L to 0.029 mg/L for the three treatments. Average monthly outflow concentrations ranged from 0.008 to 0.017 mg/L in all three treatments.
- DRP - Monthly average inflow concentrations ranged from 0.002 mg/L to 0.011 mg/L for the three treatments. Average monthly outflow concentrations ranged from 0.002 to 0.007 mg/L in Treatment 1 (Test Cell 13), 0.001 to 0.006 mg/L in Treatment 2 (Test Cell 8), and 0.002 to 0.008 mg/L in Treatment 3 (Test Cell 3).
- DOP - Monthly average inflow concentrations ranged from 0.004 mg/L to 0.027 mg/L for the three treatments. Average monthly outflow concentrations ranged from 0.006 to 0.011 mg/L in Treatment 1 (Test Cell 13), 0.005 to 0.011 mg/L in Treatment 2 (Test Cell 8), and 0.006 to 0.009 mg/L in Treatment 3 (Test Cell 3).

3.5.2 Nitrogen

Detailed monthly and weekly TN trend charts are provided in Appendices A and C, respectively. The time series plots shown in Exhibits C-16, C-17, and C-18 indicated that nitrogen levels decreased in all three treatments as water passed through each cell.

Specific nitrogen parameters for the study period from May through October 1999 are presented below.

- TN - Average monthly inflow concentrations were variable during the study period, with values ranging from 0.62 to 2.58 mg/L. Average monthly outflow concentrations

ranged from 0.63 to 1.74 mg/L in Treatment 1 (Test Cell 13), 0.65 to 1.70 mg/L in Treatment 2 (Test Cell 8), and 0.57 to 1.60 in Treatment 3 (Test Cell 3).

- TKN - Average monthly inflow concentrations ranged from 0.60 to 2.56 mg/L. Average monthly outflow concentrations ranged from 0.44 to 1.66 mg/L in Treatment 1 (Test Cell 13), 0.65 to 1.70 mg/L in Treatment 2 (Test Cell 8), and 0.46 to 1.60 in Treatment 3 (Test Cell 3).
- NO_2+NO_3-N - Average monthly inflow concentrations ranged from 0.01 to 0.31 mg/L. Average monthly outflow was typically below the detection limit of 0.01 to 0.03 mg/L in all treatments.
- NH_4-N - Average monthly inflow concentrations ranged from 0.02 to 0.22 mg/L. Average monthly outflow was typically below the detection limit of 0.02 mg/L in all treatments.
- Org-N - Average monthly inflow concentrations ranged from 0.55 to 2.18 mg/L. Average monthly outflow concentrations ranged from 0.42 to 1.58 mg/L in Treatment 1 (Test Cell 13), 0.63 to 1.68 mg/L in Treatment 2 (Test Cell 8), and 0.55 to 1.58 in Treatment 3 (Test Cell 3).

3.5.3 Other Parameters

Other parameters of interest for the study period from February through October 1999 are presented below.

- Total Organic Carbon **-** Monthly average inflow concentrations ranged from 26 to 40 mg/L at all three treatments. Monthly average outflow concentrations ranged from 21 to 69 mg/L in Treatment 1 (Test Cell 13), 23 to 39 mg/L in Treatment 2 (Test Cell 8), and 21 to 40 mg/L in Treatment 3 (Test Cell 3).
- Total Suspended Solids - Monthly average inflow concentrations ranged from 0.6 to 6.3 mg/L at all three treatments. Monthly average outflow concentrations ranged from 1.0 to 9.0 mg/L in Treatment 1 (Test Cell 13), 1.8 to 4.8 mg/L in Treatment 2 (Test Cell 8), and 2.0 to 26 mg/L in Treatment 3 (Test Cell 3). TSS detection was reduced to 2.0 mg/L in August 1999 and to 1.0 mg/L in September 1999.
- Calcium - Monthly average inflow concentrations ranged from 46 to 95 mg/L at all three treatments. Monthly average outflow concentrations ranged from 16 to 71 mg/L in Treatment 1 (Test Cell 13), 30 to 72 mg/L in Treatment 2 (Test Cell 8), and 30 to 78 mg/L in Treatment 3 (Test Cell 3).
- Alkalinity **-** Monthly average inflow concentrations ranged from 137 to 310 mg/L as $CaCO_3$ at all three treatments. Monthly average outflow concentrations ranged from 104 to 278 mg/L as $CaCO_3$ in Treatment 1 (Test Cell 13), 125 to 278 mg/L as $CaCO_3$ in Treatment 2 (Test Cell 8), and 114 to 288 mg/L as $CaCO_3$ in Treatment 3 (Test Cell 3).

3.6 Mass Balances

As a preliminary assessment of PSTA performance, inflow and outflow mass balances were estimated for each of the ENR Test Cells using the inflow and outflow concentration and HLR data presented in Section 3.2. Mean treatment inflow and outflow loads were used to

calculate mean treatment removal rates for TP and TN. First-order TP rate constants were calculated from the monthly data assuming C* equals 0 mg/L. Contributions of rainfall to phosphorus and nitrogen loads to the Test Cells were not included in these mass loading estimates. Preliminary estimates indicate that rainfall load may make up between 1 to 10 percent of the total load of these elements. Final mass balance analyses for this project will include estimates of rainfall loads of TP and TN derived from available data.

3.6.1 Phosphorus

Exhibit 3-10 provides monthly, quarterly, and period-of-record treatment means for inflow and outflow TP.

The revised Research Plan identified an average experimental HLR of 6 cm/d to all Test Cells, with Cell 3 (Treatment 3) receiving a variable load over a variable depth during operations while depths in Cells 8 and 13 (Treatments 2 and 1, respectively) are held constant (CH2M HILL, 1999). Assuming an average influent concentration of 0.040 mg/L, the calculated TP mass loads were expected to average 0.88 grams per square meter per year ($g/m^2/y$) for all treatments but Treatment 3 would be expected to see greater monthly variation in loads.

As shown in Exhibit 3-10, the HLRs were only 73 to 77 percent of the target loading rates, and inflow concentrations were only approximately 62 percent of the planned value. Because of the lower than expected HLRs and TP concentrations in the Test Cells, monthly TP mass loadings have averaged significantly lower than originally anticipated, averaging from approximately 0.40 to 0.44 $g/m^2/y$ in the three treatments during the 9-month study period, with monthly averages ranging from 0.23 to 0.60 $g/m^2/y$.

Period-of-record TP mass removals were -11, 7.5, and -43 percent in Treatments 1, 2, and 3, respectively. Average long-term outflow TP concentrations for the Test Cells ranged from 0.021 to 0.028 mg/L. These long-term estimates are low because of initial releases of particulate TP from the Test Cells following system startup. TP removal efficiencies were much higher during the last two quarters of operation. During the project 5th quarter (August – October 1999) the average removal efficiencies were 38, 45, and 26 percent in Treatments 1, 2, and 3, respectively.

Average TP rate constants were calculated from monthly mean concentration data and inflow HLRs using the k-C* model. For this analysis, C* was assumed to be equal to 0.0 mg/L. This assumption returns the lowest value of the first-order removal constant, k.

The k-C* model equation, arranged to solve for the removal rate (k) is:

$$k = -q_{avg} \ln\left(\frac{C_{out} - C^*}{C_{in} - C^*}\right)$$

Exhibit 3-10

Period-of-Record, Quarterly, and Monthly Summaries Total Phosphorus Mass Balance Data from the ENR Test Cells

			TP (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	**Cell**	**Date**	**Inflow**	**Outflow**	**(m^3/d)**	**(m^3/d)**	**(m^3/d)**	**(cm/d)**	**Inflow**	**Outflow**	**($g/m^2/y$)**	**(%)**	**(m/y)**
Period of Record													
1	13	1999	0.025	0.028	121.23	130.30	125.76	4.60	0.436	0.487	-0.051	-11.63	-1.69
2	8	1999	0.025	0.021	121.09	136.97	129.03	4.61	0.434	0.401	0.032	7.47	3.53
3	3	1999	0.025	0.027	117.01	151.60	134.31	4.36	0.401	0.573	-0.172	-42.93	-1.06
Quarterly													
1	13	Qtr-3	0.022	0.044	118.75	135.75	127.25	4.52	0.364	0.803	-0.439	-120.67	-12.33
1	13	Qtr-4	0.024	0.018	122.91	152.90	137.91	4.67	0.415	0.378	0.037	8.89	6.13
1	13	Qtr-5	0.030	0.027	121.52	95.47	108.49	4.60	0.554	0.344	0.210	37.88	1.62
2	8	Qtr-3	0.022	0.030	118.58	144.21	131.39	4.52	0.372	0.595	-0.223	-59.83	-5.32
2	8	Qtr-4	0.025	0.018	122.75	137.56	130.16	4.68	0.419	0.352	0.067	15.97	5.18
2	8	Qtr-5	0.030	0.016	121.45	128.97	125.21	4.59	0.530	0.290	0.239	45.18	10.28
3	3	Qtr-3	0.022	0.039	99.00	187.61	143.30	3.77	0.304	1.051	-0.747	-245.55	-11.55
3	3	Qtr-4	0.025	0.023	107.69	119.96	113.82	4.01	0.363	0.360	0.004	0.99	1.56
3	3	Qtr-5	0.029	0.021	147.14	156.73	151.94	5.41	0.567	0.419	0.148	26.05	6.42
Monthly													
1	13	Feb-99	0.019	0.086	122.53	143.64	133.08	4.67	0.316	1.720	-1.404	-444.94	-28.47
1	13	Mar-99	0.020	0.041	114.73	128.80	121.77	4.35	0.331	0.720	-0.389	-117.64	-11.93
1	13	Apr-99	0.025	0.035	122.84	139.59	131.21	4.69	0.428	0.632	-0.204	-47.55	-5.70
1	13	May-99	0.023	0.022	122.80	155.72	139.26	4.64	0.388	0.473	-0.084	-21.73	1.09
1	13	Jun-99	0.019	0.018	122.96	149.64	136.30	4.68	0.332	0.384	-0.052	-15.65	1.13
1	13	Jul-99	0.031	0.013	122.96	154.17	138.57	4.67	0.526	0.277	0.249	47.28	16.57
1	13	Aug-99	0.035	0.036	123.03	98.25	110.64	4.65	0.587	0.415	0.172	29.37	-0.80
1	13	Sep-99	0.023	0.021	122.97	66.07	94.52	4.66	0.390	0.189	0.201	51.55	1.19
1	13	Oct-99	0.017	0.019	118.03	110.43	114.23	4.47	---	0.331	---	---	-1.76
2	8	Feb-99	0.021	0.025	122.37	142.03	132.20	4.67	0.361	0.494	-0.133	-36.87	-3.03
2	8	Mar-99	0.021	0.028	114.55	148.65	131.60	4.37	0.345	0.585	-0.240	-69.63	-5.70
2	8	Apr-99	0.025	0.031	122.68	139.77	131.22	4.68	0.429	0.610	-0.182	-42.38	-4.00
2	8	May-99	0.023	0.021	122.64	110.77	116.70	4.71	0.393	0.317	0.076	19.40	1.73
2	8	Jun-99	0.020	0.020	122.80	155.57	139.19	4.67	0.339	0.447	-0.108	-31.82	-0.59
2	8	Jul-99	0.031	0.014	122.80	141.84	132.32	4.67	0.526	0.270	0.256	48.68	14.89
2	8	Aug-99	0.033	0.017	122.87	122.40	122.64	4.64	0.562	0.291	0.271	48.19	10.89
2	8	Sep-99	0.022	0.015	122.82	142.57	132.69	4.63	0.371	0.294	0.078	20.86	6.99
2	8	Oct-99	0.019	0.016	118.15	130.84	124.50	4.46	---	0.287	---	---	3.50
3	3	Feb-99	0.019	0.035	122.37	162.01	142.19	4.66	0.323	0.788	-0.465	-143.88	-12.07
3	3	Mar-99	0.020	0.038	114.55	147.25	130.90	4.29	0.320	0.769	-0.450	-140.68	-12.07
3	3	Apr-99	0.026	0.037	83.52	221.48	152.50	3.24	0.313	1.320	-1.006	-320.98	-8.06
3	3	May-99	0.023	0.026	73.69	60.89	67.29	2.97	0.226	0.232	-0.006	-2.56	-1.43
3	3	Jun-99	0.022	0.025	122.80	148.84	135.82	4.48	0.361	0.490	-0.128	-35.55	-1.90
3	3	Jul-99	0.031	0.017	122.80	142.92	132.86	4.47	0.503	0.325	0.178	35.29	10.33
3	3	Aug-99	0.032	0.021	130.82	169.70	150.26	4.78	0.560	0.445	0.115	20.59	8.09
3	3	Sep-99	0.022	0.024	232.15	164.12	198.13	8.58	0.601	0.431	0.170	28.26	-1.76
3	3	Oct-99	0.019	0.019	117.67	130.18	123.93	4.35	---	0.369	---	---	0.00

where:

k = area-based rate constant (m/y)
q_{avg} = average HLR (m/y)
C_{out} = outflow concentration (mg/L)
C_{in} = inflow concentration (mg/L)

Average monthly k values have typically increased for all treatments since startup. Initial values were negative while k values for June and July were all positive. Values for August through October were lower than the estimates for June and July. The highest quarterly k value average was for Treatment 2 (Test Cell 8) with a value of 10.3 m/y. Rising quarterly k values may indicate that initial sediment TP releases have diminished and that the experimental systems will attain greater P removal rates as they continue to mature.

Detailed figures illustrating the above k value trends are provided in Appendix D.

3.6.2 Nitrogen

Exhibit 3-11 presents a summary of TN mass balances in the PSTA Test Cells by month, quarter, and period-of-record for the 9-month operational period. For the period-of-record, average inflow TN mass loadings for Treatments 1, 2, and 3 were estimated to be 32.0, 31, and 30 $g/m^2/y$, respectively. Outflow mass loadings were reduced by an average of 40, 38, and 47 percent during this period. Average first-order removal rate constants for TN were 8.9, 7.7, and 9.3 m/y in Treatments 1, 2, and 3, respectively, and did not appear to vary in a consistent pattern during the period of data collection. A majority of the reduction in TN concentrations resulted from removal of inorganic nitrogen forms with very little change in concentrations of organic nitrogen in the PSTA Test Cells.

3.7 Sediments

Pre-existing and newly deposited soils within the PSTA Test Cells (South ENR Test Cell Site) were sampled to a depth of approximately 10 cm at randomly selected locations along each of the internal monitoring boardwalks. Exhibit 3-12 summarizes monthly and quarterly average sediment data from the PSTA Test Cells during the 3rd, 4th, and 5th project quarters. Key parameter analyses are highlighted as follows.

3.7.1 Bulk Density

Sediment samples were collected monthly from internal stations and analyzed for wet density and percent solids. Bulk density is estimated in these samples by multiplying the sample's wet density by the percent solids.

The peat soils in Treatment 1 (Test Cell 13) are highly organic and exhibit relatively low bulk densities, averaging 0.48 grams per cubic centimeter (g/cm^3), as compared to the shellrock soils of Treatments 2 and 3 (Test Cell 8 and 3), which averaged 1.43 and 1.38 g/cm^3, respectively, during the first 8 months of research. Bulk densities generally increased in Treatment 1 (Test Cell 13) from an average of 0.32 g/cm^3 in February to 0.61 g/cm^3 in August and then declined to approximately 0.45 g/cm^3 in October. Average monthly bulk density estimates tended to be less variable in Test Cells 3 and 8.

Exhibit 3-11

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the ENR Test Cells

			TN (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TN ($g/m^2/y$)		Removal		Calc_k
Treatment	**Cell**	**Date**	**Inflow**	**Outflow**	**(m^3/d)**	**(m^3/d)**	**(m^3/d)**	**(cm/d)**	**Inflow**	**Outflow**	**($g/m^2/y$)**	**(%)**	**(m/y)**
Period of Record													
1	13	1999	1.83	1.08	122.22	130.53	126.38	4.63	31.63	18.84	12.78	40.42	8.88
2	8	1999	1.78	1.12	122.06	134.24	128.15	4.63	30.66	18.98	11.69	38.11	7.72
3	3	1999	1.90	1.04	115.15	157.26	136.21	4.29	29.52	15.75	13.77	46.64	9.38
Quarterly													
1	13	Qtr-3	2.08	1.21	120.95	136.84	128.89	4.59	34.74	20.63	14.11	40.63	9.03
1	13	Qtr-4	1.41	0.81	122.91	162.50	142.71	4.66	24.01	13.75	10.26	42.74	9.39
1	13	Qtr-5	1.94	1.22	123.02	91.21	107.11	4.65	35.61	23.82	11.79	33.12	7.85
2	8	Qtr-3	2.00	0.90	120.79	144.68	132.74	4.59	33.42	15.31	18.11	54.18	13.40
2	8	Qtr-4	1.39	1.01	122.75	133.21	127.98	4.67	23.66	17.27	6.39	27.00	5.44
2	8	Qtr-5	1.88	1.47	122.86	123.10	122.98	4.64	34.45	27.03	7.42	21.53	4.23
3	3	Qtr-3	2.01	1.21	100.65	200.90	150.77	3.82	28.27	16.71	11.56	40.90	7.15
3	3	Qtr-4	1.80	0.93	104.48	119.43	111.96	3.89	23.94	12.41	11.53	48.16	9.45
3	3	Qtr-5	1.87	1.00	142.74	144.18	143.46	5.23	36.56	19.33	17.22	47.12	11.99
Monthly													
1	13	Feb-99	2.27	1.74	122.53	143.64	133.08	4.67	38.73	29.69	9.04	23.35	4.54
1	13	Mar-99	2.16	0.63	118.53	129.11	123.82	4.49	35.28	10.63	24.65	69.88	20.22
1	13	Apr-99	1.90	0.95	122.85	138.74	130.80	4.65	32.29	16.10	16.20	50.16	11.80
1	13	May-99	1.47	1.16	122.77	200.51	161.64	4.64	24.92	19.46	5.46	21.93	4.00
1	13	Jun-99	1.25	0.84	123.04	126.16	124.60	4.69	21.38	14.39	7.00	32.72	6.80
1	13	Jul-99	1.51	0.44	122.91	160.84	141.87	4.66	25.73	7.40	18.33	71.24	21.14
1	13	Aug-99	2.24	1.60	123.03	98.25	110.64	4.65	37.98	27.27	10.71	28.20	5.68
1	13	Sep-99	1.40	1.20	122.98	56.01	89.49	4.65	23.76	20.36	3.39	14.29	2.62
1	13	Oct-99	0.98	0.86									
2	8	Feb-99	2.25	0.98	122.37	142.03	132.20	4.67	38.33	16.71	21.62	56.40	14.14
2	8	Mar-99	1.85	1.10	118.37	150.30	134.34	4.51	30.15	18.76	11.39	37.78	8.59
2	8	Apr-99	1.76	0.86	122.69	140.47	131.58	4.65	29.94	14.61	15.33	51.19	12.22
2	8	May-99	1.39	1.38	122.62	106.75	114.68	4.68	23.63	23.75	-0.12	-0.51	0.06
2	8	Jun-99	1.25	1.00	122.88	146.71	134.80	4.68	21.32	17.09	4.24	19.86	3.80
2	8	Jul-99	1.53	0.65	122.76	146.17	134.46	4.66	26.02	10.97	15.05	57.84	14.68
2	8	Aug-99	2.32	1.70	122.87	122.40	122.64	4.64	39.25	28.74	10.51	26.77	5.24
2	8	Sep-99	0.62	1.50	122.82	126.57	124.70	4.63	10.47	25.33	-14.86	-141.94	-14.92
2	8	Oct-99	0.98	1.20									
3	3	Feb-99	2.22	1.43	122.37	162.01	142.19	4.66	37.74	24.31	13.43	35.59	7.48
3	3	Mar-99	1.98	0.67	118.37	142.82	130.60	4.44	31.84	11.26	20.58	64.63	17.63
3	3	Apr-99	1.80	1.09	87.44	236.35	161.90	3.35	21.56	12.91	8.65	40.12	6.09
3	3	May-99	2.58	1.28	67.80	58.05	62.93	2.75	25.81	12.80	13.01	50.41	7.01
3	3	Jun-99	1.25	0.93	122.88	150.26	136.57	4.47	20.40	15.20	5.20	25.51	4.82
3	3	Jul-99	1.57	0.57	122.76	149.99	136.37	4.46	25.60	9.23	16.37	63.94	16.60
3	3	Aug-99	2.24	1.60	130.82	169.70	150.26	4.78	38.90	26.11	12.79	32.89	5.84
3	3	Sep-99	0.91	0.46	202.34	16.57	109.46	7.48	24.85	12.56	12.29	49.45	18.63
3	3	Oct-99	0.98	0.93									

Exhibit 3-12

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data from the ENR Test Cells

Treatment	Cell	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)
Period of Record										
1	13	1999	1.16	41.3	0.48	42.3	329	285	2761	47925
2	8	1999	1.93	74.0	1.43	8.6	805	752	93	3883
3	3	1999	1.89	72.6	1.38	6.8	886	848	76	3278
Quarterly										
1	13	Qtr-3	0.91	41.3	0.38		424	419		
1	13	Qtr-4	1.23	40.7	0.50	42.3	318	257	1072	48850
1	13	Qtr-5	1.26	42.1	0.54		276	224	4450	47000
2	8	Qtr-3	1.92	70.5	1.35		823	831		
2	8	Qtr-4	1.98	76.3	1.52	8.6	820	738	52	4915
2	8	Qtr-5	1.88	74.1	1.40		777	714	135	2850
3	3	Qtr-3	1.90	68.9	1.31		957	952		
3	3	Qtr-4	1.89	73.7	1.39	6.8	823	774	75	4655
3	3	Qtr-5	1.89	73.9	1.40		902	852	77	1900
Monthly										
1	13	Feb-99	0.92	31.4	0.32		468	454		
1	13	Apr-99	0.90	51.2	0.43		380	384		
1	13	May-99	1.16	39.5	0.46		368	307	1072	48850
1	13	Jun-99	1.25	42.0	0.52	42.3	300	238		
1	13	Jul-99	1.28	40.5	0.52		286	228		
1	13	Aug-99	1.23	48.5	0.61		296	244		
1	13	Sep-99	1.31	41.5	0.54		276	238	4450	47000
1	13	Oct-99	1.25	36.3	0.45		257	190		
2	8	Feb-99	1.91	71.2	1.36		876	876		
2	8	Apr-99	1.93	69.8	1.35		770	785		
2	8	May-99	1.93	70.0	1.35		856	765	52	4915
2	8	Jun-99	2.03	81.0	1.64	8.6	791	730		
2	8	Jul-99	2.00	78.0	1.56		814	720		
2	8	Aug-99	1.70	67.0	1.14		817	756		
2	8	Sep-99	2.02	79.5	1.60		726	689	135	2850
2	8	Oct-99	1.94	75.7	1.47		787	698		
3	3	Feb-99	1.90	67.6	1.28		1034	1031		
3	3	Apr-99	1.90	70.3	1.33		879	873		
3	3	May-99	1.80	69.5	1.25		867	735	75	4655
3	3	Jun-99	1.91	78.0	1.49	6.8	873	764		
3	3	Jul-99	1.96	73.5	1.44		729	824		
3	3	Aug-99	1.76	67.5	1.19		959	893		
3	3	Sep-99	1.98	77.7	1.54		904	878	77	1900
3	3	Oct-99	1.94	76.6	1.48		843	785		

3.7.2 Phosphorus

Sediment samples were collected monthly from the PSTA Test Cell internal monitoring stations and analyzed for TP and total inorganic phosphorus (TIP), and quarterly for non-reactive phosphorus (NRP). NRP analyses for sediment samples are not yet available, and will be incorporated into the next quarterly report.

In Treatment 1 (Test Cell 13), the average monthly TP concentration varied between 257 and 468 milligrams per kilogram (mg/kg) with an average monthly TIP concentration between 190 and 454 mg/kg. TP and TIP were at their greatest concentrations during the initial sampling event (February 1999) and generally declined in the succeeding samples. The estimated TP stored in the top 10 cm of soil in Treatment 1 has been relatively constant, ranging from approximately 12 to 18 g/m^2 since startup.

In Treatment 2 (Test Cell 8), the monthly average TP concentration varied between 726 and 876 mg/kg with an average TIP concentration between 689 and 876 mg/kg. TP and TIP were at their greatest concentrations during the initial sampling event (February 1999), and TIP declined in the succeeding samples. TP concentration did not exhibit the decreasing trend as did Treatment 1. The monthly average TP estimated in the top 10 cm of shellrock soils in Treatment 2 was somewhat variable, ranging from 93 to 128 g/m^2 and averaging 115 g/m^2 since startup.

In Treatment 3 (Test Cell 3), the average TP concentration varied between 730 and 1,034 mg/kg with an average TIP concentration varying between 735 and 1,031 mg/kg. TP and TIP were highest during the initial sampling event (February 1999) and have been relatively constant since that time. The TP stored in the top 10 cm of shellrock soils in Treatment 3 was variable, ranging from 105 to 139 g/m^2 with an average of 121 g/m^2.

3.7.3 Nitrogen

The peat soils of Treatment 1 (Test Cell 13) exhibited an average TKN concentration of 2,761 mg/kg. In contrast to the peat soils in Treatment 1, Treatments 2 and 3 displayed lower average TKN measurements of 93 and 76 mg/kg, respectively.

3.7.4 Volatile Solids and Total Organic Carbon

The peat soils of Treatment 1 (Test Cell 13) exhibited a greater average volatile solids (42 percent) and TOC concentration (48,850 mg/kg) in comparison to the mineral soils of Treatments 2 and 3 (Test Cells 8 and 3, respectively). Volatile solids in Treatments 2 and 3 averaged 8.6 and 6.8 percent, respectively, and TOC concentrations averaged 3,883 and 3,278 mg/kg, respectively. There was an apparent decline in TOC concentration in the soils of the shellrock Test Cells between the 3rd and 5th quarters.

3.8 Biological Analyses

Algal and macrophytic plant communities are being closely monitored in the PSTA Test Cells. The indices chosen for these studies are intended to characterize the changes in these plant communities over time and to contrast the effects of various experimental treatments. Measured parameters include percent cover, 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.

3.8.1 Plant Cover

Plant cover in the PSTA Test Cells was estimated visually each month. An observer estimated cover of each of the following five plant groups in three zones within each PSTA Test Cell:

- Blue-green algal mat
- Green algal mat
- Floating aquatic plants
- Submerged aquatic plants
- Emergent macrophytes

The three zones used for estimating plant cover are the areas delimited by the two boardwalks in each cell. Plant cover is estimated in 1 of 10 cover categories, and the mid-value of each category is used for averaging cover values from the three zones. These 10 cover categories include:

1. <1 percent
2. 1–5 percent
3. 5–10 percent
4. 10–25 percent
5. 25–50 percent
6. 50–75 percent
7. 75–90 percent
8. 90–95 percent
9. 95–99 percent
10. >99 percent

A test of this semi-quantitative plant cover estimation technique was conducted in October. Three of the PSTA researchers independently estimated percent cover in the PSTA Test Cells using this method. Exhibit 3-13 illustrates the results of this comparison. Based on this test, it was found that one of the three researchers was identifying the presence of floating aquatic plants in the Test Cells and one was underestimating the presence of green algal mats. These inconsistencies will be eliminated in future data collection efforts.

Exhibit 3-14 summarizes the plant cover estimates for the PSTA Test Cells for the first three quarters of operation. Data are presented by treatment number. Plant cover has increased dramatically in all three of the PSTA Test Cells. This cover is dominated by macrophytes in all cells. At the end of the 5th quarter, Treatment 1 (Test Cell 13) had an estimated total plant cover of 198 percent, indicating the presence of multiple plant strata, with individual cover contributions of 96, 71, and 31 percent cover by submerged aquatic plants, algal mats, and emergent macrophytes, respectively. Macrophyte cover in this peat-based cell is dominated by the submerged aquatic plants hydrilla (*Hydrilla verticillata*) and stonewort (*Chara* sp.). Blue-green algal mats covered approximately 69 percent of this cell during the October sampling event. Coverage by green algal mats and floating aquatic plants was insignificant. Emergent macrophyte cover is approximately evenly shared by the planted species spikerush (*Eleocharis cellulosa*) and volunteer specimens of cattail (*Typha* sp).

In contrast to the peat-based Test Cell, Treatments 2 and 3 (Test Cells 8 and 3, respectively) with shellrock substrate had less cover by all species of plants. Total plant cover in October

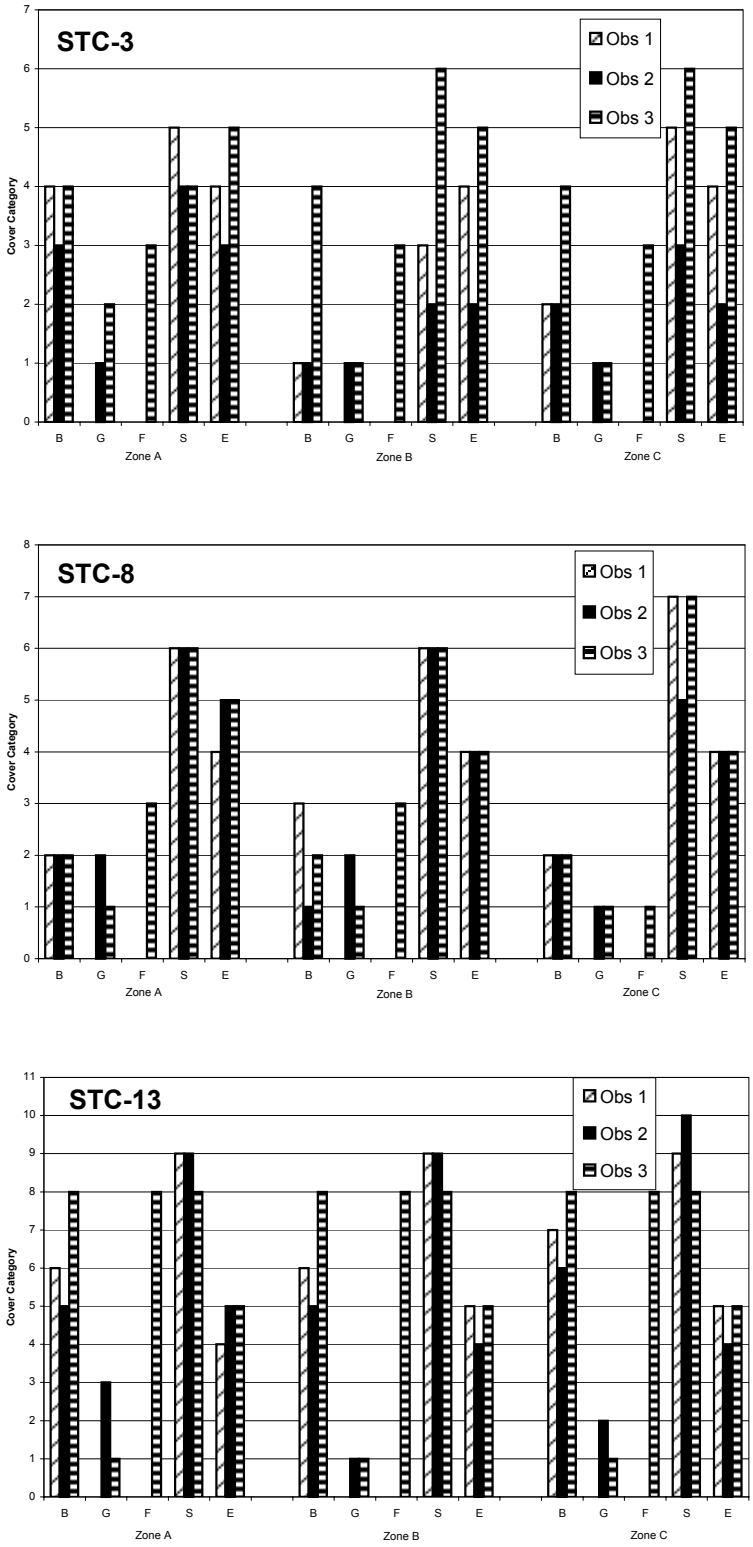


Exhibit 3-13
Comparison of Test Cell Percent Cover Estimates by Three Researchers in October 1999

Exhibit 3-14

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover Estimates from the ENR Test Cells

Treatment	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	26%	2%	15%	1%	66%	28%	82%	118%
2	8	1999	3%	1%	10%	1%	25%	4%	35%	39%
3	3	1999	5%	1%	11%	1%	15%	6%	27%	34%
Quarterly										
1	13	Qtr-3	4%	4%	4%	1%	22%	8%	27%	35%
1	13	Qtr-4	10%	0%	14%	0%	94%	11%	108%	119%
1	13	Qtr-5	69%	2%	31%	0%	96%	71%	127%	198%
2	8	Qtr-3	2%	2%	2%	1%	2%	4%	5%	9%
2	8	Qtr-4	3%	0%	8%	0%	15%	3%	24%	27%
2	8	Qtr-5	3%	1%	22%	2%	64%	4%	88%	92%
3	3	Qtr-3	3%	2%	2%	1%	3%	5%	6%	11%
3	3	Qtr-4	4%	0%	14%	0%	19%	4%	33%	37%
3	3	Qtr-5	10%	1%	20%	3%	28%	10%	50%	61%
Monthly										
1	13	Feb-99	1%	0%	2%	0%	9%	1%	11%	12%
1	13	Mar-99	1%	0%	2%	0%	13%	1%	16%	17%
1	13	Apr-99	14%	14%	8%	3%	54%	28%	65%	93%
1	13	May-99	3%	0%	8%	0%	97%	3%	105%	108%
1	13	Jun-99	11%	0%	18%	0%	93%	11%	110%	121%
1	13	Jul-99	18%	1%	18%	0%	93%	18%	110%	128%
1	13	Oct-99	69%	2%	31%	0%	96%	71%	127%	198%
2	8	Feb-99	0%	0%	1%	0%	0%	0%	1%	2%
2	8	Mar-99	1%	0%	2%	0%	1%	1%	3%	4%
2	8	Apr-99	8%	8%	3%	3%	8%	15%	14%	29%
2	8	May-99	2%	0%	3%	0%	11%	3%	14%	17%
2	8	Jun-99	3%	0%	11%	0%	18%	3%	28%	31%
2	8	Jul-99	3%	1%	11%	0%	18%	4%	28%	32%
2	8	Oct-99	3%	1%	22%	2%	64%	4%	88%	92%
3	3	Feb-99	1%	0%	1%	0%	0%	1%	1%	2%
3	3	Mar-99	1%	1%	2%	0%	2%	2%	4%	6%
3	3	Apr-99	8%	8%	3%	3%	8%	15%	14%	29%
3	3	May-99	5%	0%	8%	0%	21%	5%	28%	33%
3	3	Jun-99	3%	0%	18%	0%	18%	3%	35%	38%
3	3	Jul-99	3%	1%	18%	0%	18%	4%	35%	39%
3	3	Oct-99	10%	1%	20%	3%	28%	10%	50%	61%

1999 was estimated as 92 percent in Treatment 2 and 61 percent in Treatment 3. Cover in these cells is also dominated by submerged and emergent macrophytes, principally stonewort, southern naiad (*Najas guadalupensis*), bladderwort (*Utricularia* sp.), spikerush, and smaller populations of cattails. Total macrophyte cover is higher in Treatment 2 (88 percent) compared to Treatment 3 (50 percent) principally because of higher submerged aquatic macrophyte cover in Treatment 2. Algal mat percent cover has been variable from month to month, peaking in April at approximately 15 percent and declining in October to approximately 4 percent in Treatment 2 and 10 percent in Treatment 3.

3.8.2 Periphyton Community

Periphyton cores were collected monthly from the PSTA Test Cells. A single sample is collected from a randomly selected location along each of the two boardwalks and analyzed separately. This sample is delineated by a large water column sampling tube (206 cm^2 bottom area), and several smaller benthic cores (12.4 cm^2 each) are collected inside of this column. All floating, submerged, and rooted plant material is removed from the column sampler prior to coring the benthic algae. Macrophytes are handled separately for identification and dry weight analysis. Water and periphyton are blended and composited so that they represent a collection from a known bottom surface area. Data for algal counts, chlorophyll, phosphorus, etc. are reported as the mass per m^2 of bottom area. It is difficult to sample the benthic algae without incorporating an unwanted and unquantified amount of soil in the samples. This problem was particularly acute at the beginning of the project before development of a relatively discrete benthic algal mat. The 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 and peat treatments, and the proportion of soil in these samples has declined during the period of study.

Exhibit 3-15 summarizes periphyton sample data for the PSTA Test Cells since the beginning of the study. Biomass numbers must be interpreted in light of the cautions described above. The peat soils in Treatment 1 (Test Cell 13) are highly organic, and their occurrence in samples is demonstrated by the very high ash-free dry weights recorded from the period prior to significant periphyton development in February through May. The fraction of this material sampled was greatly reduced in the samples collected since May, and data from June through October provide a better estimate of the actual average periphyton ash-free dry weight biomass in this treatment (between 256 and 833 g/m^2). Ash weights for these samples indicate a fairly large mineral residue. A large fraction of this ash appears to be calcium (16 to 54 percent).

Estimated periphyton ash-free dry weight biomass in the samples from Treatments 2 and 3 (Test Cells 8 and 3, respectively) was generally lower than in Treatment 1 (Test Cell 13), averaging between 121 and 133 g/m^2 during the period-of-record. These biomass estimates have been somewhat variable each month with maximum estimated values of approximately 190 to 262 g/m^2 in October.

TP, TIP, and TKN concentrations measured in these samples were variable throughout the period-of-record. Periphyton TP in Treatment 1 (Test Cell 13) averaged 0.651 g/m^2 for the period from June through October. TIP averaged 0.123 g/m^2 during this period, or approximately 20 percent of the periphyton TP. The average TP in the periphyton in Treatments 2 and 3 (Test Cells 8 and 3, respectively) averaged between 0.18 and

Exhibit 3-15

Period-of-Record, Quarterly, and Monthly Summaries of Periphyton Data from the ENR Test Cells

			Periphyton Biomass (g/m^2)			Ca	Chl_a (corr)	Pheo_a	TP	TIP	TKN	Blue Green Algae		Diatoms		Green Algae		Other Taxa		Total Taxa		Biovolume		
Treatment	Cell	Date	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)*10^6	(# taxa)	(cm^3/m^2)	Evenness	SWDI
Period of Record																								
1	13	1999	2348.0	1530.9	826.8	346.1	212.9	70.5	1.012	0.247	9.34	37768.1	7.6	2028.6	10.1	5676.8	8.4	72.4	0.9	45507.9	26.4	15.53	0.721	3.30
2	8	1999	547.7	425.5	133.2	105.9	27.7	13.2	0.288	0.130	2.89	22002.8	10.8	2052.1	12.1	1352.1	7.8	135.4	2.8	25451.0	31.7	10.26	0.715	3.55
3	3	1999	484.0	364.2	120.7	69.1	18.8	8.8	0.180	0.053	1.15	15482.9	10.1	1039.6	11.6	881.1	8.0	166.9	3.2	17481.8	31.3	1.98	0.732	3.62
Quarterly																								
1	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	8308.1	15.0	0.24	0.793	2.99
1	13	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	9.8	0.0	0.0	39083.4	32.2	21.36	0.700	3.48
1	13	Qtr-5	1084.4	696.0	474.9	202.2	256.4	94.2	0.485	0.110	9.46	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
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	5.82	0.665	3.19
2	8	Qtr-4	726.6	563.1	163.6	130.0	26.7	4.4	0.492	0.256	1.60	18075.2	11.8	2660.8	15.7	1169.0	7.8	12.6	0.3	21913.4	35.5	18.78	0.741	3.81
2	8	Qtr-5	386.5	292.6	122.8	70.6	38.6	29.9	0.129	0.038	4.17	37915.7	14.2	2266.8	8.3	1491.7	5.7	158.5	2.8	41768.5	30.0	3.21	0.722	3.54
3	3	Qtr-3	399.2	322.2	77.8	94.5	12.8	8.7	0.178	0.026		1480.9	4.3	557.0	12.3	661.5	10.0	165.2	2.8	2794.2	28.3	0.54	0.773	3.69
3	3	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	3.82
3	3	Qtr-5	437.3	317.8	121.4	50.4	15.0	4.2	0.073	0.019	1.65	26083.8	12.8	958.1	7.5	673.0	6.5	150.7	2.9	27833.5	29.2	1.82	0.693	3.37
Monthly																								
1	13	Feb-99	1718.1	1090.7	627.4	338.0	65.9	14.6	0.872	0.041		61.3	0.5	397.8	8.0	195.4	3.0	0.0	0.0	654.5	11.5	0.24	0.890	3.05
1	13	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	1366.4	3.0	0.0	0.0	15961.8	18.5		0.695	2.93
1	13	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	30688.0	39.0	18.38	0.698	3.68
1	13	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	66562.6	29.5	29.75	0.710	3.45
1	13	Jul-99	1340.9	863.6	494.3	224.7	208.7	18.9	0.662	0.243		16876.5	8.5	1007.7	9.5	2115.5	10.0	0.0	0.0	19999.6	28.0	15.96	0.692	3.32
1	13	Aug-99	1083.7	751.7	335.4	249.2	121.3	6.6	0.402	0.141		18782.1	9.0	338.8	4.5	3194.5	8.5	0.0	0.0	22315.3	22.0	13.01	0.690	3.08
1	13	Sep-99	1094.3	775.7	318.6	139.3	256.2	48.8	0.401	0.116	9.46	42578.2	14.5	543.4	5.0	6172.5	11.5	0.0	0.0	49294.1	31.0	20.75	0.765	3.79
1	13	Oct-99	1913.2	1080.2	833.1	171.2	391.8	19.9	0.651	0.072		152142.7	14.0	219.9	3.5	5949.8	12.0	274.5	2.0	158586.9	31.5	10.63	0.628	3.12
2	8	Feb-99	339.6	300.1	39.5	187.4	22.4	1.8	0.156	0.010		2210.7	3.5	719.0	14.0	790.6	8.0	0.0	0.0	3720.3	25.5	5.82	0.697	3.23
2	8	Apr-99	702.5	536.8	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		0.634	3.16
2	8	May-99	933.1	738.4	194.8	169.8	32.4	10.8	0.627	0.340	1.60	8660.9	10.0	1921.1	23.5	778.4	8.0	0.0	0.0	11360.4	41.5	8.52	0.718	3.86
2	8	Jun-99	803.8	626.0	177.8	132.9	24.3	1.3	0.597	0.300		28889.4	12.0	3743.3	14.5	1367.7	8.5	0.0	0.0	34000.4	35.0	45.37	0.746	3.83
2	8	Jul-99	443.0	324.8	118.2	87.3	23.6	1.2	0.254	0.129		16675.4	13.5	2317.8	9.0	1361.1	7.0	25.2	0.5	20379.4	30.0	2.43	0.759	3.73
2	8	Aug-99	460.8	369.1	91.7	75.6	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
2	8	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
2	8	Oct-99	611.8	421.8	190.0	38.7	7.5	2.3	0.054	0.008		15083.2	15.0	591.6	8.0	336.6	4.5	82.1	3.5	16103.9	31.0	0.78	0.739	3.67
3	3	Feb-99	413.2	353.0	60.2	155.0	23.8	15.3	0.204	0.009		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
3	3	Apr-99	385.2	291.4	95.4	33.9	1.8	2.2	0.152	0.043		1362.7	5.0	331.2	12.5	976.7	14.0	182.9	3.0	2853.4	34.5		0.759	3.87
3	3	May-99	307.2	199.1	108.2	35.0	13.7	4.0	0.087	0.033	0.64	4301.5	8.5	962.0	18.0	696.0	11.0	23.6	1.5	5983.1	39.0	1.23	0.725	3.83
3	3	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
3	3	Jul-99	463.8	351.0	112.4	58.7	25.4	6.2	0.173	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
3	3	Aug-99	478.9	382.5	96.4	42.9	28.9	3.7	0.053	0.024		46884.2	17.0	2189.4	10.5	1085.9	8.0	56.5	1.0	50216.1	36.5	3.00	0.753	3.90
3	3	Sep-99	618.9	505.4	113.9	66.3	5.7	0.7	0.114	0.020	1.65	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
3	3	Oct-99	827.3	565.1	262.2	49.6	10.4	4.6	0.053	0.015		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

SWDI = Shannon-Weaver Diversity Index

0.29 g/m^2 with approximately 29 to 45 percent of that phosphorus in inorganic forms. TKN averaged approximately 9.3 g/m^2 in Treatment 1 (Test Cell 13) for the period-of-record, and average TKN concentrations were between 1.15 and 2.89 g/m^2 in the shellrock treatments. Average TKN concentrations increased in all of the treatments between the 4th and 5th quarters.

Chlorophyll provides a more direct method of estimation of algal populations in these periphyton samples. Chlorophyll concentration corrected for phaeophytin averaged 213 milligrams per square meter (mg/m^2) in Treatment 1 (Test Cell 13) samples and was much lower in the shellrock mesocosms with 28 and 19 mg/m^2 in Treatments 2 and 3 (Test Cells 8 and 3), respectively.

Detailed algal taxonomy and cell counts are being conducted on these periphyton samples. Although incorporated soils sometimes make counting imprecise, these cell numbers and their associated volumes provide the best indicator of actual periphyton community structure.

As shown in Exhibit 3-15, the average number of algal cells in Treatment 1 (Test Cell 13) has increased from approximately 0.6 x 10^9 per m^2 to 159 x 10^9 per m^2 with an average number of taxa ranging between 11 and 39. Blue-green algae species have dominated the cell counts in these samples. Average total cell counts peaked in October. Since grow-in in May, the algal biovolume in these samples has varied between approximately 11 and 30 cm^2/m^2. The Shannon-Weaver Diversity Index (SWDI) has varied between 3.0 and 3.8 units, and evenness has varied between 0.63 and 0.71 during this period.

In Treatment 2 (Test Cell 8), the average number of cells increased from approximately 3.7 x 10^9 per m^2 in February to a maximum of 71 x 10^9 per m^2 in September. An average of 26 to 41 taxa are represented in the counts. Blue-green algae have dominated the cell counts in these samples. The algal biovolume in these samples has varied between approximately 1 and 45 cm^3/m^2. The SWDI has varied between 3.2 and 3.9 units, and evenness has varied between 0.63 and 0.76.

In Treatment 3 (Test Cell 3), the average number of cells increased from approximately 2.7 x 10^9 per m^2 in February to a maximum of 50.2 x 10^9 per m^2 with an average of 22 to 39 taxa represented in the counts. Blue-green algae have dominated the cell counts in these samples. Average total cell counts rose declined in the September and October samples. The algal biovolume in these samples has varied between 0.5 and 3.6 cm^3/m^2. The SWDI has varied between 3.0 and 3.9 units, and evenness has varied between 0.64 and 0.79.

These periphyton data indicate that algal populations have highest biovolume, chlorophyll, and biomass in the peat-based Test Cell (Treatment 1). Algal diversity in this cell is typically slightly lower than in the other two treatments. Cell counts are also typically higher in this treatment. Blue-green species dominate the algal populations in all three of the PSTA Test Cells. Of the two shellrock treatments, Treatment 2 (Test Cell 8) typically has had higher periphyton cell counts and biovolume than Treatment 3 (Test Cell 3).

3.9 Ecosystem Metabolism

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 oxygen changes must be corrected for the effects of diffusion of oxygen into or out of the water column. A diffusion coefficient of 0.20 g of oxygen per square meter per hour ($O_2/m^2/hr$) has been used for preliminary analysis until actual diffusion rates are measured in the field.

Changes in DO content of the water column during a daily period can be used to estimate the processes of community respiration and photosynthesis. The combination of respiration and photosynthesis is called community metabolism (CM). This is also equal to gross primary productivity (GPP) that includes 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. The conversion between oxygen and ash-free dry weight 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.

Exhibit 3-16 summarizes the ecosystem metabolism estimates for the PSTA Test Cells to-date. CM of the PSTA Test Cell ecosystems generally increased during the start-up period of this research, reaching maximum levels in May in Treatment 1 (Test Cell 13), June in Treatment 2 (Test Cell 8), and August in Treatment 3 (Test Cell 3). Because the initial colonization of Treatment 1 by submerged aquatic plants, this cell initially had the highest metabolism and increased from approximately 1.7 g $O_2/m^2/d$ in March to 6.4 g $O_2/m^2/d$ in May, before declining to 1.2 g $O_2/m^2/d$ in October. Photosynthetic efficiency increased to approximately 2.8 percent in this cell by June. NPP_{24hr} increased in this cell to 1.25 g $O_2/m^2/d$ in May and declined to -2.65 g $O_2/m^2/d$ in October. Based on the average estimated NPP during this period (0.22 g $O_2/m^2/d$) and the conversions described previously, a net accumulation is expected of approximately 0.44 g ash-free dry weight per square meter per day ($afdw/m^2/d$) or 98 g $afdw/m^2$ during the 222-day operational period. This value is less than the biomass of 833 g $afdw/m^2$ estimated in October.

CM also varied on a seasonal basis in Treatments 2 and 3 (Test Cells 8 and 3, respectively) during the period of research. Estimated average maximum monthly values were 5.1 and 3.7 g $O_2/m^2/d$ in Treatments 2 and 3, respectively. Estimated rates of NPP_{24hr} in Treatment 2 were negative early in the project and have increased to a maximum positive value of 1.0 g $O_2/m^2/d$ in June and then declined to lower values during the autumn months. NPP_{24hr} in Treatment 3 (Test Cell 3) increased to a maximum of 0.52 g $O_2/m^2/d$ in August but has been negative during most months.

Exhibit 3-16

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the ENR Test Cells

Treatment	Cell	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 Res $g/m^2/hr$	PAR(24hr) $E/m^2/d$	Efficiency %
Period of Record										
1	13	1999	1.231	3.445	3.222	3.445	0.222	0.134	36.9	1.788
2	8	1999	1.274	2.975	2.774	2.975	0.201	0.116	37.5	1.516
3	3	1999	0.733	2.278	2.513	2.278	-0.235	0.105	39.2	1.113
Quarterly										
1	13	Qtr-3	1.273	2.127	1.593	2.127	0.534	0.066	42.0	0.970
1	13	Qtr-4	2.697	5.674	4.595	5.674	1.078	0.191	39.9	2.719
1	13	Qtr-5	-1.042	1.427	2.830	1.427	-1.403	0.118	26.9	1.014
2	8	Qtr-3	0.678	1.879	2.070	1.879	-0.191	0.086	38.7	0.928
2	8	Qtr-4	2.042	4.357	3.548	4.357	0.810	0.148	39.1	2.134
2	8	Qtr-5	1.638	3.737	3.581	3.737	0.156	0.149	28.4	2.517
3	3	Qtr-3	0.540	1.641	1.852	1.641	-0.211	0.077	42.9	0.732
3	3	Qtr-4	0.603	2.556	2.993	2.556	-0.437	0.125	39.1	1.252
3	3	Qtr-5	1.384	3.082	2.985	3.082	0.097	0.124	31.6	1.867
Monthly										
1	13	Mar-99	1.025	1.689	1.295	1.689	0.394	0.054	41.4	0.781
1	13	Apr-99	1.521	2.565	1.892	2.565	0.674	0.079	42.5	1.155
1	13	May-99	3.087	6.440	5.186	6.440	1.254	0.216	44.9	2.742
1	13	Jun-99	2.021	4.529	3.849	4.529	0.680	0.160	31.1	2.787
1	13	Jul-99	3.173	4.080	1.451	4.080	2.628	0.060	48.4	1.613
1	13	Aug-99	0.552	2.783	2.834	2.783	-0.051	0.118	30.5	1.743
1	13	Sep-99	-2.528	0.146	2.216	0.146	-2.070	0.092	24.0	0.116
1	13	Oct-99	-1.470	1.088	3.742	1.088	-2.654	0.156	25.3	0.823
2	8	Feb-99	0.440	1.457	1.835	1.457	-0.377	0.076	32.2	0.865
2	8	Mar-99	0.580	1.628	1.797	1.628	-0.169	0.075	40.2	0.774
2	8	Apr-99	1.117	2.757	2.741	2.757	0.016	0.114	44.9	1.175
2	8	May-99	1.483	3.269	2.798	3.269	0.471	0.117	45.8	1.365
2	8	Jun-99	2.391	5.051	4.043	5.051	1.008	0.168	33.4	2.897
2	8	Jul-99	2.272	4.790	3.829	4.790	0.961	0.160	37.7	2.430
2	8	Aug-99	1.848	4.231	3.812	4.231	0.419	0.159	24.4	3.322
2	8	Sep-99	1.620	4.226	4.468	4.226	-0.241	0.186	34.2	2.363
2	8	Oct-99	1.474	2.894	2.623	2.894	0.271	0.109	26.9	2.060
3	3	Feb-99	-0.154	0.360	0.949	0.360	-0.589	0.040	34.6	0.199
3	3	Mar-99	0.495	1.570	1.843	1.570	-0.272	0.077	40.6	0.739
3	3	Apr-99	0.626	1.786	1.907	1.786	-0.121	0.079	45.9	0.745
3	3	May-99	0.546	2.352	2.803	2.352	-0.451	0.117	45.2	0.996
3	3	Jun-99	0.476	2.568	3.183	2.568	-0.615	0.133	32.0	1.538
3	3	Jul-99	1.042	2.993	2.967	2.993	0.025	0.124	42.3	1.352
3	3	Aug-99	1.808	3.669	3.153	3.669	0.517	0.131	38.3	1.834
3	3	Sep-99	0.835	2.502	2.949	2.502	-0.447	0.123	26.1	1.832
3	3	Oct-99	1.458	2.976	2.803	2.976	0.173	0.117	29.0	1.961

Note: 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.

Based on the average estimated NPP_{24hr} during the entire operational period (0.20 g $O_2/m^2/d$) and the conversions described previously, a net accumulation is expected of approximately 0.40 g afdw/m^2/d or 89 g afdw/m^2 during the 222-day operational period. This value is similar to the biomass of approximately 92 g afdw/m^2 measured in August but lower than values estimated in September and October.

NPP_{24hr} estimates for Treatment 3 (Test Cell 3) were negative until July. This finding conflicts with the measured periphyton biomass accumulation in this cell. Additional data will need to be collected to help explain this apparent discrepancy. Average photosynthetic efficiencies in Treatments 2 and 3 for the period-of-record were estimated as 1.5 and 1.1 percent, respectively.

3.9.1 PAR Extinction

PAR is defined as the incident solar radiation in the range of wavelengths from 400 to 700 nanometers (nm). These wavelengths include much of the energy directly used in photosynthesis by algae and macrophytic plants. Attenuation of PAR through the water column is an indicator of how much usable solar energy is reaching benthic algae in the PSTA Test Cells. The extinction of this PAR is compared between different systems by calculating an extinction coefficient, n as:

$$n = (\ln I_o - \ln I_Z)/Z$$

where:

n = extinction coefficient in m^{-1}
I_o = incident PAR just below the water surface (μmol/m^2/s)
I_Z = PAR at a distance Z below the surface measurement (μmol/m^2/s)
Z = distance between measurements (m)

Exhibit 3-17 summarizes the PAR extinction data for the PSTA Test Cells since the project started in February 1999. Period-of-record average extinction coefficients were approximately 3.5 m^{-1} in Treatment 1 (Test Cell 13) and approximately one-half of this value in Treatments 2 and 3 (shellrock Test Cells). Monthly average PAR extinction coefficients generally varied between 1.03 and 2.94 m^{-1} until September and October when values increased to 4.8 and 10.5 m^{-1} in Treatment 1. Extinction coefficients in Treatments 2 and 3 (Test Cells 8 and 3) also increased somewhat during September and October, indicating the color or clarity of the inflow water declined during this period.

3.10 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.

Exhibit 3-17

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the ENR Test Cells

Treatment	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	0.63	1252.7	469.0	0.50	3.46
2	1999	0.60	1356.1	662.5	0.46	1.72
3	1999	0.70	1488.4	592.4	0.57	1.77
Quarterly						
1	Qtr-3	0.65	1476.0	463.8	0.51	2.24
1	Qtr-4	0.59	1513.1	743.1	0.49	1.94
1	Qtr-5	0.64	508.6	65.9	0.52	7.65
2	Qtr-3	0.62	1187.6	611.2	0.44	1.57
2	Qtr-4	0.56	1643.0	922.0	0.44	1.33
2	Qtr-5	0.65	1206.5	358.5	0.52	2.56
3	Qtr-3	0.68	1426.8	556.0	0.53	1.97
3	Qtr-4	0.69	1551.8	683.2	0.57	1.54
3	Qtr-5	0.77	1485.7	516.8	0.65	1.80
Monthly						
1	Feb-99	0.66	1741.3	448.3	0.47	2.94
1	Mar-99	0.67	1432.2	481.3	0.54	1.84
1	Apr-99	0.64	1261.7	458.9	0.52	2.01
1	May-99	0.46	2039.2	1258.2	0.34	1.48
1	Jun-99	0.66	1619.4	594.2	0.58	1.97
1	Jul-99	0.67	880.7	377.0	0.54	2.38
1	Sep-99	0.62	767.8	129.8	0.50	4.83
1	Oct-99	0.66	249.4	1.9	0.54	10.47
2	Feb-99	0.62	752.6	356.8	0.41	1.86
2	Mar-99	0.60	1356.9	770.1	0.44	1.36
2	Apr-99	0.64	1396.8	653.8	0.48	1.57
2	May-99	0.46	1081.1	610.9	0.34	1.67
2	Jun-99	0.61	2095.5	1117.7	0.49	1.29
2	Jul-99	0.62	1752.5	1037.5	0.50	1.03
2	Sep-99	0.66	1803.3	506.8	0.53	2.61
2	Oct-99	0.63	609.7	210.1	0.50	2.51
3	Feb-99	0.68	941.1	253.0	0.47	2.73
3	Mar-99	0.71	1902.8	747.4	0.60	1.48
3	Apr-99	0.63	1436.7	603.7	0.51	1.71
3	May-99	0.43	1251.6	784.9	0.30	1.89
3	Jun-99	0.82	1506.2	539.5	0.70	1.47
3	Jul-99	0.82	1897.6	725.3	0.70	1.26
3	Sep-99	0.78	1865.4	715.7	0.66	1.44
3	Oct-99	0.77	1106.0	317.9	0.65	2.17

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

3.10.1 Phosphorus and TSS Trends

Exhibit 3-18 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 3-19 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 3-20 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 3-21 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 3-22 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.

3.10.2 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 3-23). The exported algal cell counts from Treatment 1 (Test Cell 13) were dominated by blue-green (95 percent) species. The cell 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*.

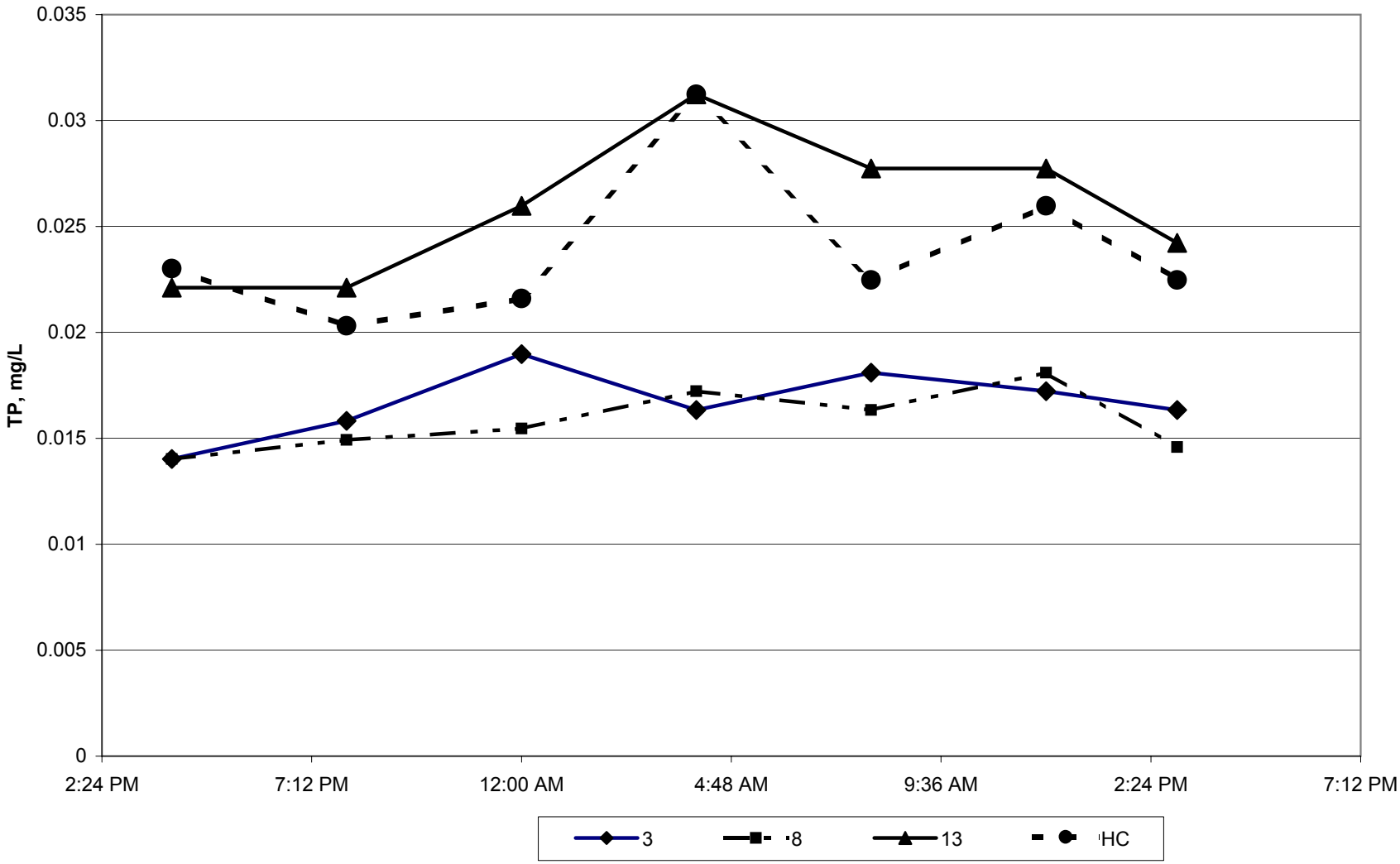


Exhibit 3-18
Diel Record of TP in the PSTA Test Cells on October 5-6, 1999

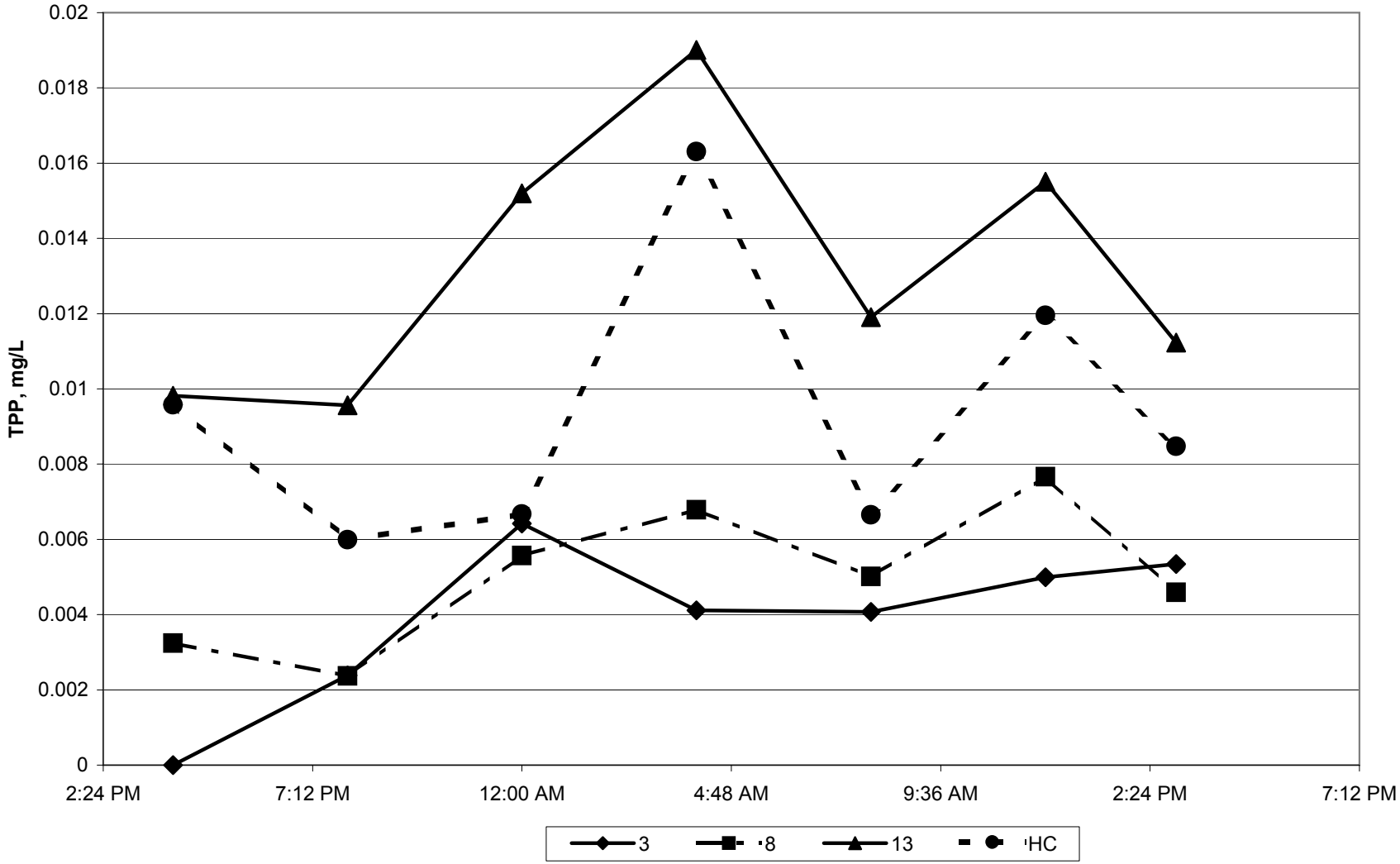


Exhibit 3-19
Diel Record of TPP in the PSTA Test Cells on October 5-6, 1999

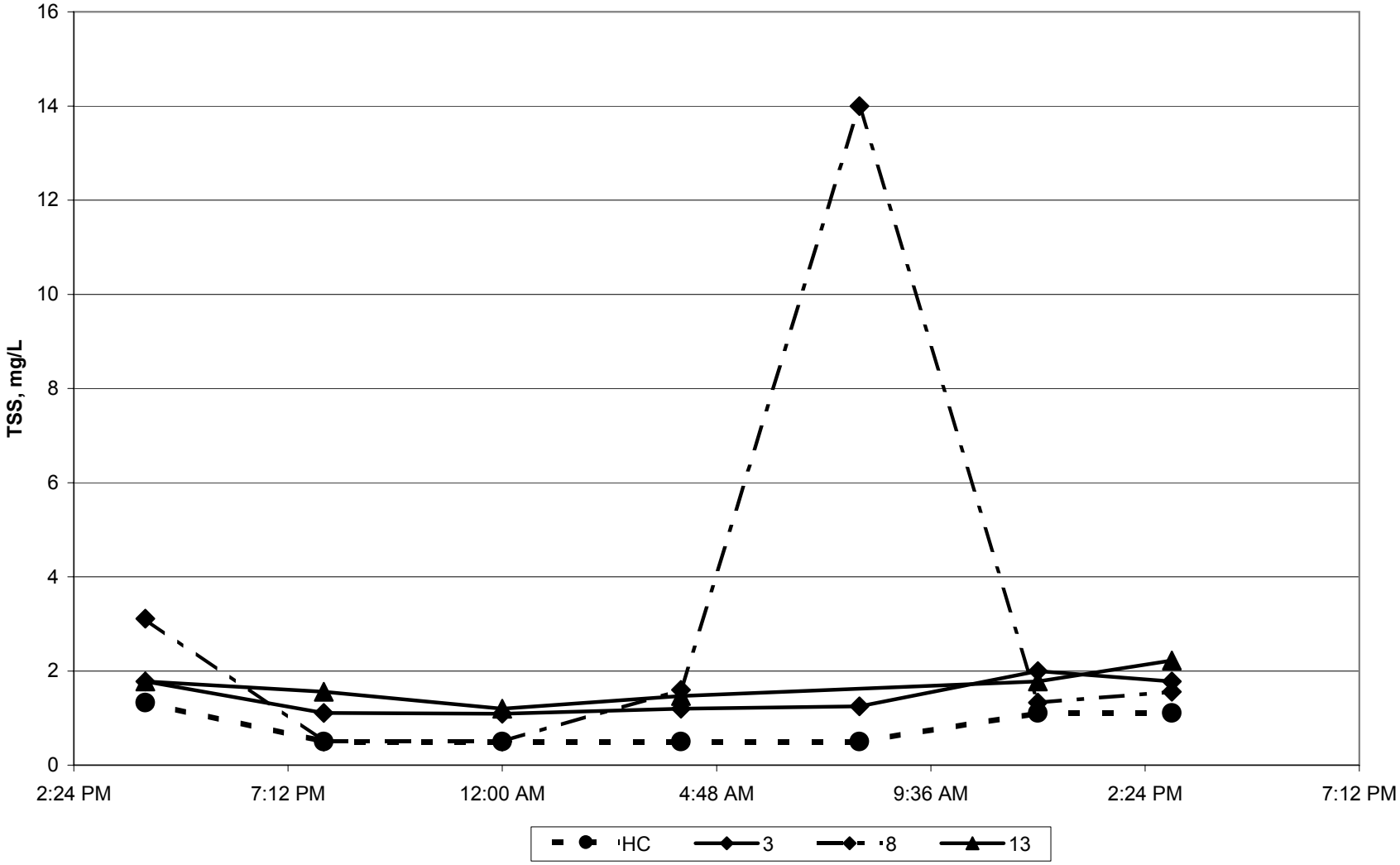


Exhibit 3-20
Diel Record of TSS in the PSTA Test Cells on October 5-6, 1999

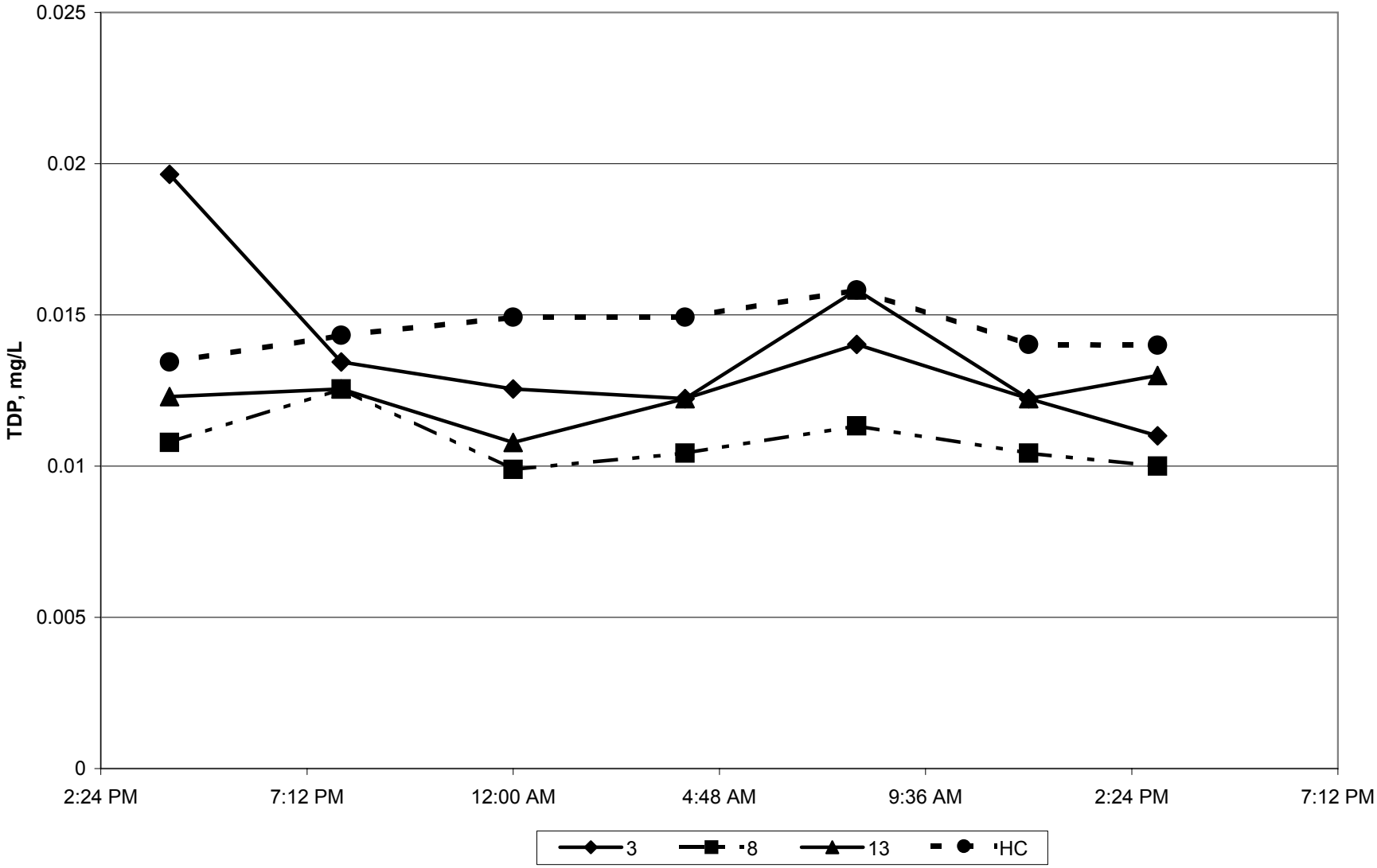


Exhibit 3-21
Diel Record of TDP in the PSTA Test Cells on October 5-6, 1999

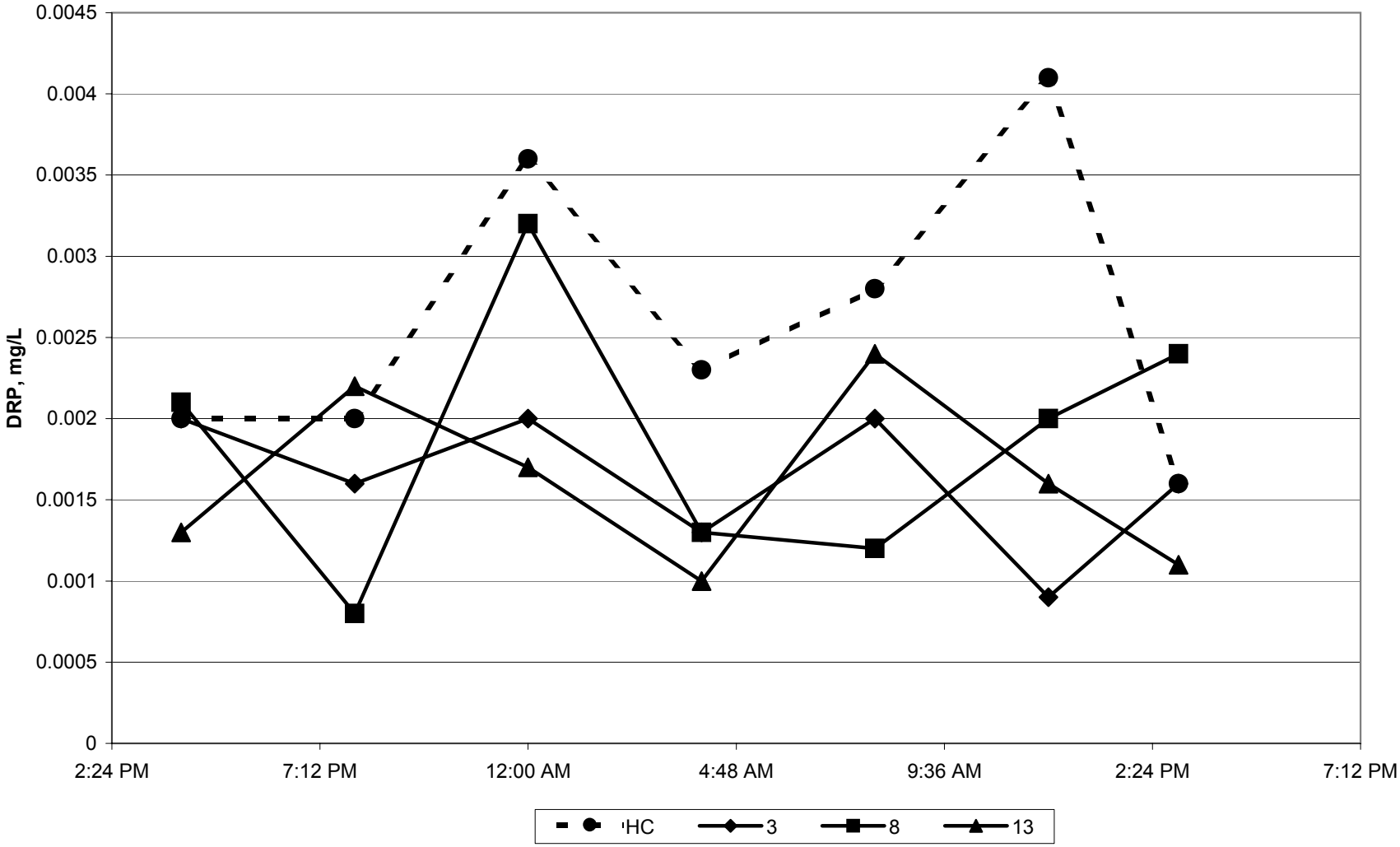


Exhibit 3-22
Diel Record of DRP in the PSTA Test Cells on October 5-6, 1999

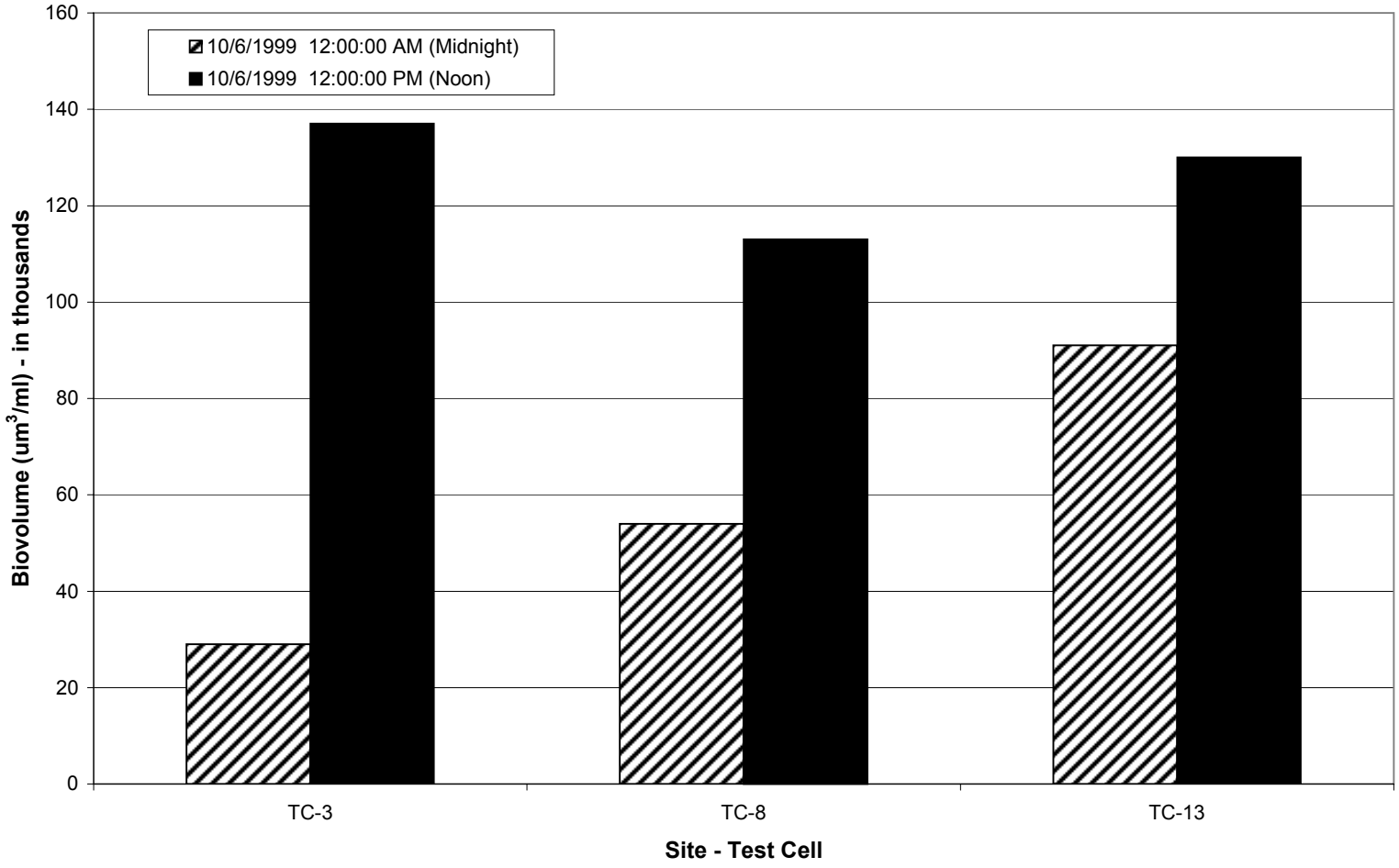


Exhibit 3-23
Diel Record of Algal Biovolume in the PSTA Test Cell Outflows on October 6, 1999

SECTION 4

Porta-PSTA Mesocosms

4.1 Porta-PSTA Treatments

A total of 24 Porta-PSTAs are deployed at the South ENR STRC. Six different priority experimental treatments are replicated three times for a total of 18 mesocosms. The priority experimental treatments identified for Phase 1 include:

- Substrate type (peat vs. shellrock)
- Water depth (60 cm or 30 cm average depth)
- HLR (6 vs. 12 cm/d)
- Variable water regime (0 to 60 cm variable water depth with variable HLR)

One set of three shellrock mesocosms (Treatment 6) receives variable inflows and has variable water depth to simulate seasonally varied scale PSTA operation.

Six additional unreplicated treatments are being demonstrated in the remaining six mesocosms. These treatments were included to demonstrate PSTA performance in treatment configurations that may be less optimal than those covered in the replicated mesocosms. These treatments include:

- Two Porta-PSTAs with sand soils to act as substrate controls
- A test of the effect of excluding all plants from both shellrock- and peat-based Porta-PSTAs using Aquashade dye (plantless controls)
- Two Porta-PSTAs that vary in depth:width ratio while holding other variables constant to assess the effects of walls and their surface area:volume effect on Porta-PSTA performance

Porta-PSTA experimental treatments are summarized in Exhibit 4-1.

4.2 Water Regime

The PSTA water regime includes the components of water depth fluctuations, HLR, and water mass balance. Exhibit 4-2 summarizes the Porta-PSTA water regime data through the 5th quarter. Monthly water level, inflow, outflow, and HLR trend charts are presented by treatment in Appendix A.

4.2.1 Water Depth

Water level measurements in the Porta-PSTA mesocosms were recorded by reading the staff gauge installed near the outflow of each tank. Readings were taken approximately twice per week.

EXHIBIT 4-1
Randomized Porta-PSTA Mesocosm/Treatment Combinations

Treatment #	Substrate	Periphyton	Macrophytes	Water Depth (cm)	HLR (cm/d)	Width (m)	Tank #
1a	Peat	Yes	Yes	60	6	1	9
1b	Peat	Yes	Yes	60	6	1	11
1c	Peat	Yes	Yes	60	6	1	18
2a	Shellrock	Yes	Yes	60	6	1	7
2b	Shellrock	Yes	Yes	60	6	1	4
2c	Shellrock	Yes	Yes	60	6	1	8
3a	Peat	Yes	Yes	30	6	1	17
3b	Peat	Yes	Yes	30	6	1	14
3c	Peat	Yes	Yes	30	6	1	12
4a	Shellrock	Yes	Yes	30	6	1	10
4b	Shellrock	Yes	Yes	30	6	1	5
4c	Shellrock	Yes	Yes	30	6	1	3
5a	Shellrock	Yes	Yes	60	12	1	16
5b	Shellrock	Yes	Yes	60	12	1	2
5c	Shellrock	Yes	Yes	60	12	1	13
6a	Shellrock	Yes	Yes	0-60	0.8-12.0	1	6
6b	Shellrock	Yes	Yes	0-60	0.8-12.0	1	15
6c	Shellrock	Yes	Yes	0-60	0.8-12.0	1	1
7	Sand	Yes	Yes	30	6	1	19
8	Sand	Yes	Yes	60	6	1	20
9	Peat	No	No	60	6	1	21
10	Shellrock	No	No	60	6	1	22
11	Shellrock	Yes	Yes	30	6	3	23
12	Peat	Yes	Yes	30	6	3	24

Exhibit 4-2 summarizes the average water depths by month for each treatment since operation began in April 1999. Actual measured water depths are close to desired settings in most treatments. Water depth in Treatment 7 (shallow sand) was lowered from 60 cm to approximately 30 cm in July 1999.

4.2.2 Water Inflows and Hydraulic Loading Rate

Water inflows to the Porta-PSTA mesocosms are estimated based on timed volume measurements at the inlet of each mesocosm. Outflows are estimated using the same method at each mesocosm outlet.

Water flows and HLRs have been variable since project startup. An increasing trend can be seen in the monthly averages summarized in Exhibit 4-2. Water inflows were purposely increased to prevent plugging of the flow control valves and to provide more consistent operation. All results should be interpreted in light of the actual measured HLRs summarized in Exhibit 4-2 rather than based on the planned settings.

4.2.3 Water Balance

Exhibit 4-2 presents monthly average water balances for each Porta-PSTA treatment since startup. Rainfall and ET data were provided by the District. ET data were not available for October. Rainfall and ET averages are the same as those summarized in Section 3 for the Test Cells. Change in storage was estimated as the product of the mesocosm area and the change in water level between the beginning and end of each month.

In general, higher residuals associated with the first month of operation can be attributed to flow variation associated with startup. Most of the water balance monthly residuals are less than 25 percent. Higher values are an indication of the periodic nature of outflow measurements and the effect of intermittent flow from clogging of the inlet valves. Because of the uncertainty related to outflow measurements, the mass balances presented in this section only rely on the inflow hydraulic loadings.

4.3 Field Parameters

Field parameters (water temperature, pH, DO, percent saturation, salinity, TDS, and specific conductance) are measured weekly in the Porta-PSTAs at the inflow and outflow points, and monthly at one internal station. In addition, one recording data sonde unit is installed in the Head Tank to continuously document inflow conditions. Two recording data sonde units are routinely rotated between the mesocosms every 3 to 4 days to provide diel monthly records for each Test Cell.

Exhibit 4-3 summarizes the field parameter data as monthly averages available for each treatment for the first 7 months of operation. Appendix A provides monthly trend graphics for key parameters measured at the Porta-PSTAs.

4.3.1 Temperature

Average water temperatures in the Head Tank and the mesocosms followed a seasonal cycle with minimum values typically recorded in April and October (between 21.8 and 26°C) and

Exhibit 4-2

Water Balances for the Porta-PSTA Mesocosm Cells

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)
1	Apr-1999	0.593	4.58	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	4.47	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	5.28	0.302	9.36	0.326	10.09	12.54	1.91	104.86	0.63	0.000	0.55	4.91
	Jul-1999	0.647	5.29	0.325	10.08	0.277	8.60	3.18	0.48	136.10	0.82	-0.006	1.15	10.89
	Aug-1999	0.664	6.41	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	9.06	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	10.38	0.609	18.88	0.584	18.09	13.86	2.11	---	---	0.006	---	---
2	Apr-1999	0.652	4.41	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	4.63	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	5.47	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	5.23	0.329	10.20	0.262	8.11	3.18	0.48	136.10	0.82	-0.012	1.77	16.55
	Aug-1999	0.645	6.34	0.322	9.97	0.209	6.48	9.36	1.43	120.04	0.72	-0.271	4.47	39.22
	Sep-1999	0.651	8.51	0.491	15.22	0.397	12.31	6.69	1.02	105.39	0.63	0.018	3.28	20.19
	Oct-1999	0.654	9.16	0.528	16.38	0.541	16.78	13.86	2.11	---	---	-0.012	---	---
3	Apr-1999	0.316	4.11	0.274	8.50	0.387	12.00	0.71	0.11	128.92	0.77	0.000	-4.17	-48.38
	May-1999	0.343	4.86	0.280	8.67	0.235	7.29	2.09	0.32	137.33	0.82	-0.622	1.49	16.59
	Jun-1999	0.318	4.89	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	5.08	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	6.33	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	8.81	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	9.31	0.556	17.23	0.531	16.47	13.86	2.11	---	---	-0.012	---	---
4	Apr-1999	0.368	4.59	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	4.69	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	5.40	0.315	9.76	0.340	10.54	12.54	1.91	104.86	0.63	0.000	0.50	4.31
	Jul-1999	0.381	5.32	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	6.16	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	8.56	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	9.74	0.575	17.83	0.577	17.90	13.86	2.11	---	---	-0.015	---	---
5	Apr-1999	0.652	9.92	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	8.80	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	9.18	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	10.34	0.586	18.17	0.566	17.56	3.18	0.48	136.10	0.82	0.018	0.26	1.38
	Aug-1999	0.630	10.47	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	14.08	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	19.41	1.106	34.29	1.012	31.38	13.86	2.11	---	---	0.012	---	---
6	Apr-1999	0.541	3.07	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	3.20	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	7.37	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	8.42	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	9.06	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	10.52	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	6.01	0.408	12.63	0.454	14.07	13.86	2.11	---	---	0.000	---	---

Exhibit 4-2

Water Balances for the Porta-PSTA Mesocosm Cells

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	5.19	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	4.91	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	5.05	0.288	8.93	0.416	12.91	12.54	1.91	104.86	0.63	0.000	-2.70	-24.90
	Jul-1999	0.391	5.91	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	5.88	0.338	10.48	0.302	9.37	9.36	1.43	120.04	0.72	0.000	1.82	15.25
	Sep-1999	0.401	7.93	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	9.94	0.575	17.82	0.408	12.65	13.86	2.11	---	---	0.000	---	---
8	Apr-1999	0.702	5.89	0.339	10.51	0.346	10.71	0.71	0.11	128.92	0.77	0.000	-0.87	-8.17
	May-1999	0.627	4.58	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	7.76	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	5.67	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	6.38	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	9.67	0.436	13.50	0.196	6.06	6.69	1.02	105.39	0.63	0.055	7.77	53.52
	Oct-1999	0.708	10.11	0.600	18.59	0.591	18.33	13.86	2.11	---	---	0.018	---	---
9	Apr-1999	0.645	6.25	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	4.78	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	5.37	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	5.16	0.323	10.01	0.226	7.01	3.18	0.48	136.10	0.82	-0.037	2.70	25.76
	Aug-1999	0.662	5.98	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	9.07	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	8.51	0.521	16.16	0.619	19.18	13.86	2.11	---	---	0.018	---	---
10	Apr-1999	0.648	7.28	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	3.91	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	5.19	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	5.09	0.325	10.07	0.220	6.81	3.18	0.48	136.10	0.82	-0.018	2.95	27.92
	Aug-1999	0.641	6.38	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	8.16	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	10.30	0.600	18.59	0.569	17.65	13.86	2.11	---	---	-0.009	---	---
11	Apr-1999	0.332	4.87	0.904	28.02	0.706	21.87	0.71	0.32	128.92	2.32	0.219	3.93	13.87
	May-1999	0.395	5.40	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	5.80	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	5.39	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	5.51	0.961	29.78	1.034	32.06	9.36	4.28	120.04	2.16	0.000	-0.15	-0.45
	Sep-1999	0.342	6.88	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	8.80	1.532	47.49	1.526	47.32	13.86	6.34	---	---	0.055	---	---
12	Apr-1999	0.362	5.40	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	5.54	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	5.68	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	5.58	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	5.78	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	6.99	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	9.14	1.582	49.04	1.482	45.95	13.86	6.34	---	---	0.000	---	---

Exhibit 4-3

Monthly Average Values of Selected Field Parameters Collected at the *Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April to July 1999*

		Treatment											
		1 (Peat)		2 (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)	
Parameter	**Month**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
Water Temp (deg C)	Apr-99	25.58	26.12	25.58	24.69	25.58	26.76	25.58	24.99	25.58	27.22	25.58	25.59
	May-99	26.67	26.44	26.67	26.43	26.67	26.11	26.67	26.27	26.67	27.39	26.67	25.33
	Jun-99	27.40	27.77	27.40	27.28	27.40	27.43	27.40	27.57	27.40	28.05	27.40	27.48
	Jul-99	29.28	30.20	29.28	29.41	29.28	30.63	29.28	29.91	29.28	31.05	29.28	29.76
	Aug-99	29.02	29.77	29.02	30.76	29.02	29.65	29.02	29.75	29.02	30.07	29.02	29.15
	Sep-99	29.18	27.56	29.18	27.73	29.18	27.22	29.18	27.75	29.18	29.43	29.18	27.77
	Oct-99	26.12	27.20	26.12	27.04	26.12	27.46	26.12	25.71	26.12	26.45	26.12	26.23
pH (units)	Apr-99	7.50	8.23	7.50	8.49	7.50	8.16	7.50	8.60	7.50	8.27	7.50	8.57
	May-99	7.51	8.46	7.51	8.82	7.51	8.24	7.51	8.76	7.51	8.22	7.51	8.55
	Jun-99	7.42	8.36	7.42	8.29	7.42	8.23	7.42	8.60	7.42	8.24	7.42	8.41
	Jul-99	7.49	8.22	7.49	8.57	7.49	7.89	7.49	8.44	7.49	8.25	7.49	8.39
	Aug-99	7.44	8.10	7.44	8.45	7.44	7.71	7.44	8.43	7.44	8.23	7.44	8.22
	Sep-99	7.32	8.02	7.32	8.38	7.32	7.51	7.32	8.03	7.32	8.18	7.32	7.82
	Oct-99	7.53	7.87	7.53	8.04	7.53	7.53	7.53	7.87	7.53	7.82	7.53	7.99
Conductivity (µmhos/cm)	Apr-99	973	1250	973	1282	973	1070	973	1192	973	1176	973	1301
	May-99	929	997	929	973	929	927	929	806	929	967	929	935
	Jun-99	823	762	823	855	823	668	823	740	823	772	823	719
	Jul-99	1042	866	1042	839	1042	926	1042	900	1042	936	1042	846
	Aug-99	1244	1120	1244	1099	1244	1223	1244	1016	1244	1177	1244	1156
	Sep-99	1228	1157	1228	1074	1228	1393	1228	1172	1228	1097	1228	1149
	Oct-99	1271	1261	1271	1122	1271	1379	1271	1149	1271	1192	1271	1133
Salinity (ppt)	Apr-99	0.51	0.66	0.51	0.68	0.51	0.55	0.51	0.63	0.51	0.62	0.51	0.69
	May-99	0.49	0.52	0.49		0.49	0.49	0.49		0.49	0.51	0.49	0.48
	Jun-99	0.43	0.39	0.43	0.45	0.43	0.33	0.43	0.38	0.43	0.40	0.43	0.37
	Jul-99	0.55		0.55	0.44	0.55		0.55	0.47	0.55	0.49	0.55	0.44
	Aug-99	0.66		0.66	0.58	0.66	0.66	0.66	0.52	0.66	0.62	0.66	0.61
	Sep-99	0.65	0.61	0.65	0.56	0.65	0.74	0.65	0.62	0.65	0.58	0.65	0.59
	Oct-99		0.67				0.77						
Total Dissolved Solids (g/L)	Apr-99	0.62	0.80	0.62	0.82	0.62	0.67	0.62	0.77	0.62	0.76	0.62	0.84
	May-99	0.59	0.64	0.59		0.59	0.60	0.59		0.59	0.63	0.59	0.59
	Jun-99	0.53	0.49	0.53	0.55	0.53	0.42	0.53	0.47	0.53	0.49	0.53	0.46
	Jul-99	0.67	0.55	0.67	0.54	0.67	0.59	0.67	0.58	0.67	0.60	0.67	0.54
	Aug-99	0.80	0.72	0.80	0.70	0.80	0.78	0.80	0.65	0.80	0.75	0.80	0.74
	Sep-99	0.79	0.74	0.79	0.69	0.79	0.89	0.79	0.75	0.79	0.70	0.79	0.74
	Oct-99	0.81	0.81	0.81	0.72	0.81	0.88	0.81	0.74	0.81	0.76	0.81	0.73
Dissolved Oxygen Saturation (%)	Apr-99	57.9	89.5	57.9	123.9	57.9	89.6	57.9	123.6	57.9	105.4	57.9	119.6
	May-99	81.8	102.5	81.8	119.2	81.8	92.0	81.8	118.2	81.8	118.4	81.8	111.4
	Jun-99	64.0	93.4	64.0	113.7	64.0	92.2	64.0	115.1	64.0	100.1	64.0	113.1
	Jul-99	42.0	97.7	42.0	114.3	42.0	94.6	42.0	113.5	42.0	111.2	42.0	105.1
	Aug-99	37.1	97.2	37.1	117.8	37.1	80.4	37.1	121.1	37.1	106.6	37.1	102.9
	Sep-99	40.4	87.8	40.4	107.2	40.4	79.3	40.4	105.9	40.4	116.1	40.4	77.4
	Oct-99	49.4	91.7	49.4	117.6	49.4	75.4	49.4	93.7	49.4	89.9	49.4	97.3
Dissolved Oxygen (mg/L)	Apr-99	4.72	7.06	4.72	10.40	4.72	7.32	4.72	10.05	4.72	8.39	4.72	9.87
	May-99	6.51	8.23	6.51	9.88	6.51	7.47	6.51	9.69	6.51	9.29	6.51	8.87
	Jun-99	5.05	7.18	5.05	8.96	5.05	7.19	5.05	9.05	5.05	7.84	5.05	8.91
	Jul-99	3.18	7.25	3.18	8.46	3.18	6.96	3.18	8.60	3.18	8.24	3.18	8.01
	Aug-99	2.82	7.26	2.82	8.74	2.82	6.06	2.82	9.12	2.82	8.05	2.82	7.84
	Sep-99	3.07	6.96	3.07	8.29	3.07	5.94	3.07	8.23	3.07	8.90	3.07	6.13
	Oct-99	4.00	7.23	4.00	9.71	4.00	5.92	4.00	8.00	4.00	7.56	4.00	8.07

Exhibit 4-3

Monthly Average Values of Selected Field Parameters Collected at the *Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments, April to July 1999*

		Treatment								Treatment			
		7 (Sand)		8 (Sand)		9 (Peat)		10 (Shellrock)		11 (Shellrock)		12 (Peat)	
Parameter	**Month**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
Water Temp (deg C)	Apr-99	25.58	26.21	25.58	26.50	25.58	26.39	25.58	26.29	25.58	27.52	25.58	28.08
	May-99	26.67	26.86	26.67	27.09	26.67	27.48	26.67	27.52	26.67	27.28	26.67	28.71
	Jun-99	27.40	27.22	27.40	28.34	27.40	26.89	27.40	24.60	27.40	26.17	27.40	26.01
	Jul-99	29.28	31.12	29.28	30.70	29.28	29.98	29.28	30.31	29.28	32.86	29.28	32.45
	Aug-99	29.02	29.08	29.02	28.97	29.02	28.66	29.02	28.03	29.02	28.27	29.02	30.42
	Sep-99	29.18	26.70	29.18		29.18		29.18	26.73	29.18		29.18	
	Oct-99	26.12	27.18	26.12	25.25	26.12	26.75	26.12	24.04	26.12	23.28	26.12	21.85
pH (units)	Apr-99	7.50	8.18	7.50	8.13	7.50	8.13	7.50	8.27	7.50	8.17	7.50	8.04
	May-99	7.51	8.69	7.51	8.66	7.51	8.16	7.51	8.45	7.51	8.70	7.51	8.12
	Jun-99	7.42	9.09	7.42	8.83	7.42	8.09	7.42	8.34	7.42	8.47	7.42	8.13
	Jul-99	7.49	8.72	7.49	8.68	7.49	8.11	7.49	8.17	7.49	8.48	7.49	7.85
	Aug-99	7.44	8.28	7.44	8.35	7.44	8.00	7.44	8.09	7.44	8.21	7.44	7.57
	Sep-99	7.32	7.97	7.32		7.32		7.32	7.88	7.32		7.32	
	Oct-99	7.53	8.00	7.53	8.06	7.53	7.85	7.53	7.90	7.53	7.84	7.53	7.62
Conductivity (µmhos/cm)	Apr-99	973	1345	973	1151	973	1442	973	1460	973	1154	973	1130
	May-99	929	868	929	901	929	997	929	1025	929	827	929	1152
	Jun-99	823	684	823	826	823	936	823	830	823	1027	823	1180
	Jul-99	1042	846	1042	819	1042	888	1042	871	1042	888	1042	962
	Aug-99	1244	1074	1244	1133	1244	1153	1244	1113	1244	1082	1244	1162
	Sep-99	1228	1154	1228		1228		1228	1217	1228		1228	
	Oct-99	1271	1210	1271	1192	1271	1059	1271	1017	1271	1057	1271	1210
Salinity (ppt)	Apr-99	0.51		0.51		0.51		0.51		0.51		0.51	
	May-99	0.49	0.45	0.49	0.47	0.49	0.52	0.49	0.53	0.49	0.43	0.49	0.61
	Jun-99	0.43	0.35	0.43	0.43	0.43	0.49	0.43		0.43	0.54	0.43	0.64
	Jul-99	0.55		0.55		0.55		0.55		0.55		0.55	
	Aug-99	0.66		0.66	0.60	0.66	0.61	0.66		0.66		0.66	
	Sep-99	0.65		0.65		0.65		0.65		0.65		0.65	
	Oct-99		0.64		0.63		0.55		0.52		0.54		0.60
Total Dissolved Solids (g/L)	Apr-99	0.62		0.62		0.62		0.62		0.62		0.62	
	May-99	0.59	0.55	0.59	0.57	0.59	0.63	0.59	0.65	0.59	0.53	0.59	0.75
	Jun-99	0.53	0.44	0.53	0.53	0.53	0.60	0.53	0.53	0.53	0.66	0.53	0.75
	Jul-99	0.67	0.54	0.67	0.52	0.67	0.57	0.67	0.56	0.67	0.57	0.67	0.62
	Aug-99	0.80	0.69	0.80	0.73	0.80	0.74	0.80	0.71	0.80	0.69	0.80	0.74
	Sep-99	0.79	0.74	0.79		0.79		0.79	0.78	0.79		0.79	
	Oct-99	0.81	0.77	0.81	0.76	0.81	0.68	0.81	0.65	0.81	0.68	0.81	0.77
Dissolved Oxygen Saturation (%)	Apr-99	57.9		57.9		57.9		57.9		57.9		57.9	
	May-99	81.8	116.3	81.8	118.7	81.8	79.1	81.8	98.2	81.8	122.3	81.8	87.8
	Jun-99	64.0	130.4	64.0	120.2	64.0	78.6	64.0	97.1	64.0	116.7	64.0	86.7
	Jul-99	42.0	133.4	42.0	129.4	42.0	77.3	42.0	88.2	42.0	124.7	42.0	86.1
	Aug-99	37.1	121.1	37.1	118.1	37.1	80.1	37.1	86.1	37.1	116.6	37.1	90.7
	Sep-99	40.4	95.6	40.4		40.4		40.4	77.8	40.4		40.4	
	Oct-99	49.4	114.8	49.4	102.1	49.4	83.6	49.4	88.3	49.4	110.7	49.4	73.4
Dissolved Oxygen (mg/L)	Apr-99	4.72	7.40	4.72	7.11	4.72	6.72	4.72	7.71	4.72	7.79	4.72	7.09
	May-99	6.51	9.21	6.51	9.39	6.51	6.23	6.51	7.71	6.51	9.53	6.51	6.64
	Jun-99	5.05	10.30	5.05	9.32	5.05	6.26	5.05	8.68	5.05	9.38	5.05	7.00
	Jul-99	3.18	9.86	3.18	9.61	3.18	5.83	3.18	6.63	3.18	8.94	3.18	6.20
	Aug-99	2.82	9.06	2.82	9.01	2.82	6.16	2.82	6.89	2.82	8.68	2.82	6.74
	Sep-99	3.07	7.64	3.07		3.07		3.07	6.18	3.07		3.07	
	Oct-99	4.00	9.06	4.00	8.34	4.00	6.66	4.00	7.40	4.00	9.54	4.00	6.03

higher values recorded during the summer months (29.8 to 32.8°C). Monthly average outflow water temperatures were typically within 1 to 3 degrees of the inflow temperatures.

4.3.2 pH

Consistent pH measurements were recorded during the study period for the Head Tank with monthly average values ranging from 7.3 to 7.5 SU. Most outflow pH monthly averages were higher than their respective inflow averages. The period-of-record inflow average pH was 7.5 SU while the outflow averages ranged from 7.8 to 8.4 SU. The overall average outflow pH by substrate type was 8.2 for shellrock, 8.0 for peat, and 8.4 for sand.

4.3.3 Conductivity

Conductivity has been variable during the 7-month period of operation. Monthly average conductivity measurements for the Head Tank ranged from 823 to 1,271 µmhos/cm. Conductivity measurements in mesocosm outflows were also variable but generally mirrored the inflow values.

4.3.4 Salinity

Salinity readings followed the same trends as conductivity. Salinity in the inflow water varied between 0.43 and 0.66 ppt on a monthly average basis. Outflow salinity averages generally mirrored the inflow values.

4.3.5 Total Dissolved Solids

Monthly average TDS concentrations in the inflow ranged between 0.53 and 0.81 g/L. Outflow TDS values generally mirrored the inflow values.

4.3.6 Dissolved Oxygen

DO percent saturation and concentrations in the Head Tank varied in response to temperature and biological activity in the ENR. Monthly average values in the inflow were between 37 and 82 percent saturation and 2.8 and 6.5 mg/L. Monthly average outflow DO was altered by travel through the mesocosms. The range of outflow monthly averages was between 73 and 133 percent saturation and 5.8 and 10.4 mg/L. Long-term average values were elevated in the shellrock treatments (8.7 mg/L) compared to the peat treatments (6.8 mg/L). Long-term average DO in the sand treatments was even higher (9.3 mg/L).

4.4 Water Quality Data

Water quality samples were collected from the Head Tank and at different locations within each mesocosm at varying frequencies in accordance with the PSTA Research Plan. Water quality monitoring at the Porta-PSTAs parallels monitoring conducted at the South ENR Test Cells as described in Section 3.5.

Monthly average values for water quality data collected from April through October 1999 at the Head Tank and the Porta-PSTAs are presented in Exhibit 4-4, and are summarized below. Appendix A provides monthly trend graphics for key parameters measured at the Porta-PSTAs.

Exhibit 4-4
Monthly Average Values of Water Quality Data Collected at the
Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments,
February 1999 to July 1999

Parameter		Treatment						Treatment						Treatment						Treatment					
		1 (Peat)		2 (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)		7 (Sand)		8 (Sand)		9 (Peat)		10 (Shellrock)		11 (Shellrock)		12 (Peat)	
	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 Phosphorus as P (mg/L)	Apr-99	0.038	0.038	0.045	0.041	0.038	0.029	0.039	0.038	0.039	0.033	0.038	0.037	0.040	0.062	0.037	0.047	0.041	0.028	0.036	0.027	0.040	0.063	0.037	0.037
	May-99	0.018	0.016	0.019	0.022	0.018	0.018	0.019	0.022	0.019	0.021	0.019	0.029	0.019	0.016	0.019	0.022	0.019	0.016	0.019	0.015	0.020	0.035	0.019	0.023
	Jun-99	0.029	0.015	0.035	0.021	0.028	0.015	0.028	0.019	0.030	0.014	0.029	0.015	0.029	0.027	0.029	0.019	0.029	0.012	0.029	0.020	0.027	0.018	0.027	0.018
	Jul-99	0.013	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	0.014	0.013	0.016	0.013	0.018
	Aug-99	0.020	0.022	0.020	0.016	0.019	0.020	0.019	0.017	0.019	0.020	0.019	0.016	0.025	0.016	0.019	0.022	0.019	0.017	0.020	0.022	0.019	0.020	0.019	0.030
	Sep-99	0.017	0.017	0.019	0.015	0.017	0.018	0.018	0.018	0.018	0.015	0.018	0.016	0.018	0.016	0.017	0.018	0.017	0.015	0.018	0.014	0.017	0.015	0.017	0.019
	Oct-99	0.020	0.016	0.021	0.014	0.020	0.016	0.021	0.014	0.021	0.016	0.021	0.016	0.020	0.013	0.020	0.016	0.020	0.017	0.020	0.014	0.020	0.015	0.020	0.017
Total Particulate Phosphorus (mg/L)	Apr-99	0.018	0.023	0.025	0.026	0.018	0.014	0.019	0.025	0.019	0.017	0.018	0.025	0.020	0.044	0.017	0.031	0.021	0.012	0.017	0.013	0.020	0.045	0.017	0.022
	May-99	0.003	0.004	0.005	0.012	0.005	0.008	0.004	0.012	0.005	0.011	0.005	0.018	0.006	0.004	0.006	0.010	0.006	0.004	0.007	0.004	0.006	0.024	0.006	0.011
	Jun-99	0.018	0.006	0.024	0.010	0.016	0.006	0.017	0.011	0.018	0.005	0.018	0.007	0.019	0.019	0.018	0.011	0.019	0.003	0.018	0.011	0.016	0.008	0.016	0.009
	Jul-99	0.004	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	0.007	0.004	-0.003	0.004	0.009
	Aug-99	0.006	0.013	0.006	0.006	0.006	0.010	0.006	0.008	0.006	0.011	0.006	0.007	0.012	0.005	0.006	0.013	0.006	0.005	0.007	0.012	0.006	0.010	0.006	0.020
	Sep-99	0.003	0.008	0.004	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	0.006	0.002	0.006	0.002	0.009
	Oct-99	0.008	0.007	0.008	0.006	0.008	0.008	0.009	0.006	0.008	0.007	0.009	0.008	0.008	0.005	0.008	0.007	0.008	0.008	0.008	0.006	0.007	0.008	0.007	0.009
Total Dissolved Phosphorus (mg/L)	Apr-99	0.020	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	0.015	0.020	0.018	0.020	0.015
	May-99	0.015	0.011	0.014	0.010	0.014	0.010	0.014	0.010	0.013	0.010	0.014	0.011	0.013	0.012	0.013	0.012	0.013	0.012	0.013	0.011	0.014	0.011	0.013	0.012
	Jun-99	0.011	0.009	0.011	0.011	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	0.009	0.012	0.010	0.011	0.009
	Jul-99	0.009	0.007	0.008	0.007	0.009	0.007	0.008	0.007	0.008	0.007	0.008	0.007	0.009	0.007	0.008	0.007	0.008	0.007	0.008	0.007	0.009	0.019	0.008	0.009
	Aug-99	0.014	0.010	0.013	0.010	0.013	0.010	0.013	0.009	0.013	0.009	0.013	0.010	0.013	0.011	0.013	0.009	0.013	0.011	0.013	0.009	0.013	0.009	0.013	0.010
	Sep-99	0.014	0.009	0.015	0.010	0.015	0.011	0.014	0.009	0.015	0.009	0.014	0.009	0.014	0.010	0.015	0.009	0.015	0.009	0.014	0.008	0.015	0.009	0.015	0.010
	Oct-99	0.012	0.009	0.013	0.009	0.012	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	0.008	0.013	0.007	0.013	0.009
Soluble Reactive Phosphorus (mg/L)	Apr-99	0.005	0.004	0.005	0.005	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	0.005	0.006	0.003	0.005	0.003
	May-99	0.003	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	0.004	0.003	0.003	0.003	0.002
	Jun-99	0.003	0.002	0.003	0.005	0.003	0.002	0.003	0.002	0.003	0.002	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	0.002
	Jul-99	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	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003
	Aug-99	0.006	0.002	0.005	0.002	0.005	0.002	0.005	0.001	0.005	0.002	0.004	0.003	0.005	0.001	0.005	0.002	0.005	0.003	0.005	0.001	0.005	0.002	0.005	0.002
	Sep-99	0.007	0.004	0.007	0.002	0.006	0.004	0.008	0.001	0.009	0.002	0.007	0.002	0.009	0.001	0.008	0.003	0.007	0.003	0.008	0.001	0.009	0.002	0.009	0.003
	Oct-99	0.005	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	0.002	0.005	0.001	0.004	0.001
Dissolved Organic Phosphorus (mg/L)	Apr-99	0.015	0.011	0.015	0.009	0.015	0.013	0.015	0.010	0.015	0.013	0.015	0.010	0.015	0.013	0.015	0.013	0.014	0.012	0.014	0.010	0.014	0.014	0.014	0.012
	May-99	0.012	0.009	0.011	0.007	0.010	0.008	0.011	0.007	0.010	0.008	0.011	0.007	0.009	0.009	0.010	0.009	0.010	0.009	0.009	0.007	0.011	0.008	0.009	0.010
	Jun-99	0.008	0.007	0.007	0.007	0.009	0.007	0.008	0.006	0.008	0.007	0.008	0.006	0.007	0.006	0.008	0.006	0.007	0.006	0.008	0.007	0.009	0.008	0.009	0.007
	Jul-99	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.005	0.005	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.016	0.005	0.006
	Aug-99	0.009	0.008	0.008	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.008	0.010	0.008	0.008	0.008	0.009	0.008	0.008	0.008	0.008	0.008	0.008
	Sep-99	0.006	0.005	0.006	0.007	0.007	0.007	0.006	0.008	0.004	0.006	0.006	0.007	0.005	0.010	0.005	0.006	0.006	0.005	0.006	0.007	0.004	0.006	0.005	0.007
	Oct-99	0.009	0.009	0.011	0.007	0.010	0.007	0.009	0.006	0.009	0.008	0.008	0.007	0.008	0.006	0.008	0.009	0.010	0.007	0.010	0.005	0.012	0.009	0.012	0.010
Total Nitrogen as N (mg/L)	Apr-99	1.48	1.04	1.48	0.92	1.48	1.30	1.48	0.99	1.48	0.91	1.48	1.43	1.48	1.73	1.48	1.34	1.48		1.48	1.49	1.48	1.38	1.48	1.59
	May-99	0.83	1.07	0.95	1.09	0.82	1.00	0.88	1.46	0.61	0.91	0.92	1.19	0.92	0.97	0.91	0.92	0.90	0.84	0.82	1.00	0.83	0.90	0.94	1.02
	Jun-99	0.89	0.45	0.89	0.72	0.89	0.46	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	0.82	0.89	0.81	0.89	0.80
	Jul-99	1.09	0.50	1.09	0.65	1.09	0.46	1.09	0.49	1.09	0.60	1.09	0.46	1.09	0.44	1.09	0.63	1.09	0.80	1.09	0.46	1.09	1.00	1.09	0.50
	Aug-99	1.46	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	1.38	1.46	1.39	1.46	1.15
	Sep-99	1.99	1.73	1.56	1.71	2.03	1.77	1.80	1.33	1.84	2.02	1.75	1.25	1.65	1.23	2.42	1.57	1.97	2.00	1.72	1.14	1.94	1.96	1.76	1.56
	Oct-99	0.82	0.90	0.82	0.76	0.82	0.63	0.82	0.66	0.82	0.83	0.82	0.68	0.82	0.32	0.82	0.72	0.82	0.89	0.82	0.67	0.82	0.90	0.82	0.69
Total Kjeldahl Nitrogen, as N (mg/L)	Apr-99	1.41	1.04	1.41	0.92	1.41	1.20	1.41	0.95	1.41	0.91	1.41	1.33	1.41	1.55	1.41	1.34	1.41	1.60	1.41	1.49	1.41	1.38	1.41	1.59
	May-99	0.73	1.07	0.85	1.09	0.72	0.97	0.78	1.46	0.51	0.91	0.81	1.19	0.83	0.97	0.84	0.92	0.83	0.78	0.75	1.00	0.76	0.90	0.87	1.02
	Jun-99	0.83	0.45	0.83	0.55	0.83	0.46	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	0.82	0.83	0.81	0.83	0.80
	Jul-99	0.94	0.50	0.94	0.65	0.94	0.46	0.94	0.49	0.94	0.60	0.94	0.46	0.94	0.44	0.94	0.63	0.94	0.80	0.94	0.46	0.94	1.00	0.94	0.50
	Aug-99	1.36	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	1.38	1.36	1.39	1.36	1.15
	Sep-99	1.97	1.73	1.56	1.71	1.97	1.77	1.78	1.33	1.84	2.02	1.73	1.25	1.65	1.23	2.42	1.57	1.90	2.00	1.72	1.14	1.94	1.96	1.76	1.56
	Oct-99	0.82	0.84	0.82	0.76	0.82	0.63	0.82	0.66	0.82	0.83	0.82	0.68	0.82	0.32	0.82	0.72	0.82	0.89	0.82	0.67	0.82	0.90	0.82	0.69
Nitrate/Nitrite, as N (mg/L)	Apr-99	0.07	0.03	0.07	0.03	0.07	0.04	0.07	0.05	0.07	0.03	0.07	0.11	0.07	0.18	0.07	0.03	0.07		0.07	0.03	0.07	0.03	0.07	0.03
	May-99	0.09	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.11	0.03	0.11	0.03	0.09	0.03	0.07	0.03	0.07	0.06	0.08	0.03	0.07	0.03	0.08	0.03
	Jun-99	0.05	0.03	0.05	0.15	0.05	0.03	0.05	0.12	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03
	Jul-99	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03
	Aug-99	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.05	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03
	Sep-99	0.04	0.03	0.03	0.03	0.06	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.07	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Oct-99	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Ammonia, as NH_3 (mg/L)	Apr-99	0.02	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	May-99	0.02	0.02	0.08	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Jun-99	0.02	0.02	0.02	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.09	0.02	0.02	0.02	0.02
	Jul-99	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Aug-99	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.07	0.02	0.05	0.02	0.02	0.02	0.02
	Sep-99	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.09	0.02	0.02	0.02	0.02	0.02	0.02
	Oct-99	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.03	0.07	0.02	0.07	0.02	0.07	0.10	0.07	0.10	0.07	0.02	0.07	0.02

Exhibit 4-4
Monthly Average Values of Water Quality Data Collected at the
Porta-PSTA Head Tank and Twelve Porta-PSTA Treatments,
February 1999 to July 1999

Parameter		Treatment						Treatment						Treatment						Treatment					
		1 (Peat)		2 (Shellrock)		3 (Peat)		4 (Shellrock)		5 (Shellrock)		6 (Shellrock-Variable Stage)		7 (Sand)		8 (Sand)		9 (Peat)		10 (Shellrock)		11 (Shellrock)		12 (Peat)	
	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
Organic Nitrogen (mg/L)	Apr-99	1.39	1.00	1.39	0.90	1.39	1.18	1.39	0.93	1.39	0.89	1.39	1.28	1.39	1.53	1.39	1.32	1.39	1.58	1.39	1.47	1.39	1.36	1.39	1.57
	May-99	0.71	1.05	0.76	1.07	0.70	0.95	0.76	1.43	0.49	0.89	0.79	1.17	0.81	0.95	0.82	0.90	0.81	0.76	0.73	0.98	0.74	0.88	0.85	1.00
	Jun-99	0.81	0.43	0.81	0.50	0.81	0.44	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	0.73	0.81	0.79	0.81	0.78
	Jul-99	0.92	0.48	0.92	0.63	0.92	0.44	0.92	0.47	0.92	0.58	0.92	0.44	0.92	0.42	0.92	0.61	0.92	0.78	0.92	0.44	0.92	0.98	0.92	0.48
	Aug-99	1.34	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	1.33	1.34	1.37	1.34	1.13
	Sep-99	1.95	1.71	1.54	1.69	1.95	1.75	1.76	1.31	1.82	2.00	1.71	1.23	1.63	1.21	2.40	1.55	1.88	1.91	1.70	1.12	1.92	1.94	1.74	1.54
	Oct-99	0.75	0.82	0.75	0.74	0.75	0.61	0.75	0.64	0.75	0.81	0.75	0.65	0.75	0.30	0.75	0.70	0.75	0.79	0.75	0.57	0.75	0.88	0.75	0.67
TOC (mg/L)	Apr-99	23.00	33.45	23.00	34.05	23.00	32.60	23.00	35.07	23.00	29.67	23.00	37.53	23.00	29.60	23.00	28.60	23.00	30.00	23.00	32.70	23.00	28.80	23.00	29.70
	May-99	22.07	27.00	22.40	30.15	21.63	26.03	22.23	29.73	21.87	24.67	21.77	33.67	21.40	23.90	21.20	24.70	21.20	23.70	21.50	26.90	21.10	23.40	21.20	23.60
	Jun-99	18.40	19.97	18.40	19.90	18.40	20.73	18.40	19.83	18.40	19.73	18.40	19.33	18.40	21.80	18.40	21.90	18.40	18.70	18.40	19.40	18.40	18.80	18.40	18.60
	Jul-99	32.00	28.27	32.00	26.37	32.00	30.60	32.00	32.73	32.00	29.17	32.00	30.77	32.00	35.50	32.00	26.50	32.00	27.40	32.00	29.90	32.00	32.10	32.00	31.50
	Aug-99	33.00	29.27	33.00	32.47	33.00	28.40	33.00	32.47	33.00	34.43	33.00	32.20	33.00	33.80	33.00	32.40	33.00	28.70	33.00	32.00	33.00	34.00	33.00	29.50
	Sep-99	39.40	38.03	39.77	38.37	40.83	38.73	38.40	34.77	40.63	39.93	38.37	36.93	40.40	38.30	41.50	36.60	41.20	38.50	40.95	39.00	41.30	36.40	42.70	37.20
	Oct-99	36.00	32.33	36.00	32.67	36.00	31.33	36.00	27.33	36.00	33.67	36.00	29.67	36.00	26.00	36.00	32.00	36.00	33.00	36.00	30.00	36.00	30.00	36.00	32.00
TSS (mg/L)	Apr-99	2.00	10.00	2.00	8.00	2.00	5.33	2.00	6.67	2.00	4.67	2.00	4.67	2.00	8.00	2.00	2.00	2.00	18.00	2.00	8.00	2.00	20.00	2.00	24.00
	May-99	4.00	5.33	2.00	13.00	2.00	5.33	2.00	5.00	6.00	6.00	2.00	3.33	9.00	2.00	4.00	12.00	2.00	10.00	14.00	32.00	4.00	10.00	6.00	14.00
	Jun-99	2.00	4.00	2.00	10.67	2.00	6.67	2.00	15.00	2.00	14.00	2.00	12.67	2.00	2.00	2.00	2.00	2.00	2.00	2.00	8.00	2.00	6.00	2.00	2.00
	Jul-99	4.00	6.67	4.00	4.67	4.00	6.67	4.00	8.67	4.00	2.67	4.00	6.67	4.00	4.00	4.00	8.00	4.00	6.00	4.00	2.00	4.00	6.00	4.00	4.00
	Aug-99	1.00	2.47	1.00	1.93	1.00	1.33	1.00	2.87	1.00	2.53	1.00	3.07	1.00	1.00	1.00	3.20	1.00	2.40	1.00	2.00	1.00	3.60	1.00	2.40
	Sep-99	1.42	3.67	3.00	2.42	1.92	1.92	2.68	2.50	0.83	1.42	2.83	2.92	2.75	3.50	2.00	3.25	2.00	3.25	3.13	1.25	2.00	3.00	1.25	1.50
	Oct-99	1.40	1.17	1.40	0.73	1.40	0.50	1.40	1.37	1.40	0.73	1.40	1.73	1.40	1.00	1.40	1.20	1.40	1.00	1.40	1.00	1.40	1.20	1.40	1.40
Calcium (mg/L)	Apr-99	38.10	46.05	38.10	36.45	38.10	44.77	38.10	34.10	38.10	41.77	38.10	32.93	38.10	44.00	38.10	43.00	38.10	52.60	38.10	40.40	38.10	42.00	38.10	49.40
	May-99	39.50	36.90	40.40	28.40	38.73	35.47	40.43	27.50	38.27	34.93	39.90	27.67	36.80	30.00	36.70	29.10	36.80	44.30	36.70	36.30	37.60	29.80	37.30	37.30
	Jun-99	47.20	39.27	47.20	30.03	47.20	45.33	47.20	32.17	47.20	37.13	47.20	39.10	47.20	27.50	47.20	34.40	47.20	38.50	47.20	36.50	47.20	30.50	47.20	46.60
	Jul-99	54.00	46.67	54.00	36.00	54.00	55.33	54.00	37.77	54.00	41.33	54.00	42.30	54.00	31.80	54.00	31.00	54.00	52.00	54.00	46.70	54.00	40.00	54.00	58.00
	Aug-99	51.60	47.00	51.60	33.67	51.60	53.47	51.60	35.30	51.60	43.97	51.60	39.77	51.60	36.70	51.60	30.00	51.60	49.20	51.60	45.90	51.60	40.80	51.60	53.40
	Sep-99	87.67	73.00	79.17	56.70	90.33	78.67	83.70	48.10	87.37	57.83	83.88	58.93	79.20	35.10	88.30	55.00	90.00	60.00	79.40	49.10	97.40	52.80	79.50	68.70
	Oct-99	60.00	53.33	60.00	41.67	60.00	54.33	60.00	36.00	60.00	53.00	60.00	41.33	60.00	32.00	60.00	46.00	60.00	53.00	60.00	38.00	60.00	43.00	60.00	53.00
Alkalinity (mg/L)	Apr-99	170.00	199.00	170.00	173.00	170.00	199.33	170.00	156.00	170.00	182.67	170.00	147.33	170.00	209.00	170.00	198.00	170.00	230.00	170.00	206.00	170.00	181.00	170.00	194.00
	May-99	164.33	164.67	166.50	128.50	165.00	141.00	164.00	112.33	167.67	142.00	167.00	113.00	160.00	145.00	163.00	147.00	165.00	189.00	162.00	167.00	161.00	134.00	163.00	167.00
	Jun-99	169.00	153.67	169.00	120.33	169.00	156.67	169.00	120.67	169.00	133.67	169.00	132.33	169.00	119.00	169.00	126.00	169.00	153.00	169.00	132.00	169.00	120.00	169.00	169.00
	Jul-99	220.00	188.67	220.00	153.67	220.00	215.00	220.00	150.00	220.00	180.33	220.00	170.67	220.00	147.00	220.00	148.00	220.00	194.00	220.00	180.00	220.00	163.00	220.00	220.00
	Aug-99	199.00	184.33	199.00	151.33	199.00	198.00	199.00	159.00	199.00	182.67	199.00	177.00	199.00	167.00	199.00	143.00	199.00	189.00	199.00	186.00	199.00	175.00	199.00	202.00
	Sep-99	286.33	244.00	279.33	223.33	286.00	250.33	273.33	191.33	278.67	207.33	280.33	220.00	280.00	168.00	280.00	185.00	286.00	226.00	281.00	202.00	274.00	190.00	288.00	248.00
	Oct-99	224.00	196.67	224.00	160.00	224.00	202.33	224.00	141.67	224.00	194.33	224.00	153.67	224.00	132.00	224.00	182.00	224.00	170.00	224.00	169.00	224.00	160.00	224.00	205.00

4.4.1 Phosphorus

Detailed TP trend charts for all treatments are provided in Appendices A and C.

- TP - Average monthly inflow concentrations ranged from 0.013 to 0.045 mg/L; average monthly outflow concentrations ranged from 0.012 to 0.047 mg/L.
- TPP - Average monthly inflow concentrations ranged from 0.002 to 0.025 mg/L; average monthly outflow concentrations ranged from 0.003 to 0.045 mg/L.
- TDP - Average monthly inflow concentrations ranged from 0.008 to 0.020 mg/L; average monthly outflow concentrations ranged from 0.007 to 0.018 mg/L.
- DRP - Average monthly inflow concentrations ranged from 0.003 to 0.009 mg/L; average monthly outflow concentrations ranged from 0.001 to 0.005 mg/L.
- DOP - Average monthly inflow concentrations ranged from 0.005 to 0.015 mg/L; average monthly outflow concentrations ranged from 0.004 to 0.016 mg/L.

4.4.2 Nitrogen

- TN - Monthly average inflow concentrations ranged from 0.61 to 2.42 mg/L; monthly average outflow TN concentrations ranged from 0.32 to 2.02 mg/L.
- TKN - Monthly average inflow concentrations ranged from 0.51 to 2.42 mg/L; monthly average outflow concentration ranged from 0.32 to 2.00 mg/L.
- NO_2+NO_3-N - Monthly average inflow concentrations ranged from 0.03 to 0.11 mg/L; monthly average outflow concentration ranged from 0.03 to 0.18 mg/L.
- NH_4-N - Monthly average inflow concentrations ranged from 0.02 to 0.08 mg/L; monthly average outflow concentrations ranged from 0.02 to 0.10 mg/L.
- Org-N - Monthly average inflow concentrations ranged from 0.49 to 1.95 mg/L; monthly average outflow concentrations ranged from 0.30 to 2.00 mg/L.

4.4.3 Other Parameters

- TOC - Monthly average inflow concentrations ranged from 18.4 to 42.7 mg/L; monthly average outflow concentrations ranged from 18.6 to 39.9 mg/L.
- Total Suspended Solids - Monthly average inflow concentrations ranged from 0.83 to 14 mg/L; monthly average TSS outflow concentrations ranged from 0.5 to 32 mg/L.
- Calcium - Monthly average calcium inflow concentrations ranged from 37 to 97 mg/L; monthly average calcium outflow concentrations ranged from 28 to 79 mg/L.
- Alkalinity - Monthly average alkalinity inflow concentrations ranged from 161 to 286 mg/L as $CaCO_3$; monthly average alkalinity outflow concentrations ranged from 112 to 250 mg/L as $CaCO_3$.

4.5 Mass Balances

As a preliminary assessment of Porta-PSTA performance, inflow and outflow mass balances were estimated for each experimental mesocosm using the inflow and outflow concentration and HLR data presented in Section 4.2. Mean treatment inflow and outflow loads were used to calculate mean treatment removal rates for TP and TN. First-order TP rate constants were calculated from the monthly data assuming C* equals 0.0 mg/L. Contributions of rainfall to phosphorus and nitrogen loads to the Porta-PSTAs were not included in these mass loading estimates. Preliminary estimates indicate that rainfall load may make up between 1 to 10 percent of the total load. Final mass balance analyses for this project will include estimates of rainfall loads of TP and TN derived from available data.

4.5.1 Phosphorus

Exhibit 4-5 provides monthly, quarterly, and period-of-record (7 months) TP mass balances by Porta-PSTA treatment.

Period-of-record average TP mass loadings to the Porta-PSTAs have ranged from 0.46 to 0.87 $g/m^2/y$. Monthly average loadings ranged from 0.24 to 1.40 $g/m^2/y$. Long-term average TP removal efficiencies have ranged between -18 to 30 percent. Monthly average TP removal efficiencies have ranged between -160 to 57 percent. The highest average TP mass removal efficiency was measured in Treatment 9 (peat Aquashade control). Other treatments that have averaged more than 20 percent TP reduction efficiency include Treatment 2 (deep shellrock), Treatment 3 (shallow peat), Treatment 6 (variable water regime shellrock), and Treatment 10 (shellrock Aquashade control).

Period-of-record average TP k values in the Porta-PSTAs have ranged from -2.4 to 5.3 m/y. Monthly average k values ranged from -10.7 to 25.4 m/y. The highest average TP k value was measured in Treatment 9 (peat Aquashade control). Other treatments that have long-term average k values more than 3 m/y include Treatment 2 (deep shellrock), Treatment 3 (shallow peat), Treatment 5 (deep, high HLR shellrock), and Treatment 10 (shellrock Aquashade control).

The observation that the Aquashade controls have some of the highest TP removal rates is an indication that high rates of algal production in non-Aquashade Porta-PSTAs and subsequent export of algal solids with associated TP may be a factor limiting the lower attainable outflow TP concentration from these mesocosms.

Detailed figures illustrating components of the TP mass balance are provided in Appendix D.

4.5.2 Nitrogen

Exhibit 4-6 presents a TN mass balance summary in the Porta-PSTAs by month, quarter, and period-of-record for the 7-month operational period. For the period-of-record, mean TN mass loads have averaged between 26.8 and 50.7 $g/m^2/y$. Monthly average TN mass loadings were between 7.4 and 94.7 $g/m^2/y$. Average period-of-record TN mass removal efficiencies were between -0.2 and 29 percent. Monthly average TN mass removal efficiencies were between -69 and 61 percent. Estimated period-of-record TN k values ranged from 0.4 to 6.1 m/y. Monthly average TN k values were between -13.1 and 30.1 m/y.

Exhibit 4-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Mesocosms

		TP (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	**Date**	**Inflow**	**Outflow**	**(m^3/d)**	**(m^3/d)**	**(m^3/d)**	**(cm/d)**	**Inflow**	**Outflow**	**($g/m^2/y$)**	**(%)**	**(m/y)**
Period of Record												
1	1999	0.021	0.020	0.38	0.33	0.35	6.25	0.458	0.380	0.077	16.92	1.71
2	1999	0.023	0.019	0.36	0.33	0.34	6.05	0.494	0.371	0.124	25.02	4.08
3	1999	0.022	0.018	0.35	0.32	0.33	5.85	0.438	0.347	0.091	20.77	3.14
4	1999	0.022	0.020	0.37	0.38	0.37	6.12	0.463	0.423	0.041	8.77	2.02
5	1999	0.022	0.020	0.67	0.63	0.65	11.24	0.870	0.758	0.112	12.90	4.02
6	1999	0.022	0.020	0.41	0.37	0.38	6.76	0.500	0.390	0.110	21.97	1.82
7	1999	0.023	0.022	0.37	0.34	0.36	6.21	0.499	0.454	0.045	8.99	1.23
8	1999	0.021	0.022	0.40	0.43	0.41	6.69	0.504	0.597	-0.093	-18.51	-0.95
9	1999	0.022	0.017	0.36	0.32	0.34	6.05	0.474	0.333	0.140	29.61	5.29
10	1999	0.022	0.018	0.38	0.31	0.35	6.36	0.505	0.398	0.107	21.25	3.93
11	1999	0.022	0.024	1.06	1.09	1.07	5.91	0.458	0.537	-0.079	-17.27	-2.43
12	1999	0.021	0.023	1.10	1.15	1.12	6.11	0.457	0.522	-0.065	-14.30	-1.97
Quarterly												
1	Qtr-3	0.038	0.038	0.28	0.31	0.28	4.58	0.632	0.668	-0.036	-5.64	0.19
1	Qtr-4	0.019	0.016	0.30	0.24	0.27	5.04	0.346	0.244	0.102	29.35	3.06
1	Qtr-5	0.020	0.019	0.48	0.43	0.46	8.03	0.541	0.460	0.081	15.01	0.69
2	Qtr-3	0.045	0.041	0.26	0.32	0.28	4.41	0.717	0.712	0.005	0.69	1.84
2	Qtr-4	0.022	0.018	0.31	0.27	0.29	5.14	0.414	0.298	0.116	28.01	3.23
2	Qtr-5	0.020	0.015	0.45	0.39	0.42	7.52	0.514	0.346	0.169	32.84	7.07
3	Qtr-3	0.038	0.029	0.25	0.35	0.27	4.11	0.563	0.547	0.016	2.83	4.29
3	Qtr-4	0.020	0.016	0.30	0.28	0.29	4.94	0.357	0.272	0.085	23.84	3.94
3	Qtr-5	0.019	0.018	0.46	0.36	0.41	7.60	0.503	0.368	0.135	26.87	1.40
4	Qtr-3	0.039	0.038	0.28	0.36	0.30	4.59	0.653	0.704	-0.051	-7.82	0.52
4	Qtr-4	0.019	0.018	0.31	0.31	0.31	5.12	0.361	0.351	0.010	2.72	0.98
4	Qtr-5	0.019	0.016	0.46	0.45	0.46	7.72	0.523	0.412	0.111	21.16	4.83
5	Qtr-3	0.039	0.033	0.60	0.68	0.63	9.92	1.403	1.317	0.086	6.13	6.60
5	Qtr-4	0.020	0.018	0.57	0.56	0.57	9.46	0.672	0.607	0.065	9.72	3.02
5	Qtr-5	0.019	0.018	0.83	0.70	0.77	13.85	0.935	0.734	0.202	21.57	4.36
6	Qtr-3	0.038	0.037	0.18	0.24	0.20	3.07	0.431	0.474	-0.043	-9.92	0.32
6	Qtr-4	0.020	0.020	0.37	0.35	0.36	6.23	0.443	0.354	0.090	20.19	-0.31
6	Qtr-5	0.020	0.016	0.51	0.42	0.46	8.44	0.582	0.401	0.181	31.17	5.63
7	Qtr-3	0.040	0.062	0.31	0.26	0.30	5.19	0.756	1.138	-0.382	-50.50	-7.87
7	Qtr-4	0.020	0.017	0.32	0.37	0.34	5.31	0.373	0.411	-0.038	-10.26	2.77
7	Qtr-5	0.022	0.015	0.45	0.32	0.39	7.51	0.562	0.289	0.273	48.61	8.84
8	Qtr-3	0.037	0.047	0.35	1.58	0.76	5.89	0.784	2.042	-1.257	-160.30	-10.72
8	Qtr-4	0.020	0.019	0.35	0.23	0.29	5.84	0.409	0.281	0.128	31.35	0.95
8	Qtr-5	0.019	0.019	0.48	0.42	0.45	7.99	0.527	0.468	0.059	11.21	0.13
9	Qtr-3	0.041	0.028	0.37	0.35	0.38	6.25	0.930	0.675	0.255	27.42	8.33
9	Qtr-4	0.019	0.014	0.30	0.22	0.26	5.08	0.352	0.184	0.167	47.52	5.07
9	Qtr-5	0.019	0.016	0.43	0.43	0.43	7.16	0.471	0.385	0.086	18.22	4.02
10	Qtr-3	0.036	0.027	0.44	0.28	0.44	7.28	1.034	0.818	0.216	20.85	7.68
10	Qtr-4	0.020	0.016	0.28	0.18	0.23	4.69	0.330	0.214	0.116	35.18	2.68
10	Qtr-5	0.020	0.017	0.47	0.44	0.46	7.91	0.539	0.455	0.084	15.50	3.95
11	Qtr-3	0.040	0.063	0.88	0.89	0.88	4.87	0.716	1.135	-0.419	-58.60	-7.84
11	Qtr-4	0.020	0.022	1.00	0.97	0.99	5.53	0.404	0.470	-0.066	-16.29	-1.64
11	Qtr-5	0.019	0.017	1.22	1.29	1.26	6.76	0.442	0.418	0.024	5.48	2.97
12	Qtr-3	0.037	0.037	0.97	0.92	0.97	5.40	0.712	0.739	-0.026	-3.67	-0.18
12	Qtr-4	0.019	0.019	1.01	1.09	1.05	5.60	0.387	0.423	-0.035	-9.11	-0.02
12	Qtr-5	0.019	0.023	1.27	1.28	1.27	7.03	0.464	0.571	-0.107	-23.15	-5.01
Monthly												
1	Apr-99	0.038	0.038	0.28	0.31	0.28	4.58	0.632	0.668	-0.036	-5.64	0.19
1	May-99	0.018	0.016	0.27	0.20	0.22	4.47	0.271	0.220	0.051	18.70	1.78
1	Jun-99	0.029	0.015	0.32	0.29	0.30	5.28	0.557	0.269	0.288	51.76	11.98
1	Jul-99	0.013	0.017	0.32	0.24	0.28	5.29	0.250	0.244	0.006	2.39	-4.34
1	Aug-99	0.020	0.022	0.38	0.30	0.34	6.41	0.466	0.400	0.066	14.19	-2.36
1	Sep-99	0.017	0.017	0.54	0.55	0.55	9.06	0.496	0.472	0.024	4.92	-0.32
1	Oct-99	0.020	0.016	0.62	0.61	0.62	10.38	0.681	0.568	0.113	16.65	9.89
2	Apr-99	0.045	0.041	0.26	0.32	0.28	4.41	0.717	0.712	0.005	0.69	1.84
2	May-99	0.019	0.022	0.28	0.23	0.25	4.63	0.320	0.298	0.022	6.91	-2.76
2	Jun-99	0.035	0.021	0.33	0.39	0.36	5.47	0.712	0.489	0.223	31.37	11.20
2	Jul-99	0.013	0.013	0.31	0.21	0.26	5.23	0.253	0.155	0.098	38.70	0.67
2	Aug-99	0.020	0.016	0.38	0.26	0.32	6.34	0.446	0.240	0.206	46.11	4.14
2	Sep-99	0.019	0.015	0.51	0.46	0.49	8.51	0.590	0.267	0.323	54.70	7.50
2	Oct-99	0.021	0.014	0.55	0.57	0.56	9.16	0.603	0.529	0.074	12.25	12.82
3	Apr-99	0.038	0.029	0.25	0.35	0.27	4.11	0.563	0.547	0.016	2.83	4.29
3	May-99	0.018	0.018	0.29	0.28	0.28	4.86	0.330	0.334	-0.003	-1.05	0.44
3	Jun-99	0.028	0.015	0.29	0.30	0.29	4.89	0.517	0.253	0.264	50.99	11.56
3	Jul-99	0.013	0.014	0.30	0.26	0.28	5.08	0.236	0.227	0.009	3.94	-1.57
3	Aug-99	0.019	0.020	0.38	0.23	0.30	6.33	0.443	0.225	0.218	49.28	-0.31
3	Sep-99	0.017	0.018	0.53	0.33	0.43	8.81	0.484	0.378	0.106	21.85	-1.74

Exhibit 4-5

Period-of-Record, Quarterly, and Monthly Summaries of Total Phosphorus Mass Balance Data from the Porta-PSTA Mesocosms

		TP (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TP ($g/m^2/y$)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(m^3/d)	(m^3/d)	(m^3/d)	(cm/d)	Inflow	Outflow	($g/m^2/y$)	(%)	(m/y)
3	Oct-99	0.020	0.016	0.56	0.59	0.57	9.31	0.609	0.602	0.006	1.01	7.55
4	Apr-99	0.039	0.038	0.28	0.36	0.30	4.59	0.653	0.704	-0.051	-7.82	0.52
4	May-99	0.019	0.022	0.28	0.37	0.32	4.69	0.319	0.492	-0.174	-54.46	-3.08
4	Jun-99	0.028	0.019	0.32	0.32	0.32	5.40	0.537	0.333	0.204	37.93	7.32
4	Jul-99	0.013	0.015	0.32	0.24	0.28	5.32	0.256	0.220	0.036	14.07	-2.00
4	Aug-99	0.019	0.017	0.37	0.32	0.35	6.16	0.424	0.323	0.101	23.91	2.09
4	Sep-99	0.018	0.018	0.51	0.50	0.50	8.56	0.568	0.483	0.085	15.04	0.94
4	Oct-99	0.021	0.014	0.58	0.63	0.61	9.74	0.658	0.528	0.130	19.77	14.92
5	Apr-99	0.039	0.033	0.60	0.68	0.63	9.92	1.403	1.317	0.086	6.13	6.60
5	May-99	0.019	0.021	0.53	0.54	0.54	8.80	0.609	0.735	-0.126	-20.69	-4.10
5	Jun-99	0.030	0.014	0.55	0.58	0.56	9.18	1.003	0.450	0.553	55.12	25.45
5	Jul-99	0.013	0.017	0.62	0.58	0.60	10.34	0.487	0.568	-0.080	-16.50	-9.61
5	Aug-99	0.019	0.020	0.63	0.44	0.53	10.47	0.740	0.502	0.238	32.19	-1.63
5	Sep-99	0.018	0.015	0.84	0.75	0.80	14.08	0.822	0.693	0.130	15.78	8.12
5	Oct-99	0.021	0.016	1.16	1.12	1.14	19.41	1.298	1.129	0.169	13.05	19.08
6	Apr-99	0.038	0.037	0.18	0.24	0.20	3.07	0.431	0.474	-0.043	-9.92	0.32
6	May-99	0.019	0.029	0.19	0.10	0.18	3.20	0.241	0.323	-0.083	-34.33	-4.58
6	Jun-99	0.029	0.015	0.44	0.46	0.45	7.37	0.766	0.384	0.382	49.92	18.39
6	Jul-99	0.013	0.013	0.50	0.46	0.48	8.42	0.404	0.369	0.035	8.57	-0.68
6	Aug-99	0.019	0.016	0.54	0.36	0.45	9.06	0.629	0.337	0.292	46.36	4.67
6	Sep-99	0.018	0.016	0.63	0.58	0.60	10.52	0.692	0.525	0.167	24.13	5.00
6	Oct-99	0.021	0.016	0.36	0.41	0.39	6.01	0.432	0.424	0.008	1.79	6.58
7	Apr-99	0.040	0.062	0.31	0.26	0.30	5.19	0.756	1.138	-0.382	-50.50	-7.87
7	May-99	0.019	0.016	0.29	0.25	0.27	4.91	0.337	0.309	0.028	8.29	2.50
7	Jun-99	0.029	0.027	0.30	0.62	0.46	5.05	0.541	0.926	-0.385	-71.10	2.09
7	Jul-99	0.013	0.013	0.35	0.29	0.32	5.91	0.282	0.230	0.052	18.48	0.34
7	Aug-99	0.025	0.016	0.35	0.26	0.31	5.88	0.529	0.259	0.270	51.02	8.14
7	Sep-99	0.018	0.016	0.48	0.25	0.36	7.93	0.521	0.237	0.284	54.50	2.99
7	Oct-99	0.020	0.013	0.60	0.49	0.54	9.94	0.643	0.372	0.271	42.12	15.51
8	Apr-99	0.037	0.047	0.35	1.58	0.76	5.89	0.784	2.042	-1.257	-160.30	-10.72
8	May-99	0.019	0.022	0.28	0.13	0.20	4.58	0.318	0.221	0.097	30.51	-1.84
8	Jun-99	0.029	0.019	0.47	0.37	0.42	7.76	0.721	0.423	0.298	41.34	10.37
8	Jul-99	0.013	0.015	0.34	0.22	0.28	5.67	0.267	0.220	0.047	17.76	-2.80
8	Aug-99	0.019	0.022	0.38	0.28	0.33	6.38	0.450	0.367	0.083	18.43	-2.35
8	Sep-99	0.017	0.018	0.58	0.67	0.63	9.67	0.494	0.614	-0.120	-24.29	-3.32
8	Oct-99	0.020	0.016	0.61	0.57	0.59	10.11	0.665	0.586	0.079	11.87	7.91
9	Apr-99	0.041	0.028	0.37	0.35	0.38	6.25	0.930	0.675	0.255	27.42	8.33
9	May-99	0.019	0.016	0.29	0.19	0.24	4.78	0.325	0.173	0.152	46.73	2.14
9	Jun-99	0.029	0.012	0.32	0.30	0.31	5.37	0.537	0.232	0.304	56.68	16.49
9	Jul-99	0.013	0.014	0.31	0.19	0.25	5.16	0.239	0.157	0.082	34.36	-1.60
9	Aug-99	0.019	0.017	0.36	0.27	0.31	5.98	0.413	0.249	0.164	39.79	2.54
9	Sep-99	0.017	0.015	0.54	0.87	0.71	9.07	0.497	0.798	-0.302	-60.71	5.40
9	Oct-99	0.020	0.017	0.51	0.54	0.53	8.51	0.559	0.475	0.084	15.01	6.16
10	Apr-99	0.036	0.027	0.44	0.28	0.44	7.28	1.034	0.818	0.216	20.85	7.68
10	May-99	0.019	0.015	0.23	0.09	0.18	3.91	0.270	0.151	0.119	44.20	2.55
10	Jun-99	0.029	0.020	0.31	0.29	0.30	5.19	0.521	0.376	0.145	27.81	6.59
10	Jul-99	0.013	0.014	0.31	0.16	0.23	5.09	0.247	0.140	0.107	43.43	-0.94
10	Aug-99	0.020	0.022	0.38	0.36	0.37	6.38	0.457	0.473	-0.016	-3.39	-1.96
10	Sep-99	0.018	0.014	0.49	0.47	0.48	8.16	0.536	0.468	0.068	12.63	7.90
10	Oct-99	0.020	0.014	0.62	0.56	0.59	10.30	0.676	0.417	0.259	38.31	14.53
11	Apr-99	0.040	0.063	0.88	0.89	0.88	4.87	0.716	1.135	-0.419	-58.60	-7.84
11	May-99	0.020	0.035	0.97	0.79	0.88	5.40	0.387	0.749	-0.362	-93.36	-10.24
11	Jun-99	0.027	0.018	1.04	1.00	1.03	5.80	0.570	0.370	0.200	35.16	8.83
11	Jul-99	0.013	0.016	0.97	1.13	1.05	5.39	0.255	0.362	-0.106	-41.52	-3.78
11	Aug-99	0.019	0.020	0.99	1.09	1.04	5.51	0.385	0.436	-0.051	-13.33	-0.43
11	Sep-99	0.017	0.015	1.24	1.34	1.29	6.88	0.352	0.298	0.054	15.26	3.37
11	Oct-99	0.020	0.015	1.58	1.62	1.60	8.80	0.569	0.428	0.140	24.68	9.91
12	Apr-99	0.037	0.037	0.97	0.92	0.97	5.40	0.712	0.739	-0.026	-3.67	-0.18
12	May-99	0.019	0.023	1.00	1.23	1.11	5.54	0.369	0.568	-0.198	-53.70	-4.89
12	Jun-99	0.027	0.018	1.02	0.94	0.99	5.68	0.540	0.352	0.188	34.87	7.72
12	Jul-99	0.013	0.018	1.00	1.07	1.04	5.58	0.253	0.385	-0.132	-52.17	-7.17
12	Aug-99	0.019	0.030	1.04	1.10	1.07	5.78	0.405	0.638	-0.233	-57.62	-9.52
12	Sep-99	0.017	0.019	1.26	1.30	1.28	6.99	0.383	0.449	-0.066	-17.22	-2.89
12	Oct-99	0.020	0.017	1.64	1.58	1.61	9.14	0.590	0.501	0.089	15.03	5.31

Exhibit 4-6

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Mesocosms

		TN (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TN ($g/m^2/y$)		Removal		Calc_k
Treatment	**Date**	**Inflow**	**Outflow**	**(m^3/d)**	**(m^3/d)**	**(m^3/d)**	**(cm/d)**	**Inflow**	**Outflow**	**($g/m^2/y$)**	**(%)**	**(m/y)**
Period of Record												
1	1999	1.209	1.064	0.42	0.35	0.37	6.98	32.261	28.965	3.296	10.22	3.24
2	1999	1.173	1.130	0.37	0.32	0.34	6.11	26.823	26.868	-0.045	-0.17	0.84
3	1999	1.227	0.947	0.39	0.35	0.37	6.45	29.945	24.528	5.417	18.09	6.10
4	1999	1.277	1.048	0.42	0.38	0.40	6.92	32.891	25.274	7.617	23.16	4.98
5	1999	1.170	1.053	0.72	0.65	0.68	11.93	50.737	46.716	4.021	7.93	4.56
6	1999	1.268	1.044	0.44	0.39	0.41	7.34	36.314	25.766	10.548	29.05	5.20
7	1999	1.244	0.983	0.39	0.31	0.35	6.58	30.191	21.995	8.196	27.15	5.65
8	1999	1.295	1.076	0.43	0.37	0.40	7.25	35.725	29.268	6.457	18.07	4.89
9	1999	1.229	1.168	0.37	0.41	0.39	6.21	29.603	29.024	0.579	1.95	1.16
10	1999	1.250	0.993	0.40	0.33	0.37	6.69	30.977	23.117	7.860	25.37	5.61
11	1999	1.214	1.192	1.12	1.12	1.12	6.22	27.299	26.988	0.311	1.14	0.42
12	1999	1.205	1.045	1.19	1.15	1.17	6.59	28.560	24.738	3.822	13.38	3.44
Quarterly												
1	Qtr-3	1.480	1.044	0.32	0.35	0.33	5.34	28.847	20.747	8.099	28.08	6.80
1	Qtr-4	0.935	0.673	0.31	0.18	0.23	5.14	18.132	11.359	6.773	37.36	6.16
1	Qtr-5	1.422	1.460	0.54	0.52	0.53	8.99	45.580	46.442	-0.862	-1.89	-0.86
2	Qtr-3	1.480	0.922	0.29	0.34	0.31	4.83	26.115	16.851	9.264	35.47	8.35
2	Qtr-4	0.978	0.795	0.32	0.26	0.29	5.27	18.746	15.102	3.644	19.44	3.99
2	Qtr-5	1.279	1.437	0.43	0.37	0.40	7.13	34.160	38.246	-4.086	-11.96	-3.03
3	Qtr-3	1.480	1.300	0.26	0.31	0.29	4.33	23.390	22.170	1.220	5.21	2.05
3	Qtr-4	0.932	0.593	0.32	0.26	0.29	5.33	18.202	12.014	6.187	33.99	8.79
3	Qtr-5	1.437	1.183	0.50	0.44	0.47	8.28	43.873	36.174	7.699	17.55	5.88
4	Qtr-3	1.480	0.988	0.30	0.33	0.32	5.08	27.421	19.003	8.418	30.70	7.49
4	Qtr-4	0.952	0.894	0.32	0.29	0.31	5.37	18.709	16.663	2.046	10.94	1.23
4	Qtr-5	1.470	1.206	0.51	0.46	0.48	8.54	44.896	35.020	9.877	22.00	6.18
5	Qtr-3	1.480	0.908	0.57	0.68	0.63	9.54	51.557	31.585	19.971	38.74	17.03
5	Qtr-4	0.863	0.659	0.60	0.50	0.55	9.95	31.466	23.377	8.089	25.71	9.79
5	Qtr-5	1.372	1.496	0.88	0.80	0.84	14.70	69.736	75.098	-5.362	-7.69	-4.62
6	Qtr-3	1.480	1.427	0.17	0.19	0.18	2.77	14.982	13.105	1.877	12.53	0.37
6	Qtr-4	0.964	0.759	0.37	0.34	0.36	6.15	22.175	12.954	9.221	41.58	5.37
6	Qtr-5	1.443	1.170	0.56	0.47	0.52	9.37	52.251	41.374	10.877	20.82	7.17
7	Qtr-3	1.480	1.730	0.32	0.21	0.27	5.37	29.009	33.909	-4.900	-16.89	-3.06
7	Qtr-4	0.964	0.657	0.34	0.37	0.35	5.59	19.862	13.173	6.689	33.68	7.83
7	Qtr-5	1.395	1.060	0.46	0.29	0.37	7.62	38.233	26.845	11.388	29.79	7.63
8	Qtr-3	1.480	1.340	0.39	0.29	0.34	6.44	34.789	31.498	3.291	9.46	2.34
8	Qtr-4	0.961	0.695	0.34	0.18	0.26	5.61	19.878	14.000	5.878	29.57	6.66
8	Qtr-5	1.567	1.370	0.55	0.58	0.56	9.15	51.885	43.793	8.091	15.59	4.48
9	Qtr-3	1.480	NA	0.37	0.35	0.36	6.16	33.276	NA	NA	NA	NA
9	Qtr-4	0.958	0.816	0.32	0.28	0.30	5.29	18.299	15.756	2.543	13.90	3.10
9	Qtr-5	1.417	1.520	0.43	0.57	0.50	7.14	39.682	42.292	-2.610	-6.58	-1.84
10	Qtr-3	1.480	1.490	0.27	0.29	0.28	4.47	24.147	24.310	-0.163	-0.68	-0.11
10	Qtr-4	0.932	0.758	0.30	0.16	0.23	4.93	16.807	13.572	3.235	19.25	3.74
10	Qtr-5	1.430	1.063	0.51	0.47	0.49	8.57	43.313	32.265	11.047	25.51	9.26
11	Qtr-3	1.480	1.380	0.90	1.07	0.98	5.01	27.064	25.235	1.829	6.76	1.28
11	Qtr-4	0.934	0.905	1.04	0.90	0.97	5.81	19.823	19.177	0.646	3.26	0.65
11	Qtr-5	1.407	1.417	1.27	1.35	1.31	7.05	34.854	35.383	-0.529	-1.52	-0.18
12	Qtr-3	1.480	1.590	1.07	0.95	1.01	5.92	31.980	34.357	-2.377	-7.43	-1.55
12	Qtr-4	0.973	0.775	1.11	1.09	1.10	6.18	21.932	17.493	4.439	20.24	5.13
12	Qtr-5	1.347	1.133	1.30	1.27	1.29	7.22	34.048	28.777	5.271	15.48	4.54
Monthly												
1	Apr-99	1.480	1.044	0.32	0.35	0.33	5.34	28.847	20.747	8.099	28.08	6.80
1	May-99	0.829	1.067	0.28	0.06	0.12	4.70	15.705	17.945	-2.240	-14.26	-4.33
1	Jun-99	0.886	0.450	0.34	0.32	0.33	5.60	18.095	9.145	8.950	49.46	13.85
1	Jul-99	1.090	0.503	0.30	0.17	0.24	4.97	19.786	9.181	10.605	53.60	14.03
1	Aug-99	1.460	1.743	0.45	0.39	0.42	7.49	39.932	47.820	-7.888	-19.75	-4.85
1	Sep-99	1.987	1.733	0.54	0.55	0.55	9.06	65.680	57.284	8.396	12.78	4.51
1	Oct-99	0.820	0.903	0.62	0.62	0.62	10.40	31.127	34.222	-3.094	-9.94	-3.67
2	Apr-99	1.480	0.922	0.29	0.34	0.31	4.83	26.115	16.851	9.264	35.47	8.35
2	May-99	0.948	1.085	0.28	0.13	0.20	4.72	16.324	18.690	-2.366	-14.50	-2.33
2	Jun-99	0.886	0.722	0.35	0.37	0.36	5.81	18.789	16.066	2.723	14.49	4.36
2	Jul-99	1.090	0.650	0.31	0.25	0.28	5.11	20.317	12.067	8.250	40.61	9.64
2	Aug-99	1.460	1.837	0.40	0.14	0.27	6.65	35.456	44.301	-8.846	-24.95	-5.57
2	Sep-99	1.557	1.713	0.51	0.46	0.49	8.51	48.408	53.305	-4.896	-10.11	-2.98
2	Oct-99	0.820	0.760	0.37	0.50	0.44	6.22	18.616	17.132	1.485	7.98	1.73
3	Apr-99	1.480	1.300	0.26	0.31	0.29	4.33	23.390	22.170	1.220	5.21	2.05
3	May-99	0.820	0.998	0.32	0.18	0.25	5.36	15.947	21.358	-5.411	-33.93	-3.85
3	Jun-99	0.886	0.456	0.29	0.30	0.30	4.88	15.796	8.145	7.651	48.44	11.84
3	Jul-99	1.090	0.460	0.34	0.31	0.33	5.75	22.863	9.656	13.207	57.77	18.10
3	Aug-99	1.460	1.151	0.47	0.43	0.45	7.76	41.353	32.631	8.722	21.09	6.73
3	Sep-99	2.030	1.767	0.53	0.33	0.43	8.81	65.485	57.022	8.463	12.92	4.47

Exhibit 4-6

Period-of-Record, Quarterly, and Monthly Summaries of Total Nitrogen Mass Balance Data from the Porta-PSTA Mesocosms

		TN (mg/L)		Inflow	Outflow	Avg_flow	q_in	MB_TN ($g/m^2/y$)		Removal		Calc_k
Treatment	Date	Inflow	Outflow	(m^3/d)	(m^3/d)	(m^3/d)	(cm/d)	Inflow	Outflow	($g/m^2/y$)	(%)	(m/y)
3	Oct-99	0.820	0.630	0.50	0.56	0.53	8.28	24.782	18.871	5.912	23.85	7.97
4	Apr-99	1.480	0.988	0.30	0.33	0.32	5.08	27.421	19.003	8.418	30.70	7.49
4	May-99	0.880	1.460	0.28	0.17	0.22	4.67	14.952	25.334	-10.381	-69.43	-8.63
4	Jun-99	0.886	0.645	0.35	0.41	0.38	5.90	19.080	13.639	5.441	28.52	6.84
4	Jul-99	1.090	0.494	0.33	0.29	0.31	5.55	22.094	10.007	12.087	54.71	16.04
4	Aug-99	1.460	1.623	0.40	0.26	0.33	6.69	35.669	39.674	-4.005	-11.23	-2.59
4	Sep-99	1.800	1.330	0.51	0.50	0.50	8.56	56.484	40.413	16.071	28.45	9.45
4	Oct-99	0.820	0.663	0.62	0.57	0.60	10.34	30.948	24.972	5.976	19.31	8.00
5	Apr-99	1.480	0.908	0.57	0.68	0.63	9.54	51.557	31.585	19.971	38.74	17.03
5	May-99	0.614	0.910	0.55	0.24	0.39	9.12	19.102	30.296	-11.194	-58.60	-13.08
5	Jun-99	0.886	0.471	0.58	0.68	0.63	9.61	31.081	16.543	14.538	46.78	22.14
5	Jul-99	1.090	0.597	0.67	0.58	0.62	11.11	44.214	23.293	20.921	47.32	24.44
5	Aug-99	1.460	1.640	0.63	0.49	0.56	10.56	56.274	63.058	-6.784	-12.06	-4.48
5	Sep-99	1.837	2.020	0.84	0.75	0.80	14.08	94.689	103.664	-8.975	-9.48	-4.89
5	Oct-99	0.820	0.827	1.17	1.16	1.16	19.46	58.244	58.572	-0.329	-0.56	-0.58
6	Apr-99	1.480	1.427	0.17	0.19	0.18	2.77	14.982	13.105	1.877	12.53	0.37
6	May-99	0.916	1.187	0.13	0.00	0.07	2.23	7.413	9.652	-2.238	-30.19	-2.10
6	Jun-99	0.886	0.569	0.44	0.52	0.48	7.34	23.730	15.058	8.672	36.54	11.88
6	Jul-99	1.090	0.458	0.53	0.52	0.53	8.89	35.382	14.855	20.528	58.02	28.15
6	Aug-99	1.460	1.580	0.64	0.40	0.52	10.67	56.843	61.753	-4.910	-8.64	-3.08
6	Sep-99	1.745	1.253	0.63	0.58	0.60	10.52	67.431	48.444	18.987	28.16	12.72
6	Oct-99	0.820	0.677	0.35	0.32	0.34	5.78	17.300	13.925	3.374	19.50	4.05
7	Apr-99	1.480	1.730	0.32	0.21	0.27	5.37	29.009	33.909	-4.900	-16.89	-3.06
7	May-99	0.917	0.966	0.32	0.08	0.20	5.36	17.940	18.899	-0.959	-5.34	-1.02
7	Jun-99	0.886	0.568	0.30	0.75	0.53	5.05	16.342	10.477	5.865	35.89	8.20
7	Jul-99	1.090	0.437	0.38	0.28	0.33	6.36	25.303	10.145	15.159	59.91	21.22
7	Aug-99	1.460	1.630	0.35	0.07	0.21	5.84	31.121	34.745	-3.624	-11.64	-2.35
7	Sep-99	1.650	1.230	0.48	0.25	0.36	7.93	47.795	35.557	12.238	25.61	8.50
7	Oct-99	0.820	0.320	0.53	0.60	0.56	8.76	26.219	10.232	15.987	60.98	30.09
8	Apr-99	1.480	1.340	0.39	0.29	0.34	6.44	34.789	31.498	3.291	9.46	2.34
8	May-99	0.908	0.922	0.30	0.04	0.17	4.92	16.306	16.557	-0.251	-1.54	-0.27
8	Jun-99	0.886	0.532	0.33	0.36	0.35	5.50	17.786	10.680	7.107	39.95	10.24
8	Jul-99	1.090	0.630	0.39	0.14	0.26	6.42	25.542	14.763	10.779	42.20	12.85
8	Aug-99	1.460	1.820	0.44	0.43	0.44	7.28	38.795	48.361	-9.566	-24.66	-5.86
8	Sep-99	2.420	1.570	0.58	0.67	0.63	9.67	85.433	55.425	30.007	35.12	15.28
8	Oct-99	0.820	0.720	0.63	0.63	0.63	10.50	31.427	27.594	3.833	12.20	4.98
9	Apr-99	1.480	NA	0.37	0.35	0.36	6.16	33.276	NA	NA	NA	NA
9	May-99	0.899	0.844	0.33	0.24	0.28	5.42	17.785	16.697	1.088	6.12	1.25
9	Jun-99	0.886	0.804	0.36	0.39	0.37	5.94	19.209	17.432	1.778	9.26	2.11
9	Jul-99	1.090	0.800	0.27	0.20	0.24	4.50	17.903	13.140	4.763	26.61	5.08
9	Aug-99	1.460	1.670	0.43	0.39	0.41	7.20	38.369	43.888	-5.519	-14.38	-3.53
9	Sep-99	1.970	2.000	0.54	0.87	0.71	9.07	65.232	66.226	-0.993	-1.52	-0.50
9	Oct-99	0.820	0.890	0.31	0.45	0.38	5.16	15.444	16.762	-1.318	-8.54	-1.54
10	Apr-99	1.480	1.490	0.27	0.29	0.28	4.47	24.147	24.310	-0.163	-0.68	-0.11
10	May-99	0.821	0.996	0.26	0.00	0.13	4.40	13.185	15.996	-2.811	-21.32	-3.10
10	Jun-99	0.886	0.822	0.33	0.36	0.35	5.56	17.980	16.682	1.299	7.22	1.52
10	Jul-99	1.090	0.455	0.29	0.11	0.20	4.84	19.256	8.038	11.218	58.26	15.43
10	Aug-99	1.460	1.380	0.44	0.36	0.40	7.32	39.008	36.871	2.137	5.48	1.51
10	Sep-99	1.720	1.140	0.49	0.47	0.48	8.16	51.228	33.954	17.275	33.72	12.25
10	Oct-99	0.820	0.670	0.64	0.59	0.61	10.62	31.786	25.971	5.814	18.29	7.83
11	Apr-99	1.480	1.380	0.90	1.07	0.98	5.01	27.064	25.235	1.829	6.76	1.28
11	May-99	0.825	0.903	1.00	0.54	0.77	5.57	16.769	18.355	-1.585	-9.45	-1.84
11	Jun-99	0.886	0.813	1.07	1.05	1.06	5.95	19.252	17.666	1.586	8.24	1.87
11	Jul-99	1.090	1.000	1.06	1.11	1.08	5.89	23.447	21.511	1.936	8.26	1.85
11	Aug-99	1.460	1.390	1.01	1.11	1.06	5.63	29.985	28.547	1.438	4.79	1.01
11	Sep-99	1.940	1.960	1.24	1.34	1.29	6.88	48.717	49.220	-0.502	-1.03	-0.26
11	Oct-99	0.820	0.900	1.56	1.62	1.59	8.64	25.860	28.382	-2.523	-9.76	-2.94
12	Apr-99	1.480	1.590	1.07	0.95	1.01	5.92	31.980	34.357	-2.377	-7.43	-1.55
12	May-99	0.942	1.020	1.13	1.34	1.23	6.29	21.638	23.430	-1.792	-8.28	-1.83
12	Jun-99	0.886	0.804	1.09	0.94	1.01	6.06	19.597	17.784	1.814	9.26	2.15
12	Jul-99	1.090	0.500	1.11	1.01	1.06	6.17	24.561	11.266	13.294	54.13	17.56
12	Aug-99	1.460	1.150	1.03	0.93	0.98	5.71	30.411	23.954	6.457	21.23	4.97
12	Sep-99	1.760	1.560	1.26	1.30	1.28	6.99	44.917	39.812	5.104	11.36	3.08
12	Oct-99	0.820	0.690	1.61	1.58	1.60	8.96	26.817	22.566	4.252	15.85	5.65

Note:
NA = Not Available

Porta-PSTA treatments with TN mass removal efficiencies greater than 20 percent include Treatment 4 (shallow shellrock), Treatment 6 (variable water regime shellrock), Treatment 7 (shallow sand), and Treatment 10 (shellrock Aquashade control). Treatments with period-of-record average TN k values greater than 5 m/y include Treatment 3 (shallow peat) and Treatments 6, 7, and 10.

4.6 Sediments

Pre-existing and newly deposited soils within the Porta-PSTA mesocosms were cored at randomly selected locations 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 4-7. A discussion of key findings is presented in the following paragraphs.

4.6.1 Temperature

On May 28, 1999, continuous monitoring of sediment temperature was initiated at the Porta-PSTAs. A temperature probe was placed approximately 1 cm into the sediments and rotated between mesocosms on a 3- to 4-day schedule. Average temperatures for each media follow the same pattern; however, air temperature was approximately 2.5°C lower than sediment and water column temperatures. Sediment and water temperatures were typically very similar.

Daily average temperatures in air water and sediment samples of the Porta-PSTA mesocosms are presented in Exhibit 4-8.

4.6.2 Bulk Density

Samples were collected monthly from each mesocosm and analyzed for density and percent solids. Bulk density was estimated by multiplying the sample's wet density by the percent solids.

The peat soils in Treatments 1, 3, 9, and 12 are highly organic and exhibit low bulk densities, which averaged between 0.28 and 0.31 g/cm^3, compared with the shellrock soils of Treatments 2, 4, 5, 6, 10, and 11, which averaged between 1.23 and 1.43 g/cm^3. The sand soil treatments averaged 1.19 and 1.32 g/cm^3.

4.6.3 Phosphorus

Sediment samples were collected monthly from the Porta-PSTAs and analyzed monthly for TP and TIP and quarterly for NRP. NRP analyses for sediment samples collected to-date are not yet available from the analytical laboratory; these will be reported when available. Treatments 7 and 8 (sand) exhibited the lowest long-term average TP concentration at the Porta-PSTA site varying between 23 and 25 mg/kg, with an average TIP concentration between 14 and 15 mg/kg. Monthly TP and TIP concentration trends in these samples are variable. Soil TP averaged 2.7 and 3.3 g/m^2 in the top 10 cm of the sand treatments.

In Treatments 1, 3, 9, and 12 (peat), the average long-term TP concentration has varied between 191 and 213 mg/kg, with an average TIP concentration between 104 and 124 mg/kg. Monthly TP and TIP concentration trends in these samples are variable. Soil TP averaged between 5.4 and 6.2 g/m^2 in the top 10 cm of the peat soil mesocosms.

Exhibit 4-7

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data from the Porta-PSTA Mesocosms

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)
Period of Record									
1	1999	1.12	25.4	0.28	65.1	191	106	9733	57233
2	1999	1.82	70.8	1.29	3.5	978	892	52	3502
3	1999	1.11	25.3	0.28	56.5	213	124	5627	35267
4	1999	1.79	69.2	1.23	3.1	971	877	38	2460
5	1999	1.85	67.0	1.25		1003	917	66	2856
6	1999	1.84	75.2	1.39		957	910	109	2361
7	1999	1.80	73.7	1.32	1.0	25	15	35	1262
8	1999	1.76	67.0	1.19	0.0	23	14	256	1985
9	1999	1.10	26.2	0.29	42.5	200	104	3450	57350
10	1999	1.87	73.2	1.37	2.0	1020	930	62	2360
11	1999	1.86	76.8	1.43	4.4	913	877	41	14300
12	1999	1.12	28.0	0.31	61.0	197	117	6055	46100
Quarterly									
1	Qtr-3	1.17	31.5	0.37		158	103		
1	Qtr-4	1.10	21.0	0.23	65.1	169	98	9600	63133
1	Qtr-5	1.12	28.4	0.32		220	114	9867	51333
2	Qtr-3	1.87	68.5	1.28		868	836		
2	Qtr-4	1.81	68.4	1.24	3.5	954	828	17	1806
2	Qtr-5	1.82	73.4	1.33		1024	962	75	4633
3	Qtr-3	1.17	27.3	0.32		184	113		
3	Qtr-4	1.10	21.2	0.24	56.5	222	152	3087	27200
3	Qtr-5	1.10	28.8	0.32		213	101	8167	43333
4	Qtr-3	1.95	67.0	1.31		903	912		
4	Qtr-4	1.69	64.9	1.08	3.1	936	815	14	2020
4	Qtr-5	1.82	74.2	1.36		1029	928	61	2900
5	Qtr-3	1.90	65.3	1.24		1000	974		
5	Qtr-4	1.84	65.4	1.21		970	882	22	2045
5	Qtr-5	1.85	69.2	1.28		1041	938	110	3667
6	Qtr-3	1.89	77.7	1.46		912	910		
6	Qtr-4	1.82	74.1	1.35		951	883	22	1218
6	Qtr-5	1.86	75.5	1.40		980	939	195	3503
7	Qtr-3	1.86	77.0	1.43		17	13		
7	Qtr-4	1.81	71.3	1.29	1.0	23	14	5	34
7	Qtr-5	1.76	74.9	1.32		30	16	64	2490
8	Qtr-3	1.86	70.0	1.30		20	16		
8	Qtr-4	1.65	55.5	0.93	0.0	15	12	2	1770
8	Qtr-5	1.83	77.5	1.42		32	16	510	2200
9	Qtr-3	1.08	24.0	0.26		206	105		
9	Qtr-4	1.10	22.8	0.25	42.5	171	94	2300	69700
9	Qtr-5	1.11	30.2	0.34		226	113	4600	45000
10	Qtr-3	1.94	66.0	1.28		1060	987		
10	Qtr-4	1.86	71.6	1.33	2.0	1014	894	19	1850
10	Qtr-5	1.86	77.2	1.44		1014	947	105	2870
11	Qtr-3	1.88	72.0	1.35		973	969		
11	Qtr-4	1.81	79.0	1.43	4.4	918	873	35	26000
11	Qtr-5	1.90	76.2	1.45		888	850	48	2600
12	Qtr-3	1.16	27.0	0.31		219	134		
12	Qtr-4	1.08	28.2	0.31	61.0	173	108	5410	34200
12	Qtr-5	1.14	28.2	0.32		213	120	6700	58000

Exhibit 4-7

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data from the Porta-PSTA Mesocosms

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									
1	Apr-99	1.17	31.5	0.37		158	103		
1	May-99	1.09	31.7	0.35		180	93	9600	63133
1	Jun-99	1.10	14.7	0.16	65.1	209	106		
1	Jul-99	1.12	16.6	0.18		117	97		
1	Aug-99	1.12	26.7	0.30		270	156		
1	Sep-99	1.11	30.2	0.34		183	100	9867	51333
1	Oct-99	1.12	28.3	0.32		206	86		
2	Apr-99	1.87	68.5	1.28		868	836		
2	May-99	1.78	63.0	1.12		1052	933	17	1806
2	Jun-99	1.83	69.3	1.27	3.5	804	683		
2	Jul-99	1.81	71.0	1.28		1038	904		
2	Aug-99	1.80	78.7	1.42		1020	949		
2	Sep-99	1.78	74.8	1.33		970	944	75	4633
2	Oct-99	1.88	66.7	1.25		1083	992		
3	Apr-99	1.17	27.3	0.32		184	113		
3	May-99	1.12	26.3	0.30		184	89	3087	27200
3	Jun-99	1.07	20.0	0.21	56.5	205	100		
3	Jul-99	1.12	17.2	0.19		277	266		
3	Aug-99	0.99	22.3	0.22		227	99		
3	Sep-99	1.12	28.3	0.32		201	113	8167	43333
3	Oct-99	1.18	35.9	0.42		210	90		
4	Apr-99	1.95	67.0	1.31		903	912		
4	May-99	1.84	65.7	1.21		914	781	14	2020
4	Jun-99	1.69	78.3	1.32	3.1	940	806		
4	Jul-99	1.55	50.7	0.72		953	858		
4	Aug-99	1.76	74.3	1.31		1064	954		
4	Sep-99	1.89	79.9	1.51		1002	854	61	2900
4	Oct-99	1.82	68.3	1.26	NA	1022	975		
5	Apr-99	1.90	65.3	1.24		1000	974		
5	May-99	1.86	72.7	1.35		971	840	22	2045
5	Jun-99	1.85	67.3	1.25		960	907		
5	Jul-99	1.82	56.3	1.02		981	890		
5	Aug-99	1.86	74.0	1.38		956	884		
5	Sep-99	1.88	74.3	1.40		1086	964	110	3667
5	Oct-99	1.81	59.2	1.08	NA	1081	966		
6	Apr-99	1.89	77.7	1.46		912	910		
6	May-99	1.80	72.7	1.31		1001	878	22	1218
6	Jun-99	1.86	75.0	1.39		935	901		
6	Jul-99	1.79	74.8	1.34		922	864		
6	Aug-99	1.84	74.3	1.37		1019	974		
6	Sep-99	1.88	75.9	1.42		917	849	195	3503
6	Oct-99	1.86	76.2	1.42		1003	994		
7	Apr-99	1.86	77.0	1.43		17	13		
7	May-99	1.80	77.0	1.39		12	8	5	34
7	Jun-99	1.86	70.0	1.30	1.0	32	22		
7	Jul-99	1.76	67.0	1.18		24	13		
7	Aug-99	1.70	78.0	1.33		24	15		
7	Sep-99	1.81	78.8	1.43		48	31	64	2490
7	Oct-99	1.78	68.0	1.21		17	3		

Exhibit 4-7

Period-of-Record, Quarterly, and Monthly Summaries of Sediment Data from the Porta-PSTA Mesocosms

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)
8	Apr-99	1.86	70.0	1.30		20	16		
8	May-99	1.75	34.0	0.60		12	10	2	1770
8	Jun-99	1.84	81.4	1.50	0.0	21	13		
8	Jul-99	1.36	51.0	0.69		12	13		
8	Aug-99	1.75	79.0	1.38		21	13		
8	Sep-99	1.87	78.4	1.47		47	32	510	2200
8	Oct-99	1.87	75.1	1.40		27	3		
9	Apr-99	1.08	24.0	0.26		206	105		
9	May-99	1.15	28.0	0.32		183	94	2300	69700
9	Jun-99	1.11	27.3	0.30	42.5	204	90		
9	Jul-99	1.04	13.1	0.14		128	97		
9	Aug-99	1.07	24.1	0.26		247	131		
9	Sep-99	1.19	31.0	0.37		206	110	4600	45000
9	Oct-99	1.07	35.6	0.38		225	99		
10	Apr-99	1.94	66.0	1.28		1060	987		
10	May-99	1.86	77.0	1.43		918	824	19	1850
10	Jun-99	1.84	63.9	1.18	2.0	1025	893		
10	Jul-99	1.88	74.0	1.39		1099	966		
10	Aug-99	1.80	78.0	1.40		1039	947		
10	Sep-99	1.93	81.0	1.56		1008	952	105	2870
10	Oct-99	1.85	72.5	1.34		995	944		
11	Apr-99	1.88	72.0	1.35		973	969		
11	May-99	1.75	78.0	1.37		969	991	35	26000
11	Jun-99	1.85	76.9	1.42	4.4	897	841		
11	Jul-99	1.84	82.0	1.51		887	785		
11	Aug-99	1.87	77.0	1.44		829	914		
11	Sep-99	1.91	79.3	1.51		902	776	48	2600
11	Oct-99	1.93	72.4	1.40		935	860		
12	Apr-99	1.16	27.0	0.31		219	134		
12	May-99	1.14	39.0	0.44		184	93	5410	34200
12	Jun-99	1.03	18.5	0.19	61.0	197	107		
12	Jul-99	1.08	27.0	0.29		139	124		
12	Aug-99	1.08	32.3	0.35		212	138		
12	Sep-99	1.16	21.9	0.25		201	98	6700	58000
12	Oct-99	1.17	30.3	0.35		226	124		

Note:
NA = Not Available

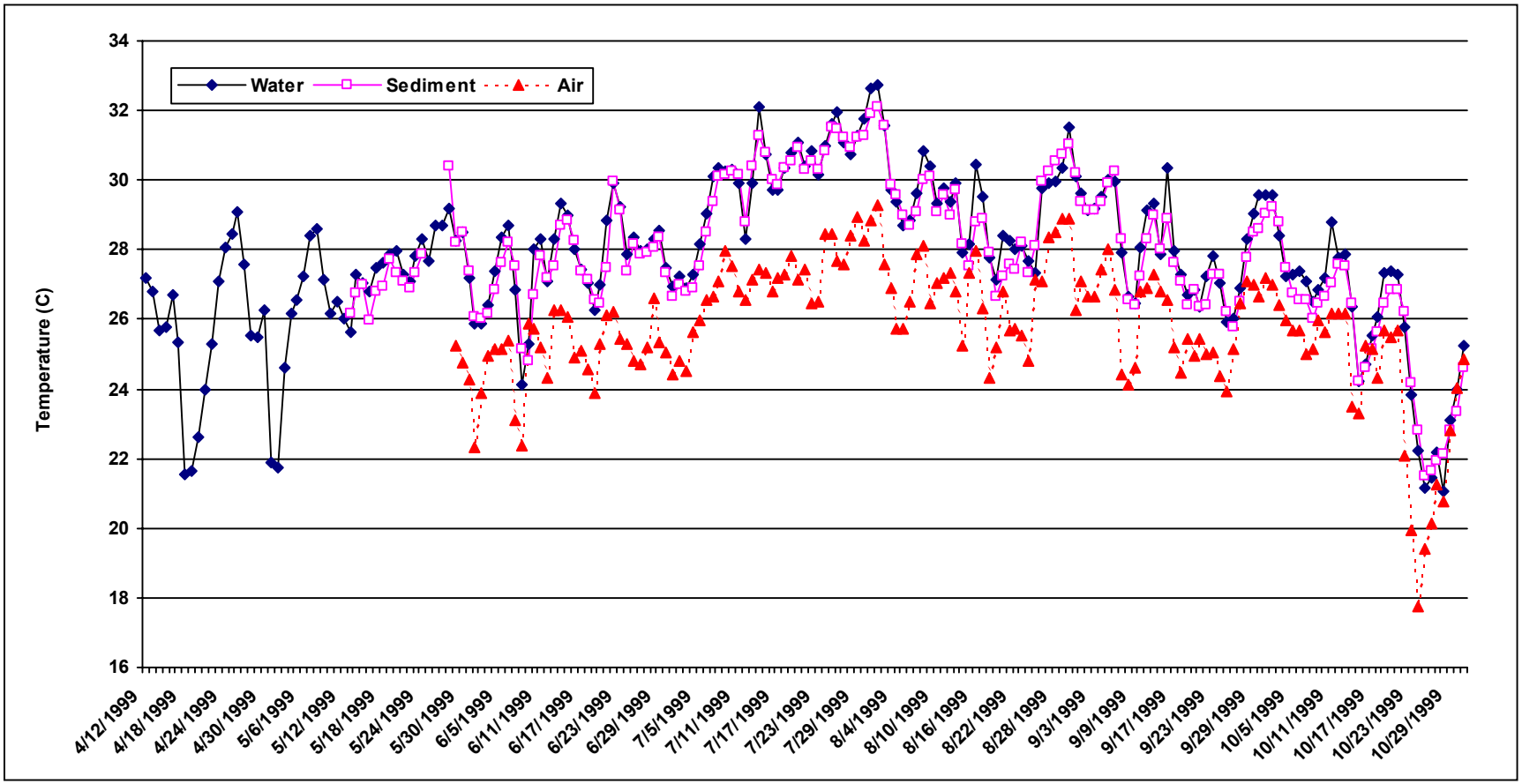


Exhibit 4-8
Daily Average Temperatures in the Air, Water and Sediments of the Porta-PSTA Mesocosms from April through October 1999

In Treatments 2, 4, 5, 6, 10, and 11 (shellrock), the average long-term TP concentration varied between 913 and 1,003 mg/kg, with an average TIP concentration between 877 and 930 mg/kg. Monthly TP and TIP concentration trends in these samples are variable. Soil TP averaged between 120 and 140 g/m^2 in the top 10 cm of the shellrock soil mesocosms.

4.6.4 Nitrogen

TKN was sampled quarterly from the Porta-PSTAs. The sandy soils of Treatments 7 and 8 exhibited long-term average TKN concentrations varying from 35 to 256 mg/kg. Shellrock treatments 2, 4, 5, 6, 10, and 11 also had low long-term average TKN concentrations, ranging from 38 to 109 mg/kg. In contrast to the sand and shellrock soils, peat soils in Treatments 1, 3, 9, and 12 displayed greater long-term average TKN measurements, ranging from 3,450 to 9,733 mg/kg.

4.6.5 Total Organic Carbon

TOC was sampled quarterly from the Porta-PSTAs. The sandy soils of Treatments 7 and 8 exhibited average TOC concentrations varying from 1,262 to 1,985 mg/kg. Treatments 2, 4, 5, 6, 10, and 11 (shellrock) had average TOC concentrations that ranged from 2,361 to 14,300 mg/kg. In comparison to the mineral soils, the peat soils of Treatments 1, 3, 9, and 12 exhibited the greatest average TOC, varying from 35,300 to 57,400 mg/kg.

4.7 Biological Analyses

Algal and macrophytic plant communities are being monitored in the Porta-PSTAs. The indices chosen for these studies are intended to characterize changes over time and to contrast the effects of experimental treatments. 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.

4.7.1 Plant Cover and Macrophyte Stem Counts

Plant cover in the Porta-PSTAs is estimated visually on a monthly basis. The method is the same as described in Section 3.8.1. Cover is estimated in three zones demarcated by the transverse reinforcement straps that cross each mesocosm. Values from these three zones are averaged to provide an estimate of cover for each mescosom.

Exhibit 4-9 summarizes the plant cover estimates for the Porta-PSTAs for the first three quarters of operation. Data are presented by treatment number.

In the 5th quarter, blue-green algal mat dominated Treatments 4, 6, 7, and 11, all of which have shallow or variable depths and shellrock or sand soils. Average algal mat cover in these treatments during the 5th quarter ranged from 8 to 33 percent. Macrophyte cover in these treatments averaged between 1 and 8 percent, and is primarily spikerush. Deep shellrock treatments (Treatments 2 and 5) had less than 5 percent algal mat cover in the 5th quarter and 6 to 11 percent macrophyte cover.

Exhibit 4-9

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta
PSTA Mesocosms

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	1%	3%	6%	0%	11%	3%	16%	19%	35.59
2	1999	2%	0%	2%	0%	4%	2%	6%	8%	4.11
3	1999	2%	2%	34%	1%	3%	5%	37%	41%	144.59
4	1999	18%	0%	4%	0%	1%	19%	5%	24%	12.53
5	1999	1%	0%	3%	0%	1%	1%	4%	5%	13.38
6	1999	5%	0%	2%	0%	1%	5%	3%	8%	6.98
7	1999	13%	0%	1%	0%	1%	14%	2%	15%	1.52
8	1999	3%	0%	1%	0%	1%	3%	2%	5%	1.03
9	1999	0%	1%	0%	0%	1%	1%	1%	1%	0.00
10	1999	0%	0%	1%	0%	0%	1%	1%	1%	0.00
11	1999	13%	0%	4%	0%	0%	14%	4%	18%	9.31
12	1999	0%	0%	43%	0%	3%	0%	46%	46%	145.84
Quarterly										
1	Qtr-3	0%	0%	1%	0%	3%	0%	4%	4%	3.83
1	Qtr-4	0%	0%	3%	0%	4%	0%	7%	7%	3.56
1	Qtr-5	2%	9%	14%	1%	22%	7%	33%	40%	85.86
2	Qtr-3	0%	0%	1%	0%	3%	0%	4%	4%	1.42
2	Qtr-4	0%	0%	1%	0%	1%	0%	2%	3%	1.15
2	Qtr-5	5%	0%	3%	0%	8%	5%	11%	16%	8.13
3	Qtr-3	1%	0%	6%	0%	5%	1%	11%	12%	6.06
3	Qtr-4	2%	2%	24%	0%	3%	4%	26%	30%	86.78
3	Qtr-5	3%	5%	67%	2%	2%	8%	71%	79%	456.56
4	Qtr-3	2%	0%	2%	0%	5%	2%	7%	8%	0.67
4	Qtr-4	4%	0%	2%	0%	0%	5%	2%	7%	2.98
4	Qtr-5	33%	0%	6%	0%	1%	33%	7%	40%	27.73
5	Qtr-3	4%	0%	1%	0%	2%	4%	4%	8%	2.67
5	Qtr-4	0%	0%	1%	0%	1%	1%	2%	3%	6.83
5	Qtr-5	2%	0%	6%	0%	0%	1%	6%	8%	25.58
6	Qtr-3	2%	0%	3%	0%	2%	2%	5%	7%	0.44
6	Qtr-4	4%	0%	2%	0%	1%	4%	2%	6%	1.70
6	Qtr-5	8%	0%	2%	0%	1%	8%	3%	11%	15.35
7	Qtr-3	1%	0%	1%	1%	3%	1%	4%	5%	1.50
7	Qtr-4	8%	0%	1%	0%	0%	8%	1%	9%	0.61
7	Qtr-5	27%	1%	1%	0%	0%	28%	1%	29%	2.44
8	Qtr-3	1%	0%	1%	0%	3%	1%	4%	5%	1.50
8	Qtr-4	3%	0%	1%	0%	1%	4%	2%	6%	0.56
8	Qtr-5	2%	0%	1%	0%	0%	2%	1%	3%	1.50
9	Qtr-3	0%	0%	0%	0%	0%	0%	0%	0%	0.00
9	Qtr-4	0%	0%	0%	0%	1%	0%	1%	1%	0.00
9	Qtr-5	0%	2%	0%	0%	0%	2%	0%	2%	0.00
10	Qtr-3	0%	0%	0%	0%	0%	0%	0%	0%	0.00
10	Qtr-4	0%	0%	1%	0%	0%	0%	1%	1%	0.00
10	Qtr-5	0%	1%	0%	0%	0%	1%	0%	1%	0.00
11	Qtr-3	2%	0%	3%	0%	0%	2%	3%	5%	1.00
11	Qtr-4	7%	0%	3%	0%	0%	7%	3%	10%	2.83
11	Qtr-5	30%	0%	8%	0%	0%	30%	8%	37%	23.19
12	Qtr-3	0%	0%	8%	0%	18%	0%	25%	25%	4.44
12	Qtr-4	0%	0%	25%	0%	1%	0%	26%	26%	74.04
12	Qtr-5	0%	1%	86%	1%	0%	1%	87%	88%	---

Exhibit 4-9

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta
PSTA Mesocosms

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
1	May-99	0%	0%	2%	0%	1%	0%	4%	4%	0.33
1	Jun-99	0%	0%	2%	0%	3%	0%	5%	5%	0.22
1	Jul-99	0%	0%	4%	0%	6%	0%	9%	10%	10.11
1	Aug-99	0%	0%	8%	1%	12%	1%	21%	22%	30.11
1	Sep-99	---	---	---	---	38%	0%	38%	38%	0.00
1	Oct-99	3%	17%	21%	1%	18%	20%	39%	59%	170.22
2	Apr-99	0%	0%	1%	0%	3%	0%	4%	4%	1.42
2	May-99	0%	0%	2%	0%	1%	0%	3%	3%	0.72
2	Jun-99	0%	0%	2%	0%	0%	0%	3%	3%	0.50
2	Jul-99	1%	0%	1%	0%	1%	1%	1%	2%	2.22
2	Aug-99	3%	0%	1%	0%	1%	3%	2%	5%	4.61
2	Sep-99	5%	0%	6%	0%	10%	5%	16%	20%	9.42
2	Oct-99	6%	0%	3%	0%	12%	6%	15%	21%	10.78
3	Apr-99	1%	0%	6%	0%	5%	1%	11%	12%	6.06
3	May-99	1%	0%	15%	0%	2%	1%	17%	18%	9.11
3	Jun-99	0%	0%	29%	0%	2%	1%	31%	32%	38.67
3	Jul-99	4%	3%	26%	0%	3%	7%	29%	35%	212.56
3	Aug-99	3%	9%	77%	1%	2%	12%	80%	92%	---
3	Oct-99	3%	1%	58%	2%	1%	4%	62%	65%	456.56
4	Apr-99	2%	0%	2%	0%	5%	2%	7%	8%	0.67
4	May-99	1%	0%	2%	0%	1%	1%	3%	4%	0.33
4	Jun-99	0%	0%	2%	0%	0%	0%	2%	2%	0.50
4	Jul-99	12%	1%	1%	0%	0%	12%	1%	13%	8.11
4	Aug-99	26%	0%	2%	0%	0%	26%	2%	28%	15.50
4	Sep-99	37%	0%	8%	0%	1%	37%	9%	45%	26.58
4	Oct-99	33%	1%	7%	0%	1%	34%	8%	42%	40.72
5	Apr-99	4%	0%	1%	0%	2%	4%	4%	8%	2.67
5	May-99	1%	0%	2%	0%	2%	1%	4%	4%	1.28
5	Jun-99	0%	0%	3%	0%	0%	0%	3%	3%	1.78
5	Jul-99	1%	0%	1%	0%	0%	1%	1%	2%	14.79
5	Aug-99	1%	0%	2%	0%	0%	1%	2%	3%	16.61
5	Sep-99	2%	1%	6%	0%	0%	1%	6%	8%	16.72
5	Oct-99	2%	0%	10%	0%	0%	2%	11%	12%	52.33
6	Apr-99	2%	0%	3%	0%	2%	2%	5%	7%	0.44
6	May-99	2%	0%	2%	0%	1%	2%	2%	4%	0.17
6	Jun-99	0%	0%	1%	0%	0%	0%	1%	1%	0.22
6	Jul-99	7%	0%	2%	0%	1%	7%	3%	10%	4.72
6	Aug-99	22%	0%	2%	0%	1%	22%	3%	25%	16.89
6	Sep-99	0%	0%	0%	0%	0%	0%	0%	0%	4.92
6	Oct-99	1%	0%	4%	0%	1%	2%	6%	7%	20.78
7	Apr-99	1%	0%	1%	1%	3%	1%	4%	5%	1.50
7	May-99	1%	0%	1%	0%	1%	1%	2%	3%	0.50
7	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.17
7	Jul-99	24%	0%	1%	0%	0%	24%	1%	25%	1.17
7	Aug-99	36%	0%	1%	0%	0%	36%	1%	37%	1.00
7	Oct-99	19%	1%	1%	0%	0%	20%	1%	21%	4.17
8	Apr-99	1%	0%	1%	0%	3%	1%	4%	5%	1.50
8	May-99	1%	0%	1%	0%	3%	1%	4%	5%	0.33
8	Jun-99	0%	0%	1%	0%	0%	0%	1%	1%	0.50

Exhibit 4-9

Period-of-Record, Quarterly, and Monthly Summaries of Algae and Macrophyte Percent Cover and Stem Count Estimates in the Porta
PSTA Mesocosms

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
8	Jul-99	9%	1%	1%	0%	0%	10%	1%	11%	0.83
8	Aug-99	3%	0%	1%	0%	0%	3%	1%	4%	1.00
8	Oct-99	1%	1%	1%	0%	0%	2%	1%	3%	2.00
9	Apr-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
9	May-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
9	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
9	Jul-99	1%	0%	0%	0%	3%	1%	3%	4%	0.00
9	Aug-99	0%	1%	0%	0%	0%	1%	0%	1%	0.00
9	Oct-99	0%	2%	0%	0%	0%	3%	0%	3%	0.00
10	Apr-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
10	May-99	0%	0%	3%	0%	0%	0%	3%	3%	0.00
10	Jun-99	0%	0%	0%	0%	0%	0%	0%	0%	0.00
10	Jul-99	0%	0%	0%	0%	1%	0%	1%	1%	0.00
10	Aug-99	0%	1%	0%	0%	0%	1%	0%	1%	0.00
10	Oct-99	1%	1%	0%	0%	0%	2%	0%	2%	0.00
11	Apr-99	2%	0%	3%	0%	0%	2%	3%	5%	1.00
11	May-99	1%	0%	3%	0%	0%	1%	3%	4%	0.28
11	Jun-99	1%	1%	2%	0%	0%	2%	2%	4%	0.83
11	Jul-99	18%	0%	3%	0%	0%	18%	3%	21%	7.39
11	Aug-99	46%	0%	7%	0%	0%	46%	7%	53%	13.67
11	Oct-99	13%	0%	8%	0%	0%	13%	8%	22%	32.72
12	Apr-99	0%	0%	8%	0%	18%	0%	25%	25%	4.44
12	May-99	0%	0%	8%	0%	1%	0%	9%	9%	7.33
12	Jun-99	0%	0%	31%	0%	0%	0%	31%	31%	31.44
12	Jul-99	0%	0%	38%	0%	1%	0%	39%	39%	183.33
12	Aug-99	0%	0%	93%	1%	0%	0%	94%	94%	---
12	Oct-99	0%	1%	79%	1%	0%	1%	80%	81%	---

The highest total plant cover was estimated in the peat soil treatments (Treatments 1, 3, and 12). Average total plant cover in these treatments in the 5th quarter was between 40 and 88 percent. This plant cover was dominated by spikerush in all peat treatments. The greatest plant cover was measured in the shallow peat mesocosms (79 percent in Treatment 3 and 88 percent in Treatment 12). Stem counts indicated that there were more than 400 stems per m^2 by October in these tanks.

Lowest plant cover was measured in the Aquashade controls (Treatments 9 and 10) with algal mat cover averages of 2 and 1 percent, respectively, in the 5th quarter. There were no macrophytes in either of these tanks. Macrophytes were not successfully established in the sand controls.

4.7.2 Periphyton Community

Periphyton cores are collected monthly from the Porta-PSTAs. A single sample is collected from a randomly selected location in each mesocosm. The methods for sampling are the same as those described in Section 3.8.2. As in the Test Cells, it is difficult to sample the benthic algae in the Porta-PSTAs without incorporating an unwanted and unquantified amount of soil in the samples. This problem was particularly acute at the beginning of the project before development of a relatively discrete benthic algal mat. 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, and the proportion of soil in these samples has declined during the period of study.

Exhibit 4-10 summarizes periphyton sample data for the Porta-PSTAs since the beginning of the study. Biomass numbers must be interpreted in light of the cautions described previously. The peat soils in Treatments 1, 3, 9, and 12 are highly organic, and their occurrence in samples is demonstrated by the higher ash-free dry weights recorded for these treatments. In the 5th quarter, the average ash-free dry weight in the peat-based treatments was between 220 and 836 g/m^2. Estimated ash-free dry weight in the shellrock treatments during the 5th quarter ranged from 140 to 260 g/m^2. Periphyton biomass in the sand treatments averaged between 244 and 311 g/m^2 during the 5th quarter. The relatively high biomass estimates in the Aquashade controls may indicate a substantial microbial growth in these systems.

The proportion of calcium in the ash weight of these samples is relatively consistent across treatments. Long-term average composition indicates that between 13 and 24 percent of this ash weight is calcium.

Chlorophyll provides a more direct method for quantifying the algal component of this biomass. Chlorophyll *a* concentrations corrected for phaeophytin averaged between 39 and 73 mg/m^2 in the peat treatments during the 5th quarter. Average chlorophyll *a* concentrations in the shellrock treatments ranged from 10 to 80 mg/m^2 during the same period. Chlorophyll *a* was highest in the sand treatments during this period with 107 to 260 mg/m^2.

Cell counts by algal group are also summarized in Exhibit 4-10. Blue-green algae typically dominate these samples in terms of total cell numbers. During the 5th quarter, average cell counts ranged between 19,000 and 30,000 cells x $10^6/m^2$ in the peat soil treatments. The shellrock cells typically had higher cell counts and ranged from 32,000 to 108,000 cells x $10^6/m^2$ during the 5th quarter. The sand treatments had even higher counts with 160,000 to 445,000 cells x $10^6/m^2$. The Aquashade controls had average cell counts between 4,000 and

Exhibit 4-10

Period-of-Record, Quarterly, and Monthly Summaries of Periphyton Data from the Porta-PSTA Mesocosms

Treatment	Date	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)	TKN (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
Period of Record																							
1	1999	1196.9	602.4	594.2	92.9	68.0	27.6	0.316	0.096	12.35	20021.1	10.7	2214.2	15.1	770.3	4.2	11.7	0.4	23016.1	30.3	5.18	0.721	3.53
2	1999	864.3	644.2	223.4	124.9	71.5	2.6	0.356	0.150	1.74	70239.2	14.9	4400.9	11.1	1058.7	5.2	11.6	0.3	75709.2	31.5	23.60	0.697	3.47
3	1999	772.7	355.4	417.4	72.3	56.9	18.6	0.247	0.056	4.39	10717.1	11.9	1336.2	17.2	292.0	4.4	9.0	0.5	12353.4	33.5	5.60	0.736	3.72
4	1999	599.2	466.6	132.8	105.5	56.1	0.6	0.432	0.105	0.74	38559.9	13.3	2902.2	10.9	522.5	3.4	8.4	0.2	41988.4	27.7	14.12	0.693	3.30
5	1999	766.5	586.2	180.3	125.1	47.9	5.1	0.414	0.131	2.02	41518.1	12.9	2136.7	10.3	739.9	4.2	8.0	0.5	44396.5	28.0	6.43	0.748	3.58
6	1999	705.8	551.8	154.0	105.7	30.0	3.4	0.370	0.176	0.76	38645.7	14.7	2528.5	12.0	845.5	3.9	20.6	0.5	42030.8	30.7	7.04	0.738	3.63
7	1999	676.6	498.9	177.7	79.0	149.4	2.3	0.206	0.019	0.90	224654.4	16.3	7370.6	11.4	4475.2	6.0	0.0	0.0	236500.3	34.0	30.41	0.718	3.65
8	1999	637.2	469.5	167.7	60.0	83.5	8.0	0.143	0.015	2.22	139995.1	16.1	3967.3	9.9	6708.8	5.1	83.8	0.5	150720.1	32.4	20.26	0.688	3.45
9	1999	1650.8	1259.5	928.9	175.7	70.0	45.5	0.592	0.141	15.92	3036.2	1.7	895.0	17.4	163.2	2.1	13.7	0.7	4108.1	21.4	1.47	0.646	2.86
10	1999	713.2	519.4	193.0	95.6	20.5	2.1	0.304	0.169	1.06	5936.6	8.3	2512.1	17.1	704.2	5.0	6.2	0.1	9159.1	30.6	5.78	0.778	3.84
11	1999	610.8	502.2	108.6	121.1	40.2	1.9	0.494	0.277	0.81	24339.1	11.7	2082.2	9.0	289.9	4.6	11.9	0.5	26720.9	25.6	8.35	0.700	3.26
12	1999	996.9	438.0	558.5	85.8	42.3	7.6	0.272	0.091	10.37	14973.0	10.1	1408.6	13.9	446.7	3.3	29.3	1.1	16851.2	28.3	2.71	0.688	3.29
Quarterly																							
1	Qtr-3	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	29.0		0.669	3.26
1	Qtr-4	872.7	469.4	403.3	71.7	73.1	29.6	0.225	0.074	8.57	19244.0	10.2	2228.7	18.6	542.1	3.8	21.7	0.7	22036.5	33.2	5.01	0.717	3.61
1	Qtr-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	27.7	5.35	0.736	3.52
2	Qtr-3	120.0	100.9	19.1	83.5	16.7	0.3	0.174	0.084		7026.4	12.5	1823.7	11.5	409.5	7.0	10.6	0.5	9270.3	31.5		0.787	3.92
2	Qtr-4	948.2	726.2	226.2	164.1	75.7	1.2	0.505	0.212	1.02	51491.9	13.5	3625.8	12.8	936.9	5.0	11.7	0.4	56066.4	31.6	30.07	0.671	3.36
2	Qtr-5	955.2	692.1	266.2	99.2	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	31.3	17.86	0.700	3.47
3	Qtr-3	864.7	305.6	559.1	106.1	28.0	16.2	0.385	0.106		1726.2	5.0	1172.9	20.3	392.2	5.3	10.6	0.7	3301.9	28.0		0.722	3.47
3	Qtr-4	915.4	388.4	527.0	81.0	80.2	19.4	0.291	0.067	4.57	6547.4	10.0	1959.2	20.9	169.1	3.3	11.3	0.6	8687.1	34.8	5.91	0.717	3.67
3	Qtr-5	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	34.0	5.29	0.758	3.84
4	Qtr-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	24.7		0.776	3.51
4	Qtr-4	562.2	432.2	130.1	94.5	55.8	0.4	0.400	0.095	0.80	42635.8	12.8	3068.0	11.7	573.6	3.4	0.0	0.0	46277.4	27.9	11.20	0.667	3.20
4	Qtr-5	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	28.6	17.04	0.691	3.33
5	Qtr-3	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	23.0		0.774	3.48
5	Qtr-4	828.0	641.9	186.0	145.5	40.4	3.5	0.476	0.151	0.81	43889.5	12.9	2236.2	10.9	583.6	4.6	7.4	0.3	46708.3	28.7	7.22	0.746	3.60
5	Qtr-5	907.2	680.5	226.7	115.0	62.4	8.4	0.413	0.130	3.23	49572.1	15.6	2106.4	9.3	1013.7	4.0	6.7	0.3	52696.6	29.1	5.63	0.742	3.60
6	Qtr-3	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	29.3		0.740	3.60
6	Qtr-4	713.5	570.9	142.6	128.6	55.8	2.6	0.444	0.189	0.69	55832.2	15.7	4238.2	14.0	895.2	3.8	8.6	0.4	60970.3	33.7	11.87	0.718	3.64
6	Qtr-5	899.4	687.6	211.7	102.0	10.5	3.6	0.374	0.207	0.83	30179.5	15.1	1053.3	9.2	1020.6	3.4	27.3	0.6	32273.2	28.2	2.21	0.758	3.64
7	Qtr-3	46.5	36.3	10.2	39.6	13.2	0.4	0.082	0.012		18421.0	6.0	2242.0	15.0	1428.4	8.0	0.0	0.0	22091.4	31.0		0.590	2.92
7	Qtr-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	38.7	23.21	0.777	4.09
7	Qtr-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	30.3	37.62	0.701	3.44
8	Qtr-3	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	33.0		0.765	3.86
8	Qtr-4	632.8	490.2	142.6	52.1	83.6	12.5	0.206	0.026	1.15	170976.1	17.0	5821.1	12.3	10956.8	5.7	227.4	1.0	187829.9	35.3	23.67	0.667	3.43
8	Qtr-5	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	29.3	16.84	0.682	3.33
9	Qtr-3	1697.7	575.2	1122.5	250.8	22.4	0.3	0.593	0.188		10691.3	2.0	1795.5	13.0	298.8	5.0	0.0	0.0	12785.6	16.0		0.503	2.01
9	Qtr-4	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	23.7	1.17	0.871	3.95
9	Qtr-5	1408.0	1958.7	703.6	149.3	55.1	41.5	0.547	0.150	8.15	3329.6	2.7	605.8	15.0	92.7	2.0	29.6	1.3	4057.7	21.0	1.77	0.469	2.06
10	Qtr-3	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	26.0		0.662	3.11
10	Qtr-4	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	32.7	8.49	0.824	4.14
10	Qtr-5	734.2	561.5	172.7	84.5	17.2	3.5	0.280	0.154	0.96	5648.6	9.0	1854.2	16.3	495.6	4.3	14.5	0.3	8012.9	30.0	3.07	0.770	3.77
11	Qtr-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	30.0		0.718	3.52
11	Qtr-4	691.3	587.4	103.9	138.7	15.6	3.1	0.603	0.397	0.76	6821.9	11.3	958.2	8.7	196.7	4.0	0.0	0.0	7976.9	24.0	3.22	0.762	3.49
11	Qtr-5	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	25.7	13.49	0.633	2.96
12	Qtr-3	857.2	312.3	544.9	117.6	22.2	5.8	0.320	0.108		1214.4	3.0	733.3	21.0	93.4	5.0	26.6	1.0	2067.6	31.0		0.618	3.06
12	Qtr-4	1474.1	571.9	901.3	112.7	52.0	6.7	0.378	0.155	19.02	7254.2	8.3	1259.7	17.7	106.1	1.7	27.1	1.0	8647.1	28.7	3.02	0.754	3.63
12	Qtr-5	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	27.0	2.39	0.646	3.03
Monthly																							
1	Apr-99	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	29.0		0.669	3.26
1	May-99	1526.0	695.8	829.9	138.9	156.7	76.5	0.487	0.179	8.57	7793.6	8.3	2822.6	21.3	443.2	4.0	53.1	1.3	11112.4	35.0	6.57	0.727	3.72
1	Jun-99	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	30.7	3.64	0.684	3.36
1	Jul-99	572.2	383.3	188.8	47.9	37.3	2.8	0.077	0.017		46058.5	14.0	2781.5	16.3	921.5	3.7	0.0	0.0	49761.4	34.0	4.81	0.741	3.75
1	Aug-99	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	31.3	5.86	0.784	3.90
1	Sep-99	1822.6	864.8	957.8	115.3	57.2	26.0	0.585	0.196	16.12	25840.8	13.3	2028.3	10.0	940.0	3.3	0.0	0.0	28809.1	26.7	3.39	0.753	3.55

Exhibit 4-10

Period-of-Record, Quarterly, and Monthly Summaries of Periphyton Data from the Porta-PSTA Mesocosms

		Periphyton Biomass (g/m^2)			Ca	Chl_a (corr)	Pheo_a	TP	TIP	TKN	Blue Green Algae		Diatoms		Green Algae		Other Taxa		Total Taxa		Biovolume		
Treatment	Date	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)*10^6	(# taxa)	(cm^3/m^2)	Evenness	SWDI
1	Oct-99	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	25.0	6.80	0.672	3.11
2	Apr-99	120.0	100.9	19.1	83.5	16.7	0.3	0.174	0.084		7026.4	12.5	1823.7	11.5	409.5	7.0	10.6	0.5	9270.3	31.5		0.787	3.92
2	May-99	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	30.5	10.12	0.752	3.70
2	Jun-99	543.6	445.2	98.3	83.4	29.5	0.4	0.263	0.136		37138.0	12.7	2673.4	11.7	187.1	2.7	19.1	0.3	40017.7	27.3	8.05	0.593	2.87
2	Jul-99	1458.8	1174.5	296.8	305.7	150.6	2.5	0.931	0.306		86038.5	16.0	4504.1	13.0	1947.5	7.3	4.8	0.3	92494.9	36.7	65.40	0.696	3.61
2	Aug-99	836.1	663.7	181.6	125.6	122.1	2.7	0.298	0.140		142815.9	17.7	12863.6	10.7	1294.9	6.3	28.3	0.7	157002.5	35.3	17.49	0.729	3.74
2	Sep-99	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	25.7	16.07	0.690	3.24
2	Oct-99	1251.6	783.9	467.7	75.0	75.8	4.1	0.211	0.090		77371.3	17.3	2149.5	11.0	1008.4	4.7	0.0	0.0	80529.2	33.0	20.01	0.679	3.42
3	Apr-99	864.7	305.6	559.1	106.1	28.0	16.2	0.385	0.106		1726.2	5.0	1172.9	20.3	392.2	5.3	10.6	0.7	3301.9	28.0		0.722	3.47
3	May-99	1250.9	491.9	758.9	67.2	118.1	32.4	0.305	0.096	4.57	5407.5	8.3	3051.5	22.3	344.2	5.0	8.1	0.3	8811.3	36.0	7.13	0.759	3.92
3	Jun-99	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	38.0	5.83	0.749	3.92
3	Jul-99	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	30.3	4.78	0.644	3.17
3	Aug-99	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	37.3	7.67	0.766	4.00
3	Sep-99	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	35.0	5.32	0.741	3.78
3	Oct-99	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	29.7	2.88	0.768	3.75
4	Apr-99	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	24.7		0.776	3.51
4	May-99	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	29.7	11.43	0.731	3.57
4	Jun-99	425.1	329.1	96.0	120.4	77.5	0.2	0.309	0.109		43913.8	13.3	3409.0	11.7	771.5	2.7	0.0	0.0	48094.3	27.7	14.37	0.651	3.13
4	Jul-99	778.8	654.2	124.7	97.9	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	26.3	7.80	0.619	2.92
4	Aug-99	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	30.3	17.50	0.713	3.49
4	Sep-99	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	27.7	24.70	0.685	3.26
4	Oct-99	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	27.7	8.91	0.674	3.23
5	Apr-99	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	23.0		0.774	3.48
5	May-99	836.4	557.9	277.2	100.9	20.5	0.4	0.351	0.285	0.81	26215.5	13.0	1427.2	11.0	432.3	6.0	3.1	0.3	28078.2	30.3	5.43	0.783	3.85
5	Jun-99	694.5	575.5	119.0	155.1	42.2	0.3	0.460	0.084		44773.9	13.7	3111.5	10.0	343.1	3.3	9.5	0.3	48212.4	27.3	8.74	0.754	3.58
5	Jul-99	953.0	792.4	161.7	180.6	58.4	9.8	0.618	0.083		60679.2	12.0	2170.0	11.7	975.4	4.3	9.6	0.3	63834.2	28.3	7.49	0.701	3.38
5	Aug-99	814.7	666.8	147.9	126.7	49.6	9.5	0.394	0.228		40335.9	18.0	2345.4	9.3	824.8	5.0	0.0	0.0	43506.1	32.3	4.76	0.774	3.88
5	Sep-99	735.9	605.6	130.3	133.5	77.3	9.6	0.435	0.083	3.23	72376.5	15.0	2429.9	10.0	1950.0	4.0	0.0	0.0	76756.4	29.0	7.67	0.692	3.34
5	Oct-99	1170.8	769.0	401.9	84.7	60.4	6.0	0.409	0.080		36003.8	13.7	1543.8	8.7	266.3	3.0	13.3	0.7	37827.2	26.0	4.47	0.762	3.58
6	Apr-99	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	29.3		0.740	3.60
6	May-99	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	34.0	8.53	0.765	3.89
6	Jun-99	889.7	711.9	177.8	165.6	68.9	0.4	0.678	0.414		79733.4	15.0	4970.7	15.0	864.3	3.3	0.0	0.0	85568.5	33.3	15.97	0.656	3.32
6	Jul-99	910.6	737.6	173.0	169.9	70.0	7.3	0.472	0.047		57497.4	16.7	4582.3	13.0	1089.4	3.7	5.7	0.3	63174.8	33.7	11.10	0.732	3.71
6	Aug-99	1167.1	987.6	179.4	205.4	9.5	5.7	0.813	0.481		21896.9	13.7	914.1	8.7	1549.6	3.3	6.1	0.3	24366.7	26.0	2.02	0.727	3.38
6	Sep-99	566.0	465.0	101.0	52.6	12.2	3.8	0.188	0.079	0.83	41178.2	15.7	1149.8	7.7	655.7	4.7	35.6	0.3	43019.3	28.3	1.59	0.795	3.83
6	Oct-99	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	30.3	3.01	0.753	3.70
7	Apr-99	46.5	36.3	10.2	39.6	13.2	0.4	0.082	0.012		18421.0	6.0	2242.0	15.0	1428.4	8.0	0.0	0.0	22091.4	31.0		0.590	2.92
7	May-99	506.7	398.4	108.3	43.1	49.7	0.4	0.166	0.026	1.19	61320.2	16.0	6555.0	16.0	1847.4	7.0	0.0	0.0	69722.6	39.0	14.91	0.677	3.58
7	Jun-99	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	35.0	15.02	0.838	4.30
7	Jul-99	459.2	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	42.0	39.69	0.816	4.40
7	Aug-99	1046.4	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	36.0	28.71	0.734	3.80
7	Sep-99	276.6	221.6	55.0	20.2	15.2	4.8	0.097	0.006	0.62	73264.3	15.0	260.1	4.0	1039.6	5.0	0.0	0.0	74564.0	24.0	3.10	0.661	3.03
7	Oct-99	2101.8	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	31.0	81.03	0.707	3.50
8	Apr-99	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	33.0		0.765	3.86
8	May-99	414.9	311.0	103.9	30.7	47.0	4.5	0.116	0.026	1.15	54304.1	11.0	5145.6	13.0	2996.7	11.0	0.0	0.0	62446.4	35.0	16.80	0.511	2.62
8	Jun-99	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	34.0	17.76	0.711	3.62
8	Jul-99	828.8	648.8	179.9	77.9	150.2	32.8	0.323	0.034		297444.0	22.0	7283.1	11.0	28674.8	3.0	227.4	1.0	333629.3	37.0	36.44	0.780	4.07
8	Aug-99	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	35.0	15.52	0.793	4.07
8	Sep-99	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	28.0	2.95	0.626	3.01
8	Oct-99	1144.1	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	182295.8	25.0	32.07	0.627	2.91
9	Apr-99	1697.7	575.2	1122.5	250.8	22.4	0.3	0.593	0.188		10691.3	2.0	1795.5	13.0	298.8	5.0	0.0	0.0	12785.6	16.0		0.503	2.01
9	May-99	2084.9	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	23.0	0.75	0.905	4.10
9	Jun-99	2817.2	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	19.0	1.16	0.902	3.83
9	Jul-99	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	29.0	1.60	0.805	3.91
9	Aug-99	2126.8	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	17.0	2.17	0.371	1.52
9	Sep-99	1097.5	4402.6	457.8	150.5	56.9	34.3	0.465	0.157	8.15	3140.1	3.0	790.8	17.0	168.1	3.0	50.2	1.0	4149.2	24.0	2.42	0.466	2.14
9	Oct-99	999.6	532.1	467.5	99.5	48.9	44.1	0.536	0.079		1247.8	3.0	538.6	14.0	109.9	3.0	19.9	2.0	1916.1	22.0	0.73	0.570	2.54

Exhibit 4-10

Period-of-Record, Quarterly, and Monthly Summaries of Periphyton Data from the Porta-PSTA Mesocosms

		Periphyton Biomass (g/m^2)			Ca	Chl_a (corr)	Pheo_a	TP	TIP	TKN	Blue Green Algae		Diatoms		Green Algae		Other Taxa		Total Taxa		Biovolume		
Treatment	Date	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)*10^6	(# taxa)	(cm^3/m^2)	Evenness	SWDI
10	Apr-99	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	26.0		0.662	3.11
10	May-99	1308.5	729.4	573.5	93.7	27.9	0.4	0.353	0.260	1.17	14702.9	9.0	4535.6	15.0	1608.2	4.0	0.0	0.0	20846.7	28.0	11.65	0.785	3.77
10	Jun-99	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	38.0	11.95	0.856	4.50
10	Jul-99	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	32.0	1.87	0.831	4.15
10	Aug-99	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	36.0	2.82	0.854	4.41
10	Sep-99	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	29.0	0.47	0.707	3.43
10	Oct-99	827.4	530.2	297.2	47.9	25.9	4.2	0.143	0.076		10056.4	5.0	3409.3	17.0	699.5	2.0	43.5	1.0	14208.8	25.0	5.91	0.748	3.48
11	Apr-99	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	30.0		0.718	3.52
11	May-99	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	27.0	3.92	0.830	3.95
11	Jun-99	1191.1	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	20.0	2.40	0.811	3.51
11	Jul-99	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	25.0	3.34	0.646	3.00
11	Aug-99	1052.5	896.3	156.2	229.0	194.1	0.2	0.953	0.504		109369.4	17.0	8585.2	7.0	924.2	4.0	0.0	0.0	118878.8	28.0	33.44	0.740	3.56
11	Sep-99	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	27.0	4.73	0.514	2.44
11	Oct-99	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	22.0	2.30	0.644	2.87
12	Apr-99	857.2	312.3	544.9	117.6	22.2	5.8	0.320	0.108		1214.4	3.0	733.3	21.0	93.4	5.0	26.6	1.0	2067.6	31.0		0.618	3.06
12	May-99	2970.4	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	23.0	1.09	0.834	3.77
12	Jun-99	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	37.0	6.11	0.813	4.24
12	Jul-99	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	26.0	1.87	0.614	2.89
12	Aug-99	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	21.0	1.96	0.686	3.01
12	Sep-99	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	37.0	3.39	0.596	3.10
12	Oct-99	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	23.0	1.82	0.656	2.97

SWDI = Shannon-Weaver Diversity Index

8,000 cells x $10^6/m^2$ during the 5th quarter. Algal biovolume estimates typically reflect the same trends as cell counts. Algal species diversity and evenness is similar between all treatments.

4.7.3 Snail Counts

Populations of at least two species of snails have been increasing in a few of the Porta-PSTA mesocosms since startup. These populations were estimated by a direct count on October 6, 1999. These counts are known to be minimum numbers since some snails are not visible because of algal and plant material in the tanks.

Exhibit 4-11 provides a summary of the snail estimates in October by Porta-PSTA. Snail colonization was highest in Tanks 20 (Treatment 8 - deep sand), 6 (Treatment 6 - variable depth shellrock), and 13 (Treatment 5 - deep shellrock). Estimated minimum snail densities in these tanks ranged from 26 to 191 per m^2 of bottom area.

4.8 Ecosystem Metabolism

4.8.1 Community Metabolism

Exhibit 4-12 summarizes the ecosystem metabolism estimates for the Porta-PSTAs by month, quarter, and period-of-record. CM of the Porta-PSTA ecosystems has averaged between 1.14 and 3.24 g $O_2/m^2/d$ during the period-of-record (approximately 232 days through October). Long-term average CM in the Aquashade controls was much lower with approximately 0.30 to 0.32 g $O_2/m^2/d$.

Long-term average NPP_{24hr} continues to be negative in the peat soil mesocosms, in spite of the evident periphyton development. Average long-term net productivity rates were between -0.71 to -0.25 g $O_2/m^2/d$. The Aquashade peat soil control was even lower with -1.16 g $O_2/m^2/d$. As mentioned in the 4th Quarterly Report, these negative numbers may indicate a consistent sediment oxygen demand in these tanks and a net loss of carbon resulting from organic sediment decomposition. Long-term average NPP_{24hr} was positive in all of the shellrock and sand mesocosms, ranging from 0.42 to 1.21 g $O_2/m^2/d$. The shellrock Aquashade control had a long-term average NPP_{24hr} of approximately zero, indicating that sediment oxygen demand is much lower in these treatments than in the peat soil treatments.

Photosynthetic efficiency was estimated to average between 0.64 to 1.7 percent in all treatments except the Aquashade controls, which averaged approximately 0.15 percent.

4.8.2 PAR Extinction

Exhibit 4-13 summarizes the PAR extinction data for the Porta-PSTAs since the project started in April 1999. Long-term average PAR extinction coefficients generally ranged between 1.6 and 3.4 m^{-1}. Extinction coefficients were highest in the Aquashade controls (4.1 to 4.3 m^{-1}).

4.9 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

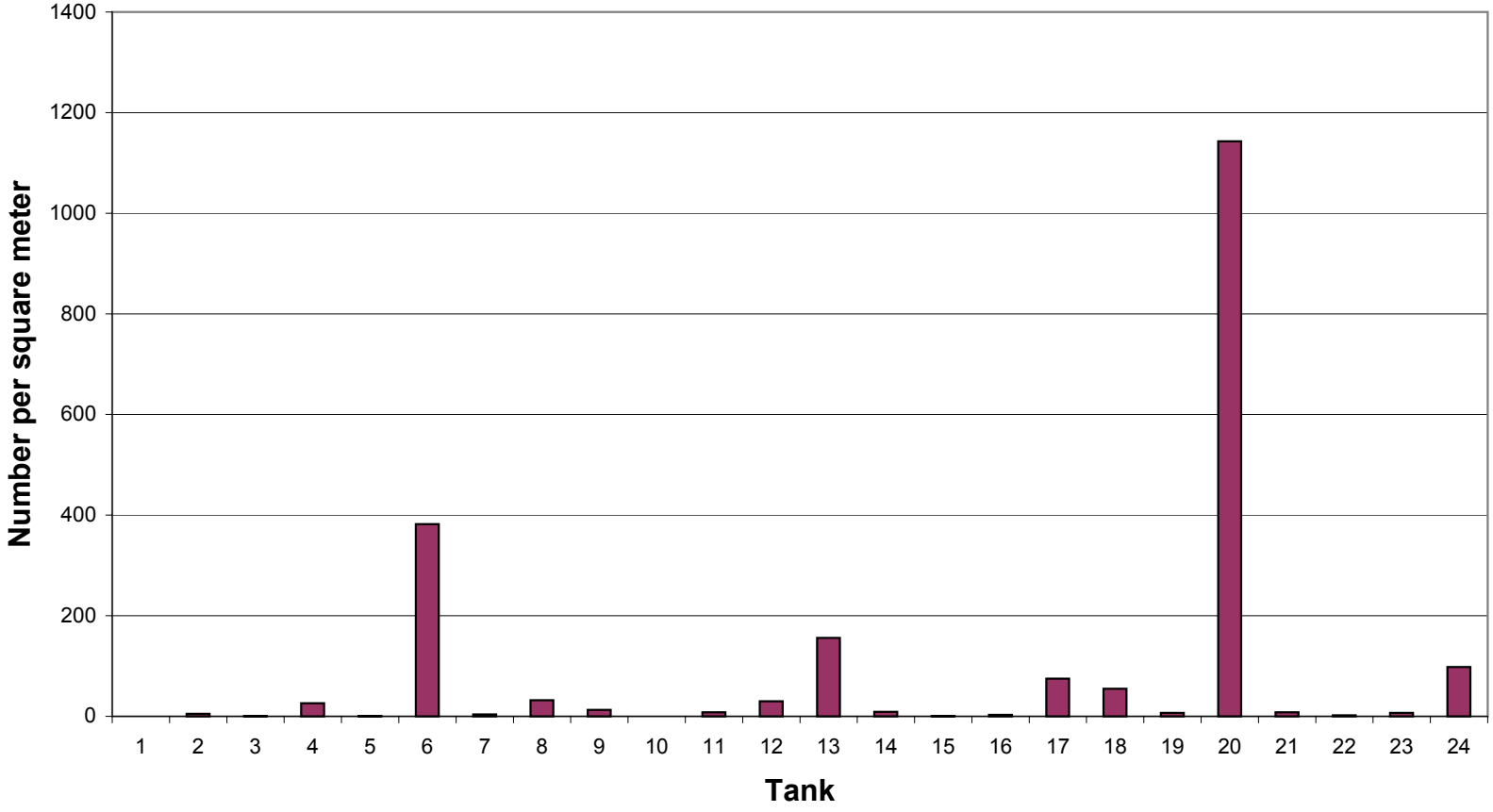


Exhibit 4-11

Summary of Snail Counts in Porta-PSTA Mesocosms, October 6, 1999

Exhibit 4-12

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Mesocosms

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 %
Period of Record									
1	1999	0.993	2.854	3.102	2.854	-0.248	0.129	36.8	1.485
2	1999	0.607	1.140	2.022	1.140	0.677	0.084	34.1	0.639
3	1999	0.292	1.660	2.223	1.660	-0.563	0.093	38.2	0.831
4	1999	1.462	2.645	1.915	2.645	0.730	0.080	36.6	1.382
5	1999	1.441	3.248	2.828	3.248	0.420	0.118	42.9	1.448
6	1999	1.354	2.722	2.191	2.722	0.531	0.091	36.1	1.441
7	1999	1.902	3.136	1.923	3.136	1.213	0.080	34.5	1.739
8	1999	1.251	2.008	1.250	2.008	0.757	0.052	27.6	1.389
9	1999	-0.183	0.302	1.870	0.302	-1.155	0.078	39.4	0.146
10	1999	0.128	0.320	1.523	0.320	-0.045	0.063	38.5	0.159
11	1999	1.550	2.513	1.593	2.513	0.920	0.066	34.9	1.376
12	1999	0.194	1.952	2.660	1.952	-0.708	0.111	47.2	0.791
Quarterly									
1	Qtr-3	0.258	1.749	2.408	1.749	-0.659	0.100	41.4	0.809
1	Qtr-4	1.435	3.912	3.963	3.912	-0.051	0.165	43.1	1.738
1	Qtr-5	1.195	2.762	2.848	2.762	-0.086	0.119	26.5	1.997
2	Qtr-3	0.202	0.283	0.970	0.283	1.153	0.040	34.9	0.155
2	Qtr-4	1.395	2.666	1.917	2.666	0.749	0.080	36.5	1.396
2	Qtr-5	1.460	3.227	3.074	3.227	0.153	0.128	25.0	2.470
3	Qtr-3	0.502	2.195	2.753	2.195	-0.558	0.115	35.8	1.172
3	Qtr-4	0.267	1.443	1.869	1.443	-0.426	0.078	40.7	0.678
3	Qtr-5	0.163	1.829	2.841	1.829	-1.012	0.118	32.3	1.082
4	Qtr-3	1.848	2.970	1.817	2.970	1.153	0.076	41.5	1.370
4	Qtr-4	1.341	2.579	1.901	2.579	0.678	0.079	36.5	1.350
4	Qtr-5	1.410	2.549	1.996	2.549	0.553	0.083	33.8	1.442
5	Qtr-3	0.973	2.283	2.145	2.283	0.137	0.089	49.4	0.884
5	Qtr-4	1.661	3.702	3.109	3.702	0.593	0.130	44.4	1.595
5	Qtr-5	1.365	3.096	2.796	3.096	0.300	0.116	35.4	1.671
6	Qtr-3	2.039	3.567	2.493	3.567	1.074	0.104	43.7	1.561
6	Qtr-4	1.050	2.154	1.686	2.154	0.469	0.070	34.8	1.186
6	Qtr-5	1.151	2.921	2.969	2.921	-0.048	0.124	29.3	1.906
7	Qtr-4	2.073	3.522	2.219	3.522	1.303	0.092	35.7	1.889
7	Qtr-5	1.306	1.787	0.887	1.787	0.899	0.037	30.5	1.122
8	Qtr-4	1.313	2.015	1.081	2.015	0.934	0.045	33.4	1.154
8	Qtr-5	1.189	2.000	1.420	2.000	0.580	0.059	21.9	1.748
9	Qtr-3	-0.121	0.120	1.756	0.120	-1.245	0.073	41.6	0.055
9	Qtr-4	-0.446	0.665	1.691	0.665	-1.026	0.070	36.7	0.347
9	Qtr-5	-0.188	1.392	2.652	1.392	-1.260	0.111	22.7	1.174
10	Qtr-3	0.104	0.218	1.343	0.218	0.158	0.056	38.5	0.108
10	Qtr-4	0.215	1.368	1.773	1.368	-0.405	0.074	50.5	0.518
10	Qtr-5	0.497	1.492	1.836	1.492	-0.344	0.077	31.0	0.921
11	Qtr-4	1.695	2.707	1.592	2.707	1.115	0.066	40.0	1.295
11	Qtr-5	1.262	2.125	1.595	2.125	0.531	0.066	24.8	1.639
12	Qtr-4	0.194	1.952	2.660	1.952	-0.708	0.111	47.2	0.791
Monthly									
1	Apr-99	0.258	1.749	2.408	1.749	-0.659	0.100	41.4	0.809
1	May-99	1.435	3.912	3.963	3.912	-0.051	0.165	43.1	1.738
1	Sep-99	0.849	2.218	2.348	2.218	-0.129	0.098	28.4	1.497
1	Oct-99	1.311	2.944	3.015	2.944	-0.071	0.126	25.8	2.179
2	Apr-99	1.517	2.123	0.970	2.123	1.153	0.040	53.9	0.754
2	Jun-99	1.119	2.033	1.388	2.033	0.645	0.058	32.0	1.214
2	Jul-99	1.808	3.615	2.711	3.615	0.904	0.113	43.3	1.597
2	Aug-99	1.113	3.002	3.240	3.002	-0.237	0.135	24.0	2.394
2	Sep-99	1.547	3.283	3.033	3.283	0.251	0.126	25.2	2.488
3	Apr-99	0.502	2.195	2.753	2.195	-0.558	0.115	35.8	1.172
3	May-99	0.201	1.247	1.674	1.247	-0.427	0.070	43.2	0.552
3	Jun-99	0.489	2.097	2.519	2.097	-0.421	0.105	32.4	1.239
3	Aug-99	0.255	2.165	3.055	2.165	-0.891	0.127	37.0	1.120

Exhibit 4-12

Period-of-Record, Quarterly, and Monthly Summaries of Ecosystem Metabolism Data from the Porta-PSTA Mesocosms

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 %
3	Oct-99	0.070	1.493	2.627	1.493	-1.134	0.109	27.7	1.031
4	Apr-99	1.848	2.970	1.817	2.970	1.153	0.076	41.5	1.370
4	Jun-99	1.140	2.002	1.335	2.002	0.668	0.056	32.6	1.175
4	Jul-99	1.517	3.084	2.397	3.084	0.687	0.100	40.0	1.475
4	Aug-99	2.191	3.453	2.163	3.453	1.290	0.090	44.8	1.476
4	Sep-99	1.076	2.162	1.924	2.162	0.238	0.080	29.1	1.420
5	Apr-99	0.973	2.283	2.145	2.283	0.137	0.089	49.4	0.884
5	May-99	1.946	4.108	3.268	4.108	0.839	0.136	47.8	1.645
5	Jun-99	0.471	2.217	2.620	2.217	-0.403	0.109	30.1	1.410
5	Jul-99	1.696	3.609	3.010	3.609	0.599	0.125	45.0	1.535
5	Aug-99	1.322	3.063	2.786	3.063	0.278	0.116	35.6	1.645
5	Sep-99	1.623	3.288	2.855	3.288	0.433	0.119	34.4	1.831
6	Apr-99	2.039	3.567	2.493	3.567	1.074	0.104	43.7	1.561
6	May-99	1.288	2.327	1.624	2.327	0.702	0.068	44.1	1.010
6	Jun-99	1.171	1.943	1.167	1.943	0.776	0.049	30.3	1.225
6	Jul-99	0.879	2.201	2.008	2.201	0.193	0.084	33.3	1.266
6	Aug-99	1.304	3.051	2.917	3.051	0.134	0.122	30.0	1.945
6	Sep-99	0.386	2.269	3.229	2.269	-0.959	0.135	25.8	1.682
7	May-99	1.106	1.812	1.101	1.812	0.711	0.046	42.8	0.811
7	Jun-99	2.798	4.805	3.058	4.805	1.746	0.127	30.3	3.029
7	Oct-99	1.306	1.787	0.887	1.787	0.899	0.037	30.5	1.122
8	Jun-99	1.313	2.015	1.081	2.015	0.934	0.045	33.4	1.154
8	Aug-99	1.520	2.987	2.347	2.987	0.640	0.098	24.5	2.328
8	Oct-99	0.859	1.014	0.494	1.014	0.520	0.021	19.2	1.009
9	Apr-99	-0.514	0.511	1.756	0.511	-1.245	0.073	44.6	0.219
9	May-99	-0.516	0.593	1.715	0.593	-1.122	0.071	50.5	0.225
9	Jun-99	-0.423	0.690	1.684	0.690	-0.994	0.070	32.0	0.412
9	Aug-99	-0.255	1.359	2.582	1.359	-1.224	0.108	19.8	1.312
9	Oct-99	-0.053	1.459	2.791	1.459	-1.333	0.116	28.5	0.981
10	Apr-99	0.717	1.500	1.343	1.500	0.158	0.056	44.6	0.643
10	May-99	0.215	1.368	1.773	1.368	-0.405	0.074	50.5	0.518
10	Oct-99	0.497	1.492	1.836	1.492	-0.344	0.077	31.0	0.921
11	May-99	1.815	2.862	1.637	2.862	1.225	0.068	44.1	1.242
11	Jun-99	1.332	2.243	1.457	2.243	0.786	0.061	27.7	1.548
11	Oct-99	1.262	2.125	1.595	2.125	0.531	0.066	24.8	1.639
12	May-99	0.194	1.952	2.660	1.952	-0.708	0.111	47.2	0.791

Note:

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.

Exhibit 4-13

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Mesocosms

Treatment	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	0.64	1311.0	594.0	0.52	1.96
2	1999	0.62	1369.9	732.6	0.50	1.68
3	1999	0.28	882.9	617.6	0.16	2.39
4	1999	0.37	1165.4	759.8	0.24	1.97
5	1999	0.62	1219.1	527.7	0.49	1.94
6	1999	0.54	1213.7	636.1	0.42	1.63
7	1999	0.41	1142.3	533.4	0.29	3.38
8	1999	0.68	1121.5	539.7	0.56	1.61
9	1999	0.63	770.5	128.5	0.50	4.26
10	1999	0.64	663.2	112.6	0.52	4.10
11	1999	0.33	1013.8	748.4	0.21	2.19
12	1999	0.34	912.5	618.9	0.22	2.46
Quarterly						
1	Qtr-3	0.61	155.9	57.3	0.49	2.03
1	Qtr-4	0.63	2016.1	994.4	0.51	1.39
1	Qtr-5	0.65	862.5	312.9	0.53	2.51
2	Qtr-3	0.61	136.9	69.1	0.49	1.43
2	Qtr-4	0.60	2160.7	1368.5	0.48	1.00
2	Qtr-5	0.65	940.9	314.9	0.53	2.34
3	Qtr-3	0.28	220.4	137.0	0.16	2.79
3	Qtr-4	0.27	1488.3	1101.7	0.15	1.89
3	Qtr-5	0.30	498.4	293.8	0.18	2.76
4	Qtr-3	0.35	200.6	148.9	0.22	1.39
4	Qtr-4	0.37	2101.1	1467.8	0.22	1.64
4	Qtr-5	0.37	655.2	334.2	0.25	2.46
5	Qtr-3	0.62	312.6	119.2	0.50	1.87
5	Qtr-4	0.61	1799.5	805.8	0.46	1.86
5	Qtr-5	0.64	906.1	367.9	0.52	2.05
6	Qtr-3	0.33	208.8	160.4	0.20	1.37
6	Qtr-4	0.51	1766.5	1051.4	0.39	1.23
6	Qtr-5	0.64	995.9	379.4	0.52	2.11
7	Qtr-3	0.67	276.7	131.7	0.55	1.35
7	Qtr-4	0.34	2251.0	1297.5	0.22	3.08
7	Qtr-5	0.37	691.8	158.0	0.25	4.25
8	Qtr-3	0.66	300.2	132.7	0.53	1.53
8	Qtr-4	0.66	2001.7	1063.8	0.54	1.19
8	Qtr-5	0.72	515.1	151.3	0.60	2.05
9	Qtr-3	0.64	275.6	45.2	0.52	3.49
9	Qtr-4	0.61	1517.9	270.5	0.48	3.65
9	Qtr-5	0.64	188.0	14.3	0.52	5.13
10	Qtr-3	0.64	289.7	48.0	0.52	3.47
10	Qtr-4	0.63	1273.9	233.7	0.50	3.36
10	Qtr-5	0.65	176.9	13.0	0.53	5.04
11	Qtr-3	0.34	283.5	224.2	0.21	1.10
11	Qtr-4	0.31	2106.7	1585.7	0.19	1.94
11	Qtr-5	0.35	164.2	85.8	0.23	2.79

Exhibit 4-13

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Mesocosms

Treatment	Date	Water Depth (m)	PAR (µmol/m^2/s) Surface	PAR (µmol/m^2/s) Bottom	Z (m)	Ext Coeff (m^{-1})
12	Qtr-3	0.37	244.2	165.4	0.24	1.60
12	Qtr-4	0.34	1681.2	1154.2	0.21	1.90
12	Qtr-5	0.34	93.6	42.8	0.22	3.73
Monthly						
1	Apr-99	0.61	155.9	57.3	0.49	2.03
1	May-99	0.65	1698.3	840.1	0.53	1.34
1	Jun-99	0.59	2174.2	1157.0	0.47	1.33
1	Jul-99	0.65	2176.0	986.2	0.52	1.52
1	Aug-99	0.64	1790.7	771.1	0.52	1.64
1	Sep-99	0.64	413.2	114.2	0.52	2.48
1	Oct-99	0.67	383.6	53.5	0.55	3.42
2	Apr-99	0.61	136.9	69.1	0.49	1.43
2	May-99	0.61	1496.7	841.0	0.49	1.16
2	Jun-99	0.57	2546.7	1492.6	0.45	1.18
2	Jul-99	0.63	2217.3	1596.0	0.51	0.72
2	Aug-99	0.65	1654.2	567.1	0.52	2.67
2	Sep-99	0.64	615.3	227.1	0.54	1.86
2	Oct-99	0.65	553.3	150.5	0.52	2.50
3	Apr-99	0.28	220.4	137.0	0.16	2.79
3	May-99	0.28	1490.3	1248.6	0.17	1.01
3	Jun-99	0.22	1228.1	882.1	0.10	2.41
3	Jul-99	0.30	1746.5	1174.2	0.18	2.24
3	Aug-99	0.29	1137.6	647.3	0.17	3.23
3	Sep-99	0.31	200.9	118.5	0.19	2.82
3	Oct-99	0.29	156.6	115.7	0.17	2.24
4	Apr-99	0.35	200.6	148.9	0.22	1.39
4	May-99	0.35	1471.8	1209.5	0.23	0.85
4	Jun-99	0.40	2352.0	1643.6	0.22	1.78
4	Jul-99	0.35	2269.7	1464.3	0.22	2.02
4	Aug-99	0.36	1160.2	567.1	0.23	3.14
4	Sep-99	0.35	566.0	268.2	0.23	3.29
4	Oct-99	0.42	239.5	167.2	0.29	0.95
5	Apr-99	0.62	312.6	119.2	0.50	1.87
5	May-99	0.62	1325.9	860.8	0.40	1.10
5	Jun-99	0.58	1940.4	762.0	0.48	2.17
5	Jul-99	0.62	2132.1	794.6	0.50	2.29
5	Aug-99	0.63	1571.2	731.8	0.51	1.52
5	Sep-99	0.65	573.9	184.3	0.52	2.18
5	Oct-99	0.64	406.9	97.5	0.54	2.65
6	Apr-99	0.33	208.8	160.4	0.20	1.37
6	May-99	0.33	1505.0	1330.0	0.20	0.52
6	Jun-99	0.59	1562.0	773.3	0.46	1.53
6	Jul-99	0.63	2232.7	1050.8	0.50	1.63
6	Aug-99	0.65	1336.4	612.7	0.53	1.53
6	Sep-99	0.63	939.5	368.9	0.51	1.97
6	Oct-99	0.65	711.6	156.7	0.53	2.84
7	Apr-99	0.67	276.7	131.7	0.55	1.35

Exhibit 4-13

Period-of-Record, Quarterly, and Monthly Summaries of PAR Extinction Measurements from the Porta-PSTA Mesocosms

Treatment	Date	Water Depth (m)	PAR (µmol/m^2/s) Surface	PAR (µmol/m^2/s) Bottom	Z (m)	Ext Coeff (m^{-1})
7	Jun-99	0.31	2468.0	2005.0	0.19	1.08
7	Jul-99	0.37	2034.0	590.0	0.24	5.08
7	Aug-99	0.37	1657.7	253.9	0.25	7.51
7	Sep-99	0.38	179.6	85.8	0.26	2.89
7	Oct-99	0.37	238.0	134.3	0.24	2.35
8	Apr-99	0.66	300.2	132.7	0.53	1.53
8	May-99	0.67	1605.6	857.2	0.55	1.14
8	Jun-99	0.61	2476.0	1395.6	0.49	1.17
8	Jul-99	0.69	1923.5	938.6	0.57	1.25
8	Aug-99	0.76	1031.5	305.6	0.64	1.90
8	Sep-99	0.70	205.7	71.7	0.58	1.81
8	Oct-99	0.69	308.1	76.6	0.57	2.44
9	Apr-99	0.64	275.6	45.2	0.52	3.49
9	May-99	0.61	1263.8	240.4	0.49	3.40
9	Jun-99	0.56	1628.0	399.6	0.44	3.18
9	Jul-99	0.64	1661.8	171.5	0.52	4.36
9	Aug-99	0.64	277.1	25.1	0.52	4.64
9	Sep-99	0.65	133.9	9.6	0.52	5.02
9	Oct-99	0.63	153.1	8.1	0.51	5.74
10	Apr-99	0.64	289.7	48.0	0.52	3.47
10	May-99	0.64	1194.8	241.0	0.52	3.09
10	Jun-99	0.59	1131.2	283.1	0.47	2.95
10	Jul-99	0.65	1495.8	177.1	0.53	4.05
10	Aug-99	0.65	247.4	21.9	0.53	4.58
10	Sep-99	0.65	132.9	9.2	0.53	5.04
10	Oct-99	0.66	150.3	7.9	0.54	5.50
11	Apr-99	0.34	283.5	224.2	0.21	1.10
11	May-99	0.34	1630.7	1382.5	0.21	0.77
11	Jun-99	0.28	2783.0	2652.0	0.16	0.30
11	Jul-99	0.33	1906.5	722.7	0.20	4.75
11	Aug-99	0.38	190.5	63.3	0.26	4.20
11	Sep-99	0.33	120.9	75.4	0.21	2.24
11	Oct-99	0.34	181.3	118.6	0.22	1.93
12	Apr-99	0.37	244.2	165.4	0.24	1.60
12	May-99	0.37	1398.3	1001.7	0.24	1.37
12	Jun-99	0.30	2274.0	1692.5	0.18	1.61
12	Jul-99	0.34	1371.4	768.5	0.21	2.71
12	Sep-99	0.34	54.5	22.2	0.22	4.09
12	Oct-99	0.34	132.7	63.4	0.22	3.37

Note:

Extinction coefficient = $(\ln PAR_{surf} - \ln PAR_{bot})/z$ and z = water depth - 0.122 m

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.

4.9.1 Phosphorus and TSS Trends

Exhibit 4-14 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 4-15 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 4-16 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 4-17 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 4-18 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.

4.9.2 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

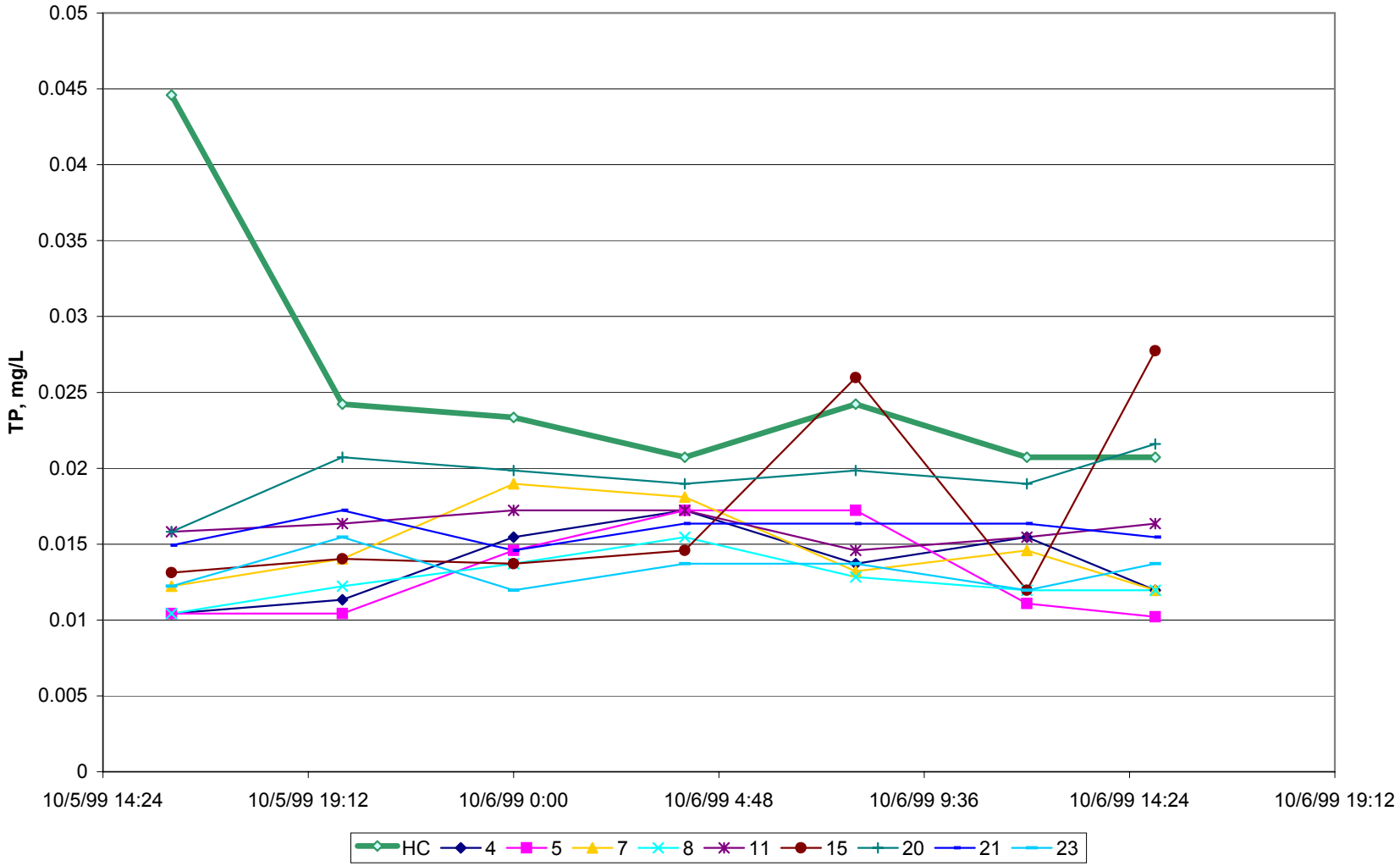


Exhibit 4-14
Diel Record of TP in the Porta-PSTA Mesocosms on October 5-6, 1999

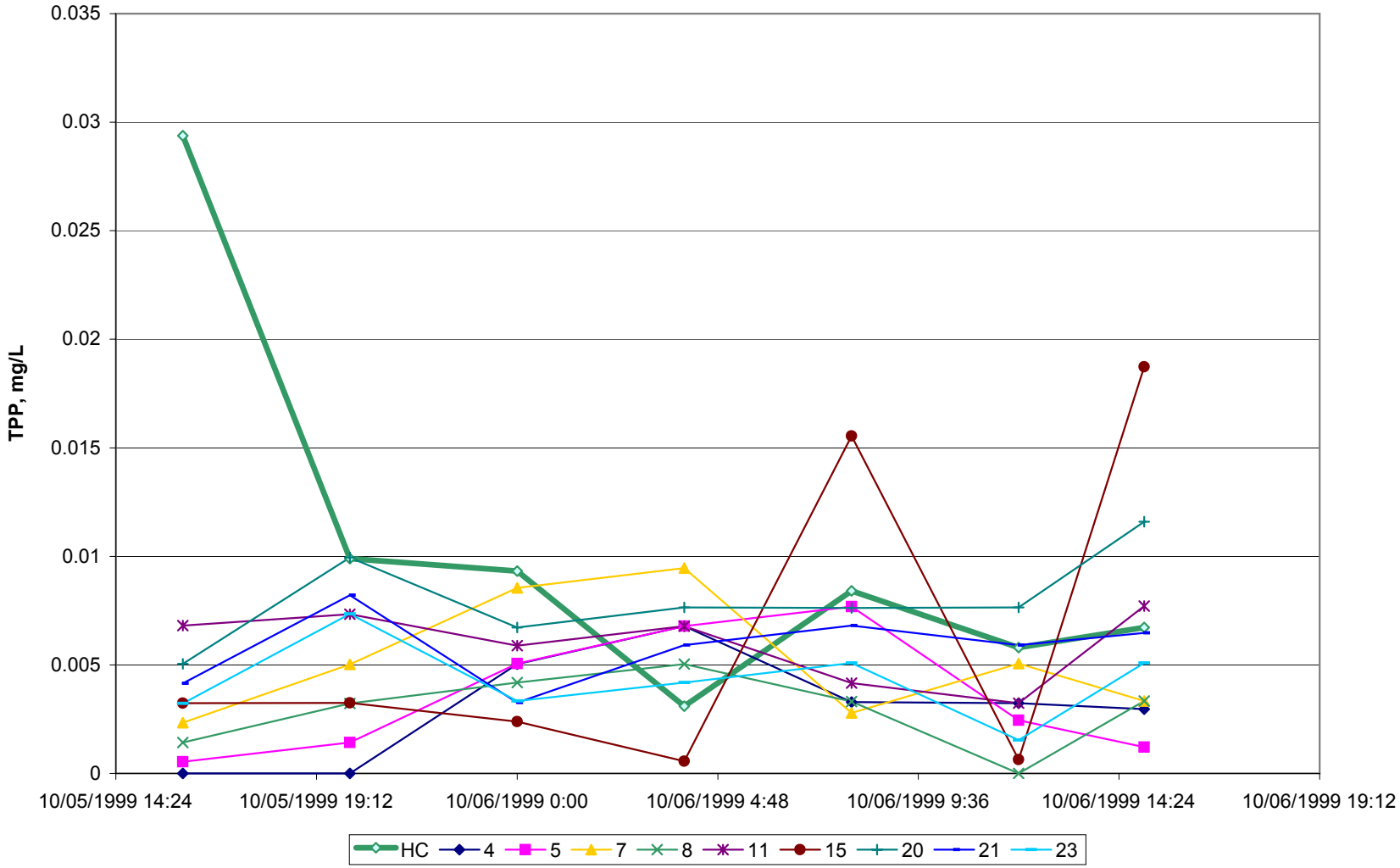


Exhibit 4-15
Diel Record of TPP in the Porta-PSTA Mesocosms on October 5-6, 1999

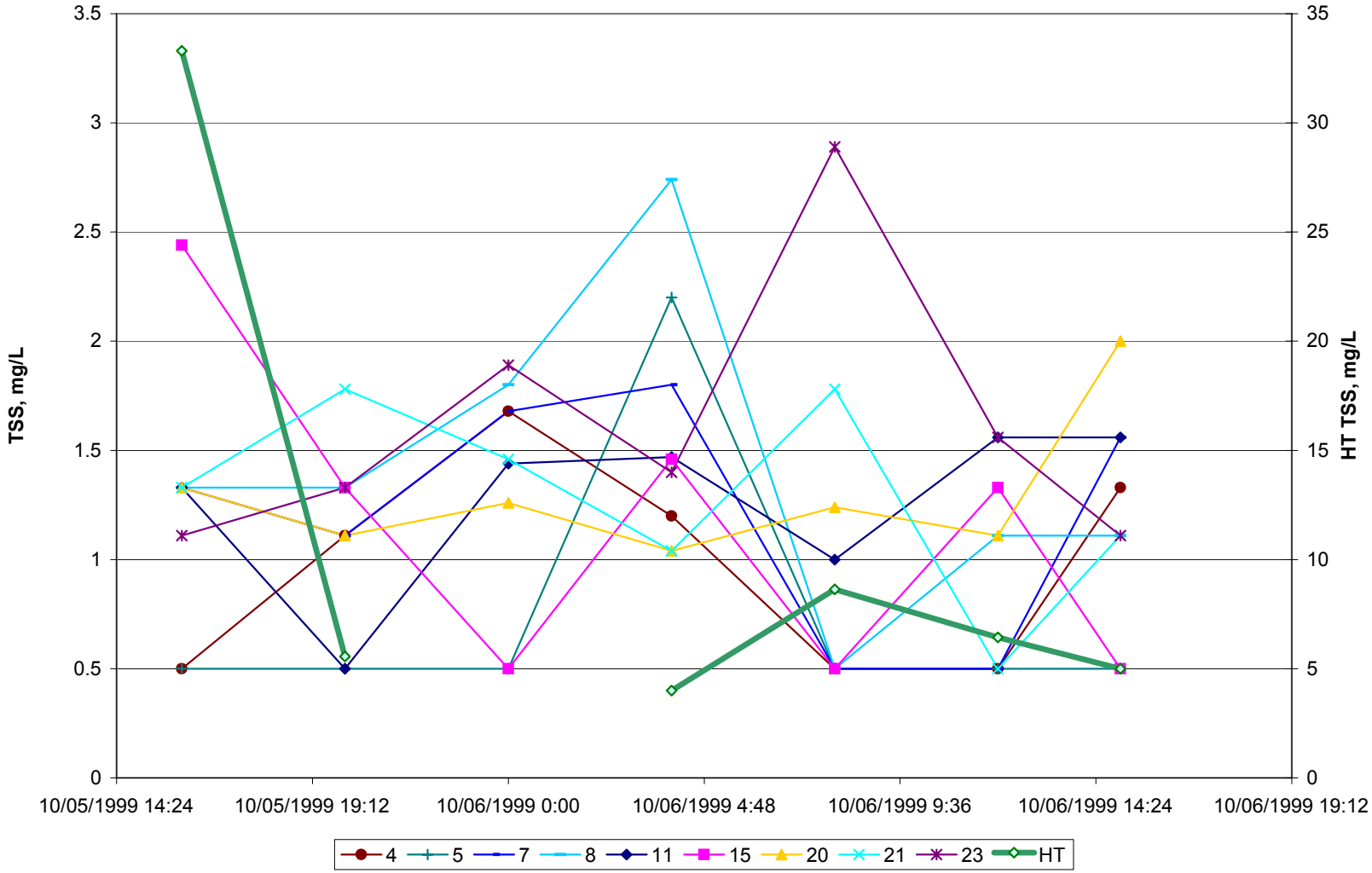


Exhibit 4-16
Diel Record of TSS in the Porta-PSTA Mesocosms on October 5-6, 1999

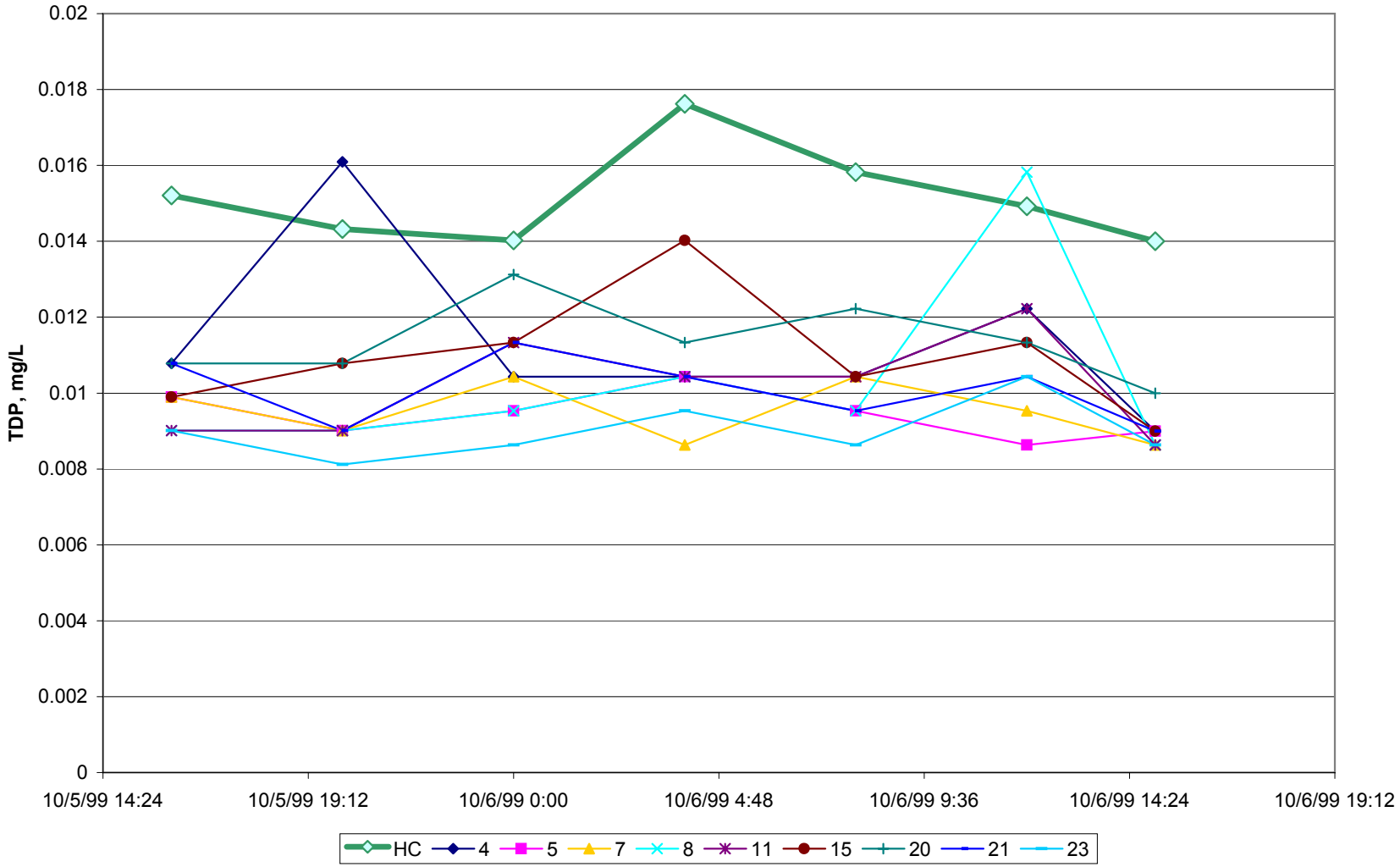


Exhibit 4-17
Diel Record of TDP in the Porta-PSTA Mesocosms on October 5-6, 1999

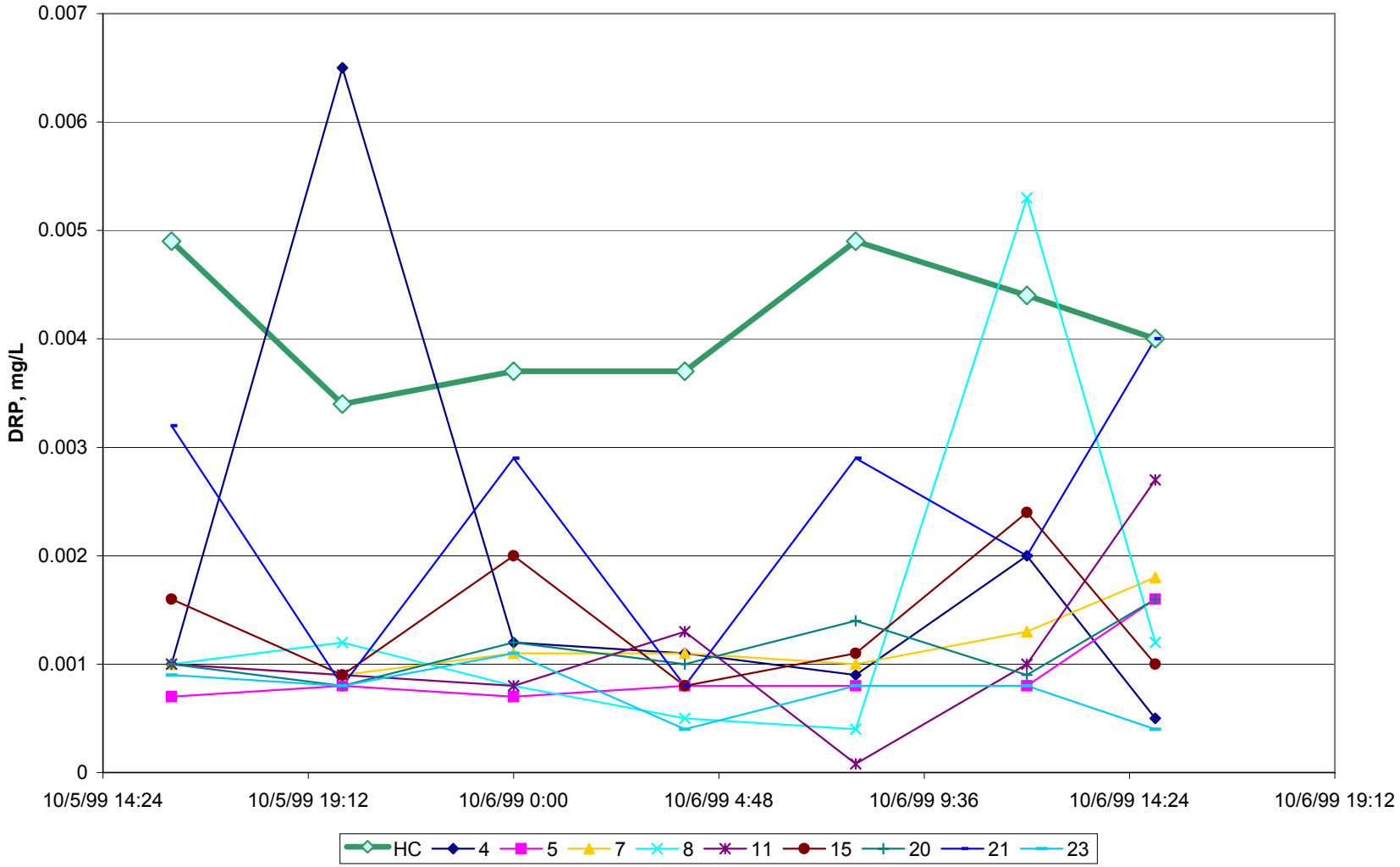


Exhibit 4-18
Diel Record of DRP in the Porta-PSTA Mesocosms on October 5-6, 1999

(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 4-19, exported algal biovolume did not show a diel pattern, even for treatment replicates (Tanks 4, 7, and 8).

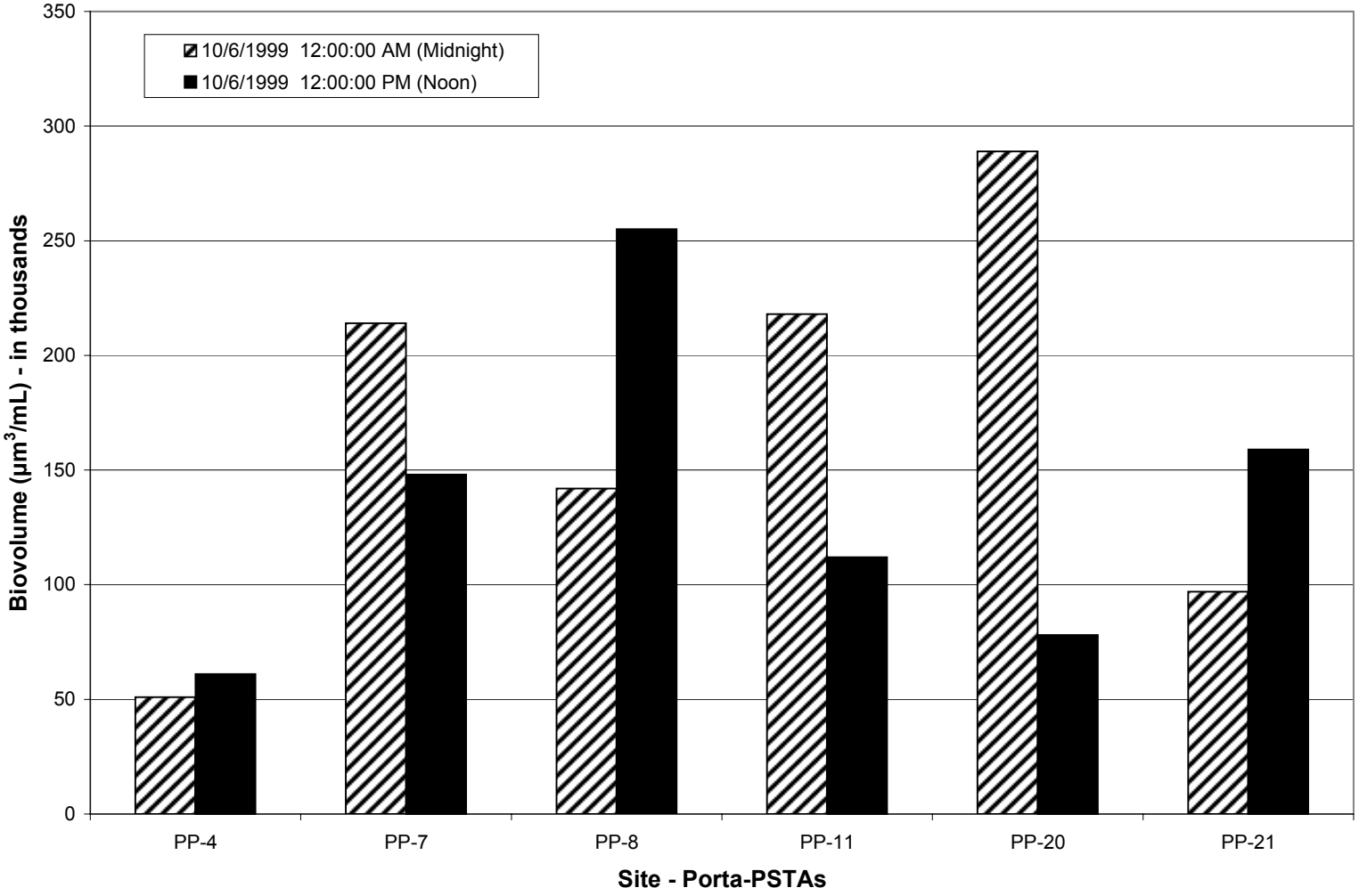


Exhibit 4-19
Diel Record of Algal Biovolume in the Porta-PSTA Mesocosms on October 5-6, 1999

SECTION 5

Statistical Analysis

5.1 Introduction

A preliminary statistical analysis of selected phosphorus parameters has been included in this quarterly report as Appendix E, using the available inflow and outflow data collected during the period from June through October 1999. For this analysis, data generated for the startup period were not included. A full analysis of all data collected has yet to be performed, given the intermediate schedule position of the project. However, Phase 2 planning studies and the project review by the SRP has created the need to at least test the following subset of hypotheses described in Section 2 of the PSTA Research Plan:

- Substrate type significantly affects PSTA sustainable TP settling rate (Hypothesis No. 3).
- PSTA annual average TP export can be sustained below 10 µg/L (Hypothesis No. 5).
- 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 section presents highlights from the preliminary statistical analysis of the effects of the experimental treatments on TP outflow from the Test Cells and Porta-PSTAs. Several data coding and analysis conventions have been assumed for economy during this analysis. Detailed descriptions of these procedures are included in Appendix E.

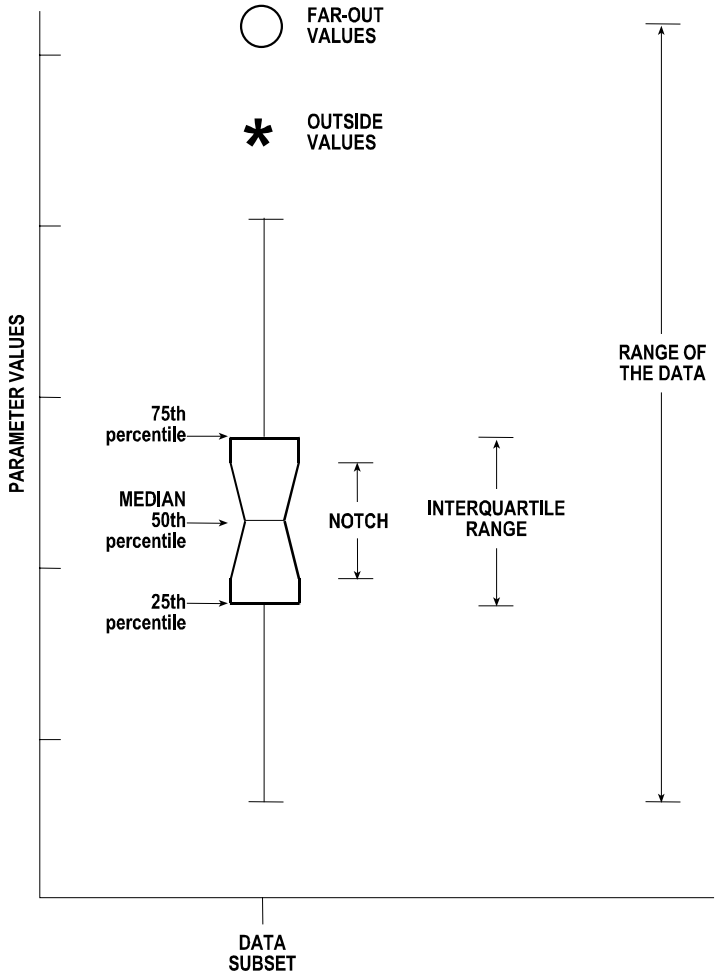
5.2 Box Plots

Box plots provide a means of readily visualizing and comparing the distributions of different data sets. Exhibit 5-1 gives a description of the components for box plots and basis for interpretation.

5.2.1 Test Cells

Exhibit 5-2 provides a comparative box plot of outflow TP concentrations from Test Cells with different substrates and deep water regimes (Treatment 1, peat substrate and Treatment 2, shellrock substrate). While not significantly different, there is clear indication that the shellrock substrate yielded a lower central tendency and TP minimum than peat.

Exhibit 5-3 compares outflow TP concentrations from Test Cells with shellrock substrates but different water regimes (Treatment 2, deep and Treatment 3, variable depth). Outflow TP concentrations were significantly lower in the shellrock treatment with consistent water depth.



Components. A BOX PLOT identifies the **MEDIAN**, (50th percentile), the lower and upper quartiles **(25th and 75th PERCENTILES),** and the **RANGE** (extreme spread of the data). The edges of the box demarcate the 25th and 75th percentiles, and so represent the middle 50 percent **(INTERQUARTILE RANGE)** of the parameter values for the data subset. The line inside the box is the **MEDIAN**. The lines, or whiskers, extend outward from the box through the range of data, excluding outliers. Two outliers are defined, based on their distance from the nearest edge of the box, relative to the range of the box. **OUTSIDE VALUES** lie 1.5 to 3 interquartile ranges away from the nearest box edge, and **FAR-OUT VALUES** lie three or more interquartile ranges away from the nearest box edge. The **NOTCH** represents the approximate 95 percent confidence interval around the median.

Interpretation. If notches from different subsets of data overlap completely, one can conclude with 95% confidence that the groups have been sampled from a common population. If notches do not overlap at all, one can conclude (with 95% confidence) that the groups represent different populations. Cases of partial overlap require explicit tests (e.g., t-Test, ANOVA, Mann-Whitney, or Kruskal-Wallis) to specify significance of differences among groups.

EXHIBIT 5-1
Generic Box Plot with Component Description

To assess whether there was an effect of mesocosm scale on system performance, Exhibits 5-4, 5-5, and 5-6 compare outflow TP concentrations from matching depth and substrate treatments in the Test Cells and Porta-PSTAs. For the shellrock substrates, outflow TP was significantly lower in the Porta-PSTAs than the Test Cells. No significant differences were indicated for the peat substrates.

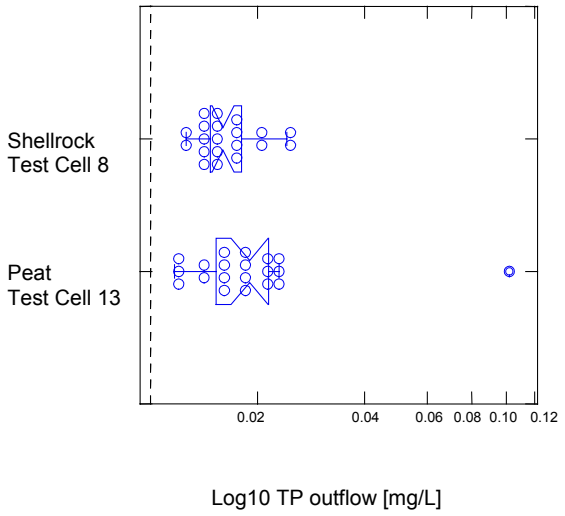


EXHIBIT 5-2
Box Plot of Test Cell Total Phosphorus Outflow Concentrations for Substrate Comparison
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

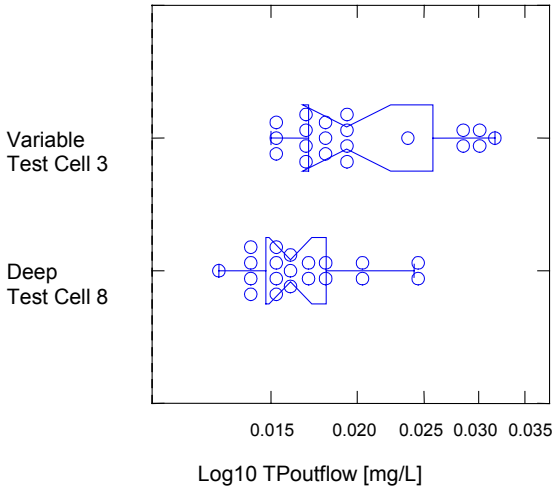


EXHIBIT 5-3
Box Plot of Test Cell Total Phosphorus Outflow Concentrations for Depth Comparison
Refer to Appendix E for coding details.

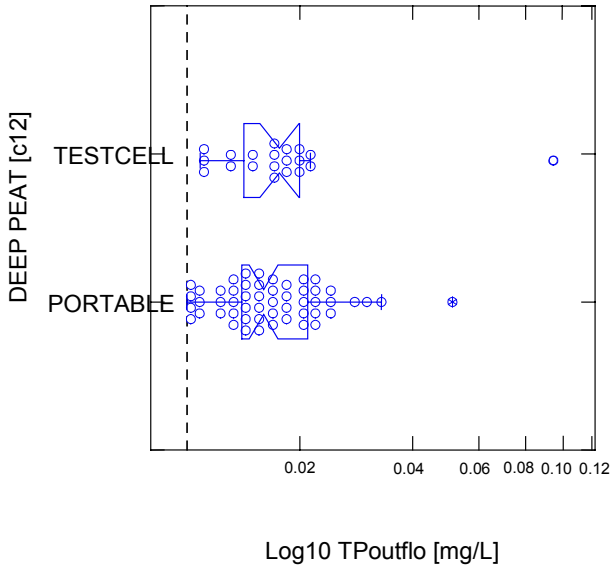


EXHIBIT 5-4
Box Plot of Test Cell Total Phosphorus Outflow Concentrations Comparing the Effects of Mesocosm Scale for Deep, Peat Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

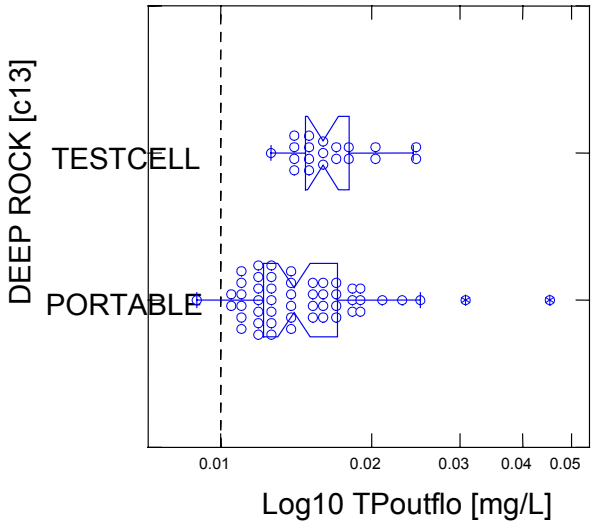


EXHIBIT 5-5
Box Plot of Test Cell Total Phosphorus Outflow Concentrations Comparing the Effects of Mesocosm Scale for Deep, Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

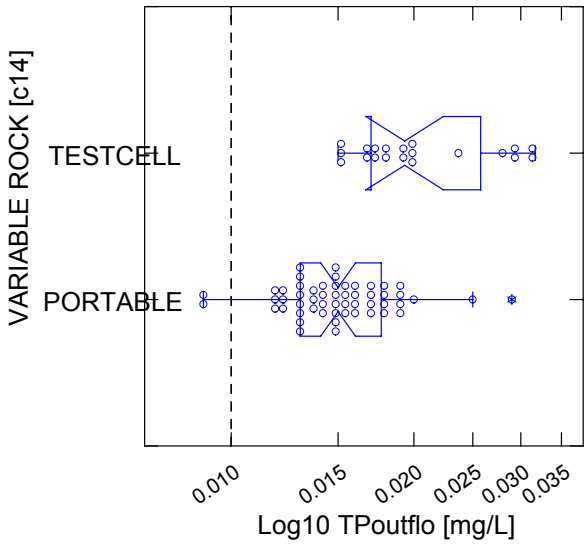


EXHIBIT 5-6
Box Plot of Test Cell Total Phosphorus Outflow Concentrations Comparing the Effect of Mesocosm Scale on Variable Depth, Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

5.2.2 Porta-PSTAs

Exhibit 5-7 provides a comparative box plot of outflow TP concentrations from Porta-PSTAs with peat, shellrock, and sand substrates and deep water regimes. Nonparametric tests described in Section 5.3.2 indicated that shellrock substrate mesocosms were statistically significantly lower than sand or peat substrate systems.

Exhibit 5-8 compares shellrock and peat substrates and shallow water regimes. Exhibit 5-9 provides a comparison of shallow and variable water regimes on shellrock substrate systems. Exhibit 5-10 compares the results of low and high HLRs. Exhibits 5-11 and 5-12 show the effect of Aquashade on deep peat and shellrock substrate systems, respectively. Exhibits 5-13 and 5-14 compare the effect of depth:width ratio on shallow peat and shallow shellrock substrate systems, respectively. Of the comparisons shown in Exhibits 5-8 through 5-14, only the depth:width ratio comparisons for shallow peat systems were significantly different between treatments. The Porta-PSTAs with a greater ratio (Cells 12, 14, and 17) discharged lower TP concentration than the single, wider demonstration treatment (Cell 23).

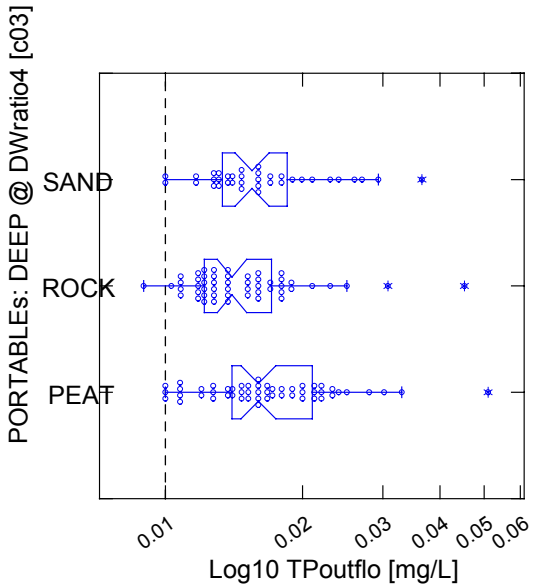


EXHIBIT 5-7
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations for Substrate Comparisons and Deep Water Regimes
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

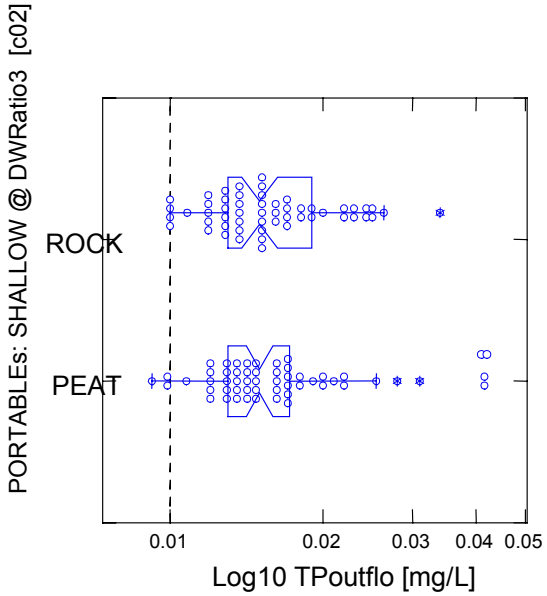


EXHIBIT 5-8
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations for Different Substrates and Shallow Depths
Refer to Appendix E for coding details.

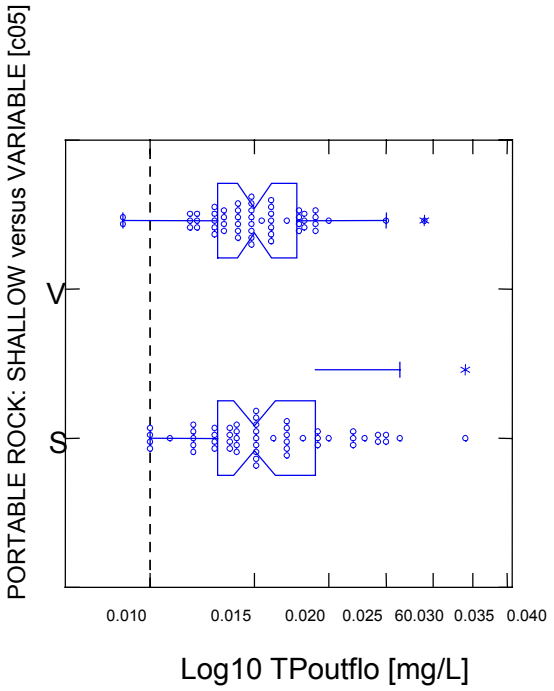


EXHIBIT 5-9
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effects of Shallow and Variable Water Depths for Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

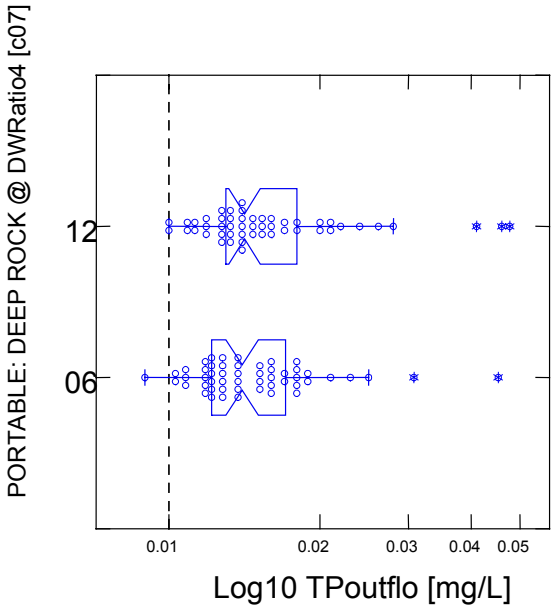


EXHIBIT 5-10
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effects of Hydraulic Loading Rate Scale for Deep, Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

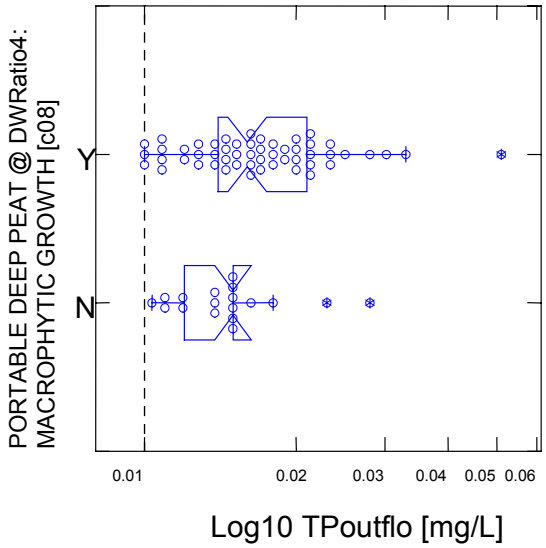


EXHIBIT 5-11
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effect of Aquashade on Deep, Peat Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

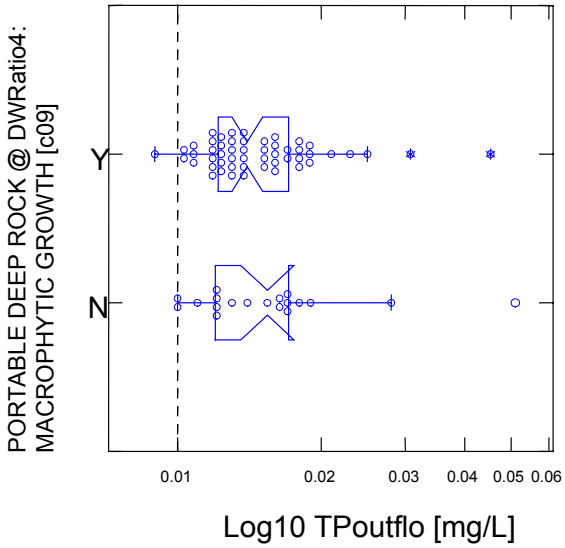


EXHIBIT 5-12
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effect of Aquashade on Deep, Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

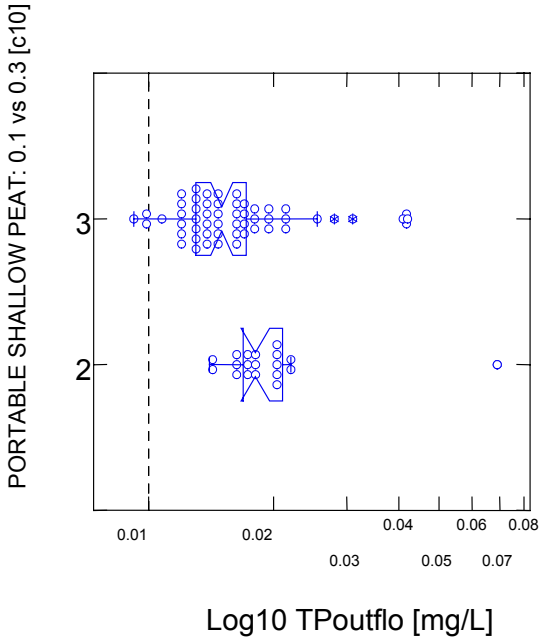


EXHIBIT 5-13
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effect of Depth:Width Ratio on Shallow, Peat Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

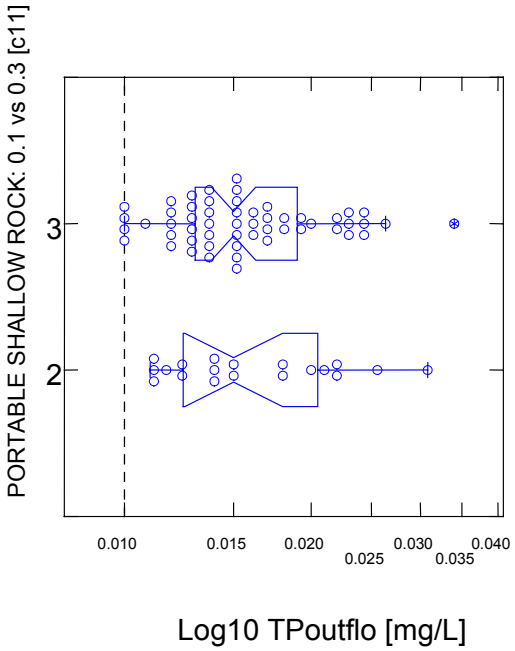


EXHIBIT 5-14
Box Plot of Porta-PSTA Total Phosphorus Outflow Concentrations Comparing the Effect of Depth:Width Ratio on Shallow, Shellrock Substrate Systems
Vertical dashed line represents 0.010 mg/L TP. Refer to Appendix E for coding details.

5.3 Statistical Tests

Graphical analysis of the TP outflow data described in Section 5.1.1 was corroborated by an analysis of variance (ANOVA) and nonparametric Kruskal-Wallis (KW) test. Analyses of inflow TP concentration showed no significant differences between any treatment or mesocosm (see Appendix E for additional information).

5.3.1 Test Cells

Exhibit 5-15 provides the ANOVA and KW test results, as well as additional comparisons for statistically significant differences, of the effects of substrate, water depth, and mesocosm scale, as approximated by the depth:width ratio, on outflow TP. No significant differences were observed between the peat (Test Cell 13) and the shellrock (Test Cell 8) periphyton systems. Consistent water depths in Test Cell 8 yielded significantly lower outflow TP than variable water depths in Test Cell 3. Mesocosm scale effects were not found in the comparison between peat-based Test Cell 13 and the Porta-PSTA treatment with comparable depths and peat substrates. However, scale effects were strongly indicated between the shellrock-based Test Cells and similar Porta-PSTA treatments with shellrock substrate. The larger Test Cell mesocosms yielded significantly greater outflow TP concentrations than comparable Porta-PSTAs for cells with variable water depths (ANOVA $p<0.001$; KW $p<0.001$), and to a lesser extent for cells with consistently deep water depths (KW $p=0.019$).

EXHIBIT 5-15
Test Cell Total Phosphorus Statistical Comparisons, June – October 1999

Parameters Tested	F	df	P	KW	P	Analysis Codes
SUBSTRATE						
PEAT * SHELLROCK	1.527	1,38	0.224	252	0.159	c01: CpDx10 * CrdX10
DEPTH						
DEEP * VARIABLE	8.415	1,38	0.006[a]	98.5	0.006[a]	c05: CrDx10 * CrVx10
						DEEP 15.4 < VARIABLE 25.6
SCALE:RATIO						
TESTCELL_0.02* PSTA_0.6	2.026	1,71	0.159	434	0.235	c12: CpDx10 * PpDX41/2/3
TESTCELL_0.02* PSTA_0.6	0.929	1,70	0.338	334	0.019[a]	c13: CrDx10 * PrDx41/2/3
						PSTA 32.9 < Test Cell 45.8
TESTCELL_0.02* PSTA_0.3	27.3	1,72	<0.001[a]	175	<0.001[a]	c14: CrVx10 * PrVx31/2/3
						PSTA 30.7 < Test Cell 55.75

Note: Refer to Appendix E for additional details on data analysis and coding.
[a]Significant Effect

5.3.2 Porta-PSTAs

Similar analyses of the Porta-PSTA results were performed to identify the relative importance of substrate and water depth.

5.3.2.1 Factor Significance

Exhibit 5-16 provides the ANOVA and KW test results, as well as additional comparisons for statistically significant differences, of the effects of substrate, water depth, and mesocosm dimension, as approximated by the depth:width ratio, on outflow TP.

No significant differences were observed between the deep peat and shellrock mesocosms or between the shallow peat and shellrock mesocosms. Non-parametric tests supported the box plot results showing outflow TP concentrations significantly lower in shellrock than sand systems, and sand substrates significantly lower than peat systems. No significant differences were noted between deep or shallow shellrock systems, nor for shellrock systems with doubled HLRs. Non-parametric statistics indicated lower outflow TP from peat mesocosms with a depth:width ratio of 0.3 compared to mesocosms with a depth:width ratio of 0.1. No significant differences were noted in a similar comparison of shellrock substrate mesocosms.

EXHIBIT 5-16
Porta-PSTA Total Phosphorus Statistical Comparisons, June – October 1999

Parameters Tested	F	df	P	KW	P	Analysis Codes
SUBSTRATE						
PEAT * SHELLROCK	0.099	1,105	0.754	1396.5	0.83	c02: PpDx41/2/3 * PrDx41/2/3
PEAT * SHELLROCK	1.932	1,36	0.173	242.5	0.07	c04: PpSx20 * PrSx20
PEAT * SHELLROCK * SAND	1.952	2,138	0.146	6.45	0.04[a]	c03: PpDx41/2/3 * PrDx41/2/3 * PsdX41/2
						ROCK 59.9 < SAND 74.2 < PEAT 79.7
DEPTH						
SHALLOW * VARIABLE	1.52	1,106	0.22	1560	0.53	c06: PrSx31/2/3 * PrVx31/2/3
HYDRAULIC LOADING RATE						
6 cm/d * 12 cm/d	1.279	1,100	0.261	1169	0.38	c07: PrDlo41/2/3 * PrDhi41/2/3
DEPTH:WIDTH RATIO						
0.3 * 0.1	3.69	1,70	0.059	749	0.002[a]	c10: PpSx31/2/3 * PpSx20
						D_W 0.3 31.8 < D_W 0.1 49.4
0.3 * 0.1	0.09	1,71	0.765	510.5	0.975	c11: PrSx31/2/3 * PrSx20

Note: Refer to Appendix E for additional details on data analysis and coding.

[a]Significant Effect

5.3.2.2 Replicate Differences

Exhibit 5-17 provides the results of ANOVA and KW nonparametric tests to determine the extent and significance in differences between replicates within treatments. No differences in TP inflow were noted within or between treatments. TP outflow concentrations were significantly greater in deep, peat-based mesocosms 11 and 18 than in 9. Shallow peat-based mesocosms 17, 12, and 14 were consecutively and significantly lower, and shallow shellrock mesocosm 10 was significantly greater than mesocosms 5 and 3. Further analysis of the relevant biological variables (e.g., submersed and emergent macrophyte cover, grazer density, algal species density, and composition) are expected to yield improved insight into replicate differences.

EXHIBIT 5-17
Statistical Analysis of Replicate Differences in Porta-PSTA Inflow and Outflow TP Concentration

Treatment: Experiment	F	df	P	KW	P	Mesocosm Ranking
TOTAL P: IN						
PSTA1: PpDx41/2/3	0.051	2,50	0.951	0.531	0.767	
PSTA2: PrDx41/2/3	0.548	2,51	0.582	0.682	0.711	
PSTA3: PpSx31/2/3	0.012	2,52	0.988	0.26	0.878	
PSTA4: PrSx31/2/3	0.009	2,55	0.991	0.099	0.952	
PSTA5: PrDX41/2/3	0.005	2,51	0.995	0.096	0.45	
PSTA6: PrVx31/2/3	0.023	2,54	0.997	0.899	0.213	
TOTAL P: OUT						
PSTA1: PpDx41/2/3	5.281	2,50	0.009[a]	14.036[a]	0.001	11,18>9
PSTA2: PrDx41/2/3	0.771	2,49	0.468	3.0	0.21	
PSTA3: PpSx31/2/3	7.066	2,50	0.002[a]	22.73[a]	<0.001	17>12>14
PSTA4: PrSx31/2/3	7.03	2,51	0.002[a]	14.687[a]	<0.001	10>5,3
PSTA5: PrDX41/2/3	2.356	2,47	0.106	3.083	0.214	
PSTA6: PrVx31/2/3	1.637	2,51	0.21	5.016	0.081	

Note: Refer to Appendix E for details on data coding and analysis.

[a]Significant Effect

5.4 Confidence Intervals

5.4.1 Test Cells

Exhibit 5-18 lists the 95 percent confidence interval about the mean for TP inflow, outflow, the difference between the two measures, and the ratio of inflow to outflow for the three Test Cells. In most cases, the intervals of TP inflow and TP outflow completely overlap, the interval about the mean difference of TP inflow minus TP outflow is centered about zero, and ratio intervals generally center around 1.

EXHIBIT 5-18
95% Confidence Interval, Test Cell Total Phosphorus

Treatment	Mesocosm	Code	TP Inflow (mg/L)	TP Outflow (mg/L)	TP Difference (mg/L)
1	Test Cell 13	CpDx10	0.015 - 0.038	0.013 - 0.031	-0.001 - 0.019
2	Test Cell 8	CrDx10	0.017 - 0.035	0.015 - 0.018	0.001 - 0.018
3	Test Cell 3	CrVx10	0.018 - 0.033	0.018 - 0.024	-0.006 - 0.014

Note: Refer to Appendix E for details on data coding and analysis.

5.4.2 Porta-PSTAs

Exhibit 5-19 lists the 95 percent confidence interval about the mean for TP inflow, outflow, and the difference between the two measures for the Porta-PSTA treatments. As with the Test Cells, the intervals of TP inflow and TP outflow completely overlap, the interval about the mean difference of TP inflow minus TP outflow is centered about zero, and ratio intervals generally center around 1.

EXHIBIT 5-19
95% Confidence Interval, Porta-PSTA Outflow Total Phosphorus

Code	TP Inflow (mg/L)	TP Outflow (mg/L)	TP Difference (mg/L)
PpDx41	0.014 - 0.024	0.012 - 0.016	0.000 - 0.011
PpDx42	0.015 - 0.025	0.016 - 0.025	-0.007 - 0.007
PpDx43	0.015 - 0.024	0.017 - 0.022	-0.006 - 0.006
PrDx41	0.016 - 0.031	0.014 - 0.017	-0.000 - 0.016
PrDx42	0.015 - 0.024	0.012 - 0.017	-0.000 - 0.011
PrDx43	0.015 - 0.024	0.013 - 0.021	-0.003 - 0.009
PpSx31	0.015 - 0.024	0.014 - 0.021	-0.004 - 0.008
PpSx32	0.015 - 0.024	0.012 - 0.014	0.002 - 0.012
PpSx33	0.015 - 0.024	0.016 - 0.024	-0.007 - 0.006
PrSx31	0.015 - 0.024	0.013 - 0.017	-0.000 - 0.010
PrSx32	0.015 - 0.024	0.012 - 0.017	0.001 - 0.010
PrSx33	0.015 - 0.024	0.017 - 0.022	-0.005 - 0.006
PrDX41	0.015 - 0.024	0.014 - 0.021	-0.005 - 0.010
PrDX42	0.015 - 0.025	0.014 - 0.026	-0.009 - 0.009
PrDX43	0.015 - 0.024	0.013 - 0.015	0.001 - 0.010
PrVx31	0.015 - 0.024	0.014 - 0.018	-0.001 - 0.009
PrVx32	0.016 - 0.025	0.014 - 0.017	-0.000 - 0.009
PrVx33	0.015 - 0.024	0.012 - 0.016	0.000 - 0.011
PsDx41	0.016 - 0.026	0.013 - 0.019	0.001 - 0.010

EXHIBIT 5-19
95% Confidence Interval, Porta-PSTA Outflow Total Phosphorus

Code	TP Inflow (mg/L)	TP Outflow (mg/L)	TP Difference (mg/L)
PsDx42	0.015 - 0.024	0.016 - 0.021	-0.003 - 0.005
PpDx40	0.015 - 0.024	0.013 - 0.017	-0.001 - 0.009
PrDx40	0.015 - 0.024	0.012 - 0.021	-0.004 - 0.009
PrSx20	0.015 - 0.024	0.006 - 0.014	-0.003 - 0.008
PpSx20	0.015 - 0.024	0.015 - 0.027	-0.009 - 0.005

Note: Refer to Appendix E for details on data coding and analysis.

5.5 Summary

Preliminary statistical analysis of the TP performance data collected between June through October 1999 for the Test Cells and Porta-PSTA mesocosms indicate the following responses to selected project hypotheses:

- **Substrate type significantly affects PSTA sustainable TP settling rate (Hypothesis No. 3) –** Data collected to date indicate that the substrate type affects TP removal performance, with significantly lower outflow TP in shellrock systems compared with outflow concentrations in peat systems. The sand substrate was found to yield intermediate outflow TP values.
- **PSTA annual average TP export can be sustained below 10 µg/L (Hypothesis No. 5) –** None of the experimental treatments at either Porta-PSTA or Test Cell scales achieved an average outflow TP of 10 µg/L or less.
- **PSTA TP export concentration is highly correlated with HLR for a given TP inflow concentration (Hypothesis No. 7) –** Test of Porta-PSTA Treatment 5 indicates that outflow TP was not correlated with a doubling of the HLR.
- **Water depth in the range of 30 to 60 cm does not significantly affect PSTA sustainable TP settling rate (Hypothesis No. 10) –** While TP settling rate was not explicitly tested in this preliminary statistical analysis, Porta-PSTA results indicated no difference between deep or shallow treatments. Significant differences between replicates within both shallow and deep Porta-PSTAs indicate that differences in biological community structure may be a factor in determining depth performance effects. Test Cell data indicated that the deep shellrock system performed marginally, but significantly better than the variable shellrock mesocosm, which had slightly greater water depth. Comparisons of similar treatments between Test Cells and Porta-PSTAs indicated a possible effect of mesocosm scale, with Porta-PSTAs achieving higher removal rates.

SECTION 6

PSTA Forecast Model Development

As described in previous quarterly reports and the *PSTA Research Plan* (CH2M HILL 1999), a forecast model is required to assist in extrapolating from research results to full-scale operational conditions. The final PSTA model must be able to simulate phosphorus chemistry and ecological development of an operational system subject to highly variable hydraulic loading and velocity effects that are infeasible to test at the mesocosm scale.

To facilitate model use and comparison of scenarios, the model is being developed in progressively more complex versions using Microsoft® Access as the model platform. Detailed descriptions of the model can be found in the *PSTA Research Plan* (CH2M HILL, 1999). Model design has focused on using simple abstractions of the complex process of phosphorus assimilation by algal growth and phosphorus export through accretion, recycle, and outflow, with emphasis on estimating the gross and net assimilation rate and predicted outflow TP concentrations for different hydraulic loading, phosphorus loading, and cell geometry.

This section provides a summary of model development tasks conducted during the 5th quarter, with a focus on the following areas: 1) preliminary calibration and sensitivity analysis; 2) selection and calibration of a light-driven algal growth algorithm; 3) incorporation of a full range of time-dependent data, including hydraulic and phosphorus inputs; 4) model enhancement for saving and reporting model scenario inputs and results; and 5) model application toward Phase 2 research and design.

6.1 Preliminary Calibration and Sensitivity Analysis

6.1.1 Approach

Sufficient data are currently available from 6 months of Porta-PSTA monitoring and almost 8 months of Test Cell monitoring to allow preliminary comparisons between model predictions and observed values. Unless noted, average values are used for this preliminary analysis. The Excel Solver routine is used to adjust estimates of hypothetically critical rate coefficients for the model to yield the observed outflow concentrations from the Test Cell and Porta-PSTA mesocosms. Care needs to be taken in interpretation of the preliminary results. All calibrations and analyses presented in this quarterly report should be considered provisional and subject to change as more data become available.

The results described in this section reflect our application of the model in a steady-state condition not subjected to significant variation in hydraulic loading, precipitation, insolation, temperature, or wind-related water movement. These time-dependent variables are specifically included in Version 1.1, which has been prepared but not yet calibrated. Significantly, a macrophyte growth routine has been developed but not explicitly included in the model. The long-term accretion of organic sediments is expected to shift a PSTA toward a marsh community and affect long-term TP removal. As they become available during the 6th

quarter, it is reasonable to expect that these important modifications will yield new insight into model behavior and extrapolated long-term performance. All of the observations and preliminary conclusions provided in this section must be viewed in this light.

Exhibit 6-1 shows a representation of the model components. Coefficients for the mass transfer rate (k_{wo}), sloughing rate (k_{so}), settling rate (k_T), and the resuspension rate (k_{Ro}) were adjusted through this calibration process. The mass transfer rate (k_{wo}) was found to be most influential on the model outcome, as described below. Model components with shading are currently being added. Descriptions of model rate constants are provided in Table 8-1 in the PSTA Research Plan. Summary results of model scenarios are provided in Appendix F.

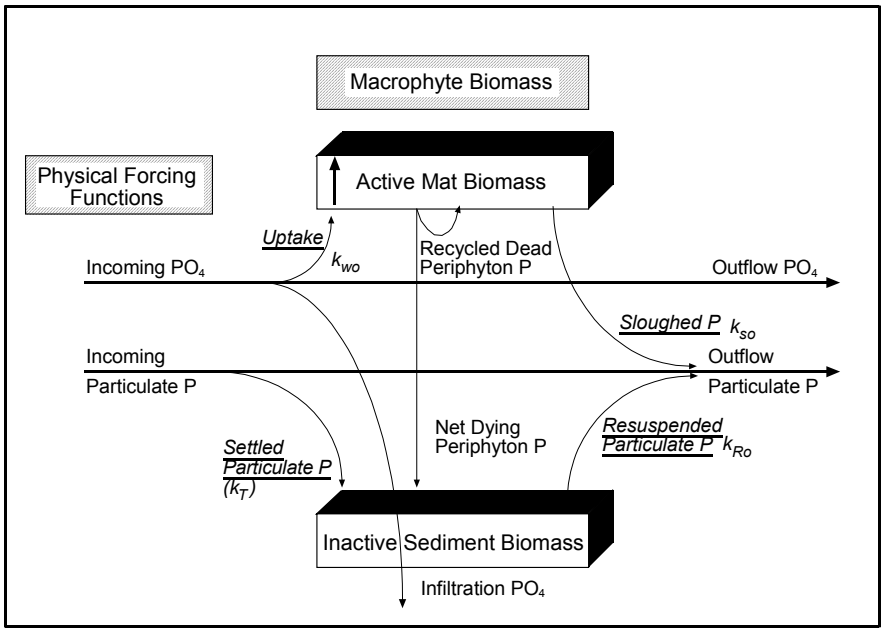


EXHIBIT 6-1
PSTA Forecast Model Components
Highlighted variables were estimated using the Solver routine.

6.1.2 Preliminary Calibration

6.1.2.1 Test Cells

Exhibit 6-2 summarizes model input variables and preliminary results for each of the Test Cells. Average water, sediment, and biomass collected during the 5th quarter were used as model inputs intended to be representative of stabilized post-startup conditions and sampling technique refinement. Solver calibration of the mass transfer rate (k_{wo}) returned solutions of 0.01 m/d for Treatment 1, 0.03 m/d in Treatment 2, and 0.02 m/d in Treatment 3.

Solutions for sloughing rate (k_{so} = 0.12 g/m^2/d) and settling rate (k_T = 0.07 m/d) were identical for the two shellrock treatments, but different for the peat treatment (k_{wo} = 0.01 m/d, k_{so} = 0.2 g/m^2/d, and k_T = 0.01 m/d). The resuspension rate (k_{Ro}) was returned as 0.1 m/d for all treatments.

Exhibit 6-2
Test Cell Model Calibration Results

Variable	Unit	Cell 13 Treatment 1	Cell 8 Treatment 2	Cell 3 Treatment 3	Source
Channel Dimensions					
Length	m	80	80	80	CH2M HILL 1999a, Table 4-2
Width	m	28	28	28	CH2M HILL 1999a, Table 4-2
Height	m	0.63	0.6	0.7	Exhibit 3-17
Number of Cells	--	1	1	1	
Mass Transfer Rates					
k_{wo}	m/d	*0.01*	*0.03*	*0.02*	Solver
w	--	0.5	0.5	0.5	CH2M HILL 1999a
Resuspension Rates					
k_{Ro}	m/d	*0.1*	*0.1*	*0.1*	Solver
r	--	0.5	0.5	0.5	CH2M HILL 1999a
Sloughing Rates					
k_{so}	gm/m^2*d	*0.12*	*0.12*	*0.12*	Solver
s	--	0.05	0.05	0.05	CH2M HILL 1999a
Water Chemistry					
Ci	µgP/L	6	5	5	Exhibit 3-9
Crain	µg/L	20	20	20	CH2M HILL 1999a
TPi	µgP/L	30	30	29	Exhibit 3-9
TSSi	mg/L	1.5	1.5	1.5	Exhibit 3-x
Temp	C	20	20	20	CH2M HILL 1999a
Water					
Qi	m^3/d	122	122	147	Exhibit 3-10
P	m/d	0	0	0	CH2M HILL 1999a
ET	m/d	0	0	0	CH2M HILL 1999a
I	m/d	0	0	0	CH2M HILL 1999a
k_T	m/d	*0.01*	*0.06*	*0.07*	Solver
Residuals					
Ri	gm/m^2	1160	1930	1890	Exhibt 3-12 , assumed for top 10 cm only
xR	mgP/kg	329	805	826	Exhibit 3-12
pR	gm/cm^3	0.48	1.43	1.48	Exhibit 3-12
aR	m^2/m^2	0.8	0.8	0.8	CH2M HILL 1999a
Biomass					
Ni	gm/m^2	1084	387	437	Exhibit 3-15, 5th Quarter Only
xNi	mgP/kg	447	333	167	Exhibit 3-15, 5th Quarter Only
pN	gm/cm^3	0.05	0.05	0.05	CH2M HILL 1999a
aN	m^2/m^2	1	1	1	CH2M HILL 1999a
Cmax	µgP/L	42	42	42	CH2M HILL 1999a
a	--	0.545	0.545	0.545	CH2M HILL 1999a
Biomass	--	0.048	0.048	0.048	CH2M HILL 1999a
m	1/day	0.02	0.02	0.02	CH2M HILL 1999a
beta	--	0.8	0.8	0.8	CH2M HILL 1999a
Run Time	yrs	1	1	1	CH2M HILL 1999a
Time Step	days	1	1	1	CH2M HILL 1999a
Observed					
Calc k	m/y	1.6	10.3	6.4	Exhibit 3-10. 5th Quarter Only
Observed TP out	µgP/L	19	16	21	Exhibit 3-10. 5th Quarter Only
Predictions					
kpredicted	m/y	2.4	11.8	7.1	
Predicted TP out	µgP/L	21.2	16.3	21.5	

Solver Constraints

$0.001<k_{wo}<0.1$

$0.1<k_{ro}<1$

$0.001<k_{so}<0.1$

$0<m<0.02$

$0.001<k_T<0.05$

beta<1

Using these rate constants, the calibrated model estimated outflow TP concentrations of 21 µg/L, 16 µg/L, and 22 µg/L for Treatments 1, 2, and 3, respectively. Predicted TP removal rate (kpredicted) values returned by the model were 2.4 m/y, 11.8 m/y, and 7.1 m/y in the same order. These values are slightly higher but in agreement with the calculated k values from the 5th quarter (see Exhibit 3-9).

6.1.2.2 Porta-PSTAs

Exhibit 6-3 summarizes model input variables and preliminary calibration results for each of the replicated Porta-PSTA treatments. The Solver routine returned values for the mass transfer rate coefficient that were consistent within substrate types. Average rate coefficients for the peat, shellrock, and sand substrate treatments were 0.01, 0.03, and 0.03 m/d for mass transfer (k_{wo}) and 0.04, 0.06, and 0.07 m/d for sedimentation (k_T), respectively. No differences were observed between treatments in either resuspension rate (k_{Ro}) or sloughing rate (k_{so}). These findings are generally consistent with those calculated for the Test Cells, reinforcing the importance of the mass transfer rate to PSTA performance.

6.1.3 Preliminary Model Sensitivity Analysis

The sensitivity of the PSTA forecast model was assessed by comparing the effect of varying rates of mass transfer (k_{wo}), sloughing (k_{so}), sedimentation (k_T), and hydraulic loading (HLR), as well as the effects of water depth and substrate type on TP removal performance. A shellrock-based Test Cell was used as an example case with average water, sediment, and periphyton biomass characteristics assumed using measured values from Treatments 2 and 3. Exhibit 6-4 summarizes the model variable inputs.

Exhibit 6-5 compares the effect of varying key parameters on outflow TP concentration and on gross TP removal rate (kpredicted). The baseline case was set to approximate average performance for Treatment 2. The model returned a predicted TP removal rate (kpredicted) of approximately 12 m/y and an average outflow TP of 17 µg/L, consistent with observed performance during the 5th quarter.

Values for internal rate coefficients were varied over an order of magnitude to assess model sensitivity. Comparison of effects indicated the following preliminary observations:

- Model performance is highly influenced by the mass transfer rate (k_{wo}) and the trapping and settling rate (k_T). Values of 0.3 m/y for k_{wo} or 1 g/m^2/d for k_T yielded an outflow TP concentration of 6 µg/L and k value of 29 m/y. Decreasing k_{wo} produced an outflow TP of 32 µg/L and a negative k value, indicating significant export of TP. A similar decrease in k_T yielded results only slightly less than the baseline conditions.

- Increasing the sloughing rate (k_{so}) increased TP export and reduced removal rate. Decreasing k_{so} slightly decreased outflow TP to 15 µg/L.

- Decreasing the depth to 0.3 m and 0.1 m slightly increased TP removal rate and decreased outflow TP to 15 µg/L.

Exhibit 6-3
Porta-PSTA Model Calibration Results

		Treatment							Substrate Average		
Variable	**Units**	**1**	**2**	**3**	**4**	**5**	**6**	**Source**	**Peat (Treatments 1 and 3)**	**Shellrock (Treatments 2, 4, and 5)**	**Sand (Treatment 6)**
h	m	0.65	0.65	0.30	0.37	0.64	0.64	Exhibit 4-13 5th Quarter Only			
Qi	m^3/d	0.46	0.42	0.41	0.46	0.77	0.46	Exhibit 4-5, 5th Quarter Only			
P	m/d	0	0	0	0	0	0	Not Available			
ET	m/d	0	0	0	0	0	0	Not Available			
I	m/d	0	0	0	0	0	0	Not Available			
TPi	µgP/L	20	20	19	19	20	20	Exhibit 4-5, 5th Quarter Only			
TSSi	mgP/L	1.5	1.5	1.5	1.5	1.5	1.5	CH2M HILL, 1999a			
Ni	gm/m^2	0	0	0	0	0	0	CH2M HILL, 1999a			
Ri	gm/m^2	1120	1820	1100	1820	1850	1860	Exhibit 4-7			
Crain	µg/L	20	20	20	20	20	20	CH2M HILL, 1999a			
T	°C	20	20	20	20	20	20	CH2M HILL, 1999a			
L	---	1.00	1.00	1.00	1.00	1.00	1.00	CH2M HILL, 1999a			
Ci	µgP/L	0.00	0.00	0.00	0.00	0.00	0.00	CH2M HILL, 1999a			
L	m	6	6	6	6	6	6	CH2M HILL, 1999a			
W	m	1	1	1	1	1	1	CH2M HILL, 1999a			
?t	day	1.00	1.00	1.00	1.00	1.00	1.00	CH2M HILL, 1999a			
Ncells	--	1	1	1	1	1	1	CH2M HILL, 1999a			
m	1/d	0.02	0.02	0.02	0.02	0.02	0.02	CH2M HILL, 1999a			
kT	m/d	*0.061*	*0.076*	*0.018*	*0.073*	*0.040*	*0.068*	Solver	0.04	0.06	0.07
b	--	0.80	0.80	0.80	0.80	0.80	0.80	CH2M HILL, 1999a			
xNi	mgP/kg	254	276	264	684	455	416	Exhibit 4-10			
ρN	gm/cm^3	0.05	0.05	0.05	0.05	0.05	0.05	CH2M HILL, 1999a			
aN	m^2/m^2	1.00	1.00	1.00	1.00	1.00	1.00	CH2M HILL, 1999a			
Cmax	µgP/L	41.5	41.5	41.5	41.5	41.5	41.5	CH2M HILL, 1999a			
a	--	0.545	0.545	0.545	0.545	0.545	0.545	CH2M HILL, 1999a			
b	--	0.048	0.048	0.048	0.048	0.048	0.048	CH2M HILL, 1999a			
xR	mgP/kg	220	1024	213	1029	1041	980	Exhibit 4-7			
ρR	gm/cm^3	0.32	1.33	0.32	0.36	1.28	1.40	Exhibit 4-7			
aR	m^2/m^2	0.80	0.80	0.80	0.80	0.80	0.80	CH2M HILL, 1999a			
k_{wo}	m/d	*0.010*	*0.041*	*0.010*	*0.023*	*0.025*	*0.034*	Solver	0.01	0.03	0.03
w	----	0.5	0.5	0.5	0.5	0.5	0.5	CH2M HILL, 1999a			
k_{Ro}	m/d	*0.100*	*0.100*	*0.100*	*0.100*	*0.100*	*0.100*	Solver	0.10	0.10	0.10
r	----	0.5	0.5	0.5	0.5	0.5	0.5	CH2M HILL, 1999a			
k_{so}	gm/m^2*d	*0.117*	*0.113*	*0.100*	*0.115*	*0.115*	*0.111*	Solver	0.11	0.11	0.11
s	---	0.05	0.05	0.05	0.05	0.05	0.05	CH2M HILL, 1999a			
Observed											
Calc k	m/y	0.7	7.1	1.4	4.8	4.4	5.6	Exhibit 4-5, 5th Quarter Only	1.0	5.4	5.6
TP out	µg/L	19	15.0	18.0	16.0	18.0	16.0	Exhibit 4-5, 5th Quarter Only	18.5	16.3	16.0
Predicted											
kpredicted	m/y	0.9	7.4	1.2	3.9	4.7	5.7		1.1	5.3	5.7
TP out	µg/L	19.4	15.3	18.1	16.2	18.1	16.3		18.8	16.5	16.3

Solver Constraints
0.001<kwo<0.1
$0.1<k_{ro}<1$
$0.001<k_{so}<0.1$
0<m<0.02
$0.001<k_T<0.05$
beta<1

Exhibit 6-4
Baseline Model Scenario Characteristics

Channel Dimensions	Units	Shellrock Baseline Example
Length	m	80
Width	m	28
Height	m	0.6
Number of Cells	--	1
Mass Transfer Rates		
k_{wo}	m/d	*0.03*
w	--	0.5
Resuspension Rates		
k_{Ro}	m/d	*0.1*
r	--	0.5
Sloughing Rates		
k_{so}	gm/m^2*d	*0.12*
s	--	0.05
Water Chemistry		
Ci	µgP/L	6
Crain	µg/L	20
TPi	µgP/L	30
TSSi	mg/L	1.5
Temp	C	20
Water		
Qi	m^3/d	134
P	m/d	0
ET	m/d	0
I	m/d	0
k_T	m/d	*0.07*
Residuals		
Ri	gm/m^2	1910
xR	mgP/kg	816
pR	gm/cm^3	1.45
aR	m^2/m^2	0.8
Biomass		
Ni	gm/m^2	412
xNi	mgP/kg	250
pN	gm/cm^3	0.05
aN	m^2/m^2	1
Cmax	µgP/L	42
a	--	0.545
Biomass	--	0.048
m	1/day	0.02
beta	--	0.8
Run Time	yrs	1
Predictions		
kpredicted	m/y	12
Predicted TP out	µg P/L	17

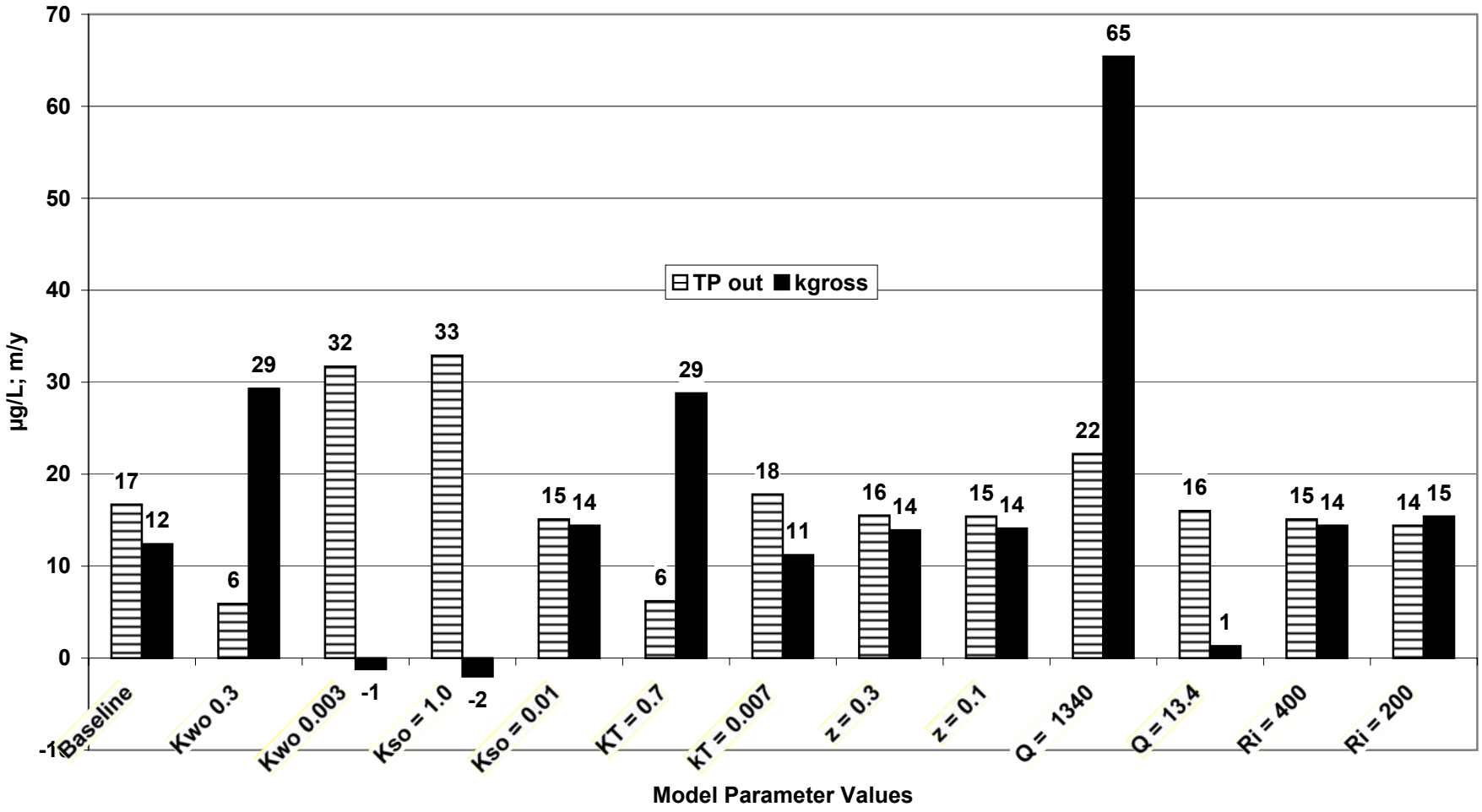


Exhibit 6-5
Comparison of PSTA Forecast Model Results for Shellrock Test Cell Baseline Case

- Increasing HLR increased outflow TP slightly and TP removal rate significantly. An increase in HLR of this magnitude would increase average system velocity to approximately 80 m/d (0.09 cm/sec). This is approximately 4.5 times the velocities being tested in the Test Cells. Decreasing HLR did not substantively affect outflow TP but did significantly reduce TP removal rate.
- A decrease in substrate TP content to 400 mg/kg and then to 200 mg/kg resulted in a small incremental decrease in TP outflow and an increase in TP removal rate.

Model performance appears most sensitive to changes in mass transfer rate, and for an equivalent depth and loading rate, phosphorus removal appears to be twice the rate for the shellrock substrate than the organic peat substrate. Within the confines of the model assumptions, a discharge criterion of 10 ug/L is attainable by increasing the mass transfer rate to 0.1 m/d or increasing the trapping and sedimentation rate to 1 $g/m^2/d$. Design approaches to achieving and sustaining these rates remain to be discerned.

6.2 Algal Growth Algorithm

Algal productivity has a direct relationship with the amount of light available to the system. Photo-inhibition has also been identified as an issue for consideration. To address both issues, an Access database was developed around two growth algorithms: the Modified Monod Method (Saturation Function) and the Steele Function, which allows for photo-inhibition. Exhibit 6-6 describes the selected algorithms.

The database has the capabilities of determining productivity levels based on a given light intensity, growth rate, and half saturation value. It can also determine these variables (mu and KI for Monod or mu and Iopt for Steele) through the use of a user-imported set of light intensities and productivities and the Solver routine. A submodel was developed to allow for transgression from light data into specific growth rates that will allow the user to calibrate the algal model aspect through the use of the Solver macro. Simple formatting and data file import/export adjustments remain to be completed.

6.3 Access Model Enhancements

Greater flexibility in the selection and inclusion of time-dependent data has been built into the model, expanding from sunlight, rain, and ET to include biomass, infiltration, phosphorus inputs, TSS, and water depth. The end result will allow the user to develop a realistic water balance for the PSTA and provide a wider range of manipulation for forecasting and design. The database allows more efficient import and processing of large long-term hydrologic and climatic input databases. Preliminary runs indicate that 10 years of hydrologic data can be imported with model run times of only a few minutes.

The Access database has also been enhanced to allow customized reports to be prepared and inputs to be modified readily. The user can now select the results of a current model or can name, store, and review the results of previous model runs. Pre-formatted reports of the variable inputs, summary results, time-dependent data, time-independent data, and graphical output are now readily produced.

Exhibit 6-6

Algal Growth Algorithms Selected for the PSTA Forecast Model

No.	Name	Formulation	Description	Reference
1	Saturation Function (similar to Monod model)	P = μmax* (I/(KI+I)	This approach has been used successfully with models for the New York City water supply reservoir system, Green Bay, Lake Michigan, and Onondaga Lake, NY, as well as a few small lakes within the Upper Peninsula. CH2M HILL staff are familiar with this model through their research at MTU with Dr. Martin Auer.	Auer and Forrer, 1998;
2	Steele Function (with photoinhibition)	P = μmax *(I/Iopt)*(exp(-(I/Iopt)+1))	Works reasonably well if photoinhibition not severe.	Auer and Forrer, 1998;

Variable Definition

P = Productivity or photosynthesis

I = Light intensity

μmax = Light saturated maximum rate (growth or photosynthesis)

Iopt = Intensity at peak growth/photosynthesis

6.4 Proposed Model Forecast Applications

The PSTA forecast model is intended to be used as an extrapolation tool to estimate long-term performance and to conceptualize the design and operational requirements for a full-scale system. With the incorporation of the time-dependent inputs, a macrophyte sub-routine, and a light-driven algal growth algorithm sensitive to seasonal changes in temperature and insolation, the model will be used to simulate long-term TP removal performance under highly variable rainfall, depth, and hydraulic loading.

Critical operational scenarios yet be quantitatively defined include periodic dryout and restart, systematic harvest, or long-term accretion of organic soils and self-shading through macrophyte growth. These actions are expected to significantly affect the evaluation of long-term cost-effectiveness. The model in its current condition allows the user to "restart" the system at varying intervals, presumably after critical growth and phosphorus accumulation periods have occurred.

As an immediate example of model application, Exhibit 6-7 provides the results of an analysis of alternative system geometry for consideration as a design basis for the Phase 2 Field Scale Mesocosm Study. The table shows the existing geometry of the Test Cell and estimated performance of the Baseline Case described earlier in Exhibit 6-4.

The field-scale mesocosms are intended to test construction approaches, water balance, and velocity effects under conditions thought to more closely resemble full-scale applications. Exhibit 6-4 shows the effect of operation of deep (0.6 m), shallow (0.3 m), and most shallow (0.1 m) systems under the following assumptions:

- Individual field-scale mesocosms would be approximately 2.5 hectare (5 acres) or less
- Individual cells would be no less than 10 m wide for simplicity of construction
- System HLR is at least 6 cm/d and sized to receive 1,200 m^3/d
- System substrate is inorganic

It is useful to note that by changing the aspect ratio (length:width) under a constant inflow and moderately shallow depth, velocity is significantly increased and system performance can be slightly improved. Greater enhancements to performance are found through the use of inorganic substrates with reduced TP content, as in limestone caprock, but with similar densities. The model results indicate that under a channel-like morphometry and an inorganic substrate similar to local limestone caprock, target concentrations of 10 µg/L may be achievable on a short-term basis. As stated earlier, predictions of long-term performance must await completion of the model enhancements described above coupled with the model validation using data obtained during the Phase 2 Field-Scale Study.

The model results indicate the need to quantify PSTA performance over a wide range of substrate types, with particular emphasis on inorganic substrates with as low phosphorus content as may be available, and the need to test PSTA performance under a variable to high velocity regime. Also, the potential effect of different macrophyte species (e.g., *Najas* sp.) on periphyton biomass and surface area warrants additional consideration; a complex, three-dimensional surface within the water column may offer the potential to increase the mass

Exhibit 6-7

Preliminary Morphometric Analysis of PSTA Phase 2 Design Alternatives

HLR (cm/d)	Flow (m^3/d)	Length (m)	Width (m)	Area ($m^{2)}$	Aspect Ratio	Water Depth (m)	Velocity (cm/s)	TP out (µg/L)	$k_{predicted}$ (m/y)	Description
6	134	80	28	2240	3	0.6	0.01	17.9	12	Test Cell Baseline Case
17	1200	708	10	7080	71	0.6	0.23	15.6	39	Case 1
24	1200	507	10	5070	51	0.3	0.46	15.5	55	Case 2
41	1200	296	10	2960	30	0.1	1.39	15.3	96	Case 3
15	1200	787	10	7870	79	0.3	0.46	12.0	48	Case 2 with R_i = 400 mg/kg
26	1200	465	10	4647	46	0.1	1.39	11.8	82	Case 3 with R_i = 400 mg/kg
11	1200	1142	10	11420	114	0.3	0.46	9.5	40	Case 2 with R_i = 200 mg/kg

Note:

Aspect Ratio Length:width ratio (unitless)

R_i Total phosphorus content in substrate, dry weight

k First-order TP removal rate

transfer rate of a more typically two-dimensional algal mat. Finally, direct quantification of the various rates estimated in this preliminary analysis should be considered, where feasible.

SECTION 7

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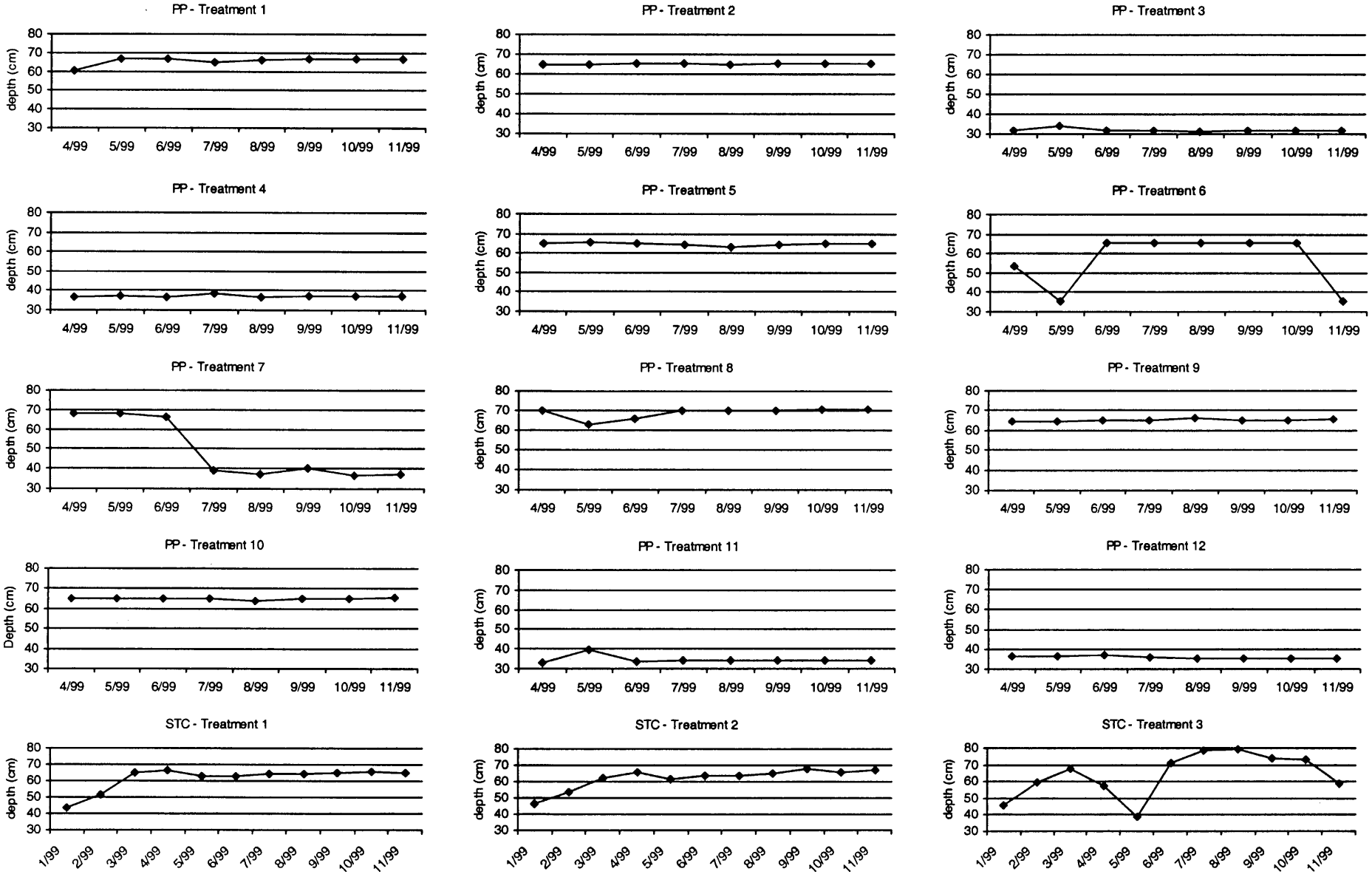
SFWMD PSTA Research Project Data Summary
Average Depth Trend Charts



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SFWMD PSTA Research Project Data Summary
Average Flow Trend Charts

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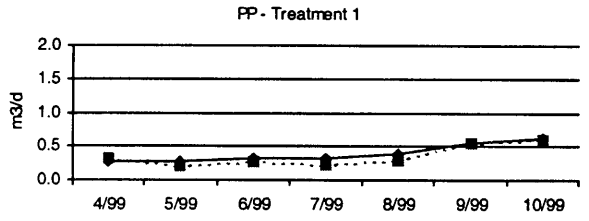

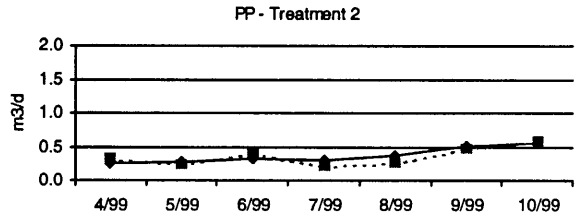

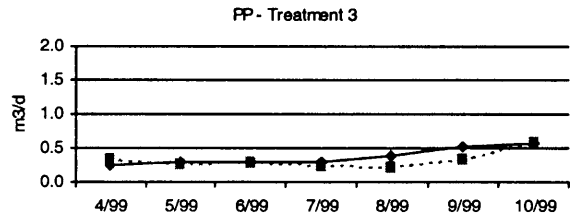

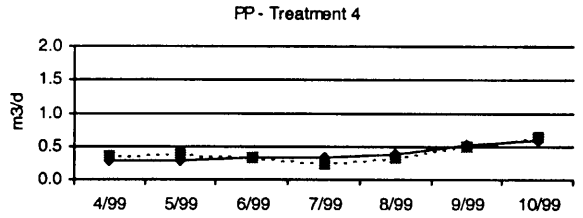

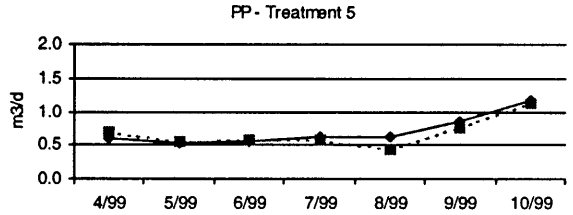

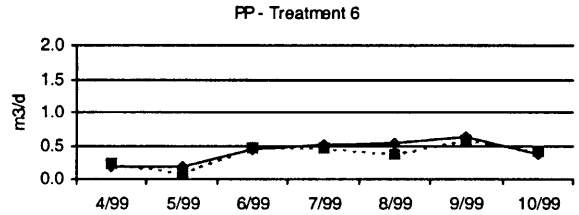

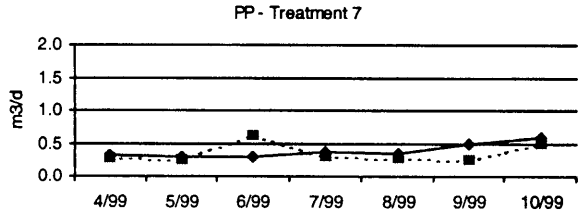

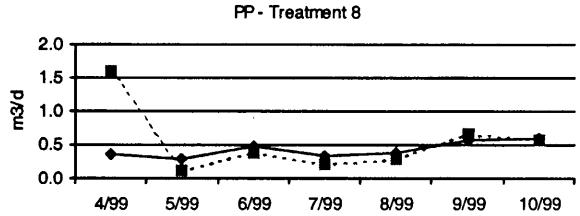

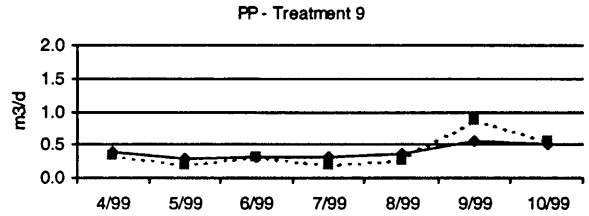

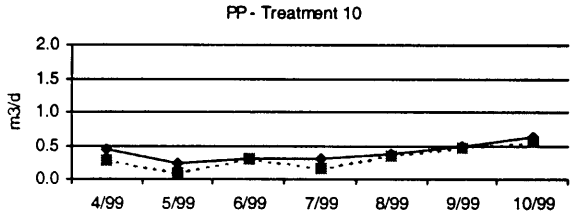

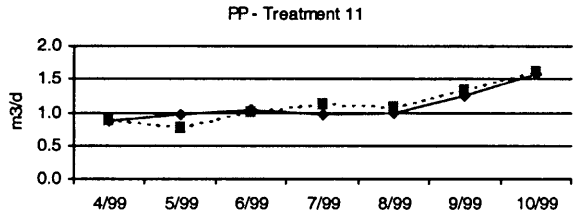

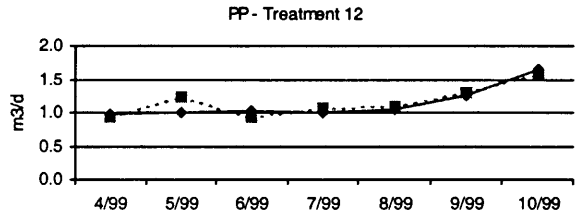

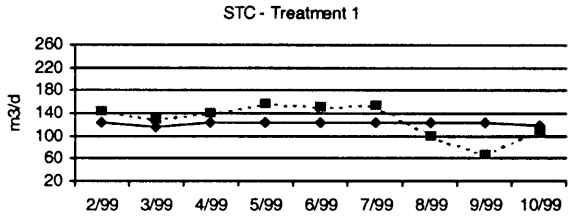

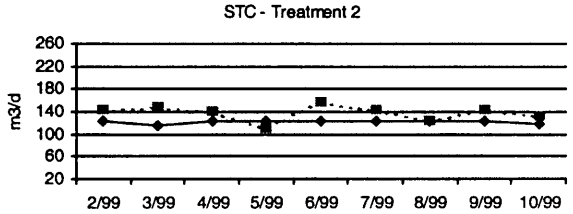

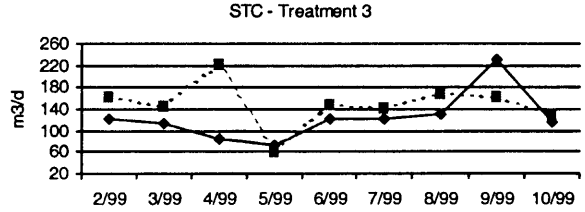

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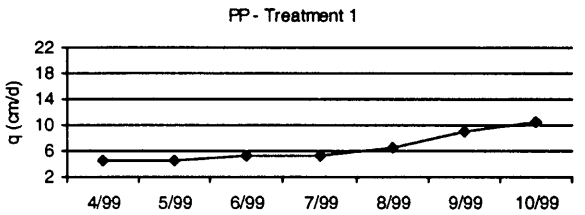
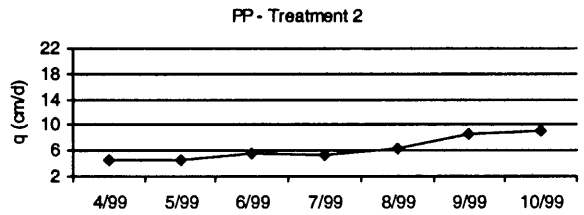
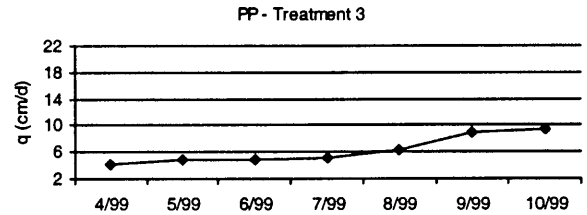
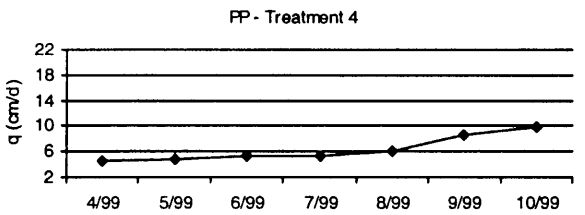
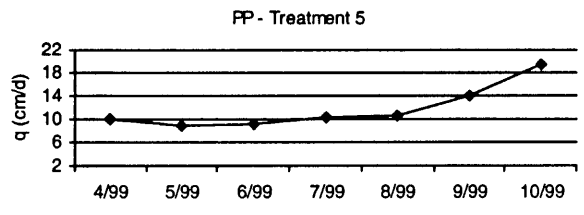
SFWMD PSTA Research Project Data Summary
Average Hydraulic Loading Rate Trend Charts

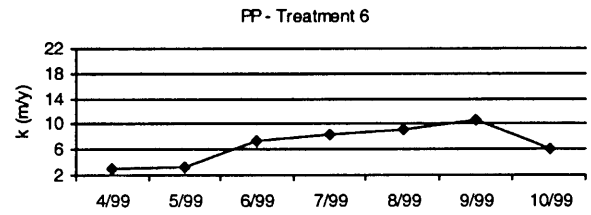


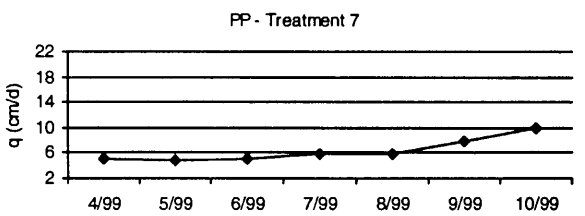


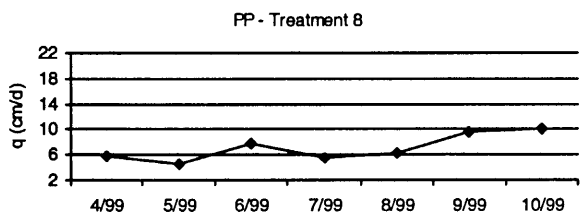


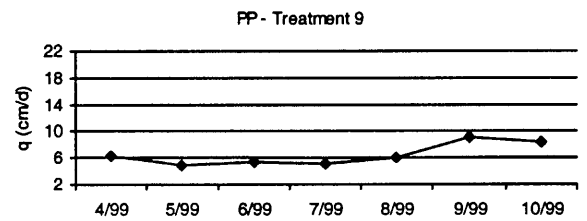


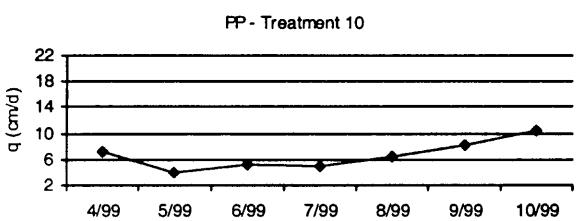


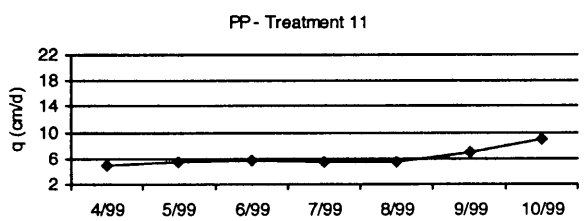


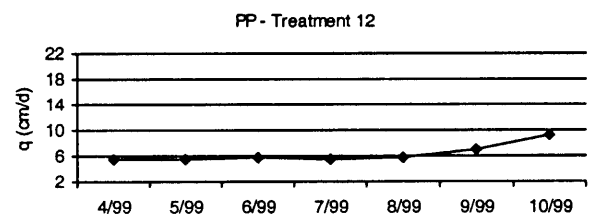


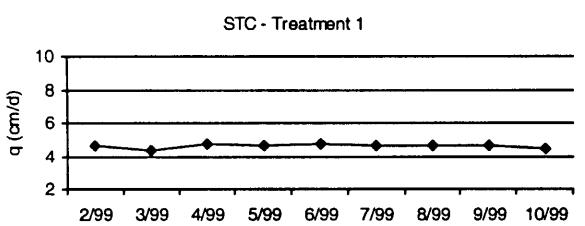


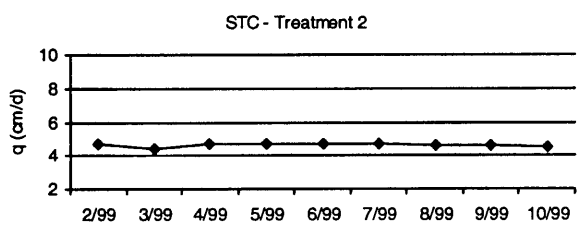


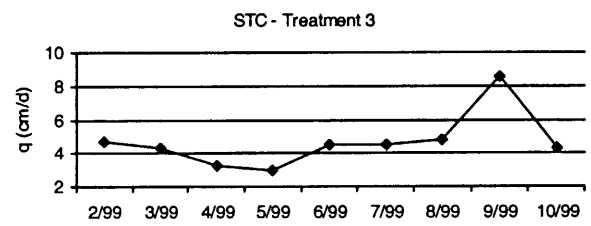












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SFWMD PSTA Research Project Data Summary
Average Total Phosphorus Concentration Trend Charts

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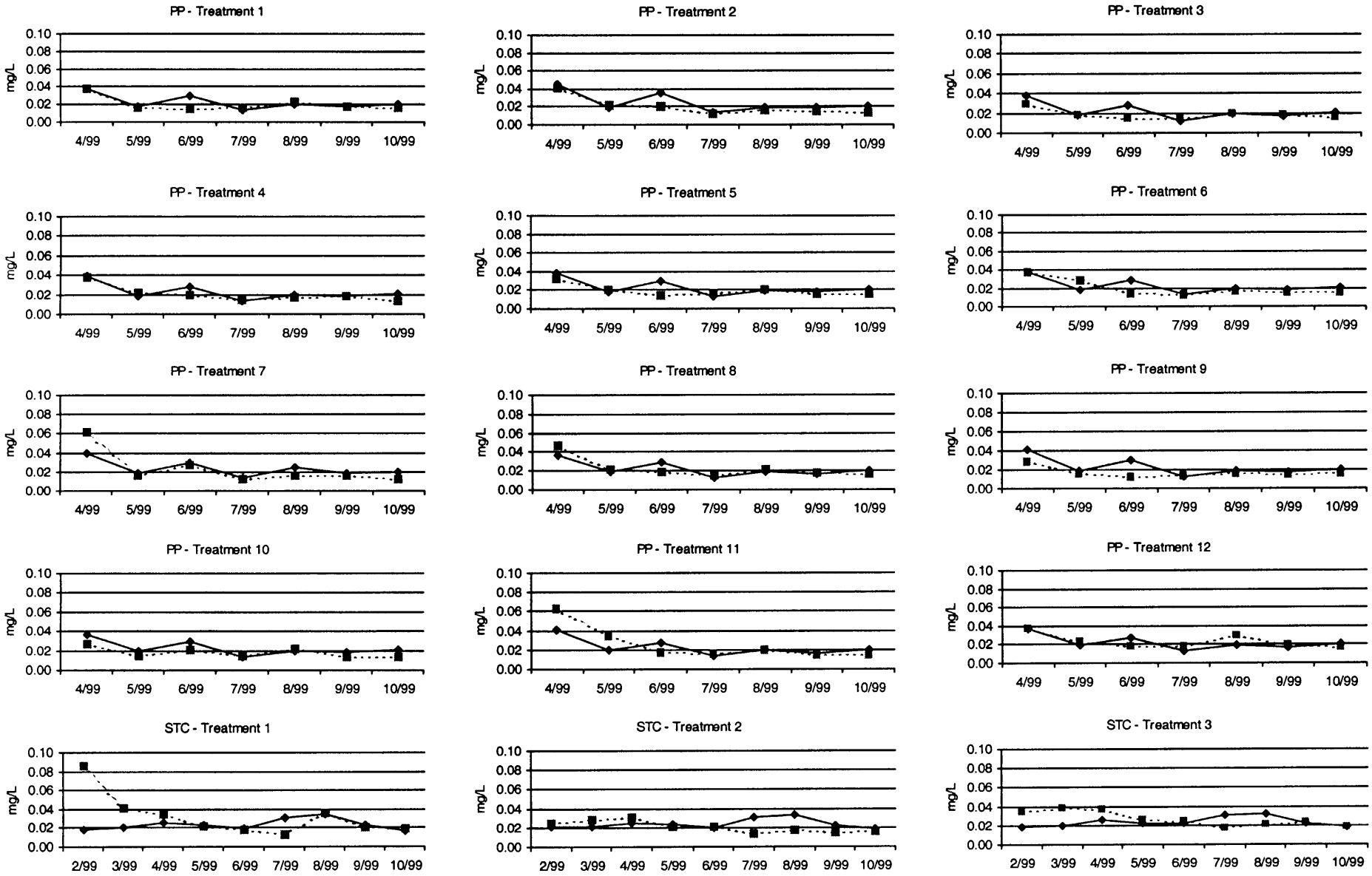

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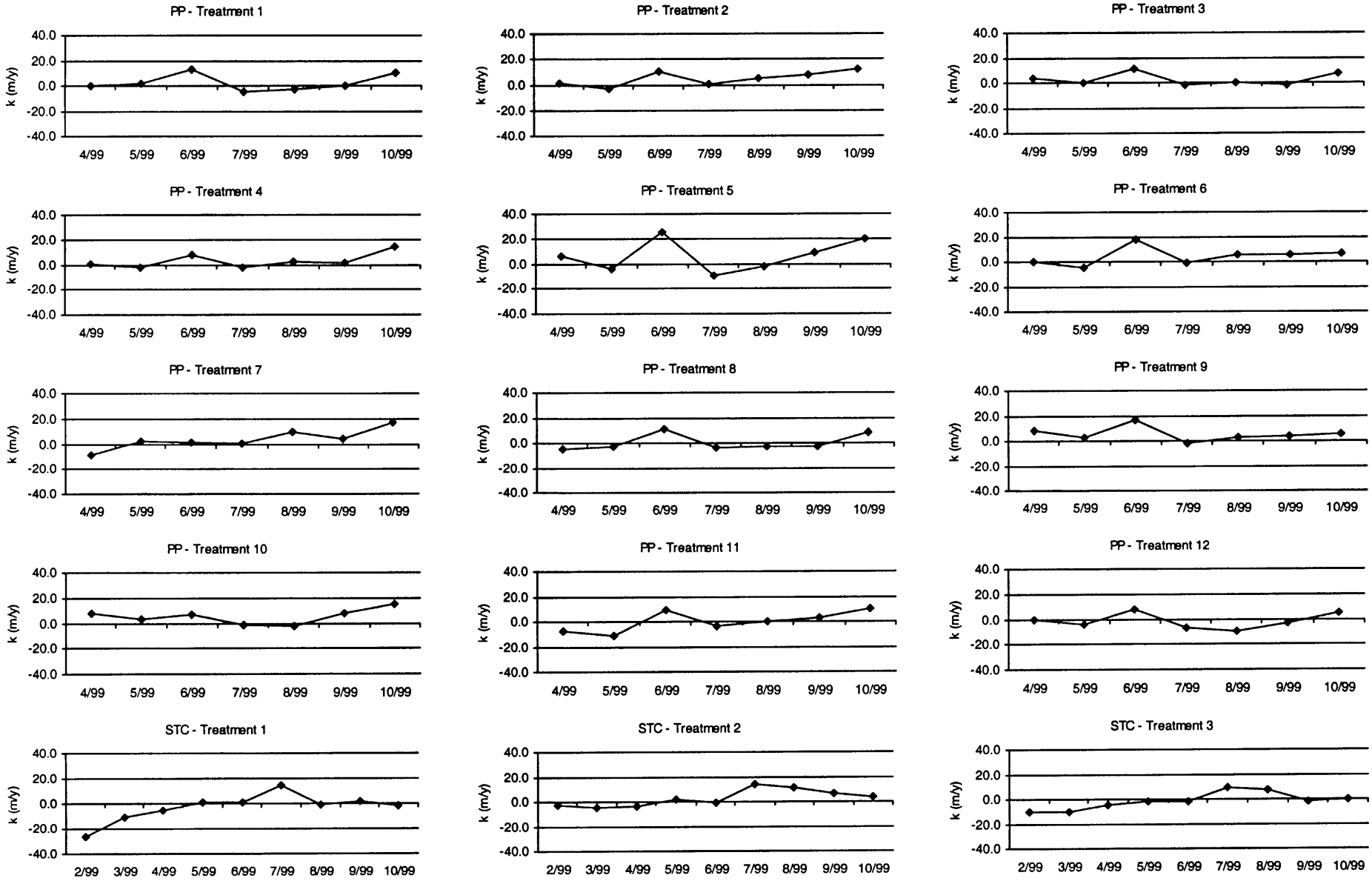

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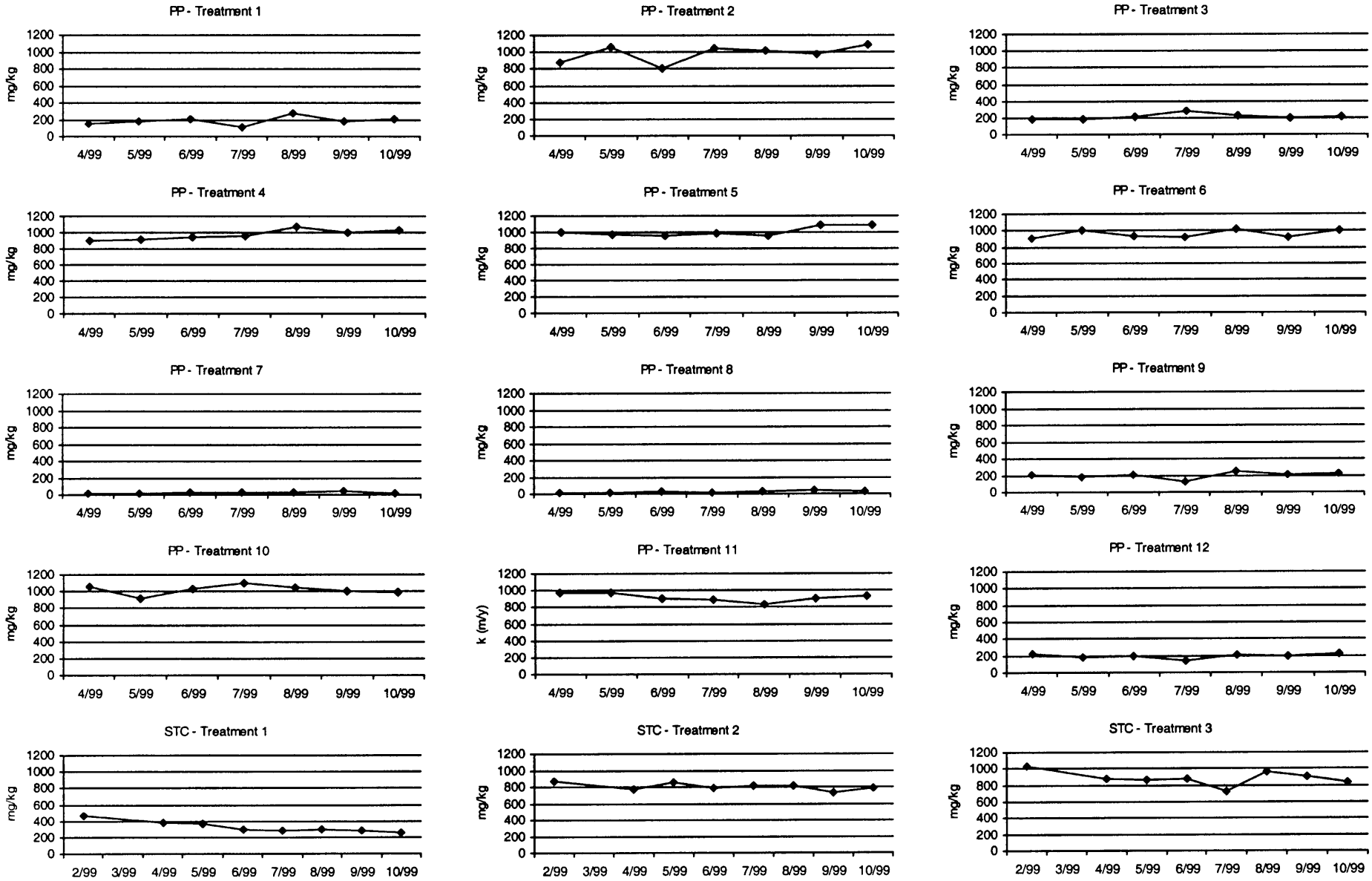
SFWMD PSTA Research Project Data Summary
Average Sediment Total Phosphorus Trend Charts



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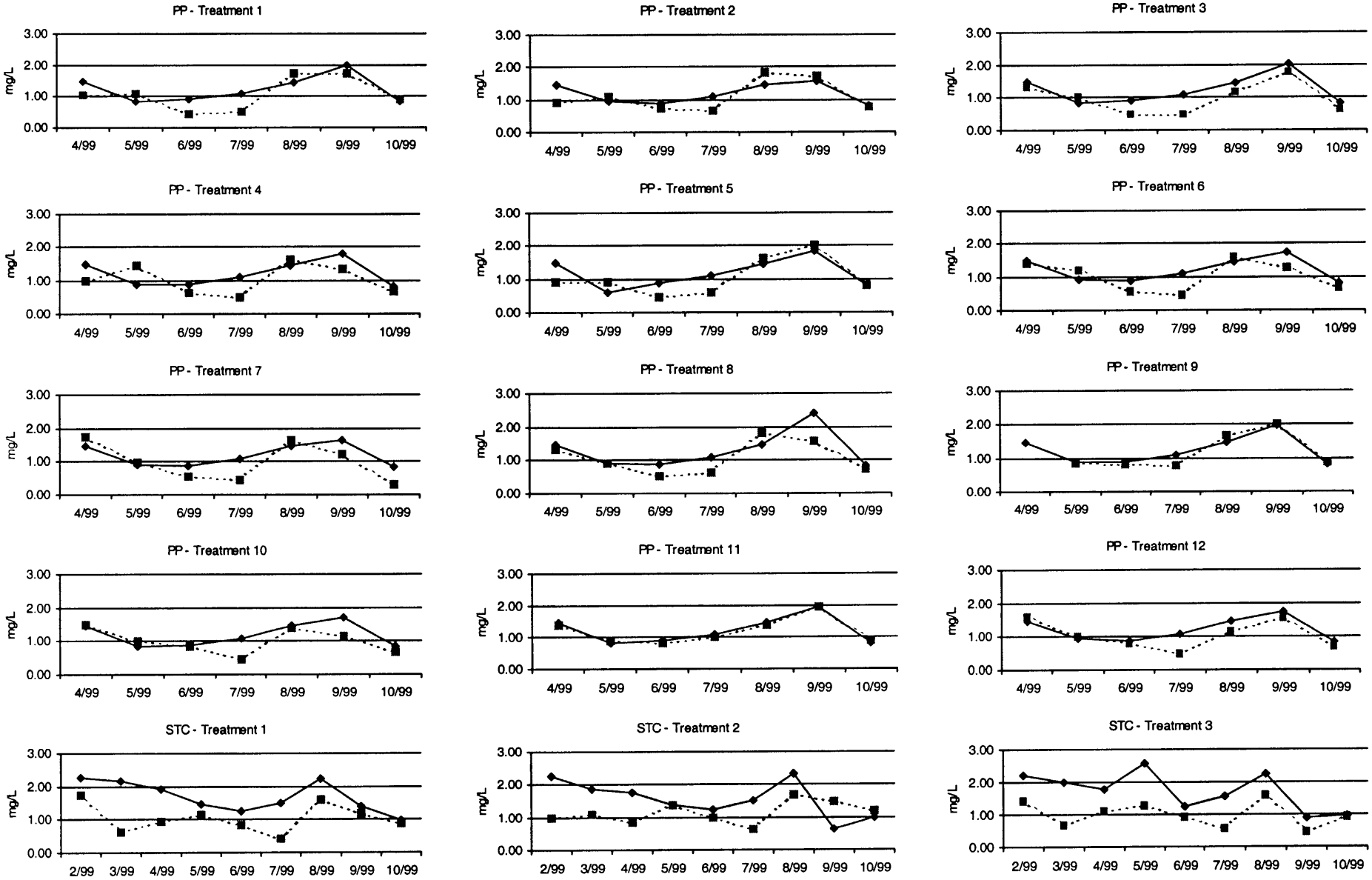
SFWMD PSTA Research Project Data Summary
Average Total Nitrogen Concentration Trend Charts

Inflow - - - Outflow



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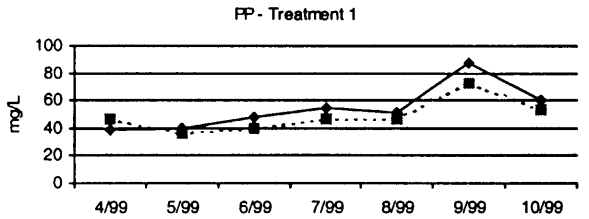
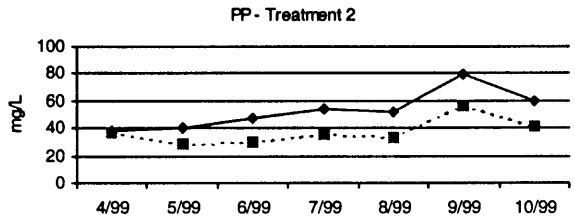
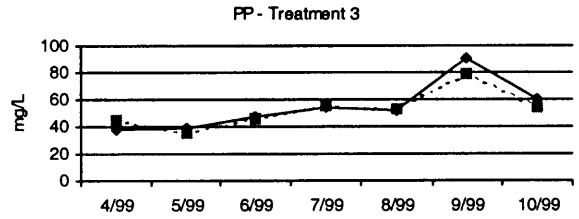
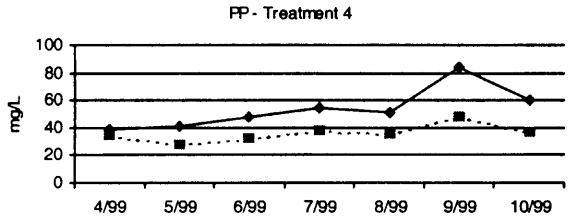
SFWMD PSTA Research Project Data Summary
Average Calcium Concentration Trend Charts

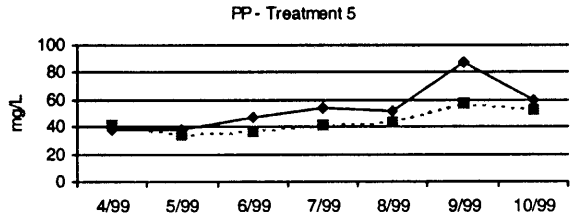
Inflow - - - Outflow

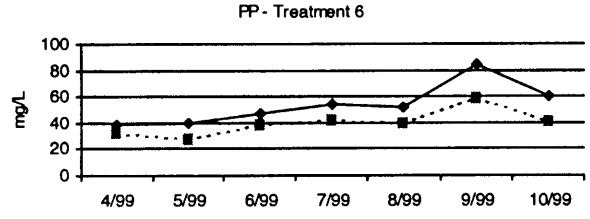


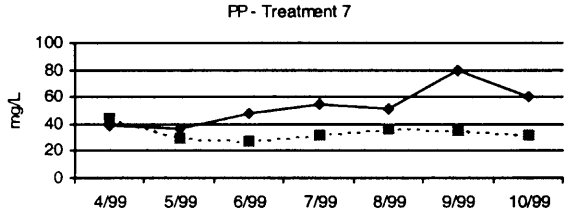


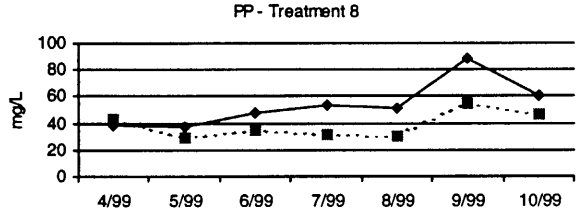


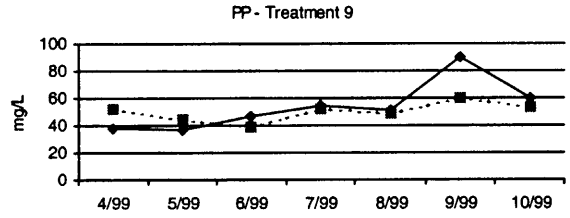


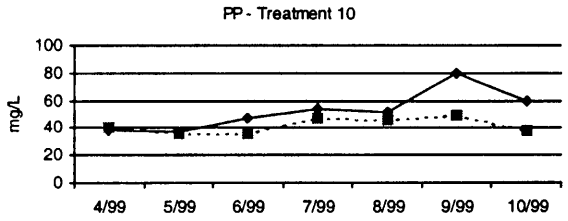


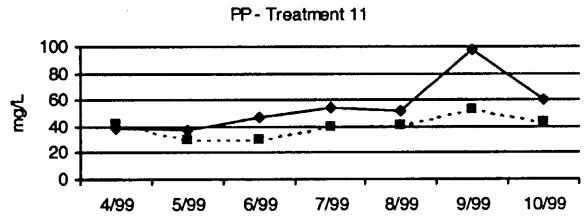


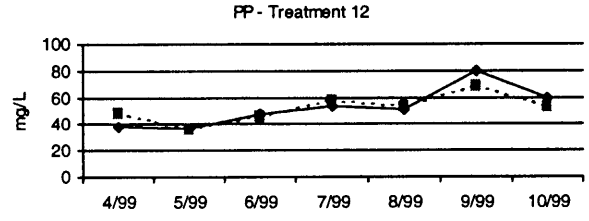


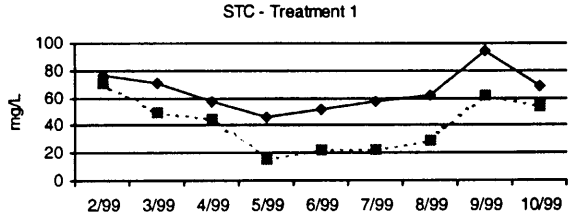


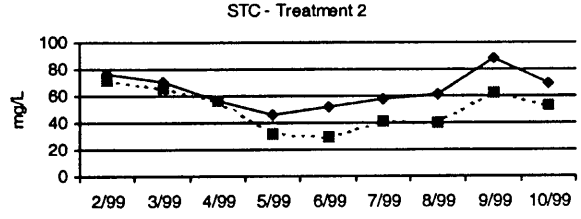


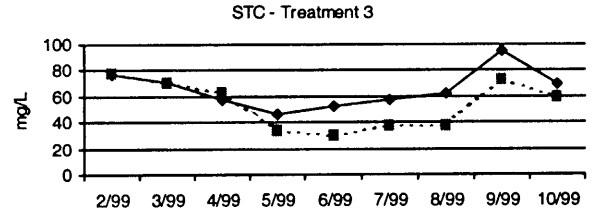












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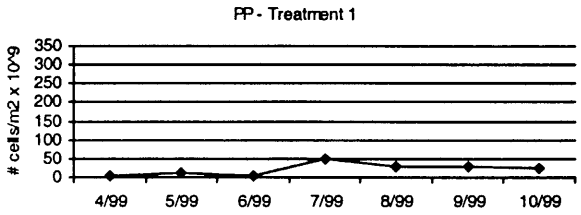
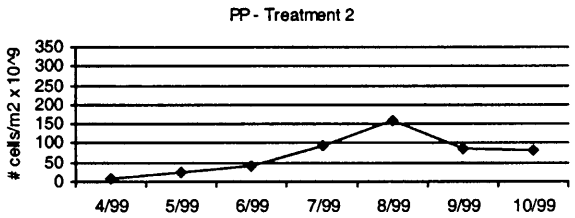
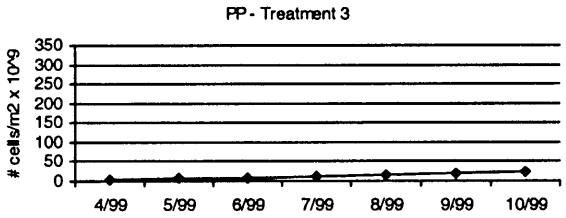
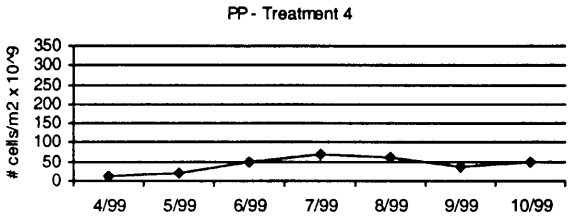
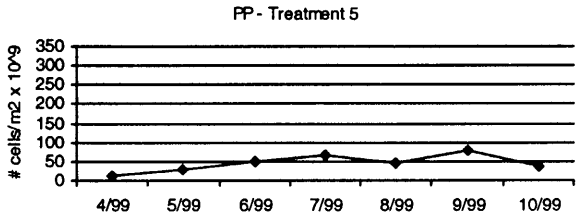
SFWMD PSTA Research Project Data Summary
Average Periphyton Cell Density Charts

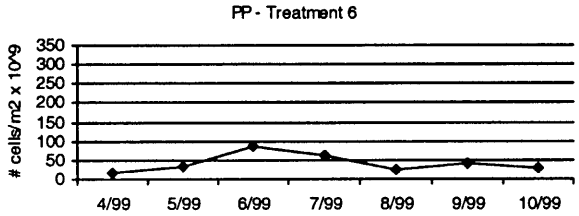


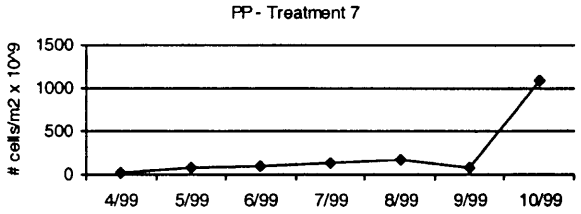


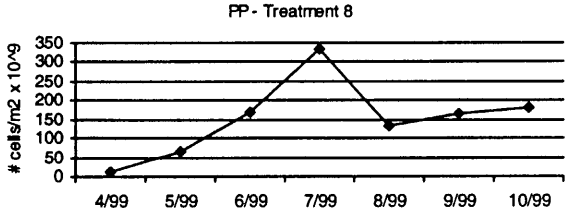


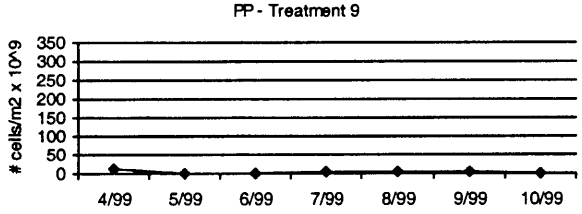


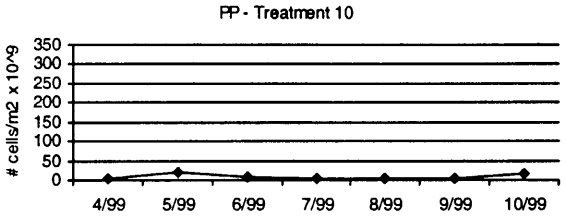


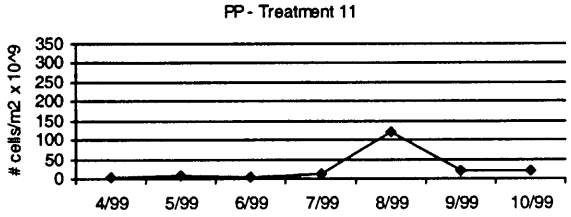


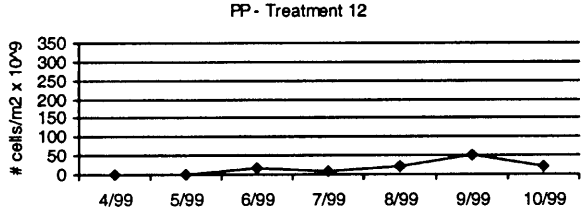


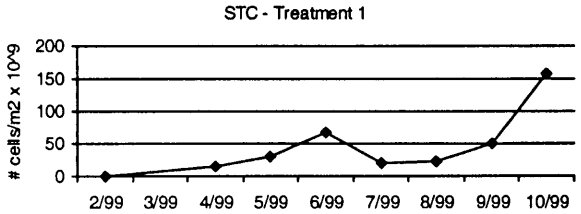


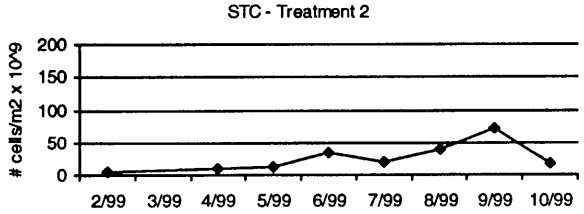


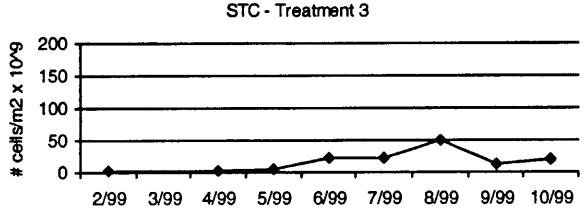












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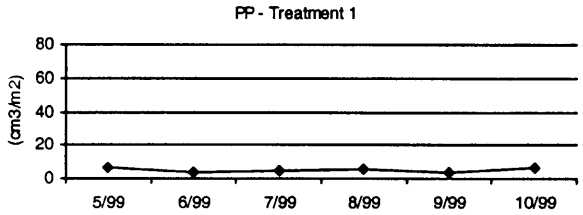
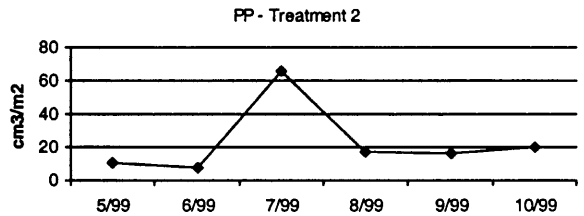
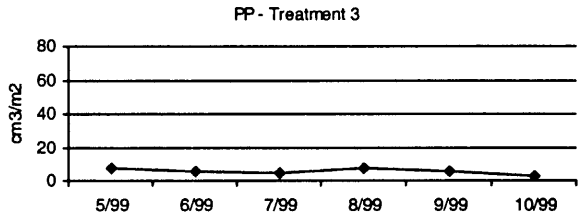
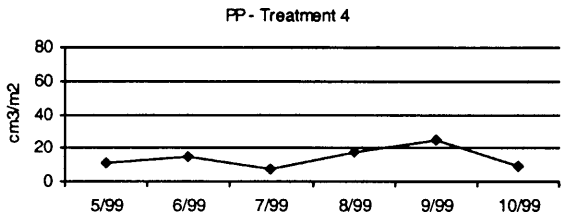
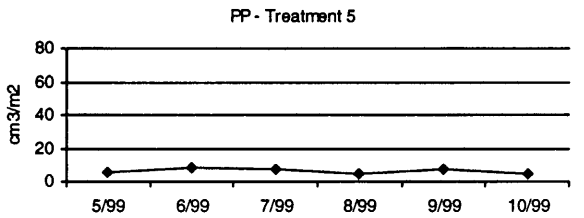
SFWMD PSTA Research Project Data Summary
Average Periphyton Biovolume Charts

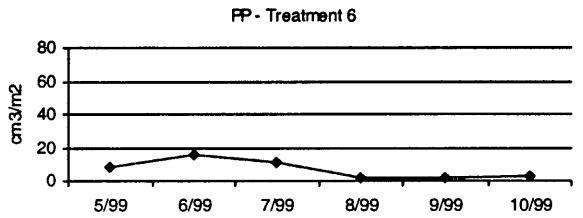


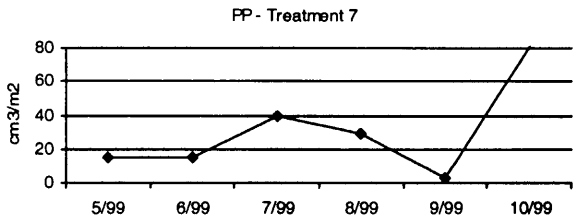


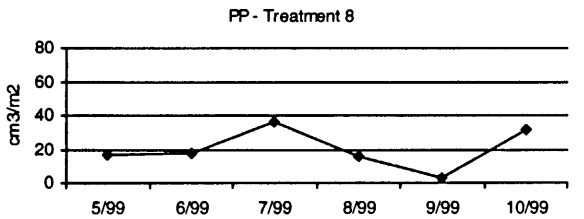


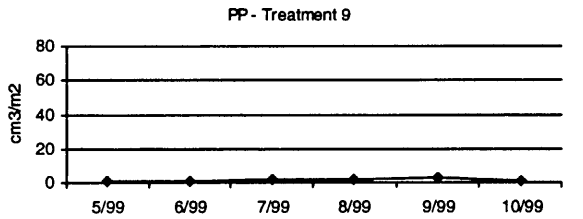


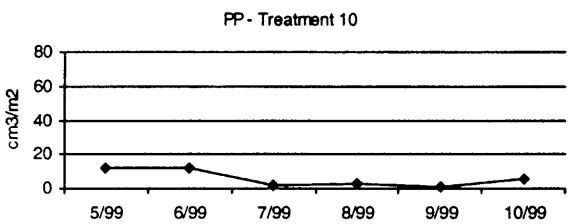


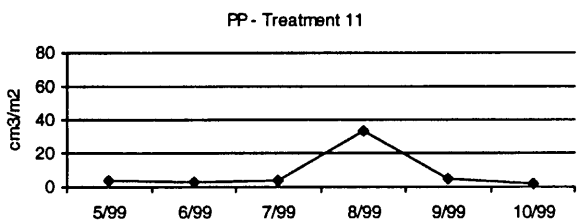


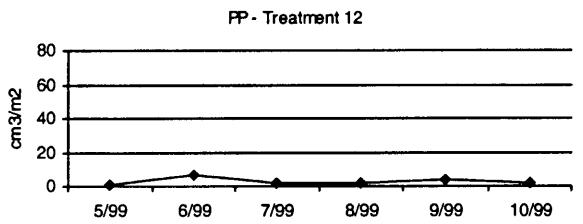


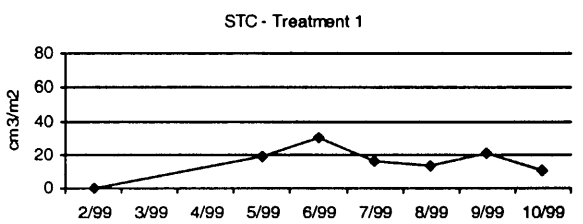


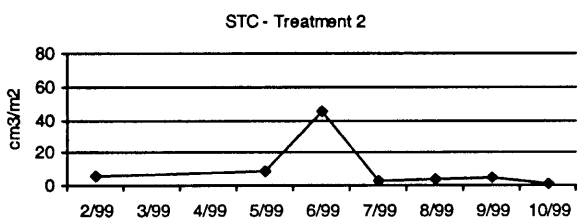


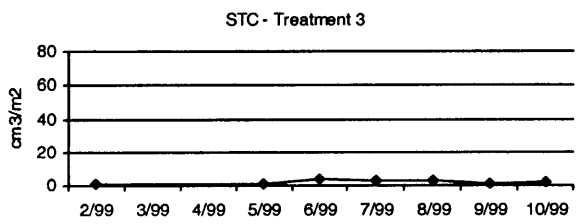












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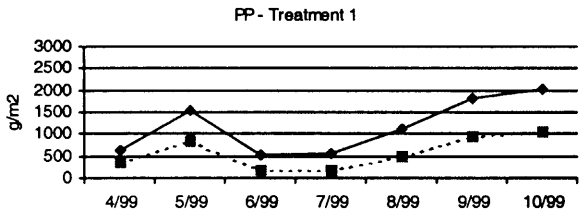
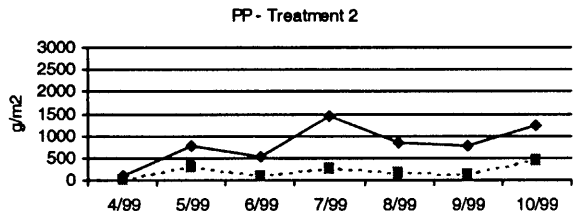
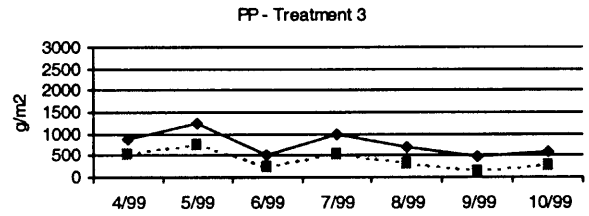
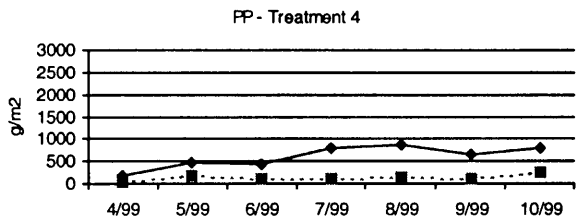
SFWMD PSTA Research Project Data Summary
Average Periphyton Biomass Trend Charts

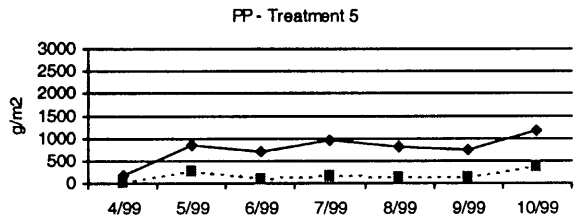
Dry Wt — Ash-Free Dry Wt

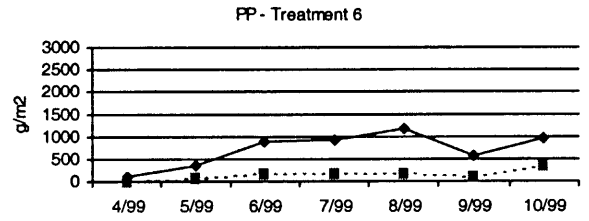


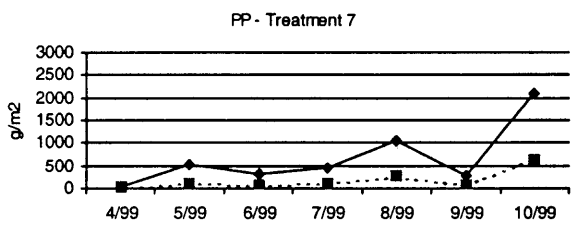


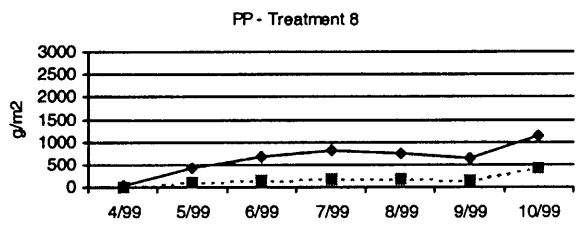


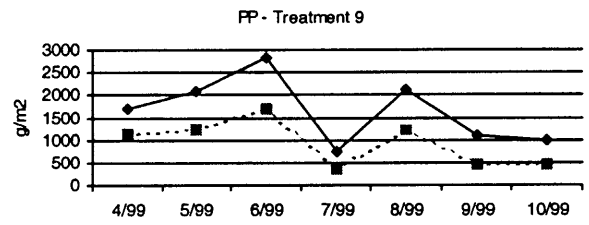


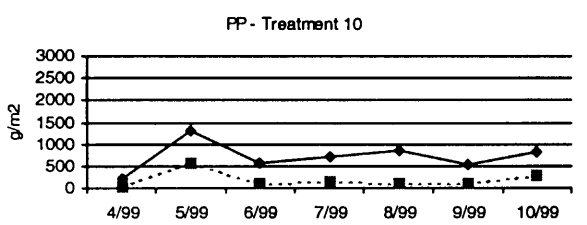


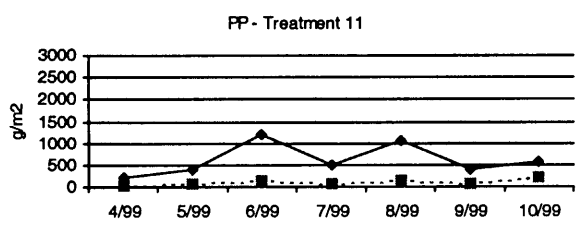


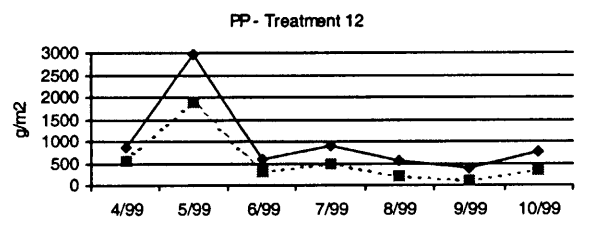


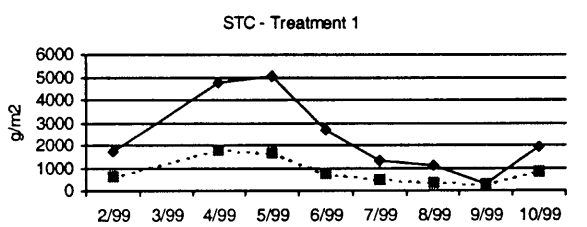


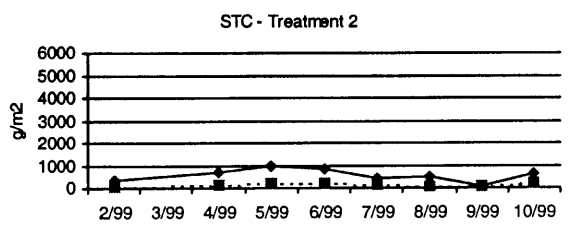


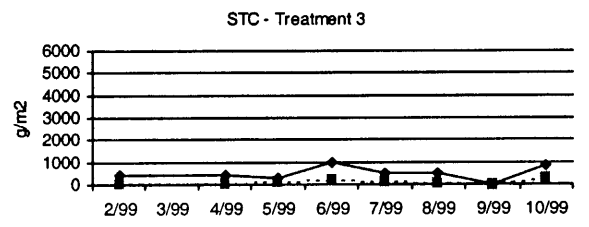












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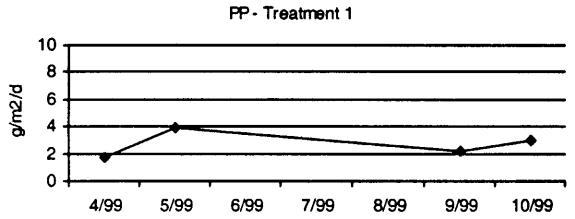
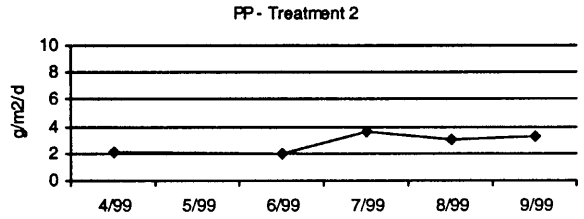
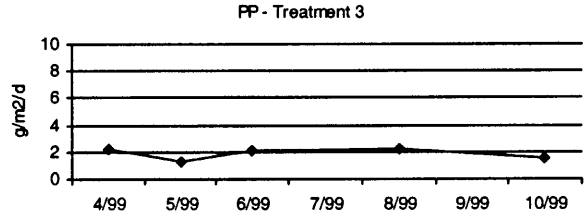
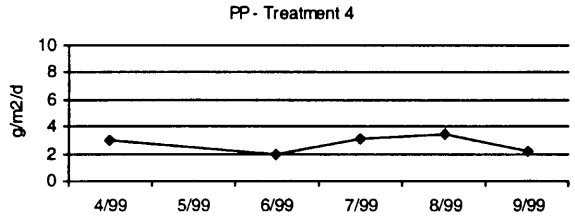
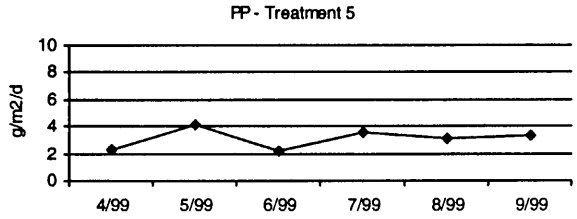
SFWMD PSTA Research Project Data Summary
Average GPP Trend Charts

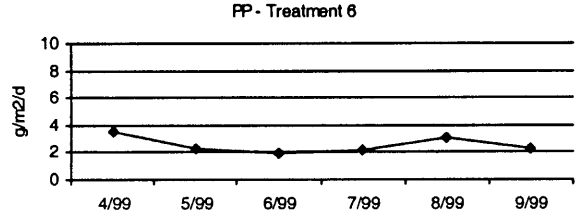


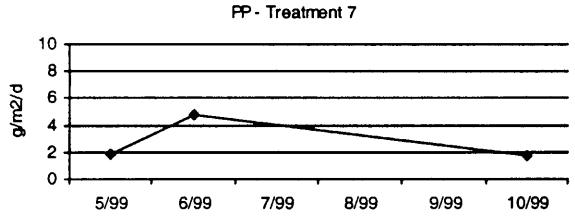


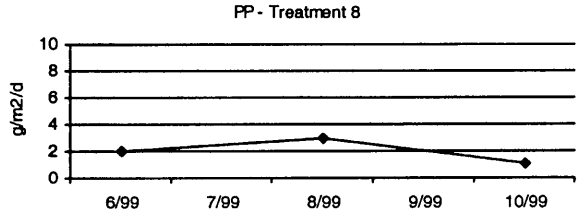


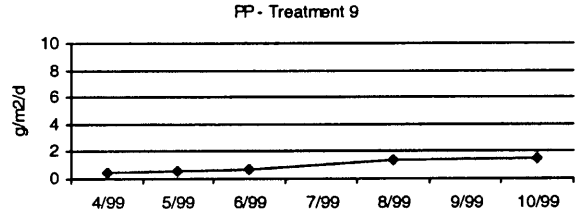


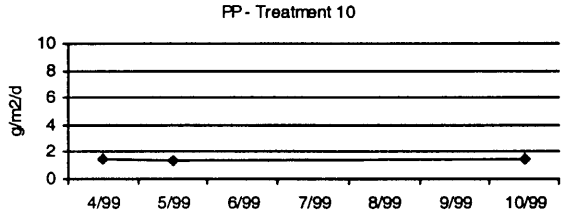


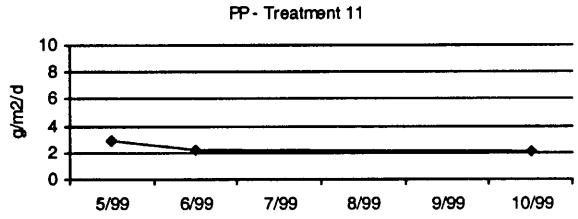


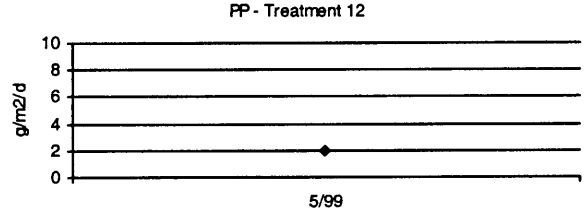


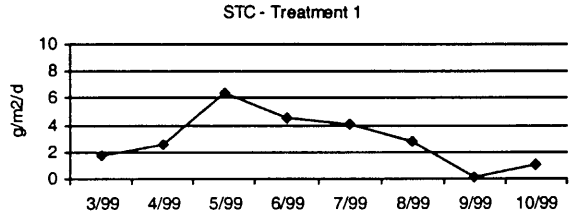


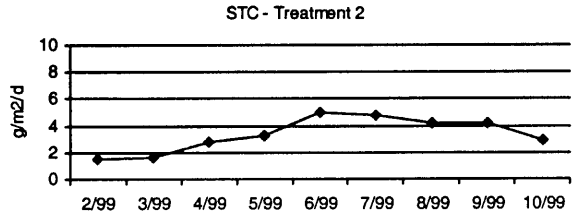


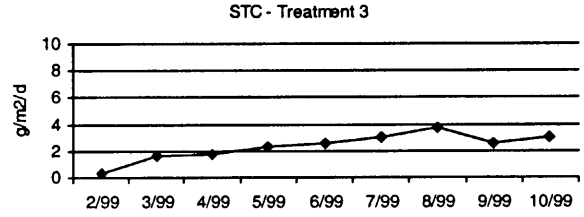












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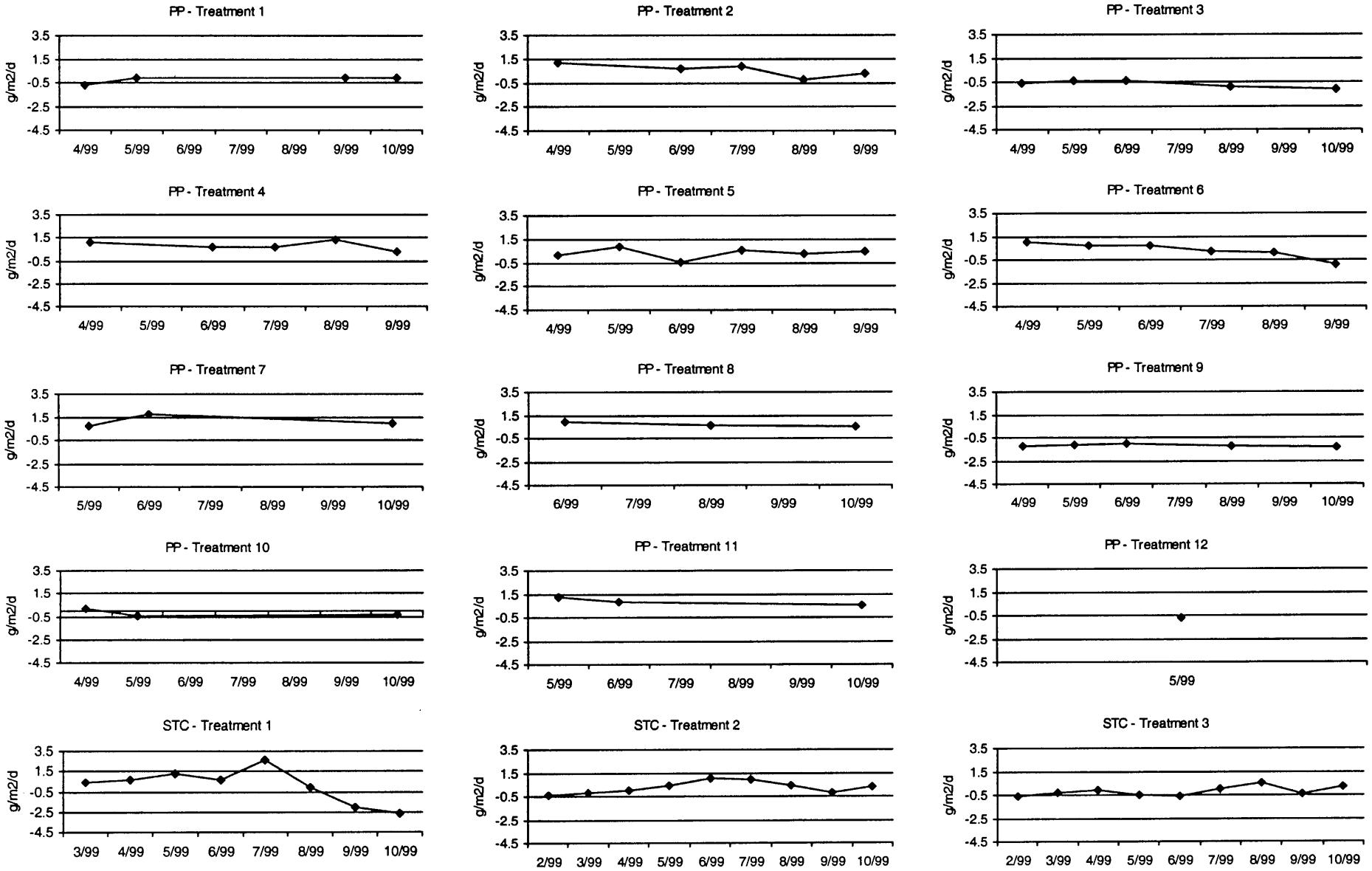
SFWMD PSTA Research Project Data Summary
Average NPP(24hr) Trend Charts



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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-τ)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/∂)

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 ∂ =	0.4150	Solver

Dimensionless Variance Guess

Pe = 2.40962785 0.516499295

∂

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-τ)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/∂)

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_a/τ_v
Dimensionless Variance =	0.8321	1/N
Wetland Dispersion Number ∂ =	1.7284	Solver

Dimensionless Variance Guess

Pe = 0.57856356 0.832099631

∂

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/$\mathcal{D}$)

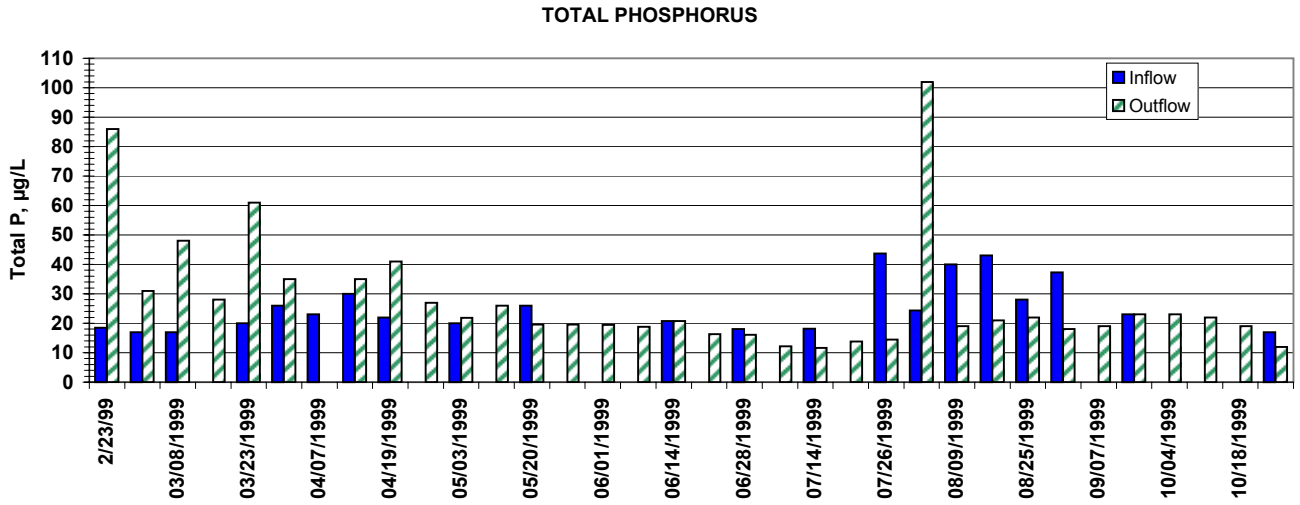
Mean Residence Time τ_a (d) =	22.42	M_1/M_0
σ^2 (d^2) =	184.66	M_2/M_0
Number of Tanks N =	2.72	τ_a^2/σ^2
Volumetric Efficiency =	1.55	τ_a/τ_r
Dimensionless Variance =	0.3673	1/N
Wetland Dispersion Number $\mathcal{D}$ =	0.2407	Solver

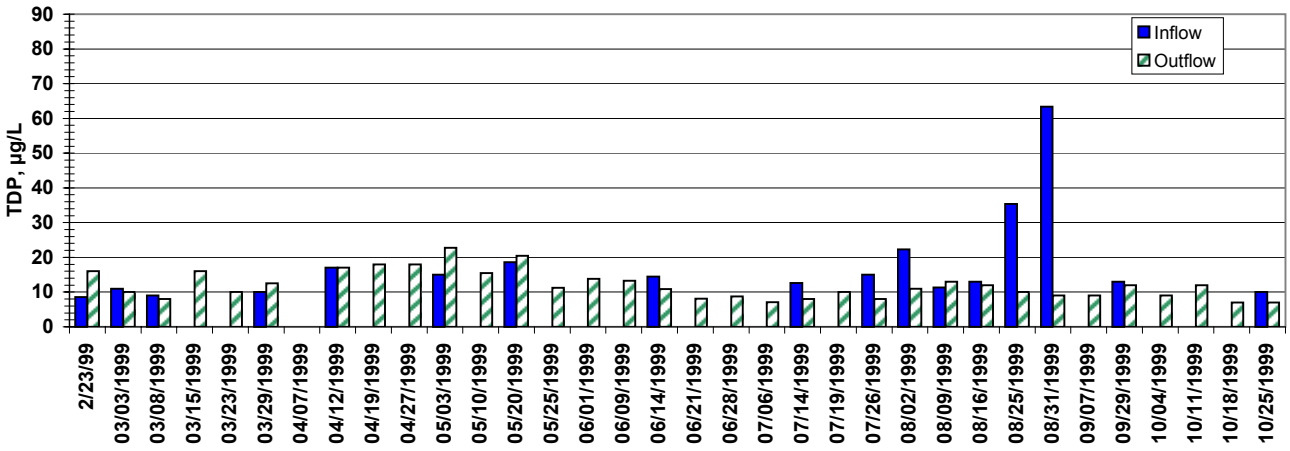
		Dimensionless Variance Guess
Pe =	4.155274	0.367299899

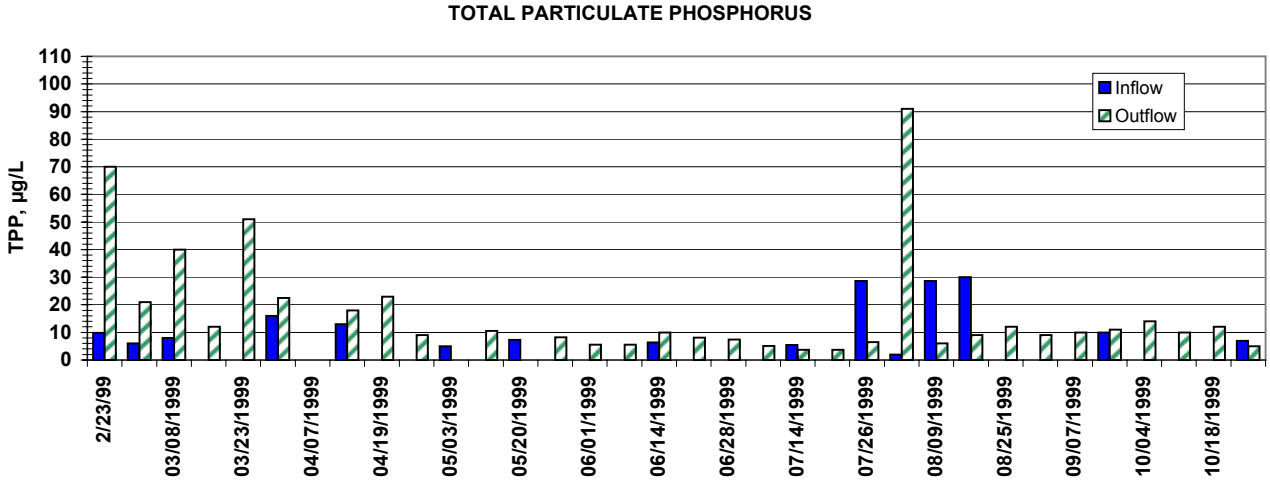
$\mathcal{D}$

0.2407

Dimensionless Variance = 2/Pe - 2/Pe^2(1 - exp(-Pe))





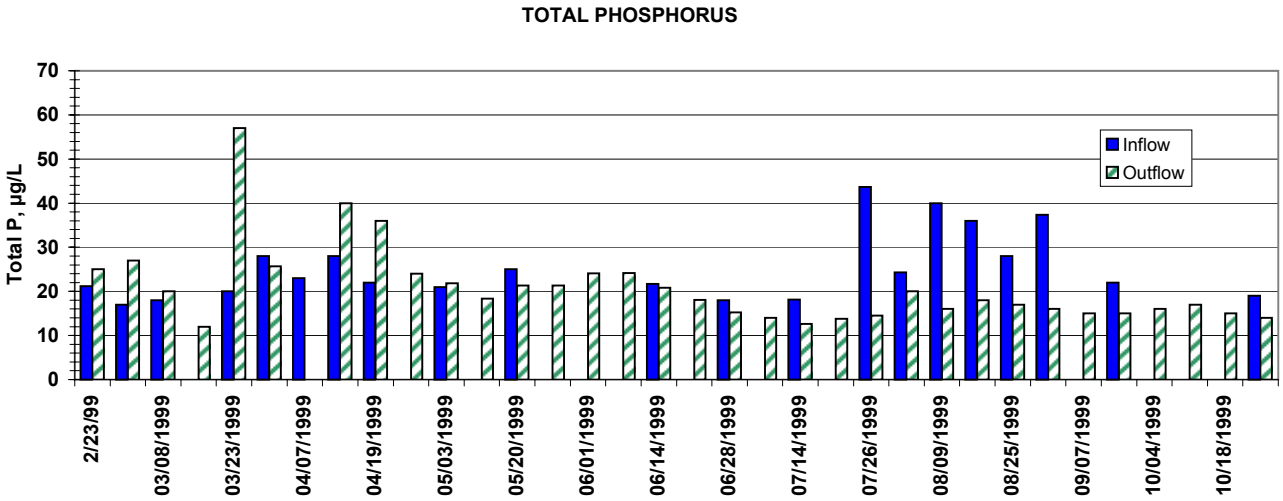


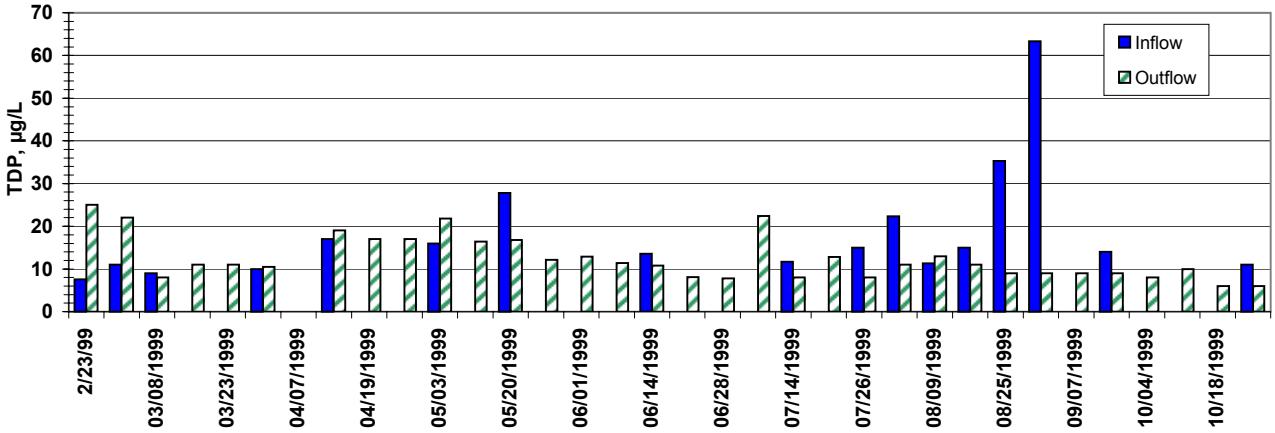
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.

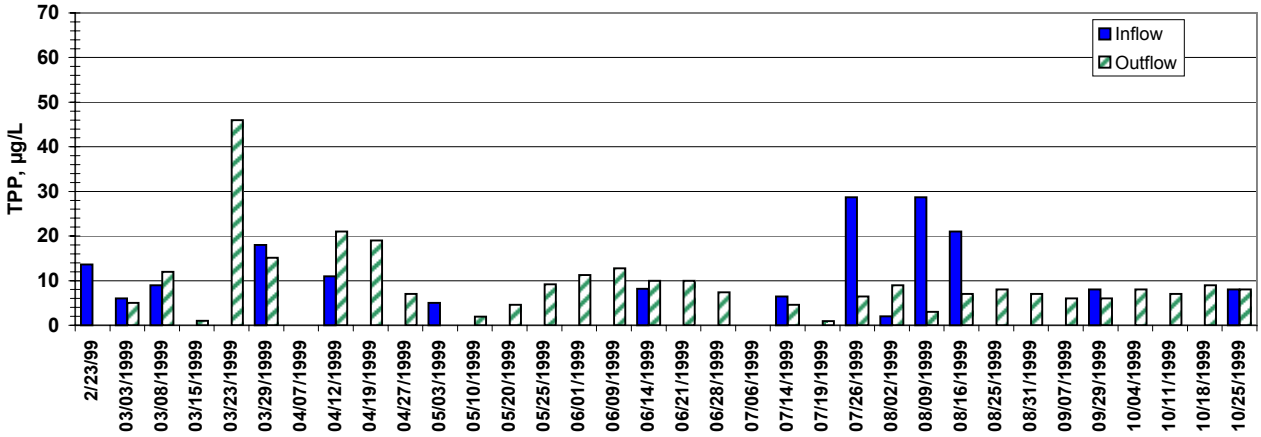
Exhibit C-1

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for South Test Cell Treatment No. 1, February - October 1999

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day





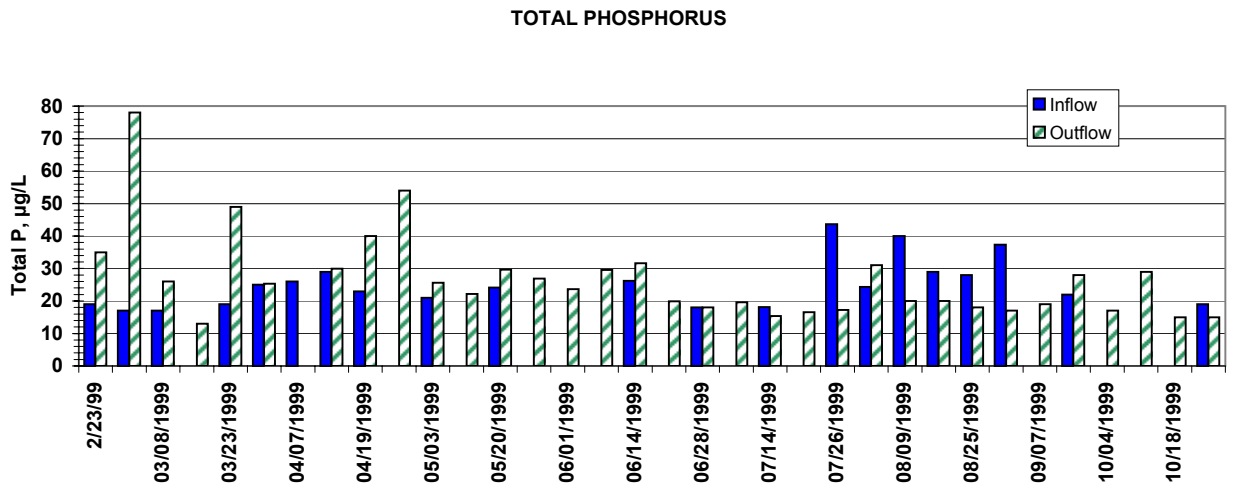


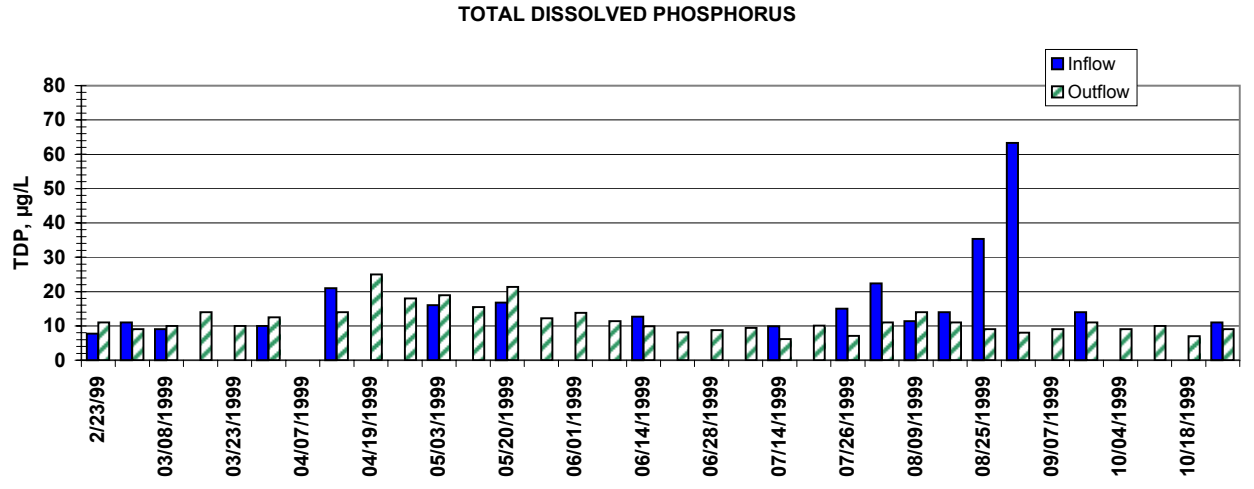
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.

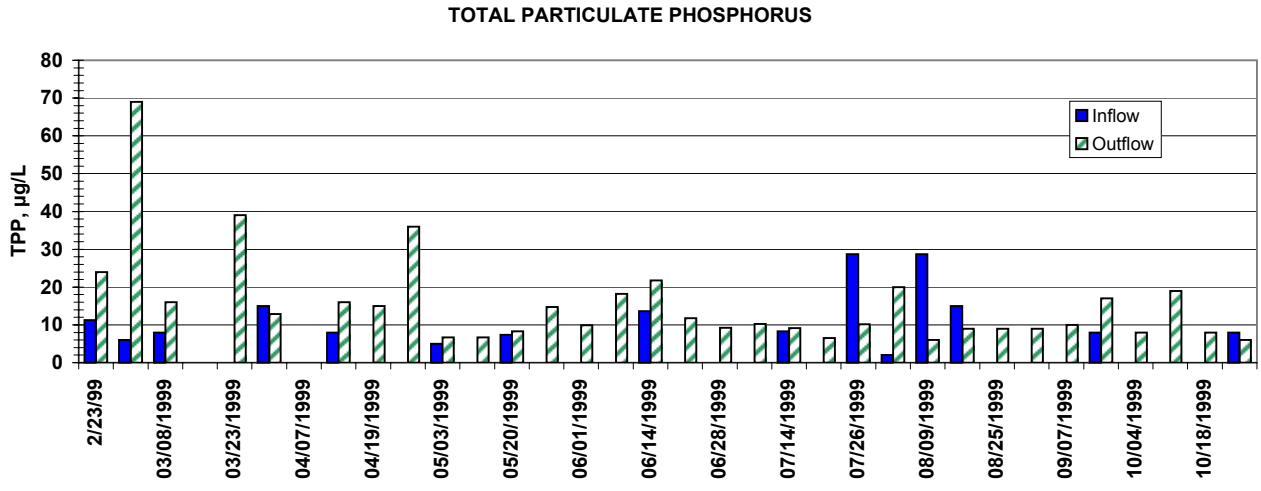
Exhibit C-2

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for South Test Cell Treatment No. 2, February - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day





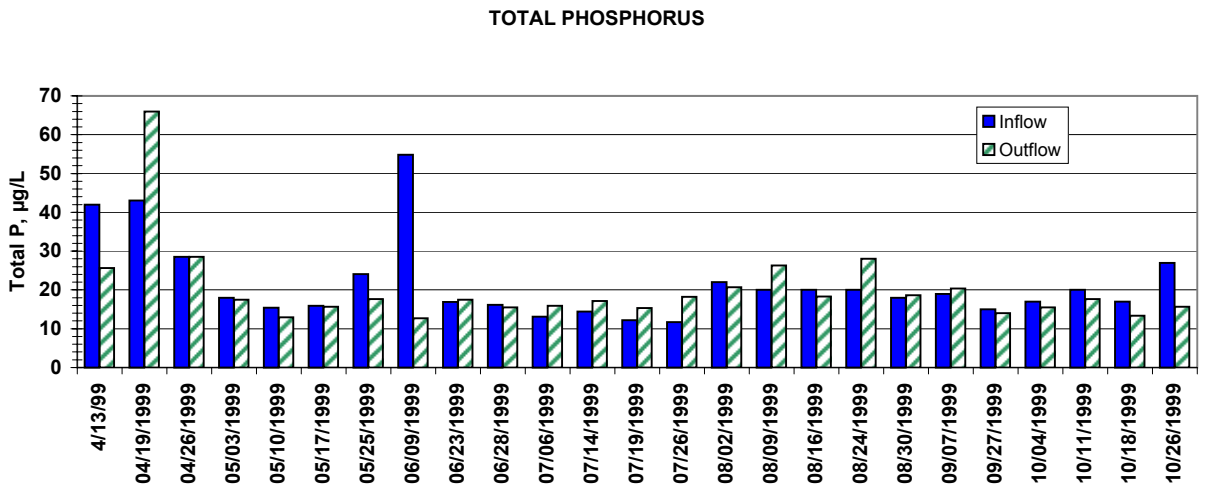


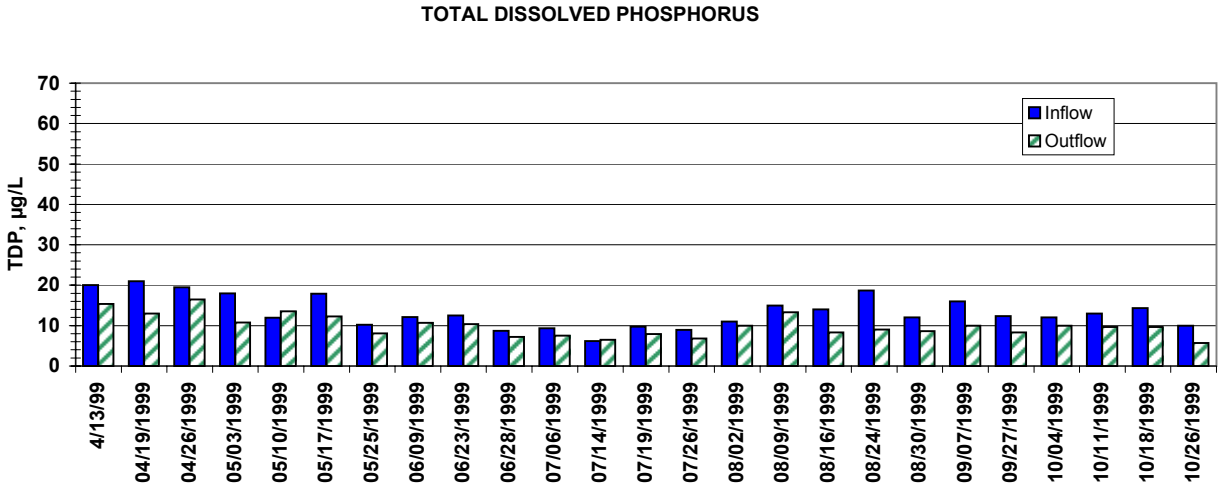
Note: Inflow TP and TDP data are collected by the District; missing data points are either not available or pending.

Exhibit C-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 - October 1999

Key Conditions:
Substrate: Shellrock
Depth: Seasonal
HLR: 6 cm/day





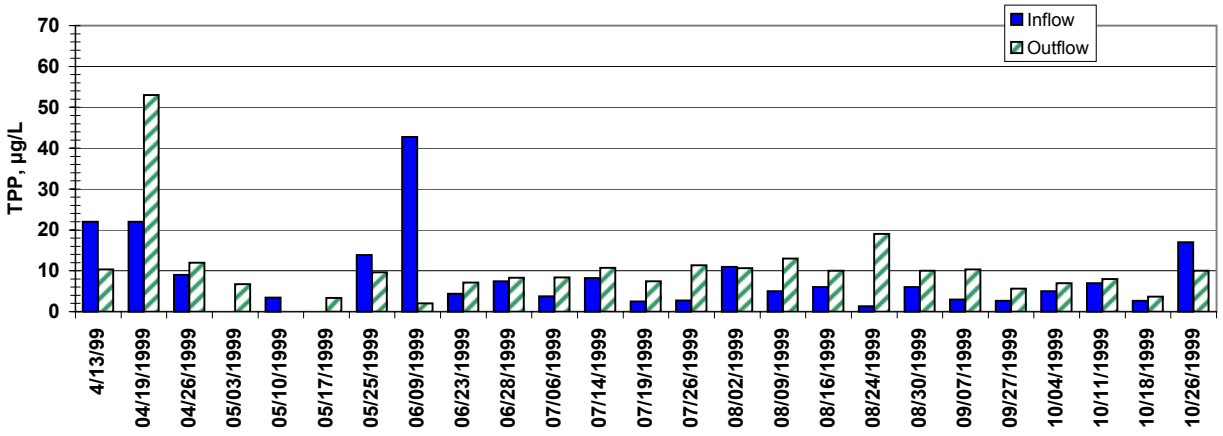
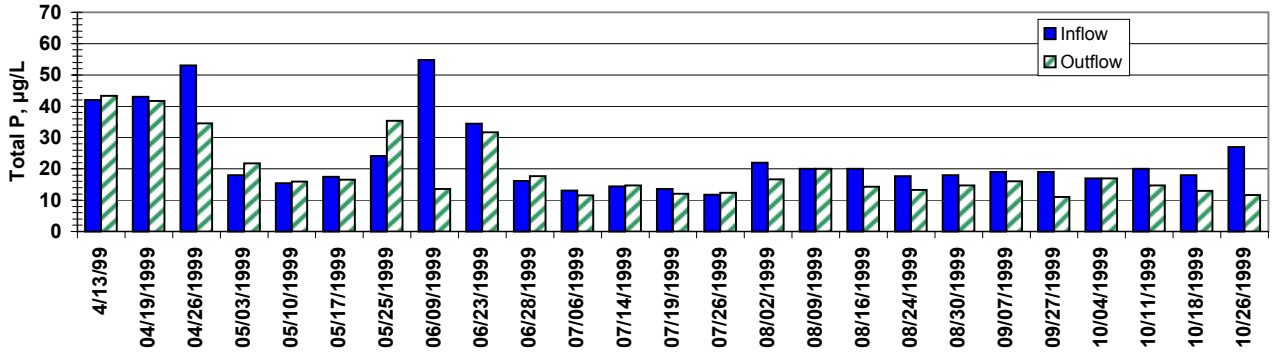


Exhibit C-4

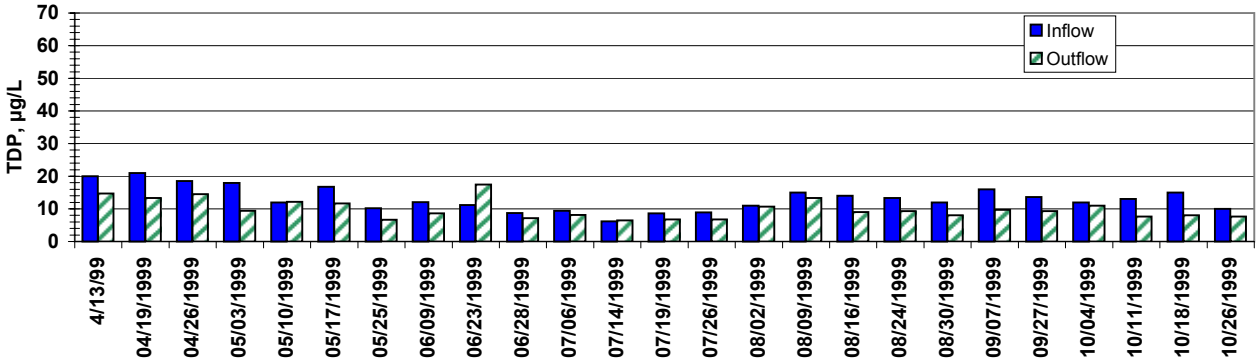
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 1, April - October 1999

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other:

TOTAL PHOSPHORUS



TOTAL DISSOLVED PHOSPHORUS



TOTAL PARTICULATE PHOSPHORUS

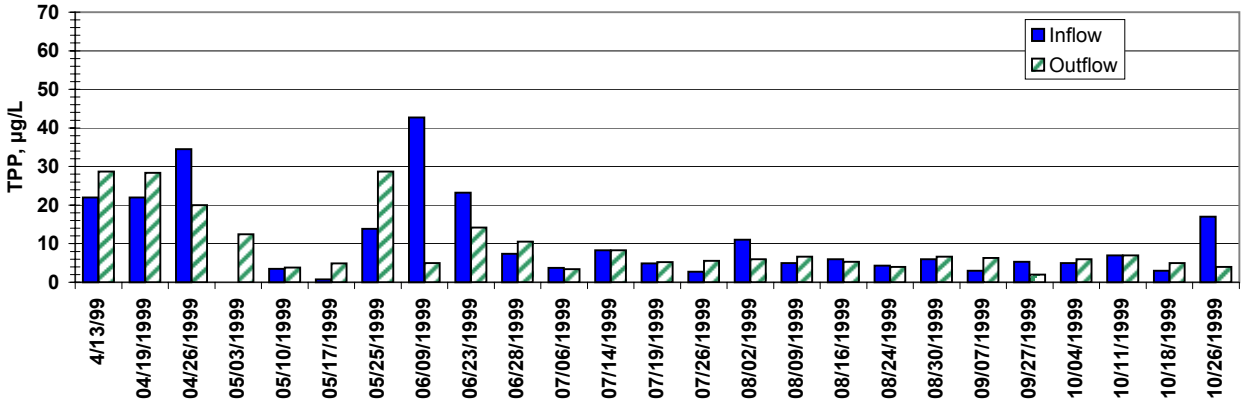
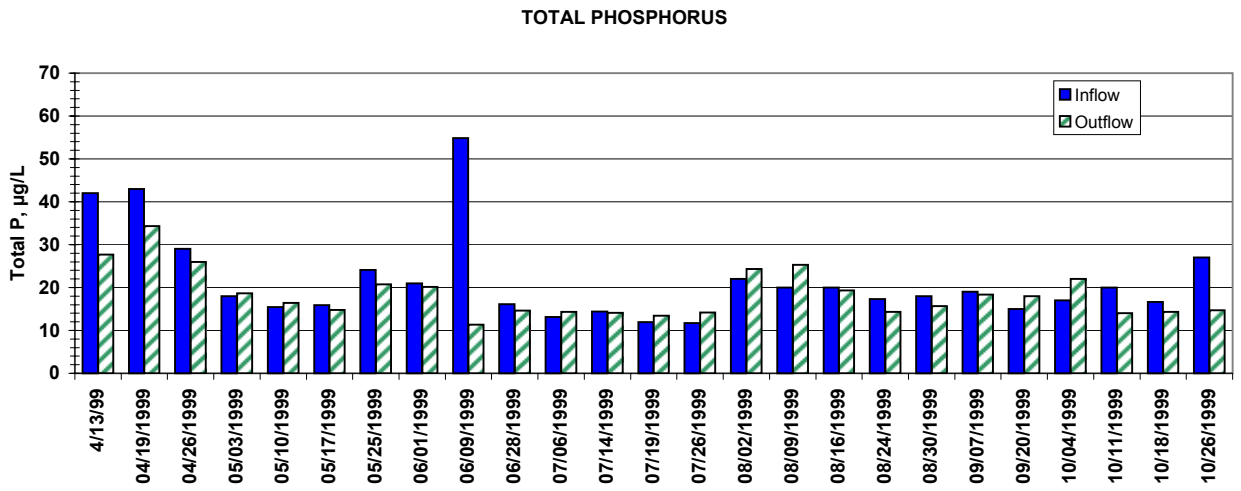
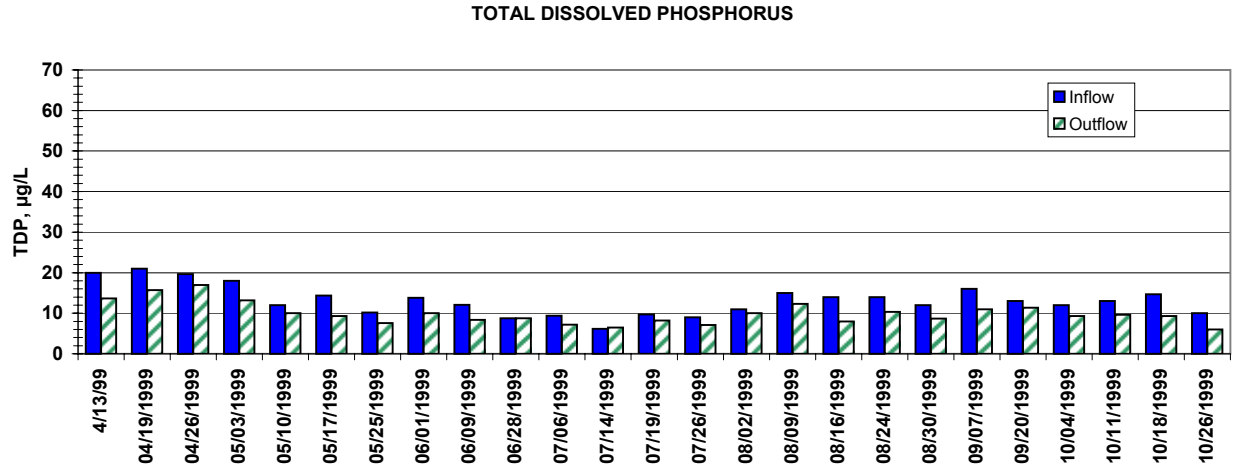


Exhibit C-5

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 2, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other:





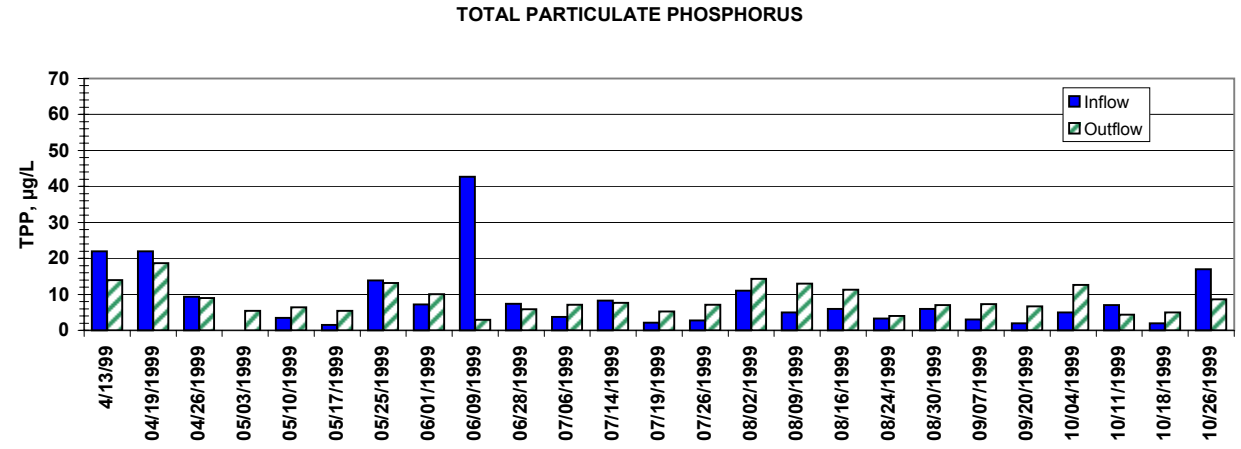
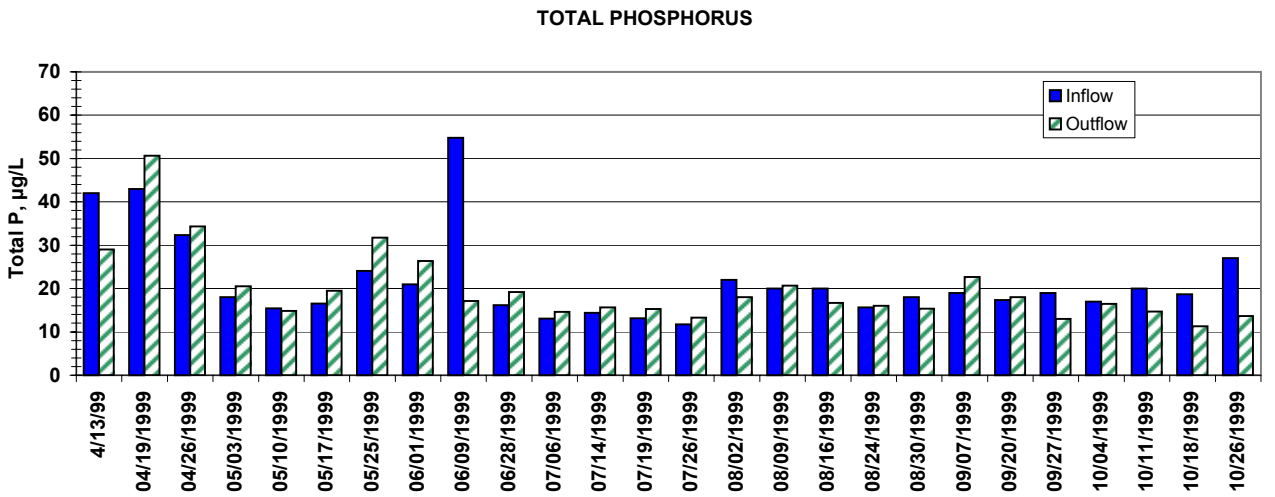
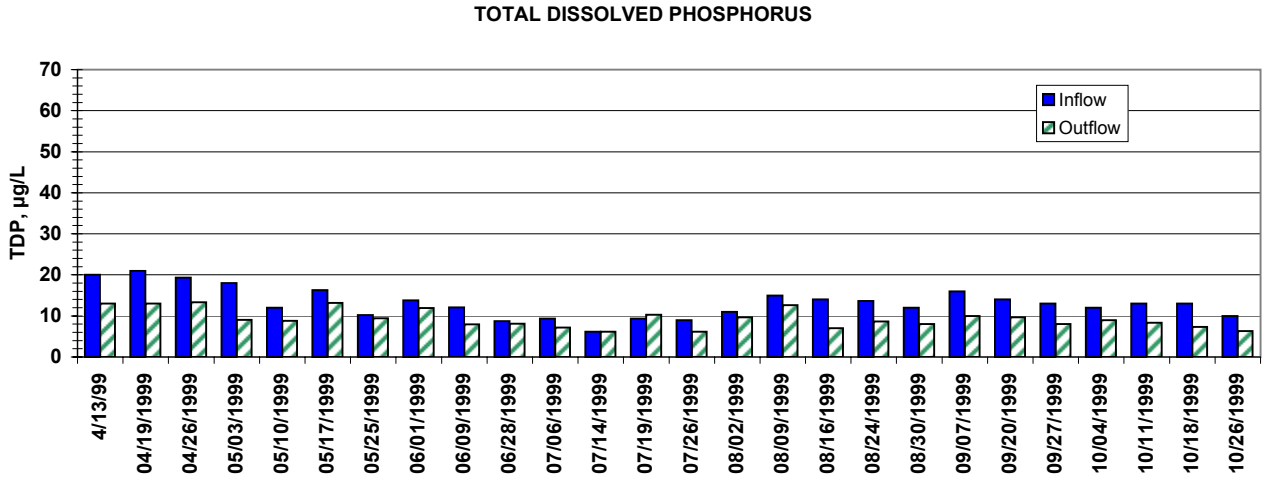


Exhibit C-6

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 3, April - October 1999

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:





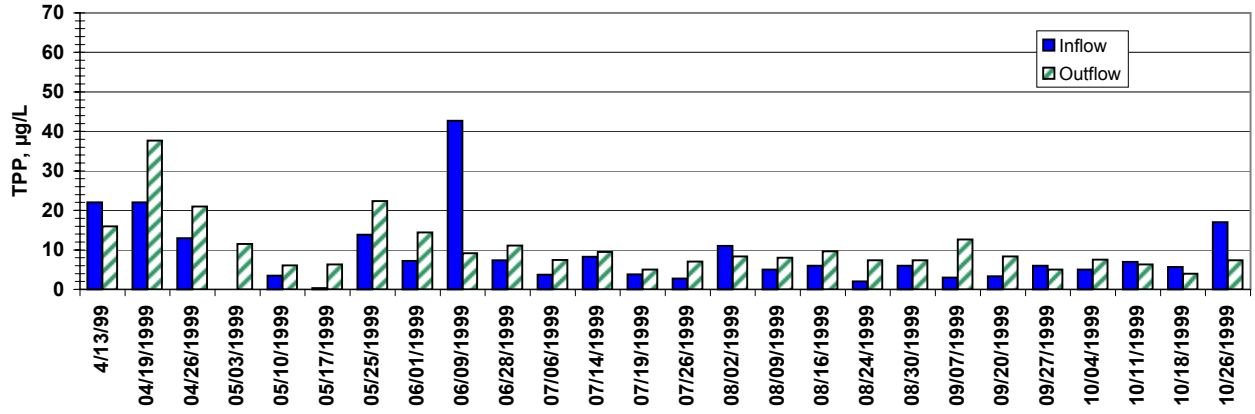
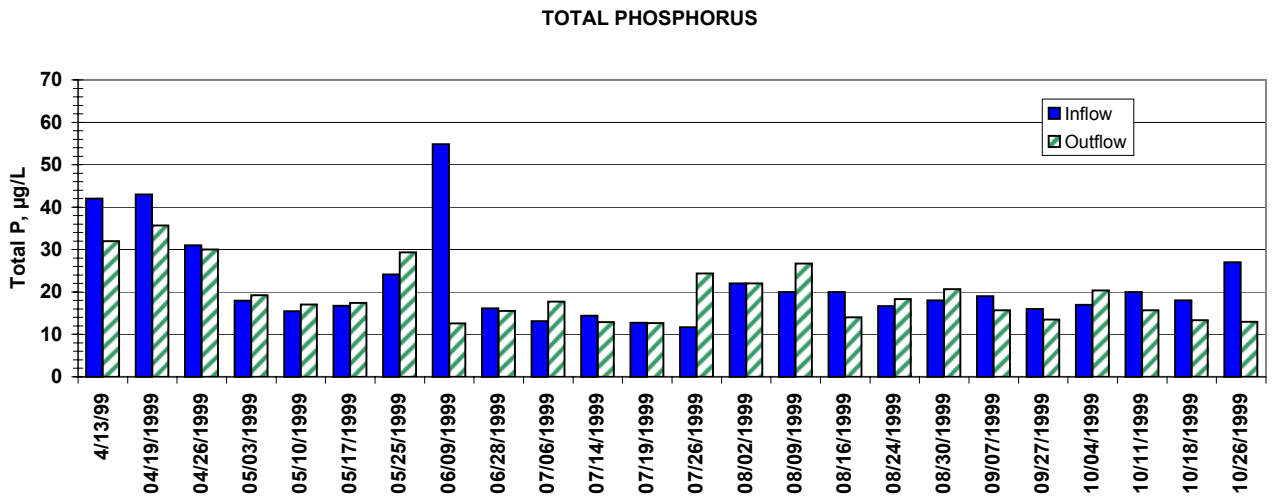
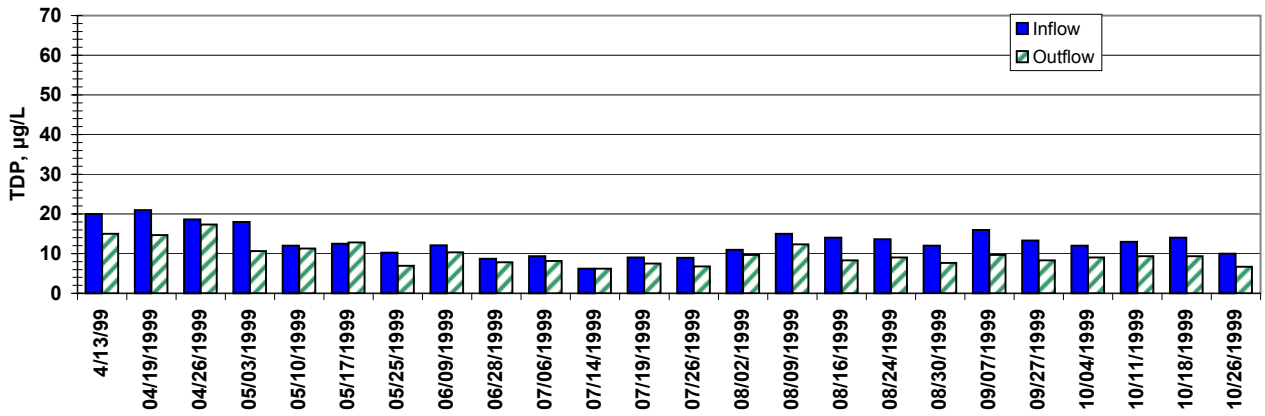


Exhibit C-7

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 4, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:





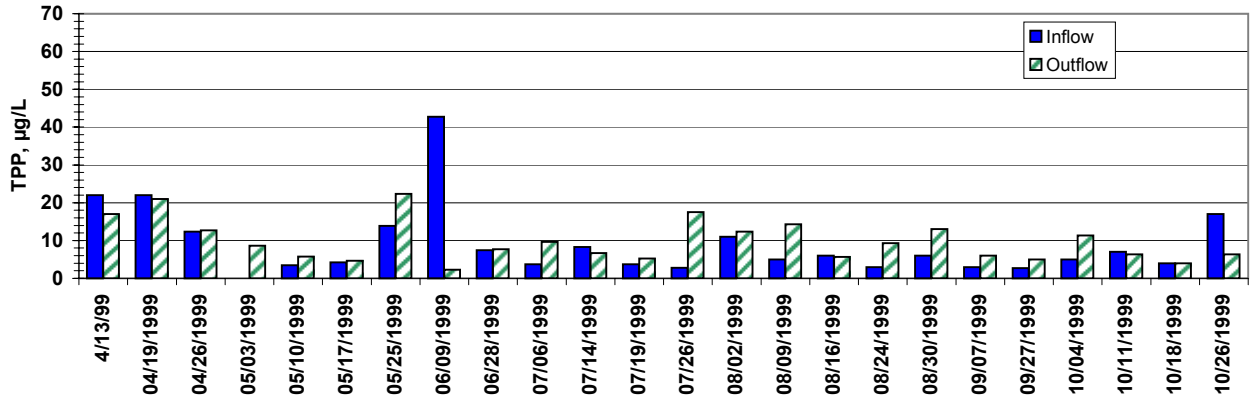
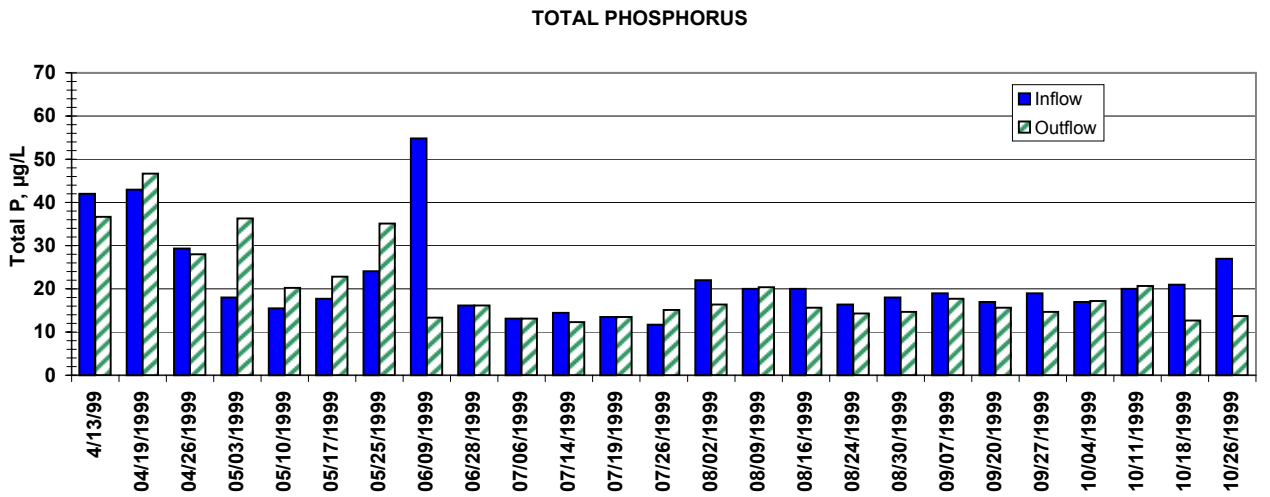
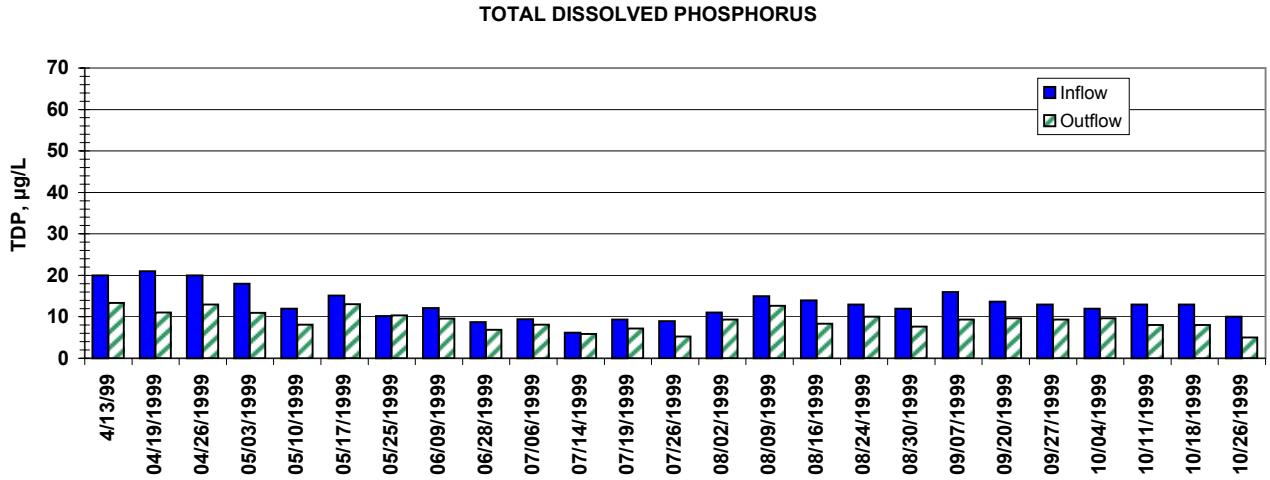


Exhibit C-8

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 5, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 12 cm/day
Other:





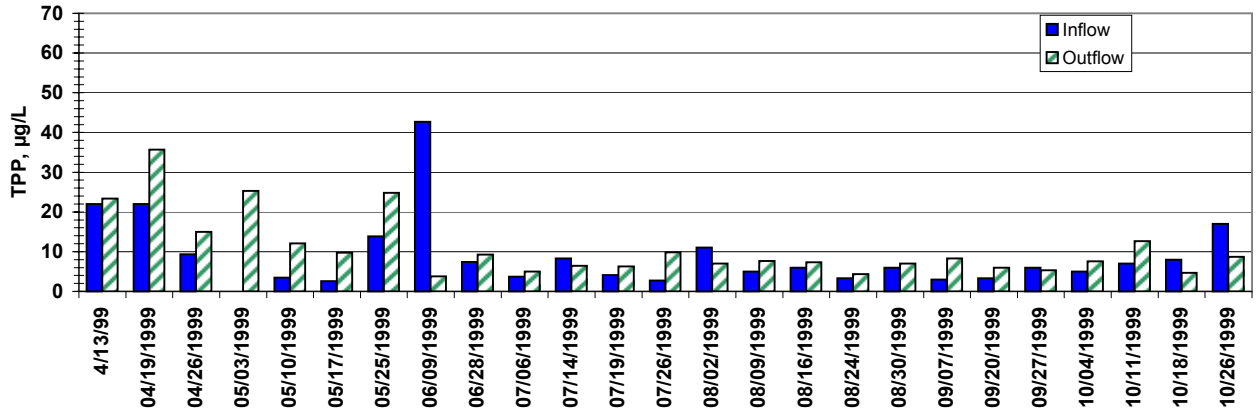
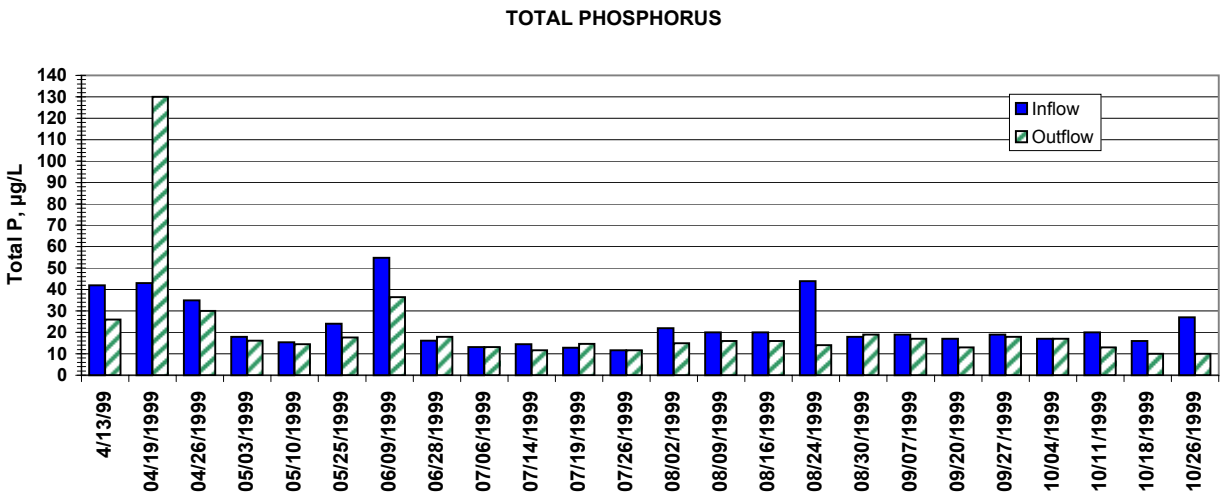
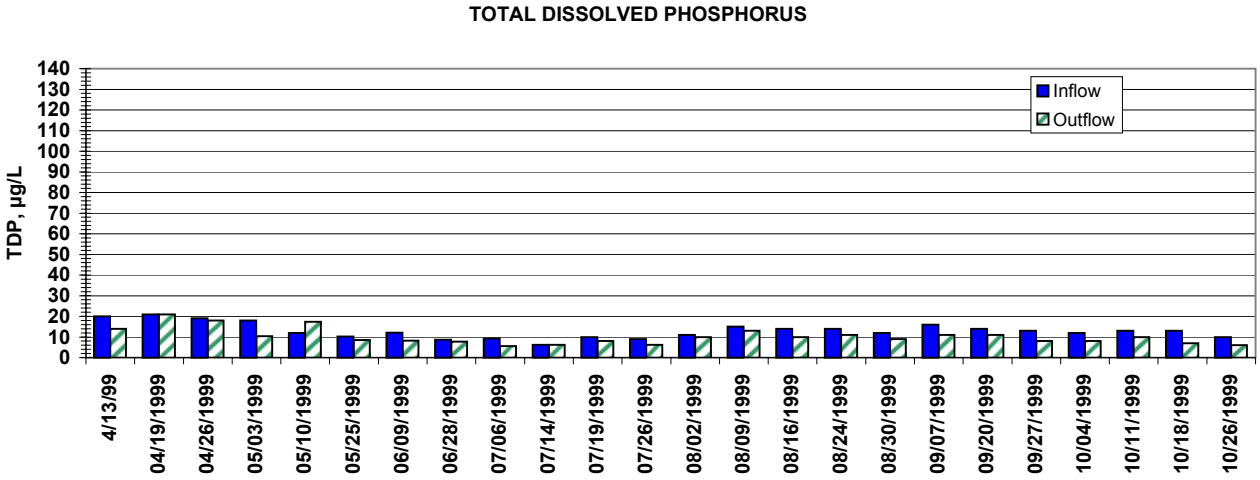


Exhibit C-9

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 6, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: Seasonal
HLR: 6 cm/day
Other:





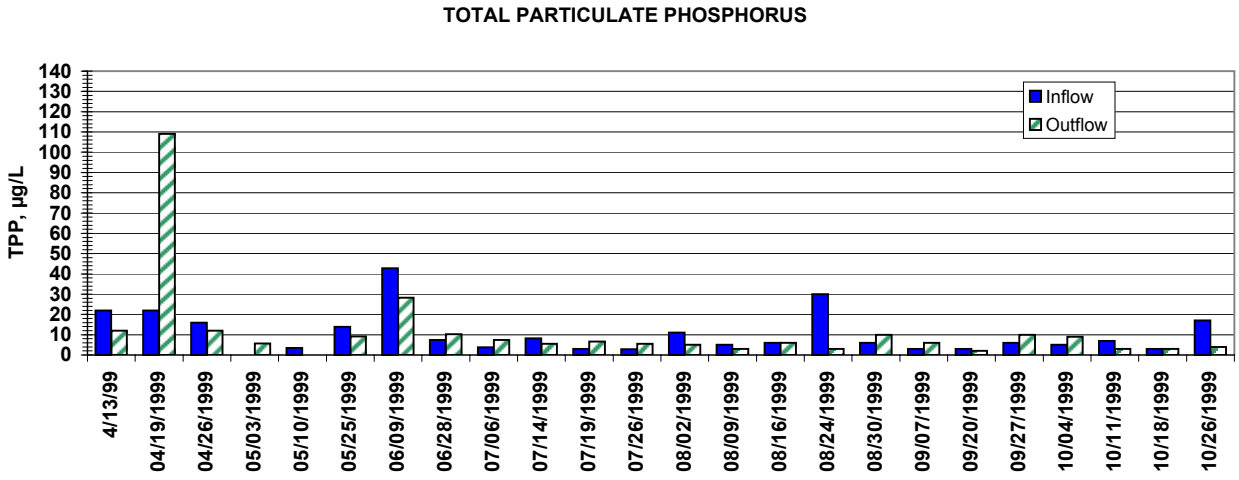


Exhibit C-10

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 7, April - October 1999

Key Conditions:
Substrate: Sand
Depth: 30
HLR: 6 cm/day
Other:

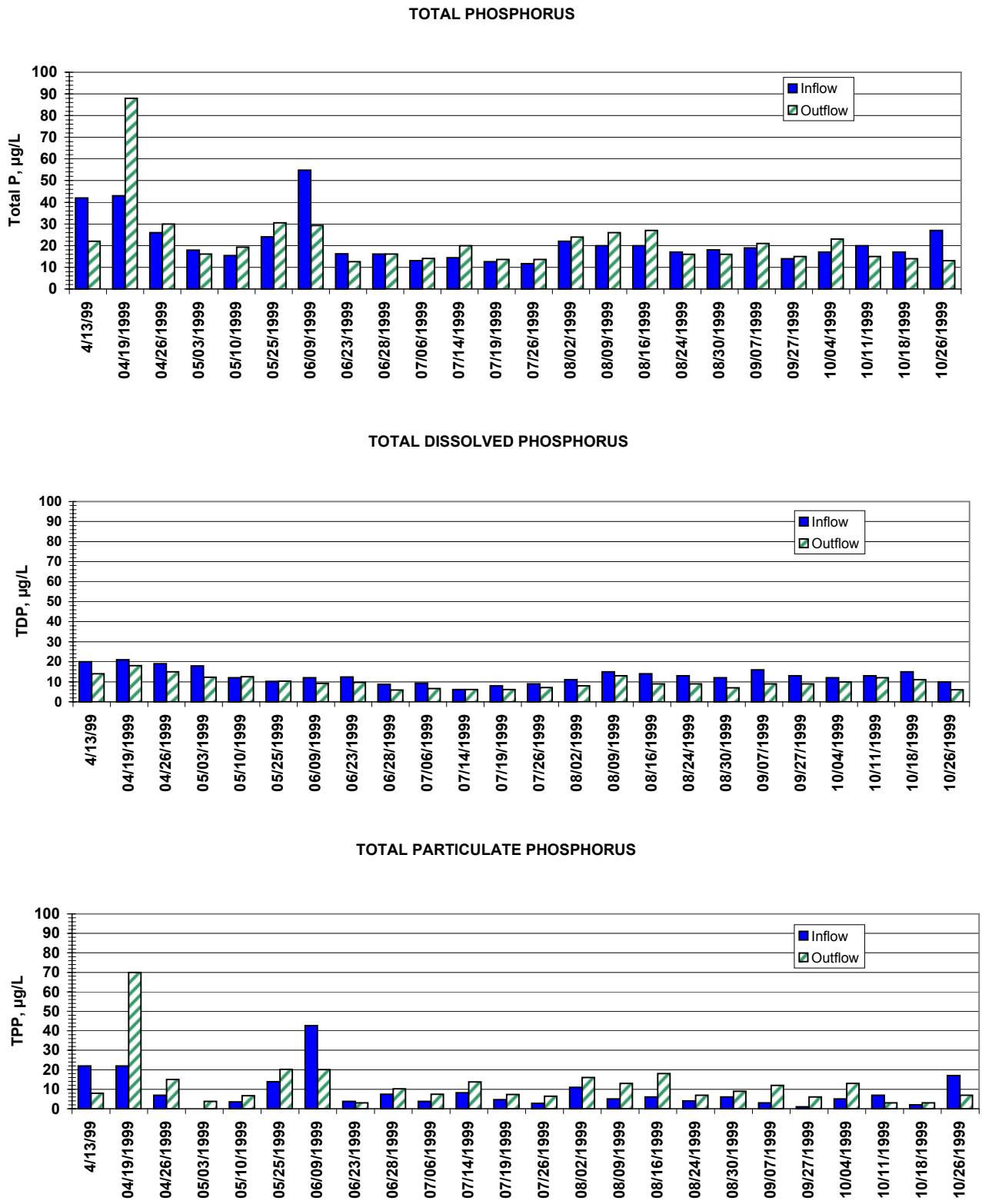
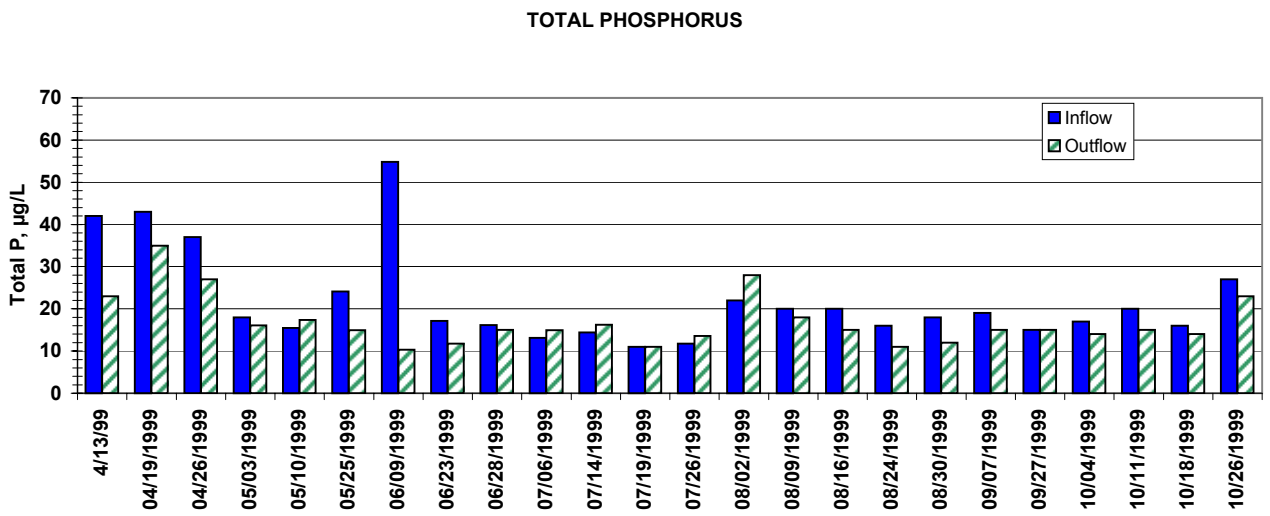
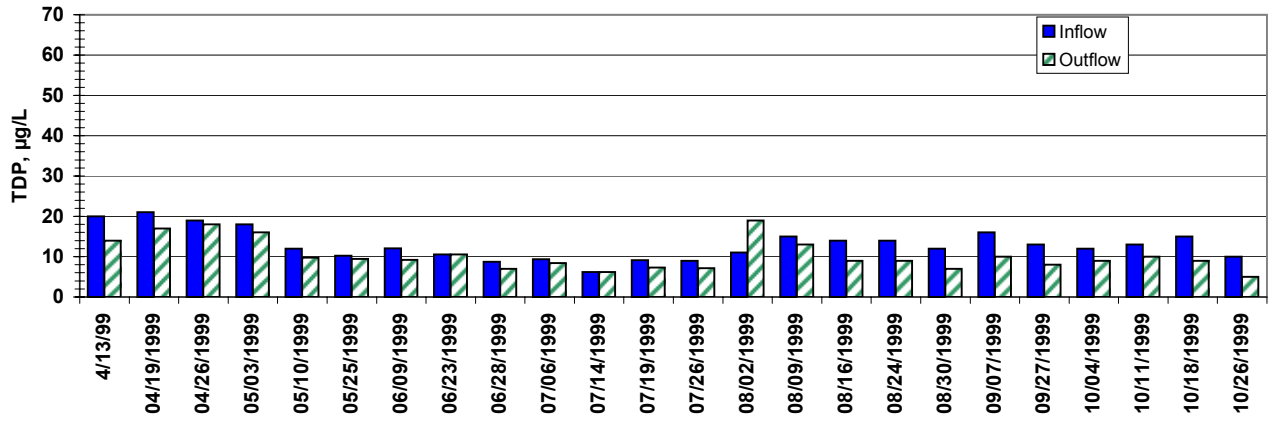


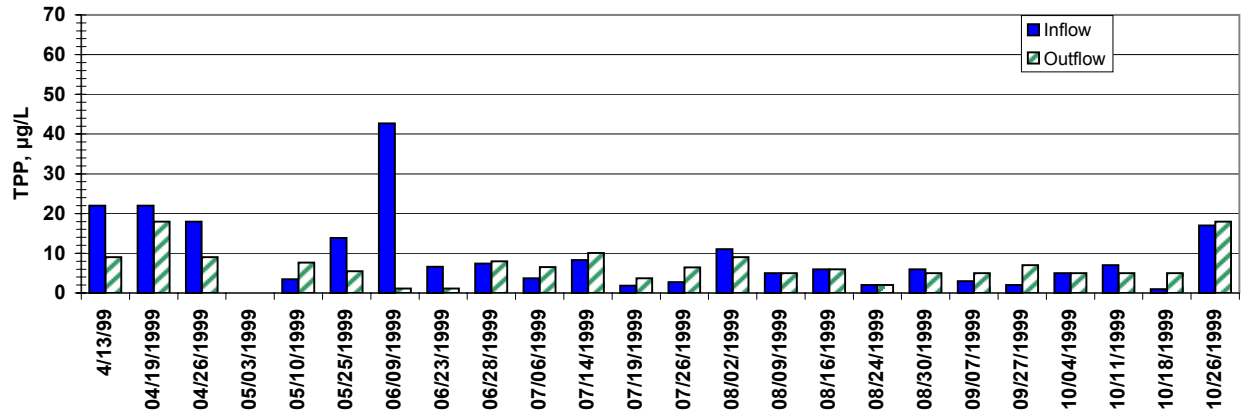
Exhibit C-11

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 8, April - October 1999

Key Conditions:
Substrate: Sand
Depth: 60
HLR: 6 cm/day
Other:

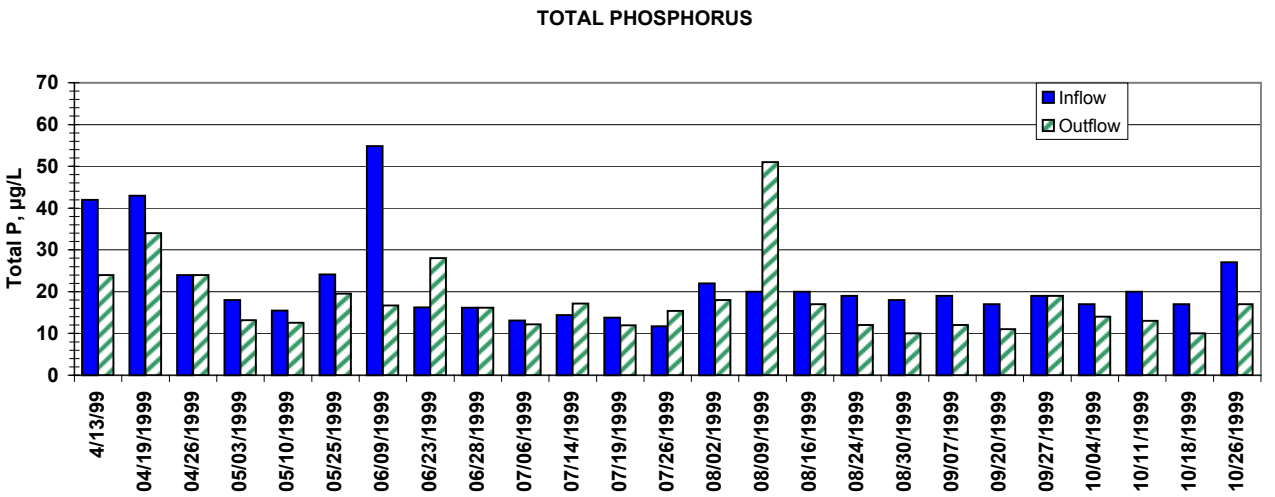


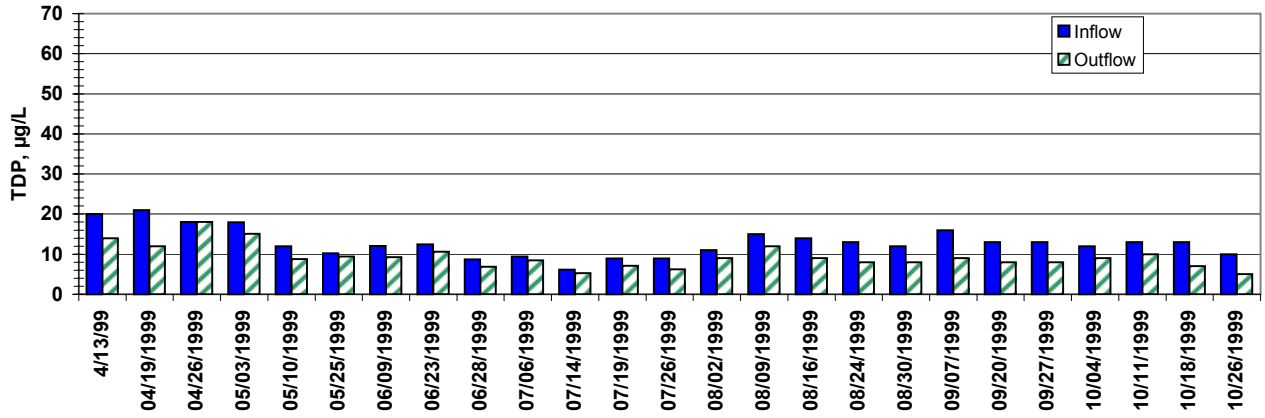




Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

Exhibit C-12
Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 9, April - October 1999





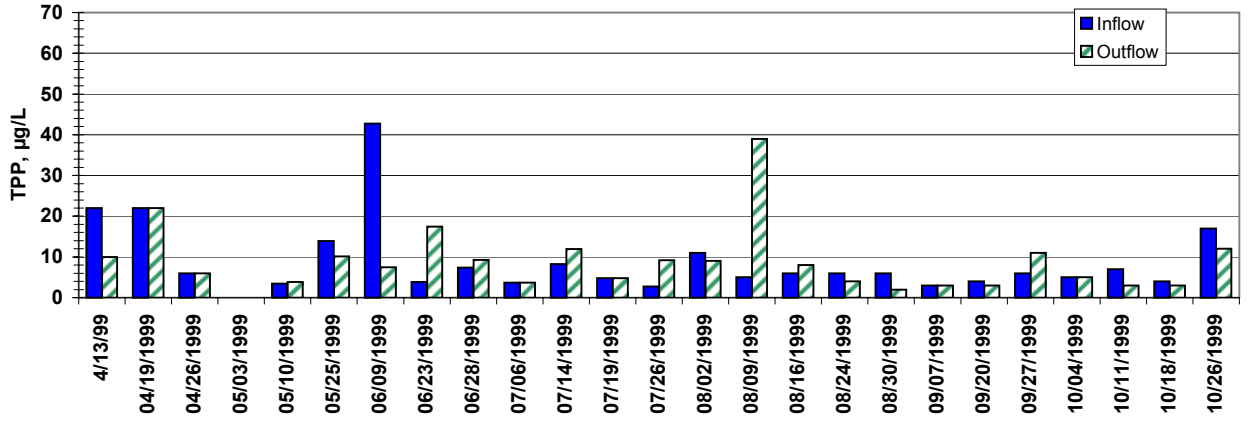


Exhibit C-13

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 10, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

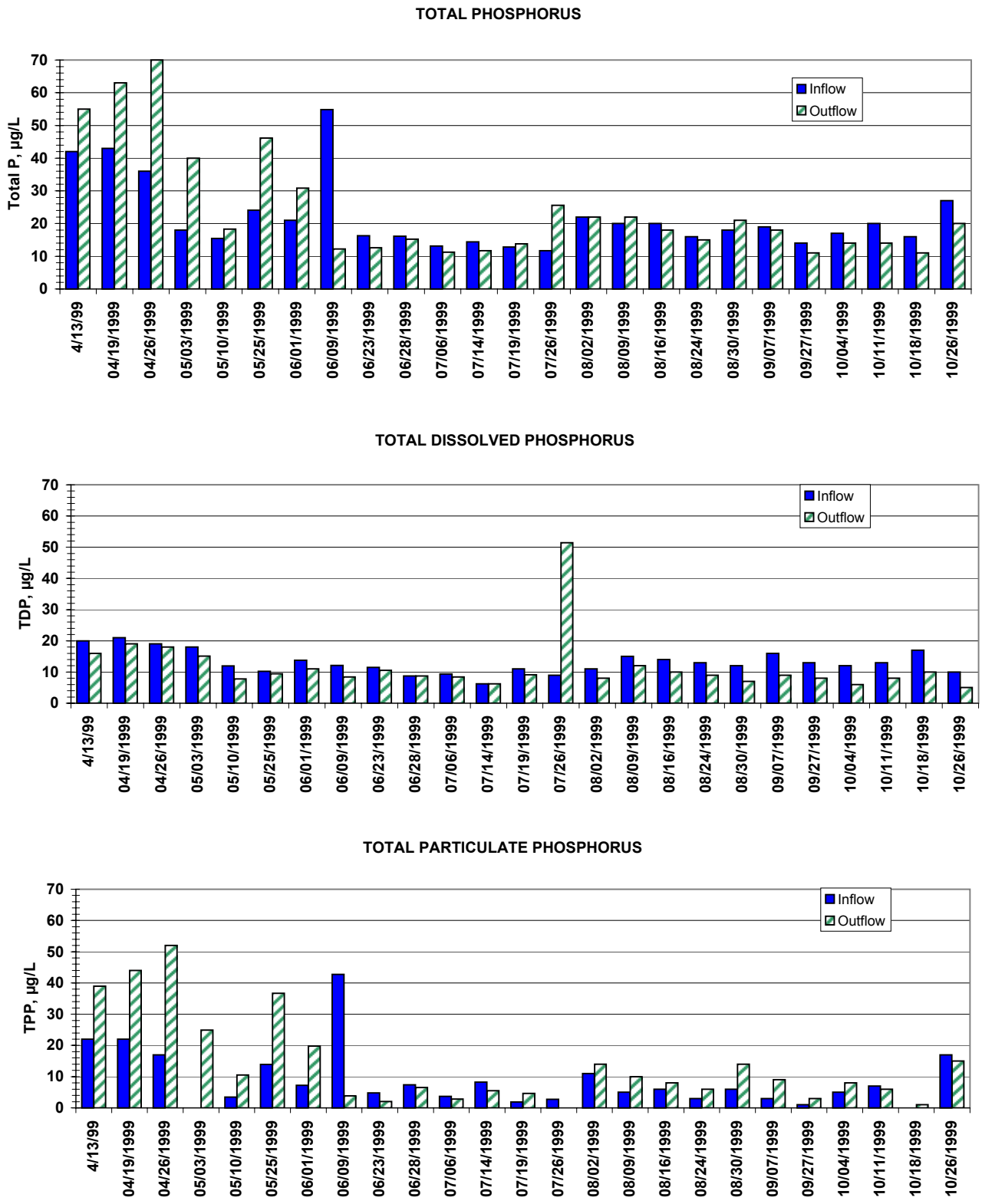
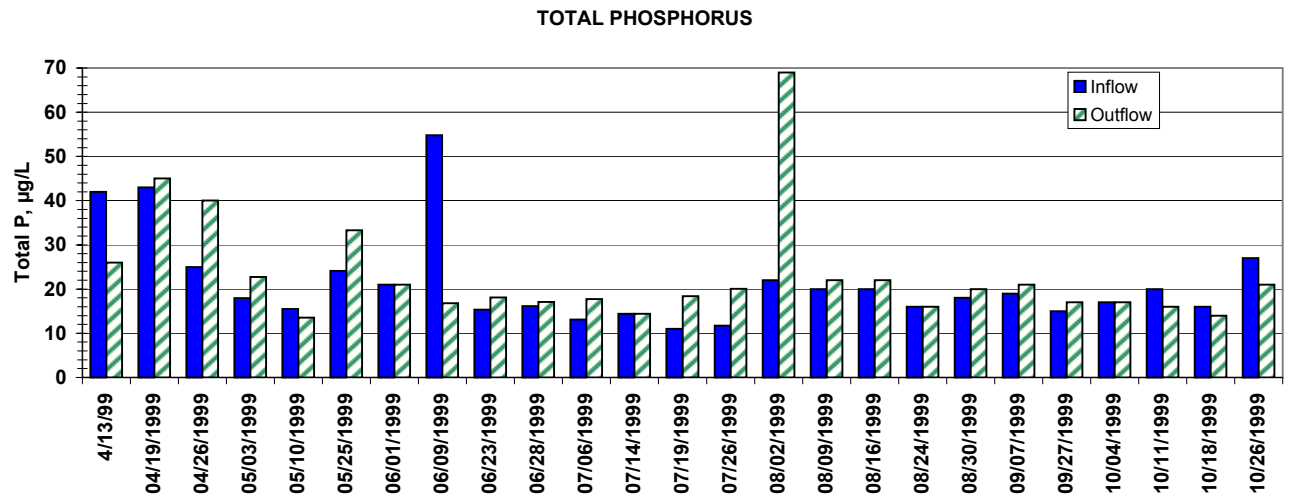
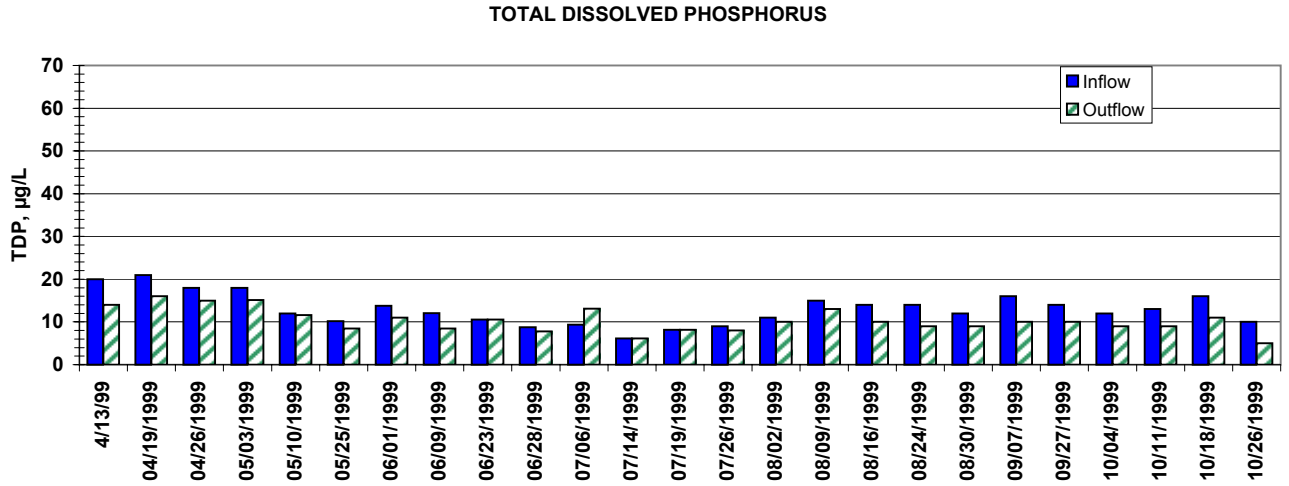


Exhibit C-14

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 11, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width





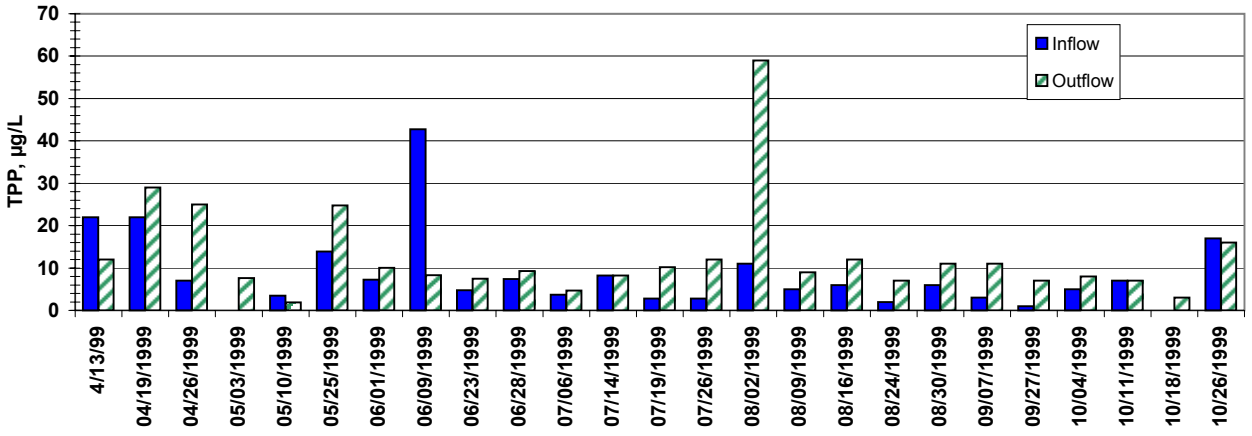
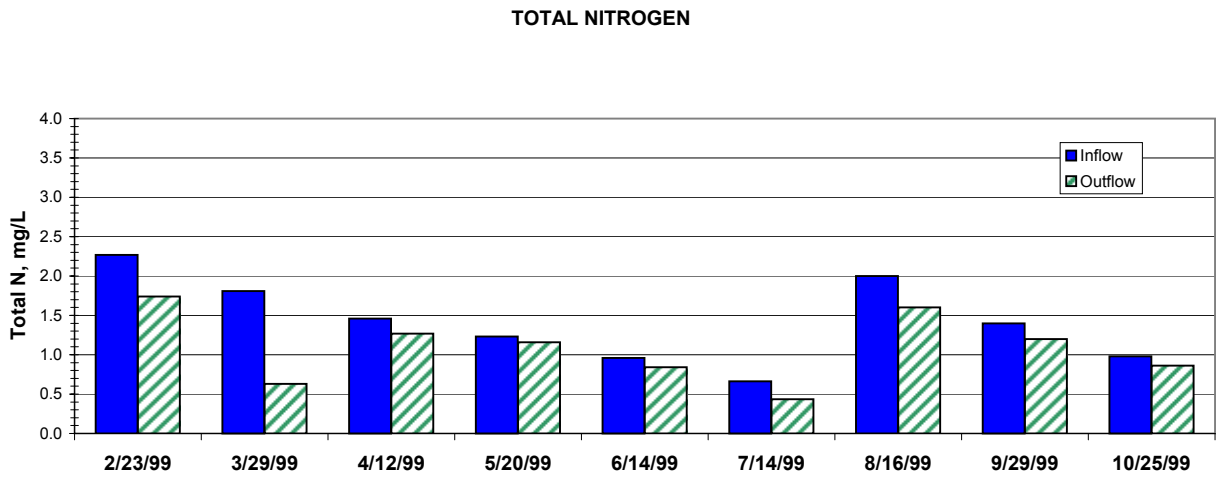
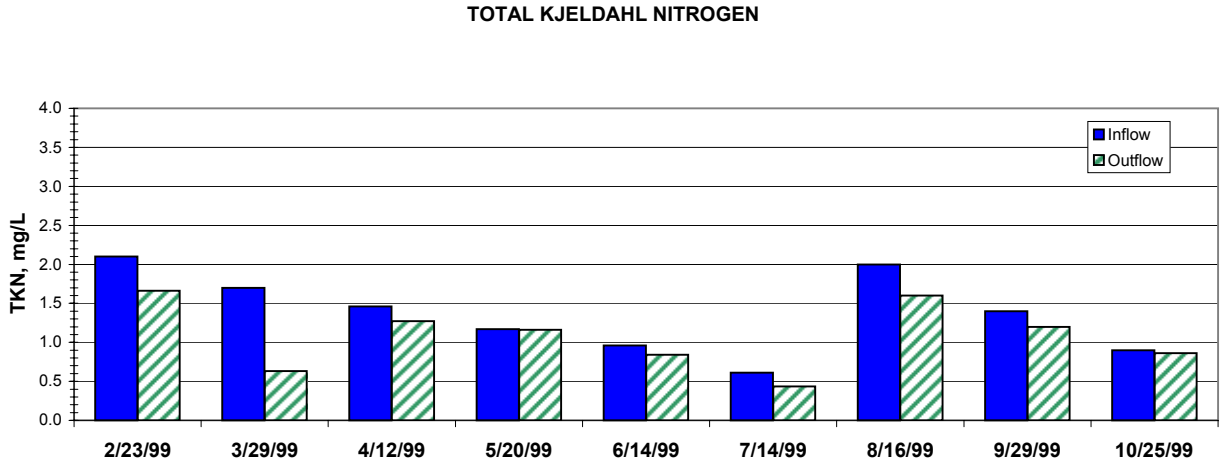


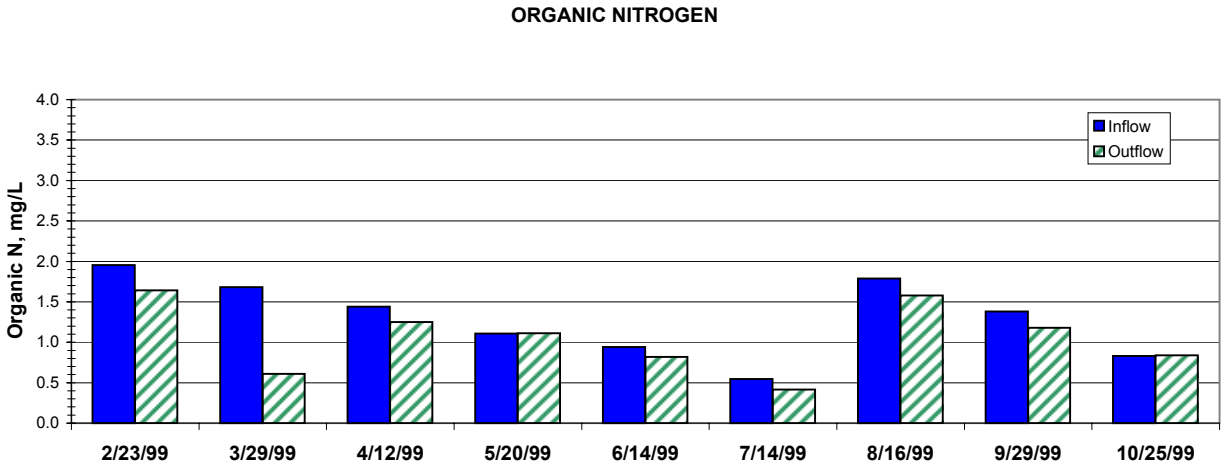
Exhibit C-15

Inflow and Outflow Weekly Average Values for Total Phosphorus, Total Dissolved Phosphorus, and Total Particulate Phosphorus for Porta-PSTA Treatment No. 12, April - October 1999

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width





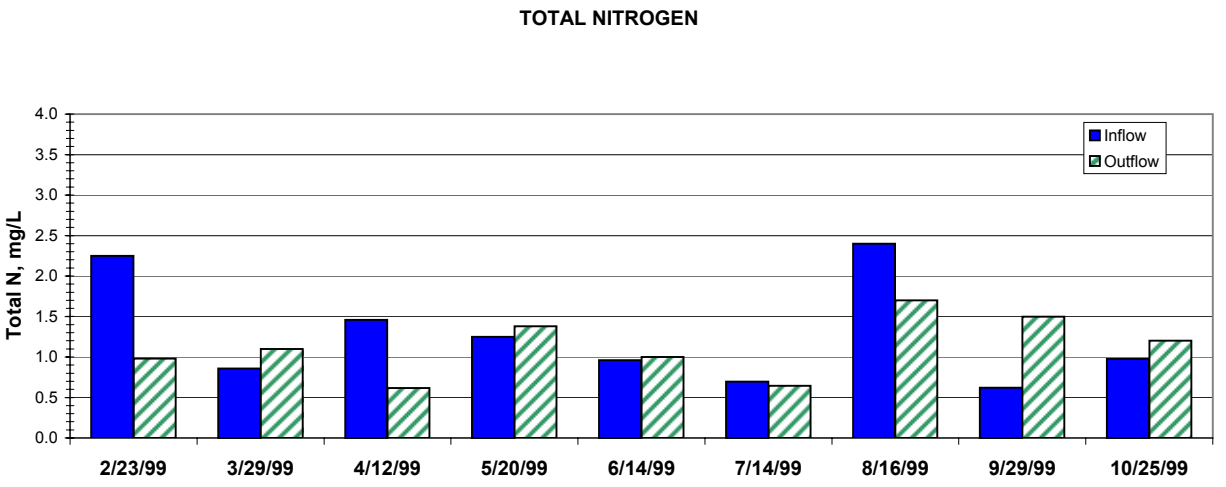


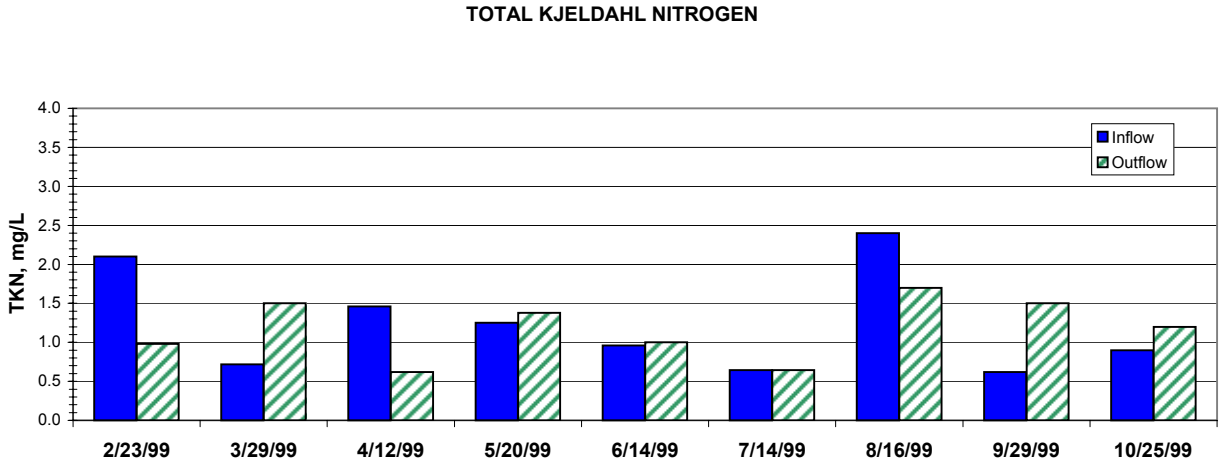
Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending.

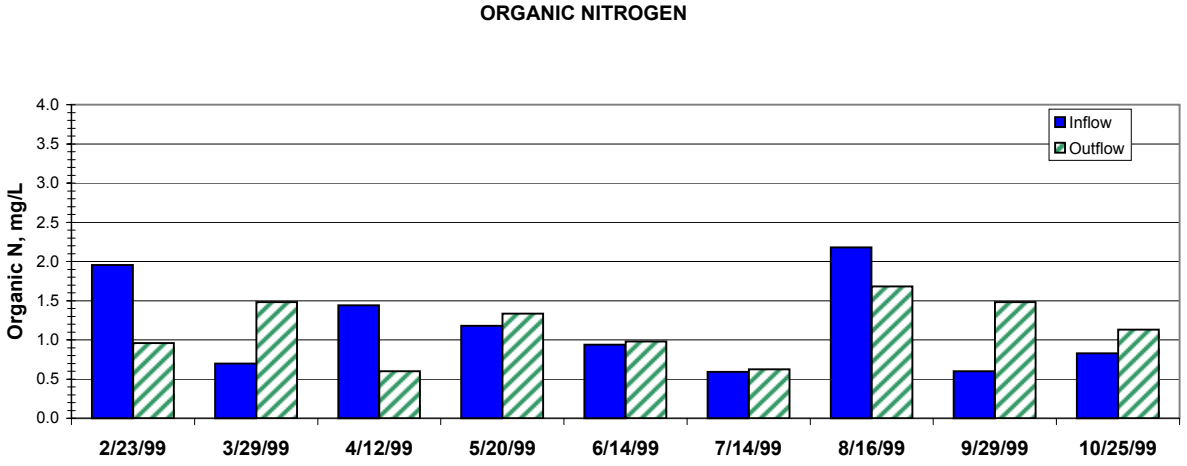
Exhibit C-16

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 1, February - October 1999

Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day





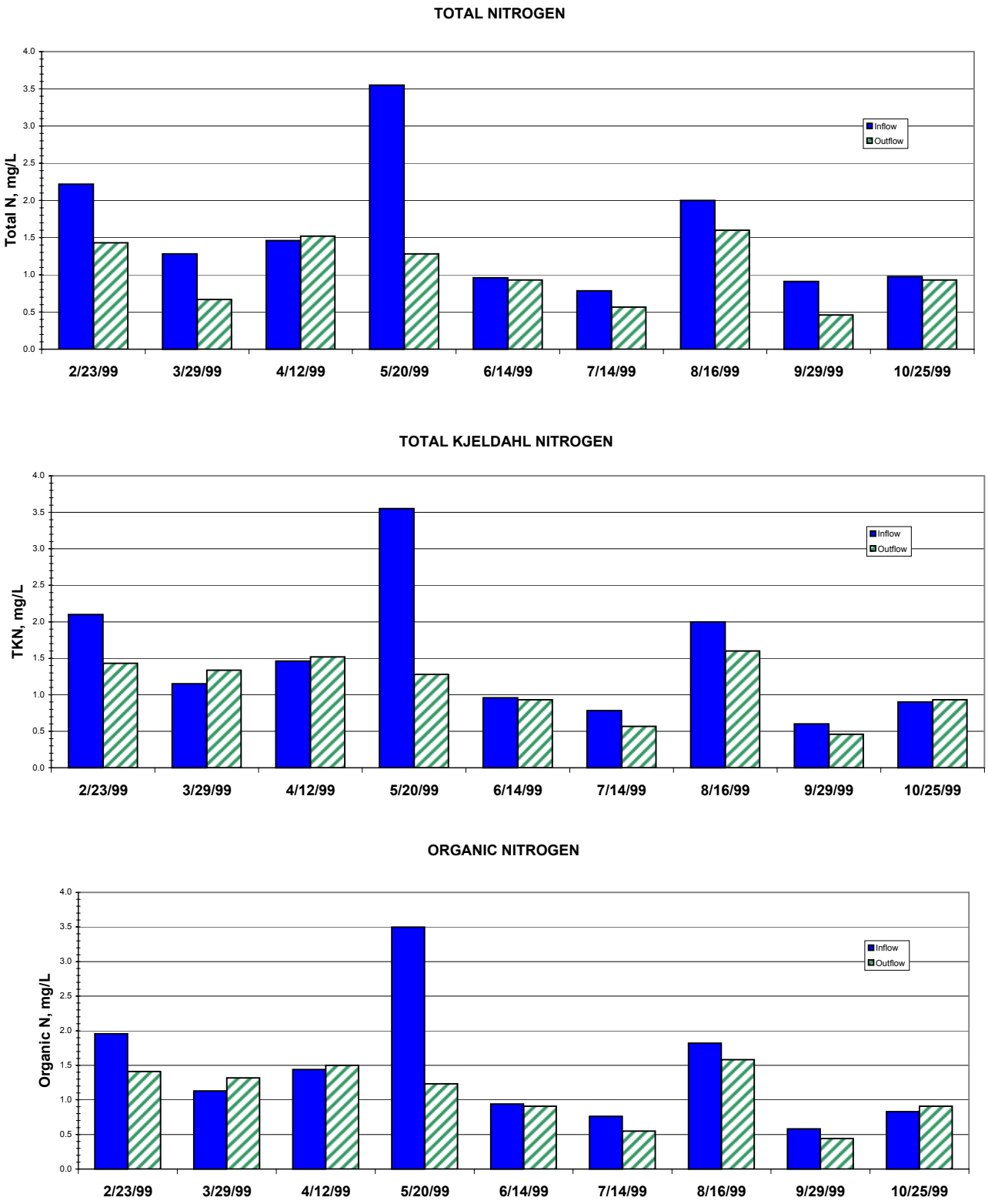


Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending.

Exhibit C-17

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 2, February - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day

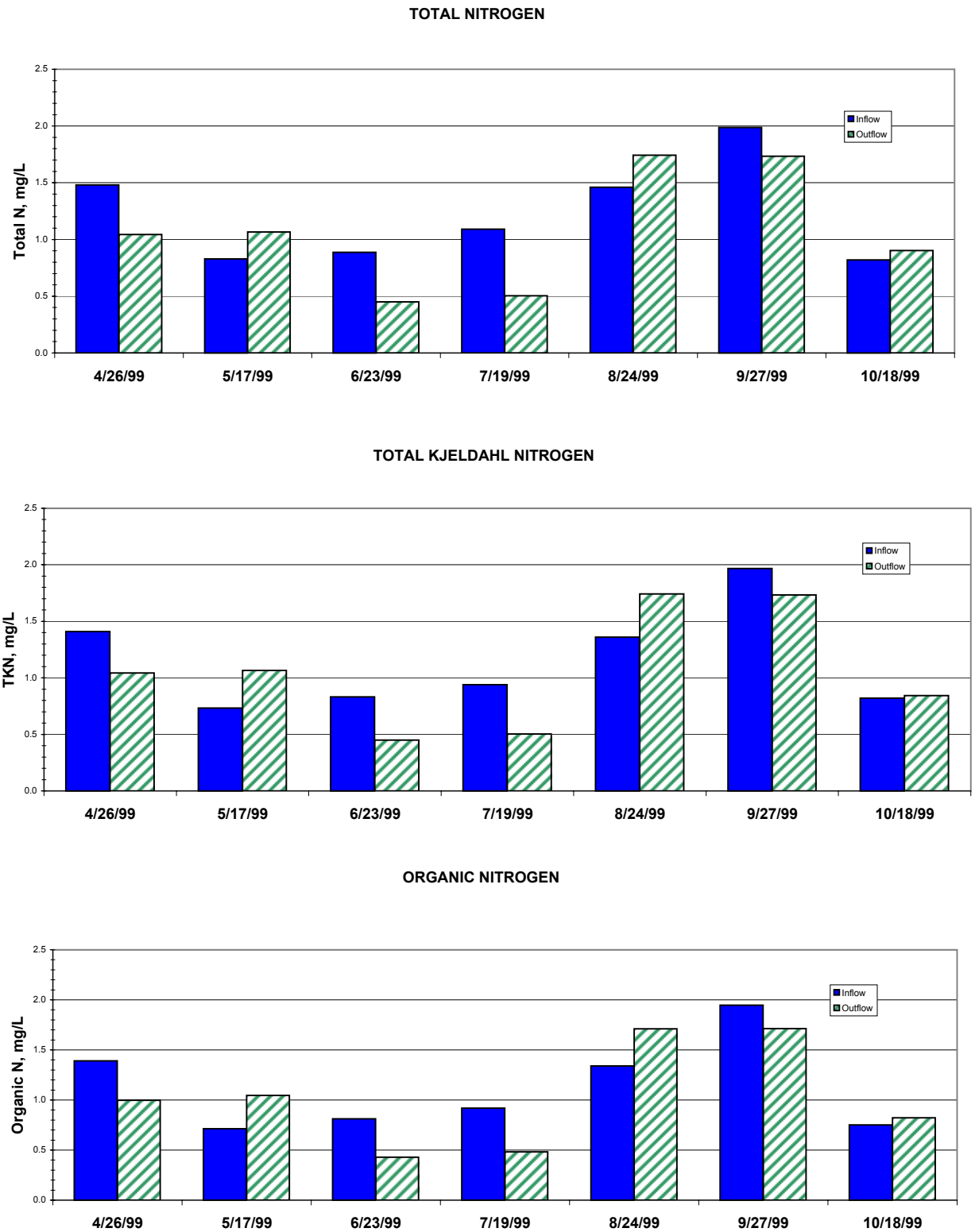


Note: Inflow TN and TKN data are collected by the District; missing data points are either not available or pending.

Exhibit C-18

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for South Test Cell Treatment No. 3, February - October 1999

Key Conditions:
Substrate: Shellrock
Depth: Seasonal
HLR: 6 cm/day

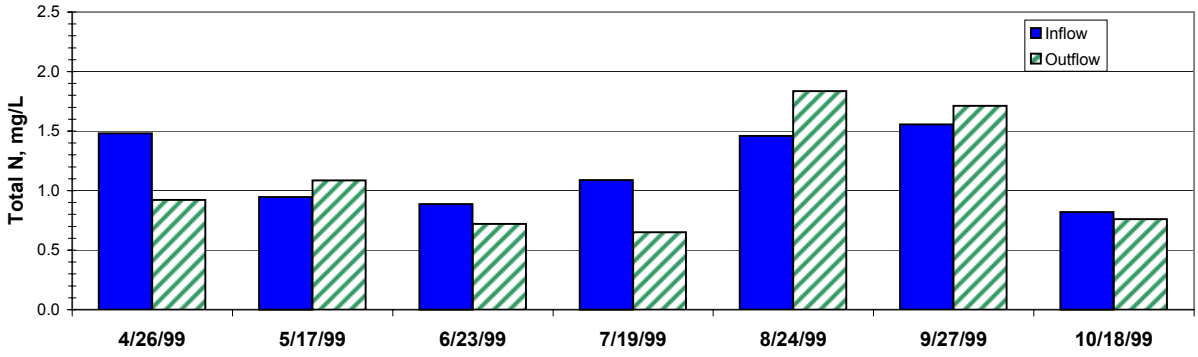


Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other:

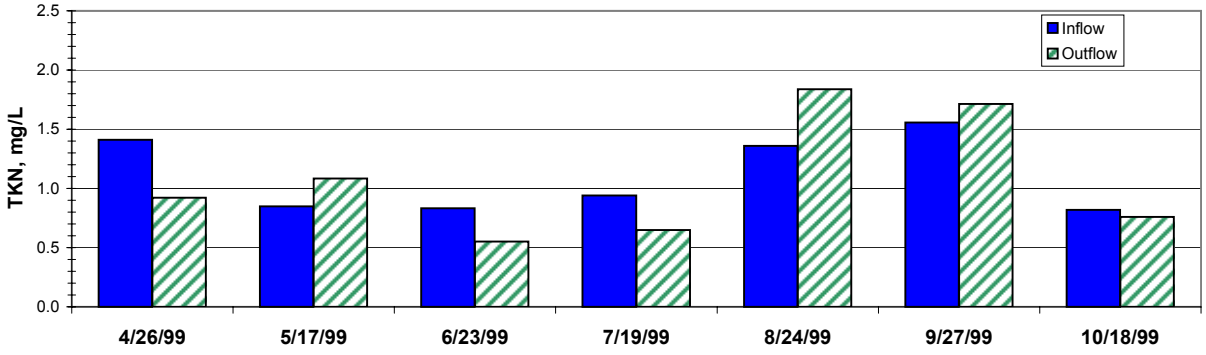
Exhibit C-19

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 1, April - October 1999

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

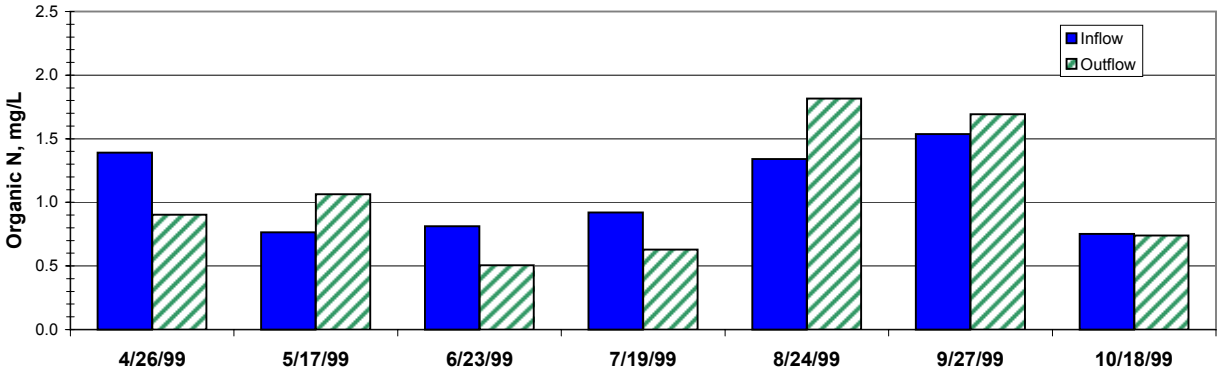
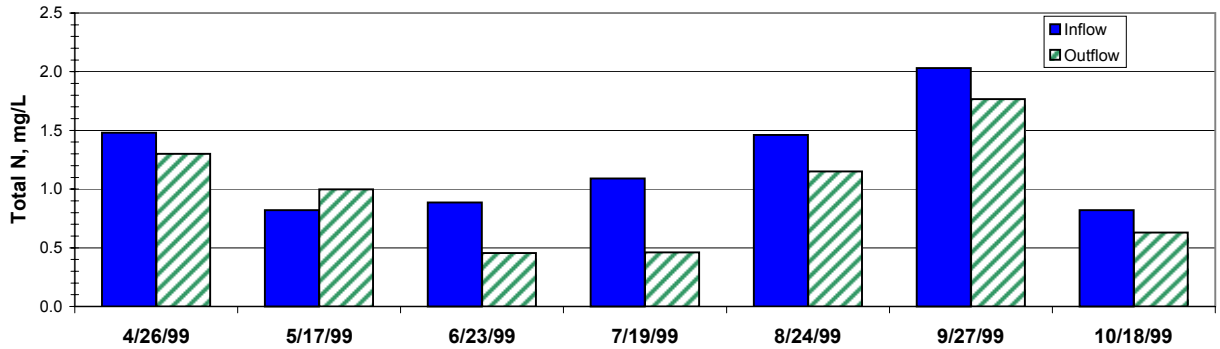


Exhibit C-20

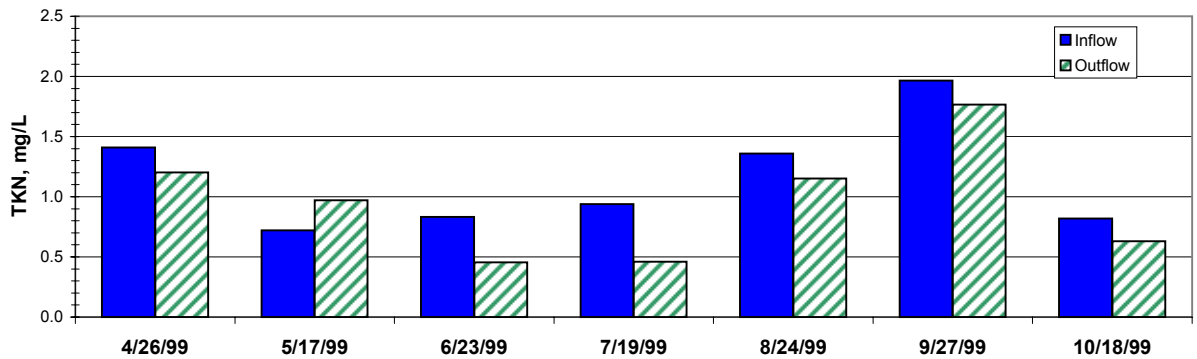
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 2, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other:

TOTAL NITROGEN



TOTAL KJELDAHL NITROGEN



ORGANIC NITROGEN

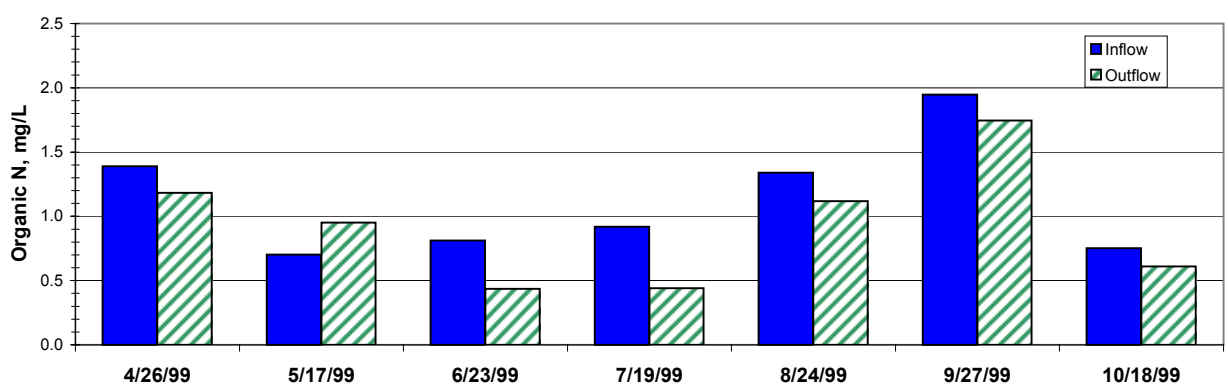
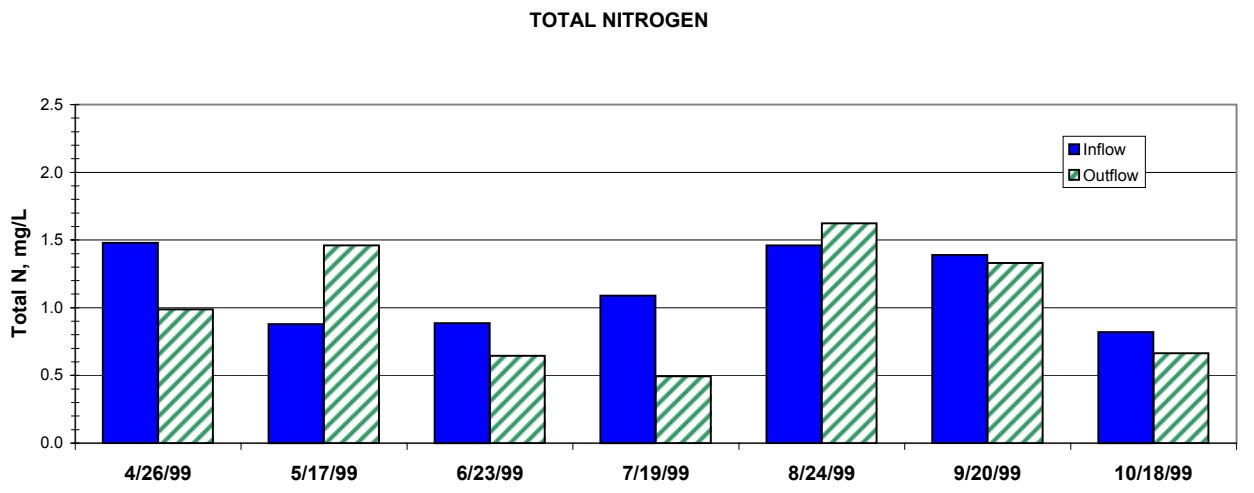
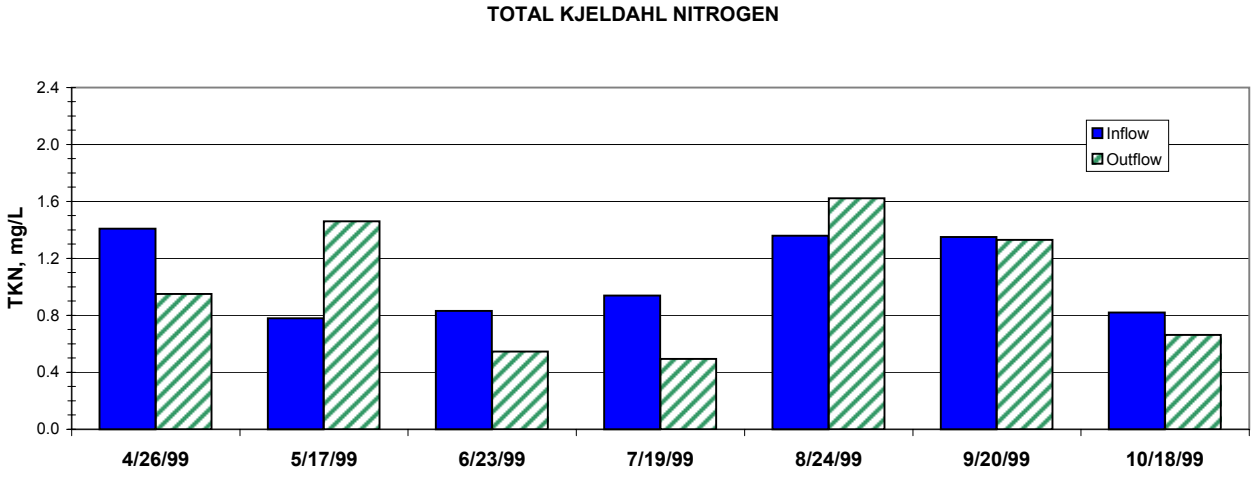


Exhibit C-21
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 3, April - October 1999

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:

DFB993630024/LSB1012.XLS





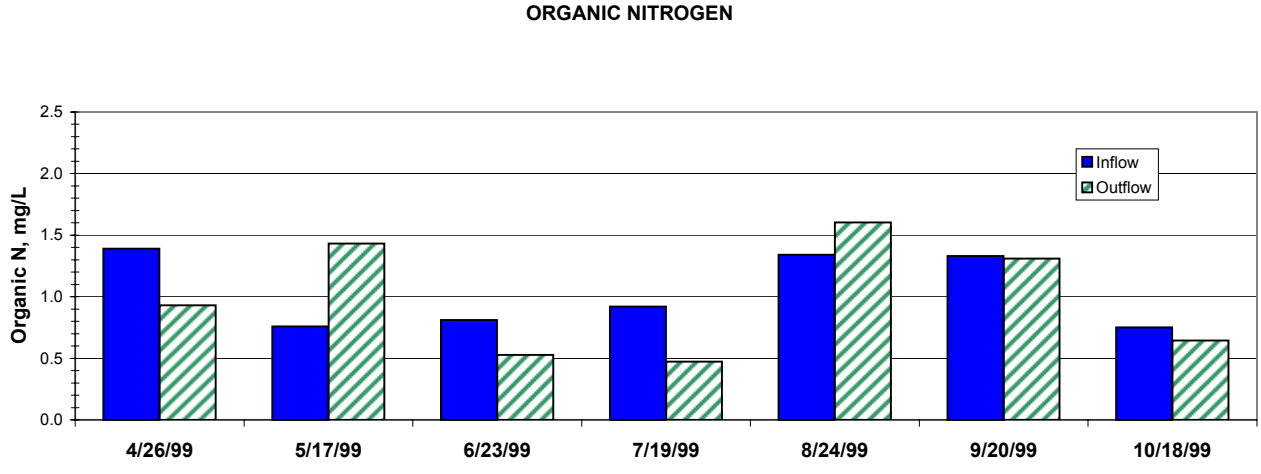
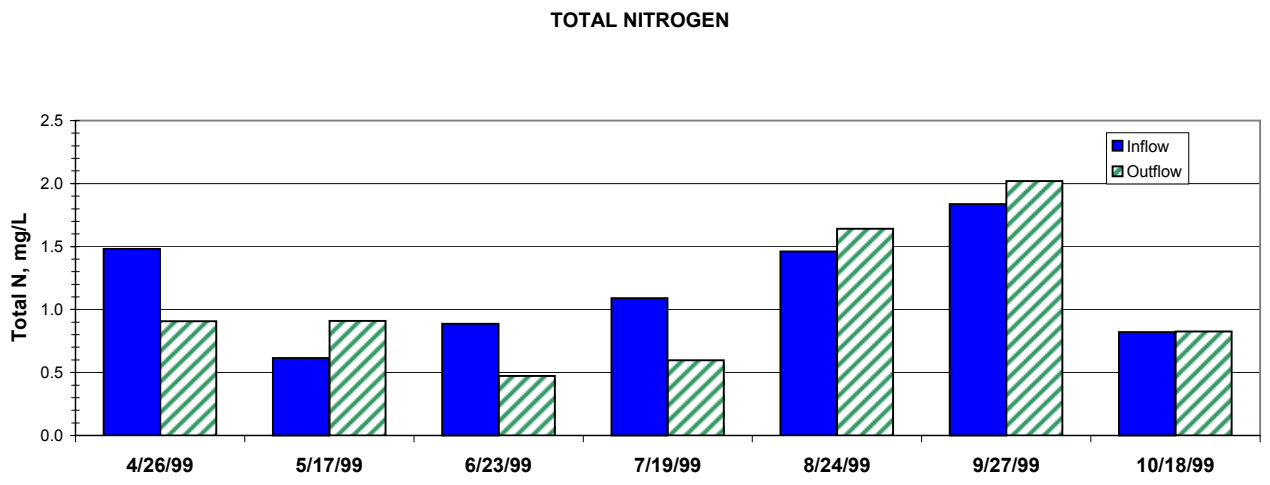
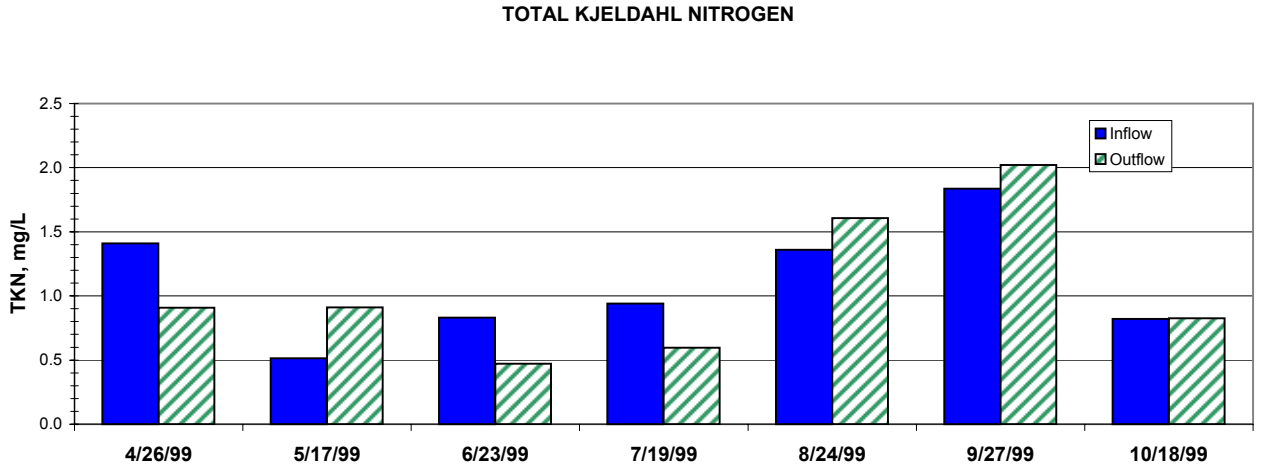


Exhibit C-22
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 4, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:





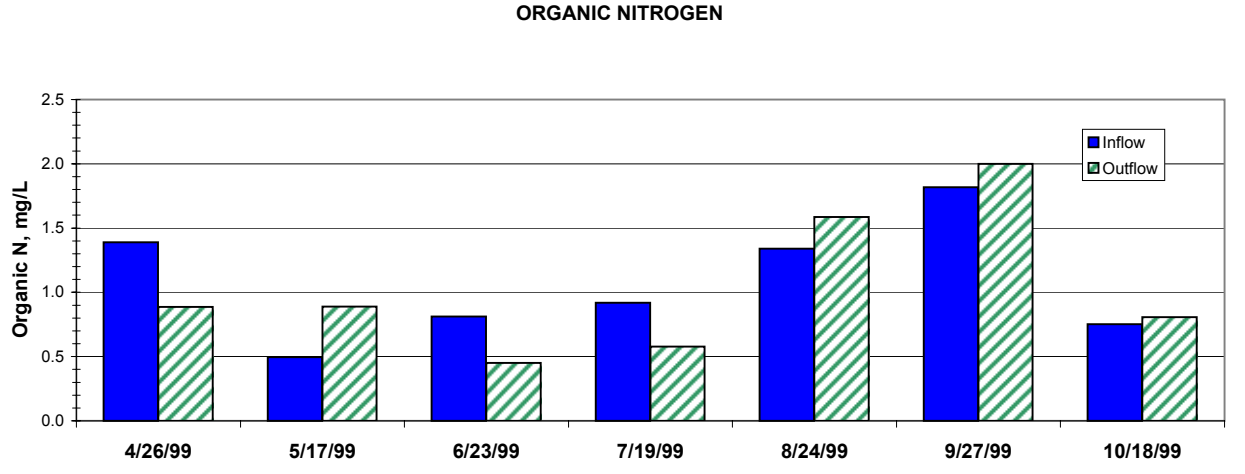
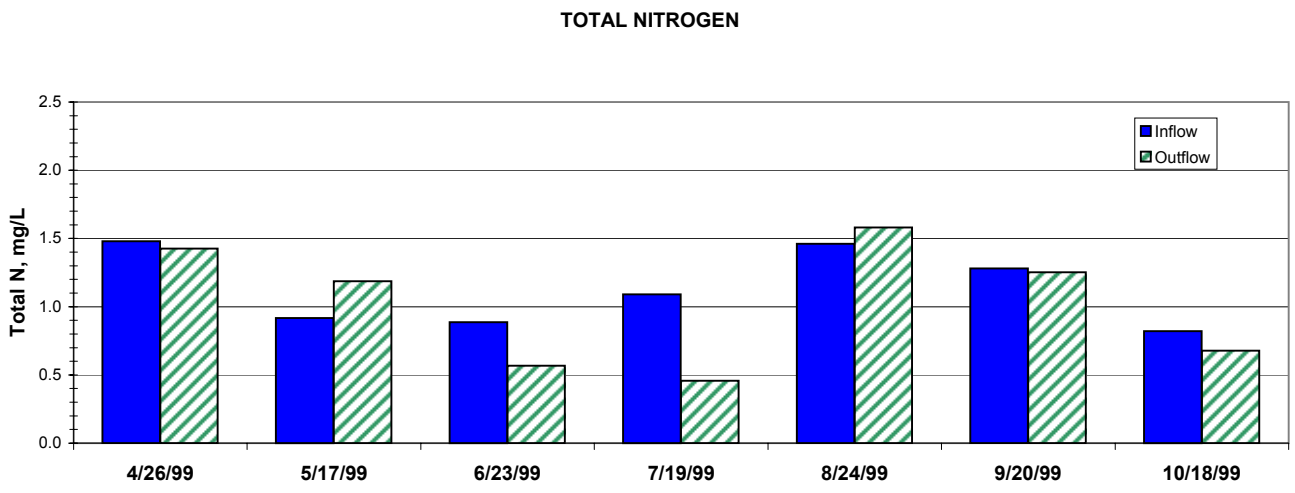
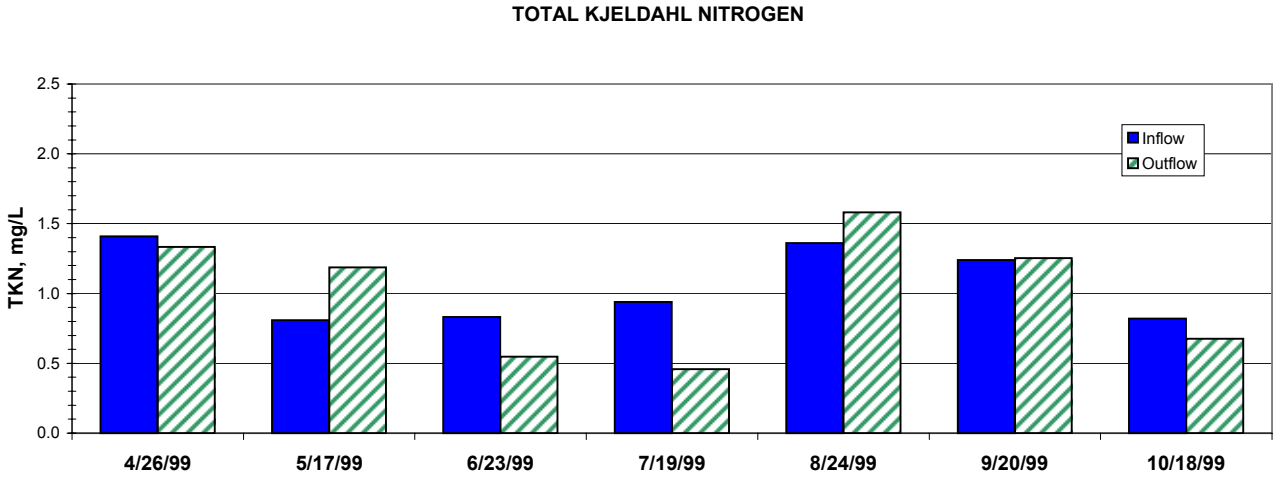


Exhibit C-23

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 5, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 12 cm/day
Other:





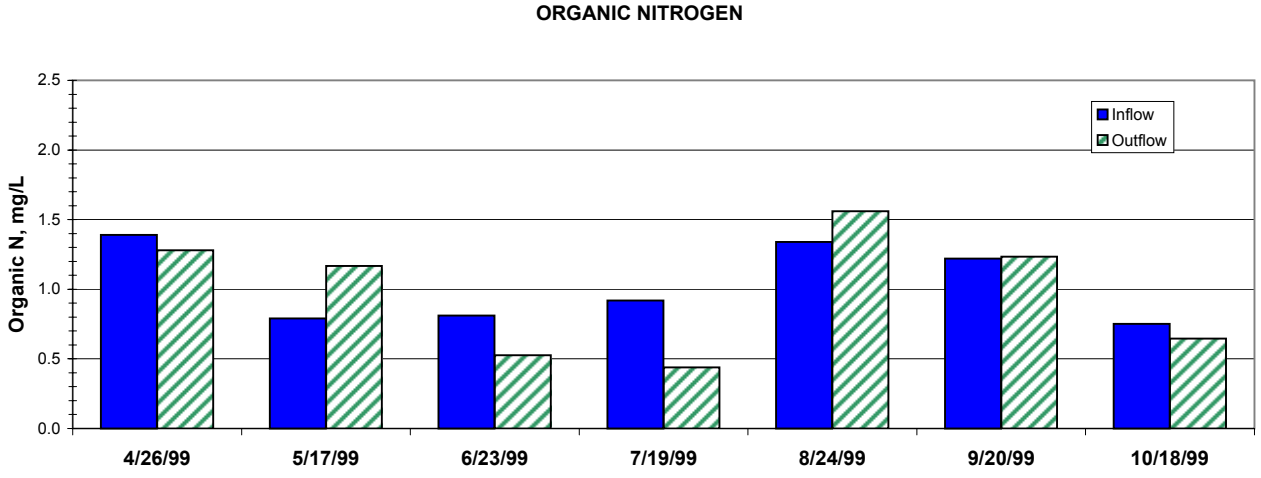
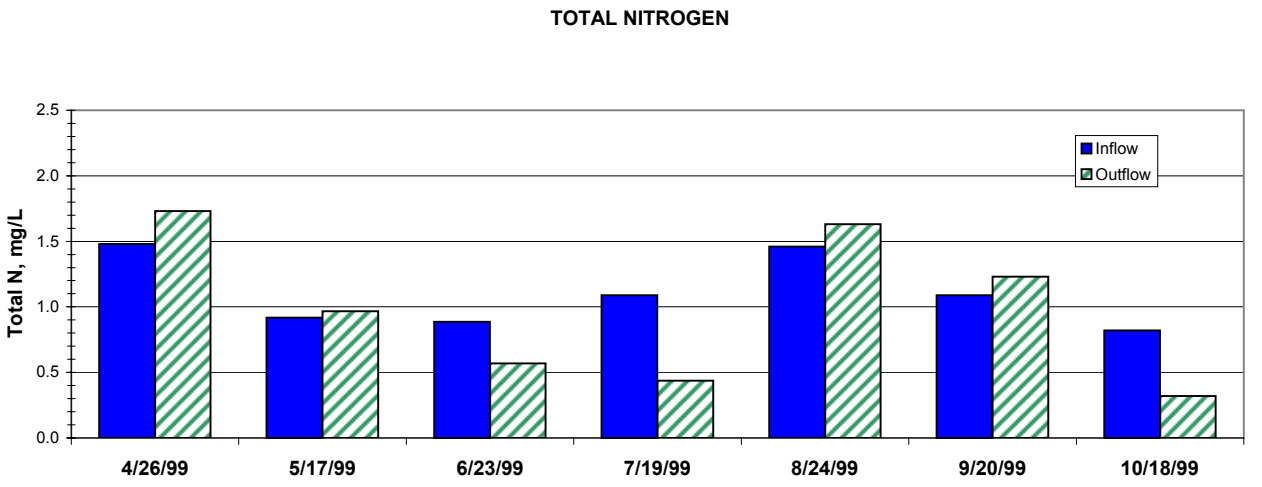
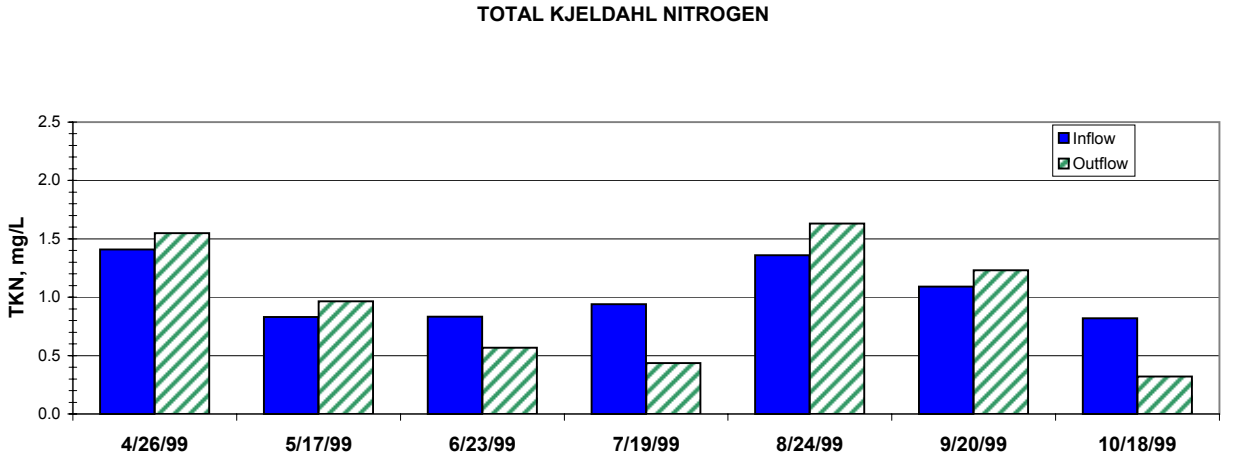


Exhibit C-24

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 6, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: Seasonal
HLR: 6 cm/day
Other:





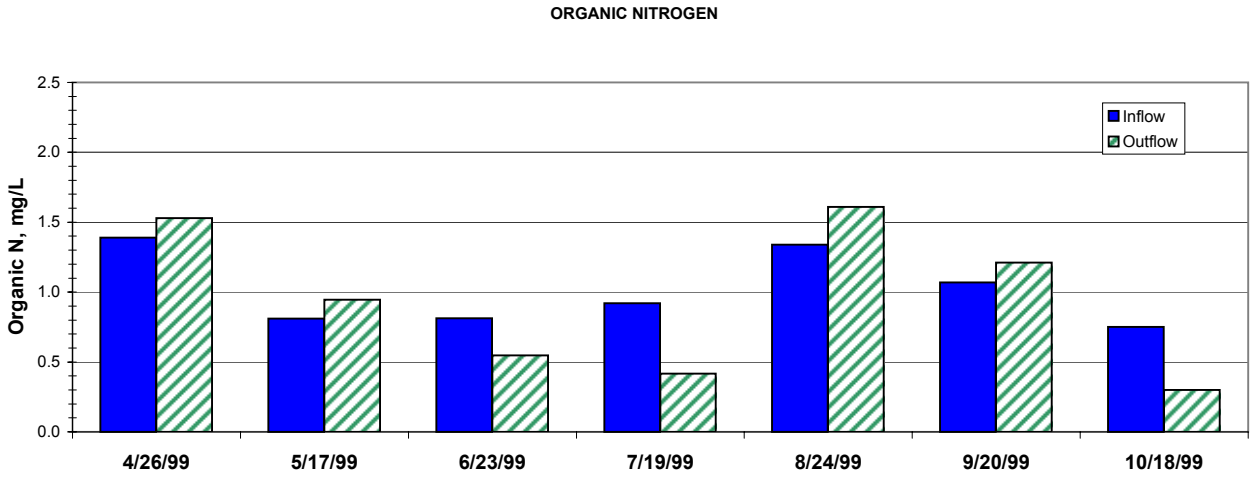
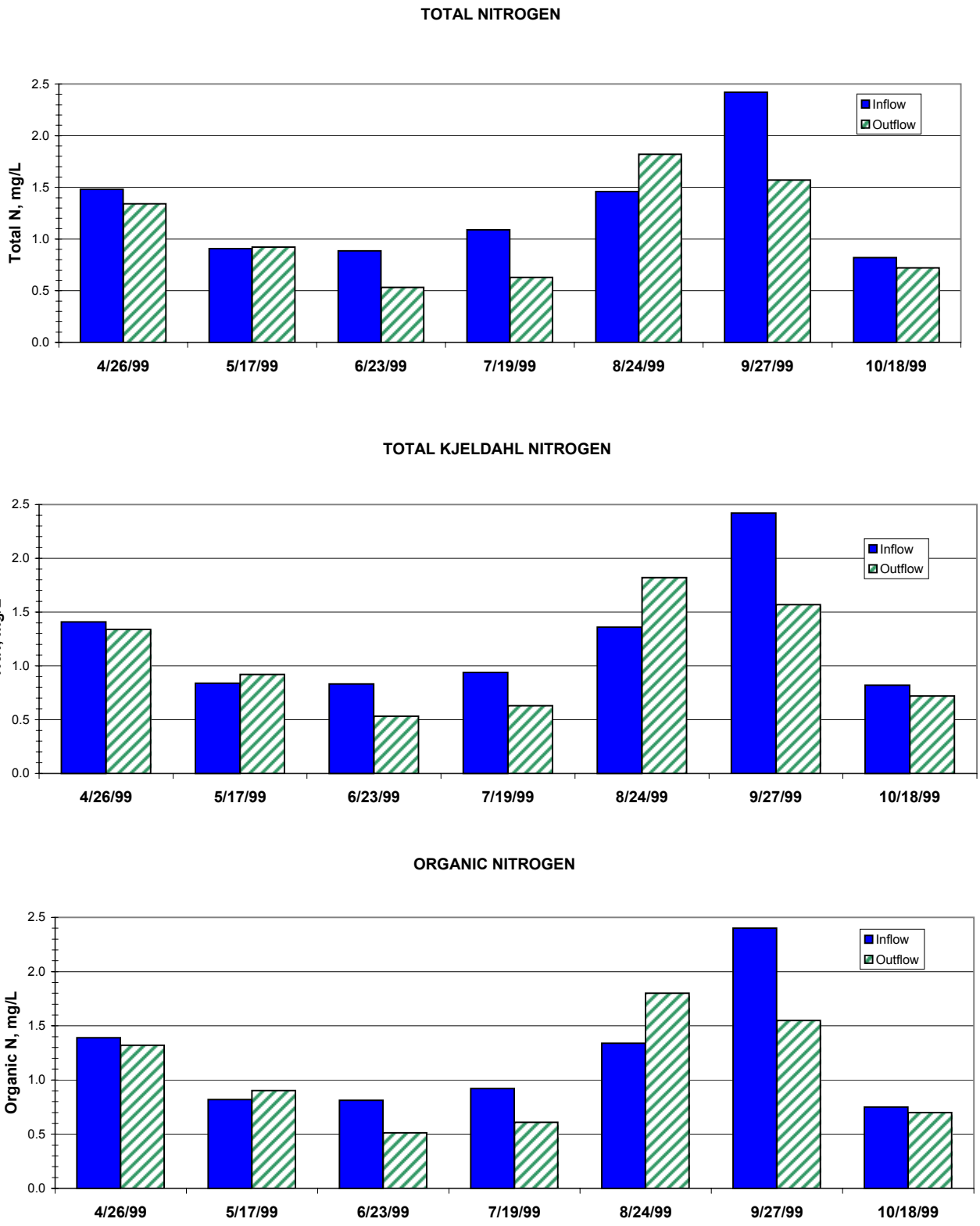


Exhibit C-25

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 7, April - October 1999

Key Conditions:
Substrate: Sand
Depth: 30
HLR: 6 cm/day
Other:

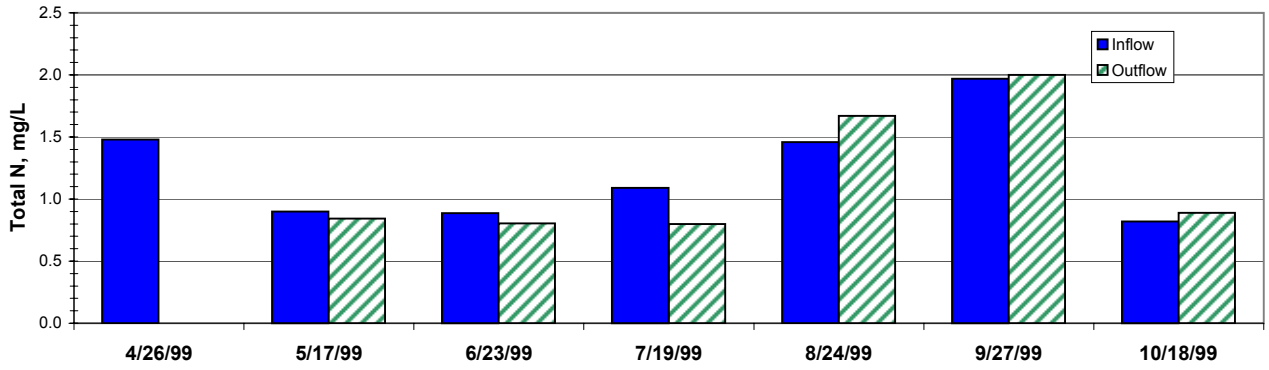


Key Conditions:
Substrate: Sand
Depth: 60
HLR: 6 cm/day
Other:

Exhibit C-26
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 8, April - October 1999

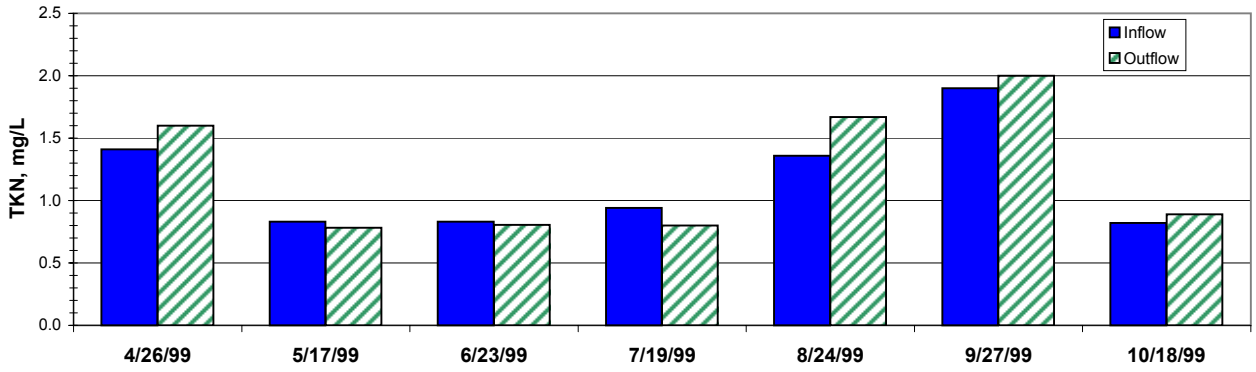
DFB993630024/LSB1012.XLS

TOTAL NITROGEN

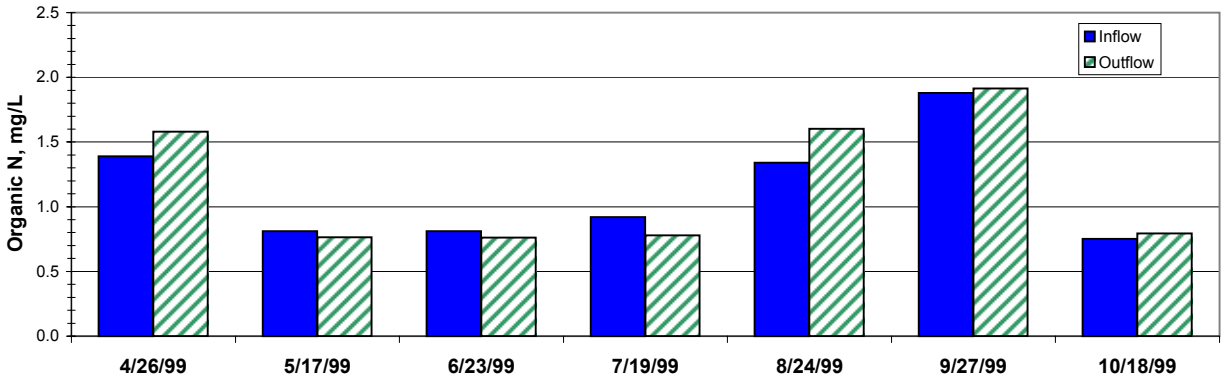


Note: Outflow TN value for 4/26/99 was flagged as questionable and thus not presented.

TOTAL KJELDAHL NITROGEN

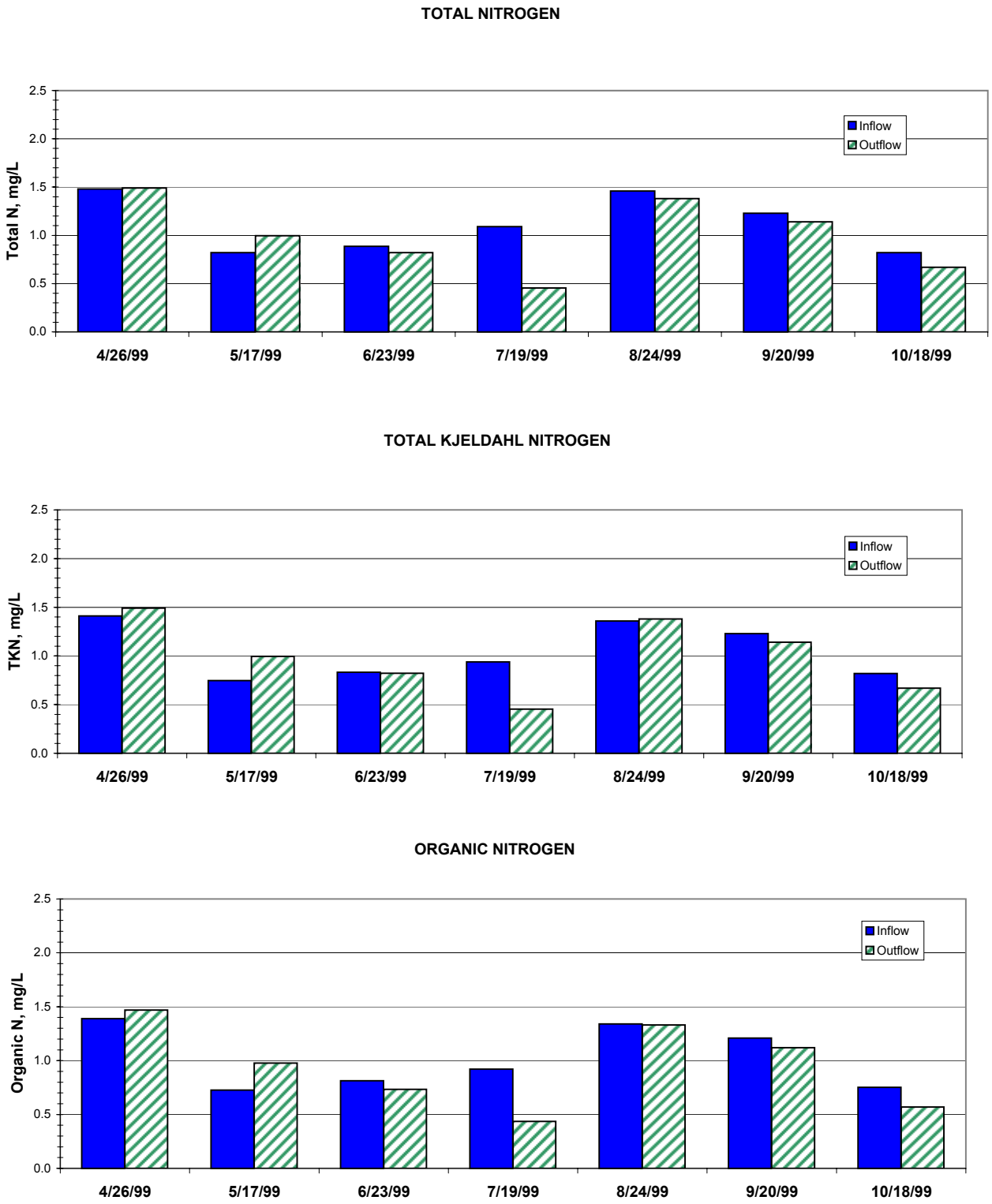


ORGANIC NITROGEN



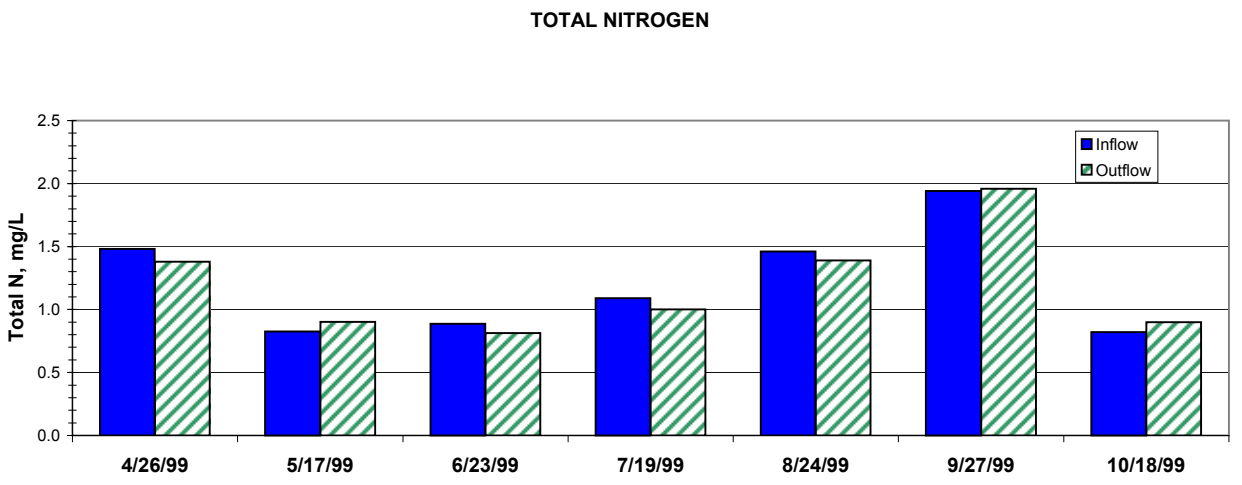
Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

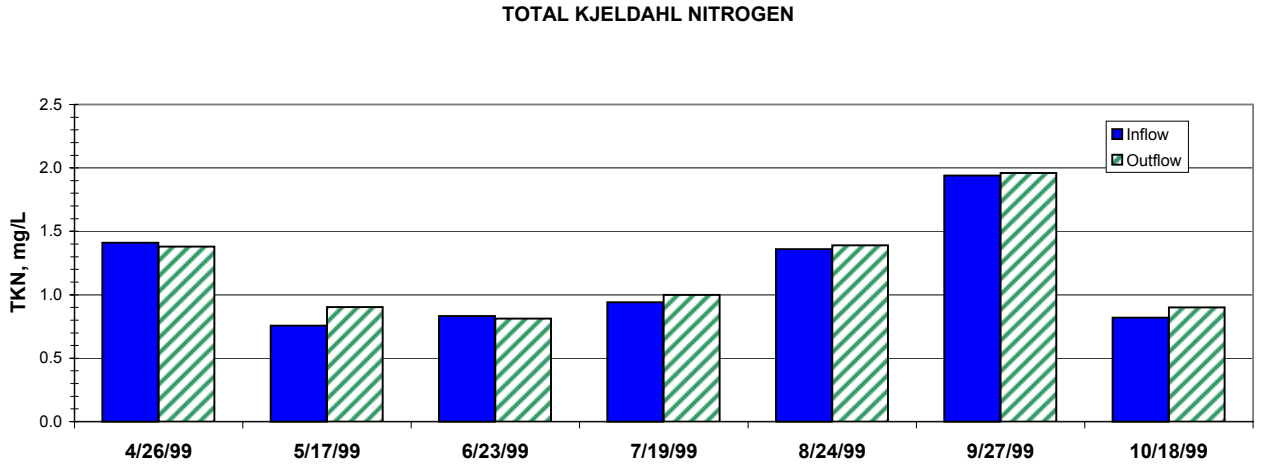
Exhibit C-27
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 9, April - October 1999



Key Conditions:
Substrate: Shelrock
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

Exhibit C-28
Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 10, April - October 1999





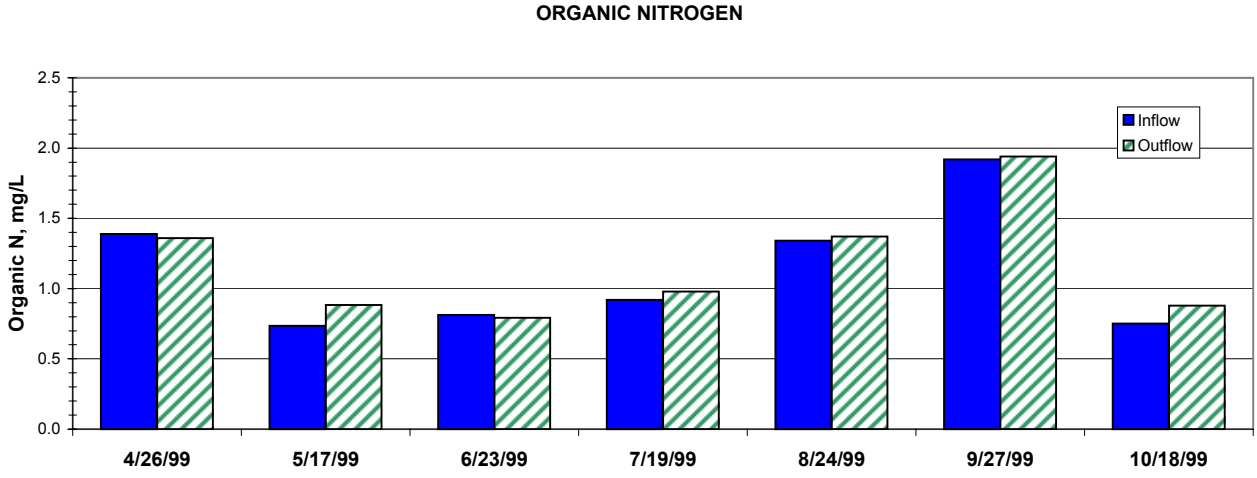
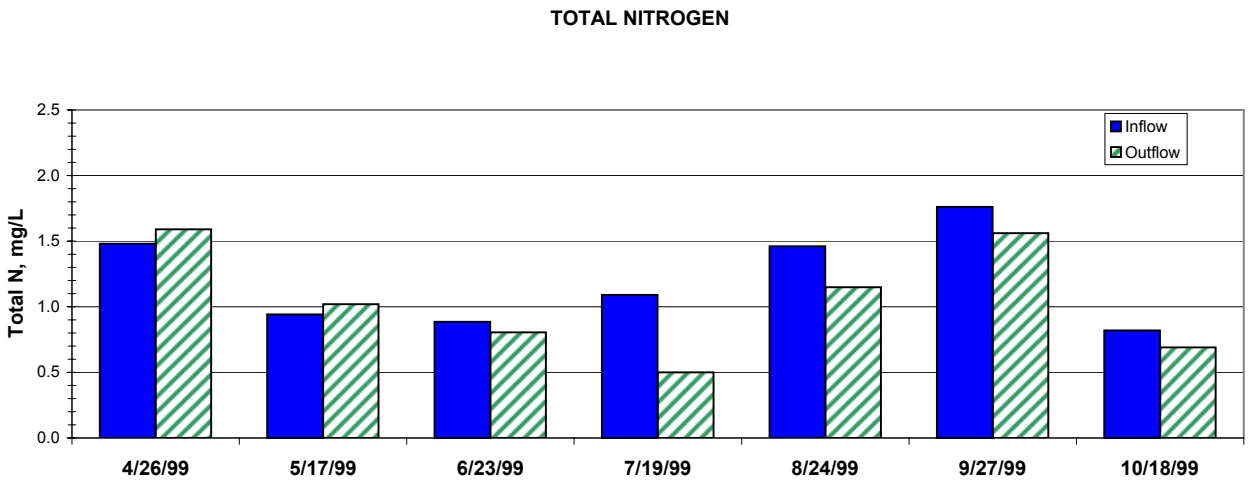
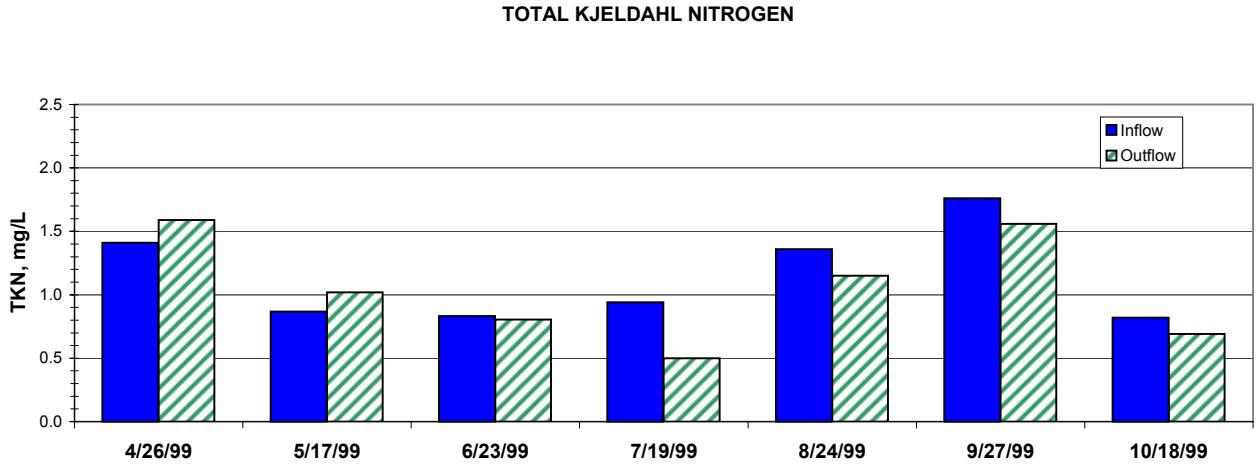


Exhibit C-29

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 11, April - October 1999

Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width





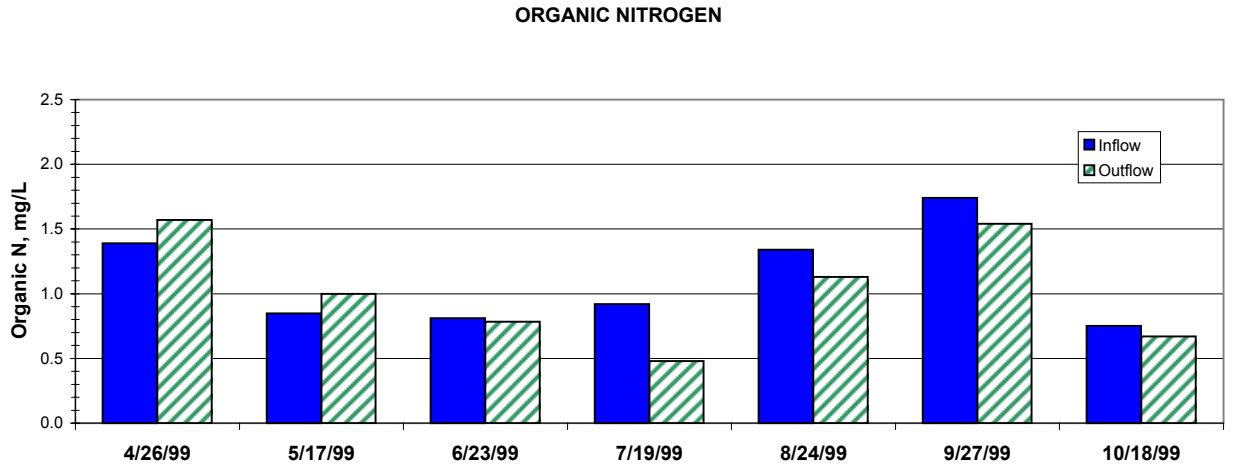


Exhibit C-30

Inflow and Outflow Weekly Average Values for Total Nitrogen, Total Kjeldahl Nitrogen and Organic Nitrogen for Porta-PSTA Treatment No. 12, April - October 1999

Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width

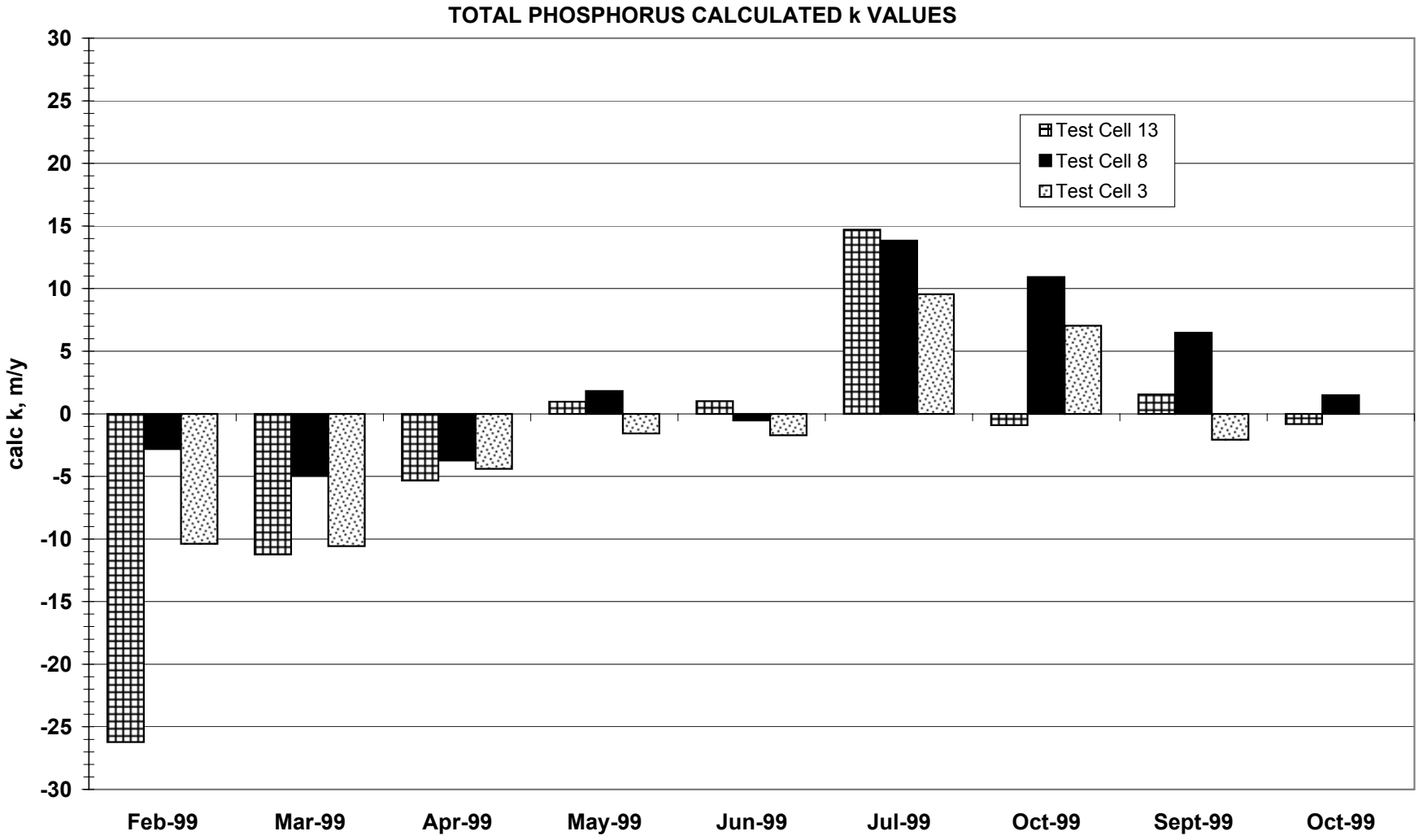
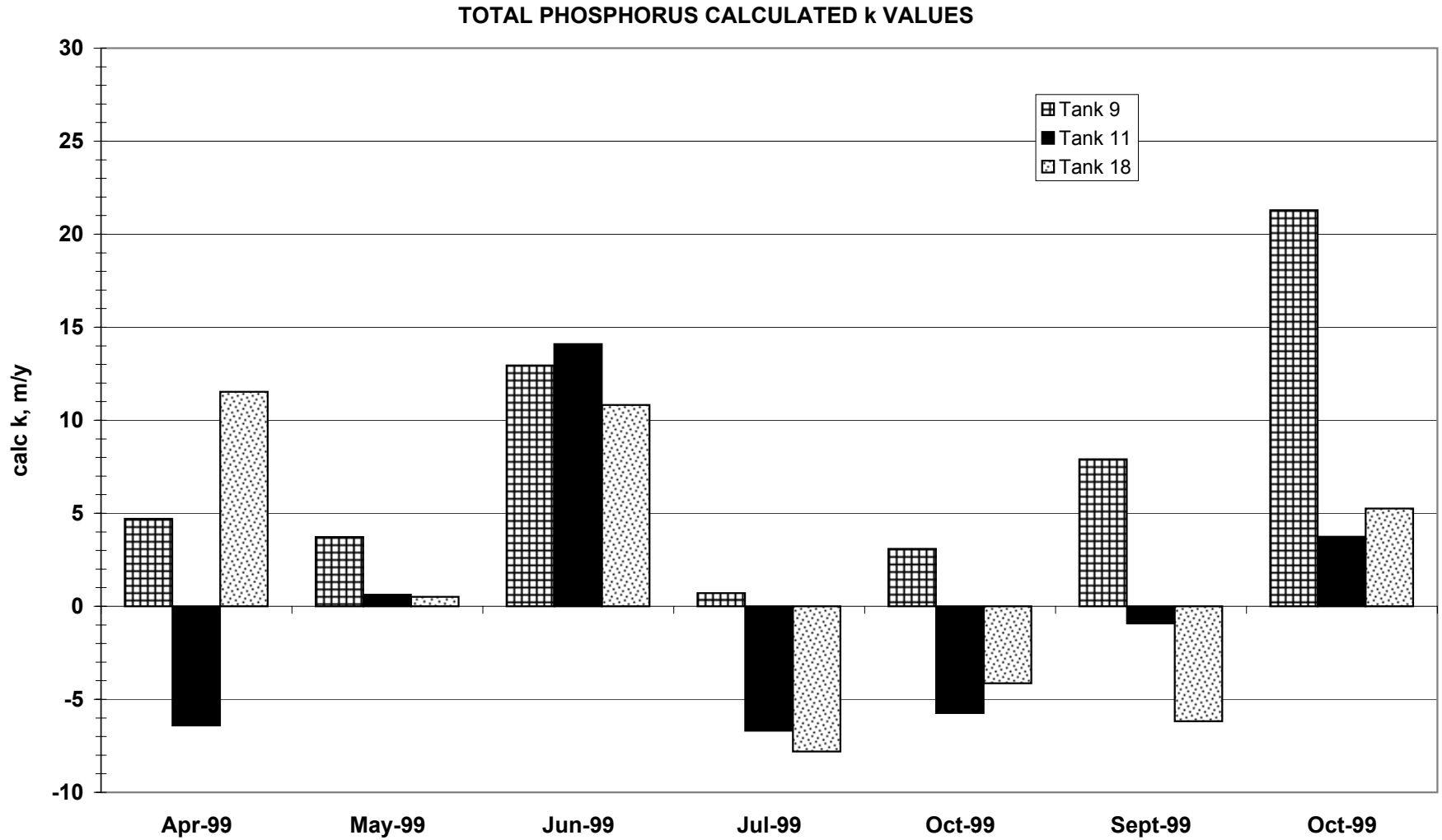


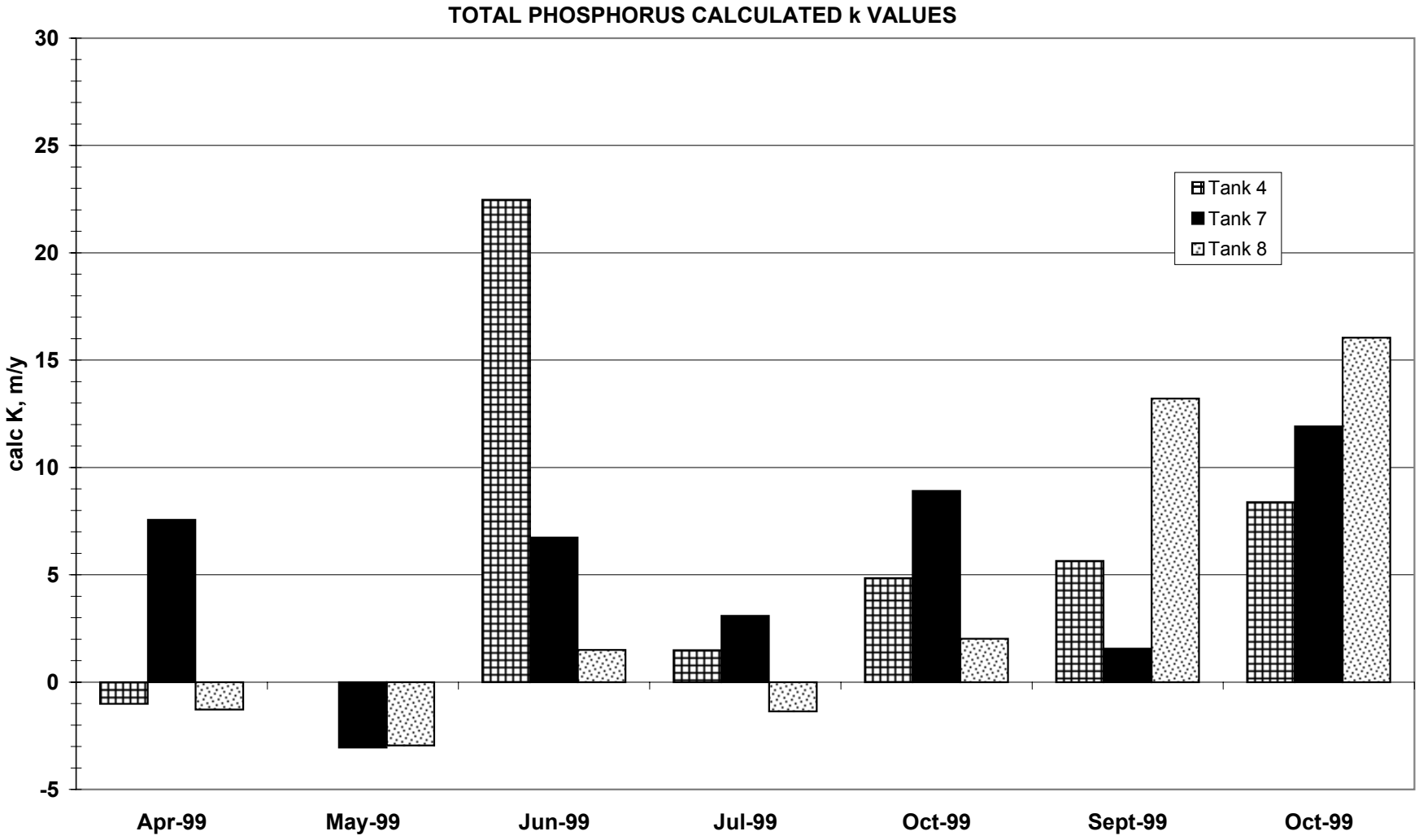
Exhibit D-1
Monthly "k" Values for Total Phosphorus for South Test Cell Treatment Nos. 1, 2, and 3, February - October 1999

Key Conditions:
Substrate: Peat/Shellrock
Depth: 60 cm and Variable
HLR: 6 cm/day
Other:



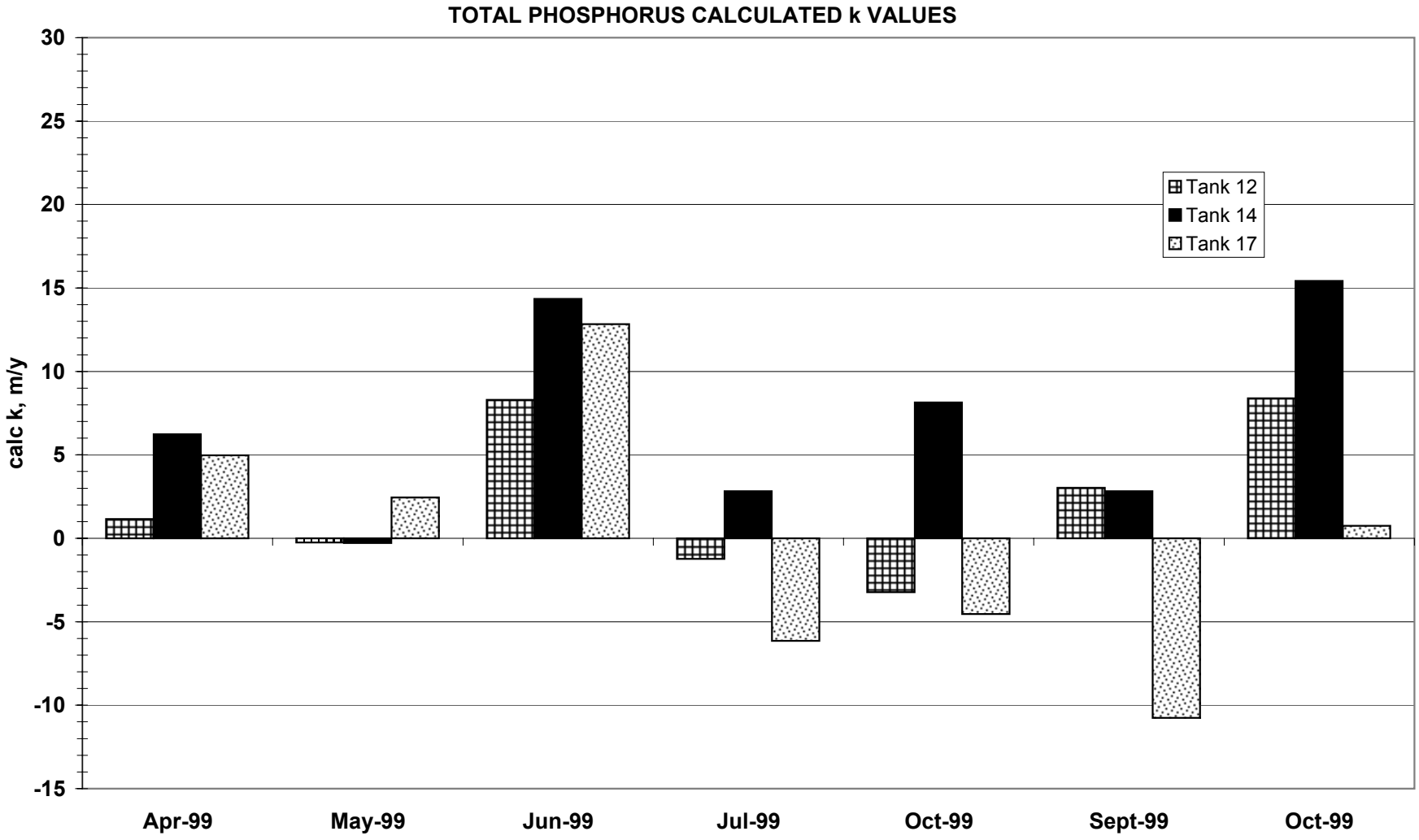
Key Conditions:
Substrate: Peat
Depth: 60 cm
HLR: 6 cm/day
Other:

Exhibit D-2
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 1, April - October 1999



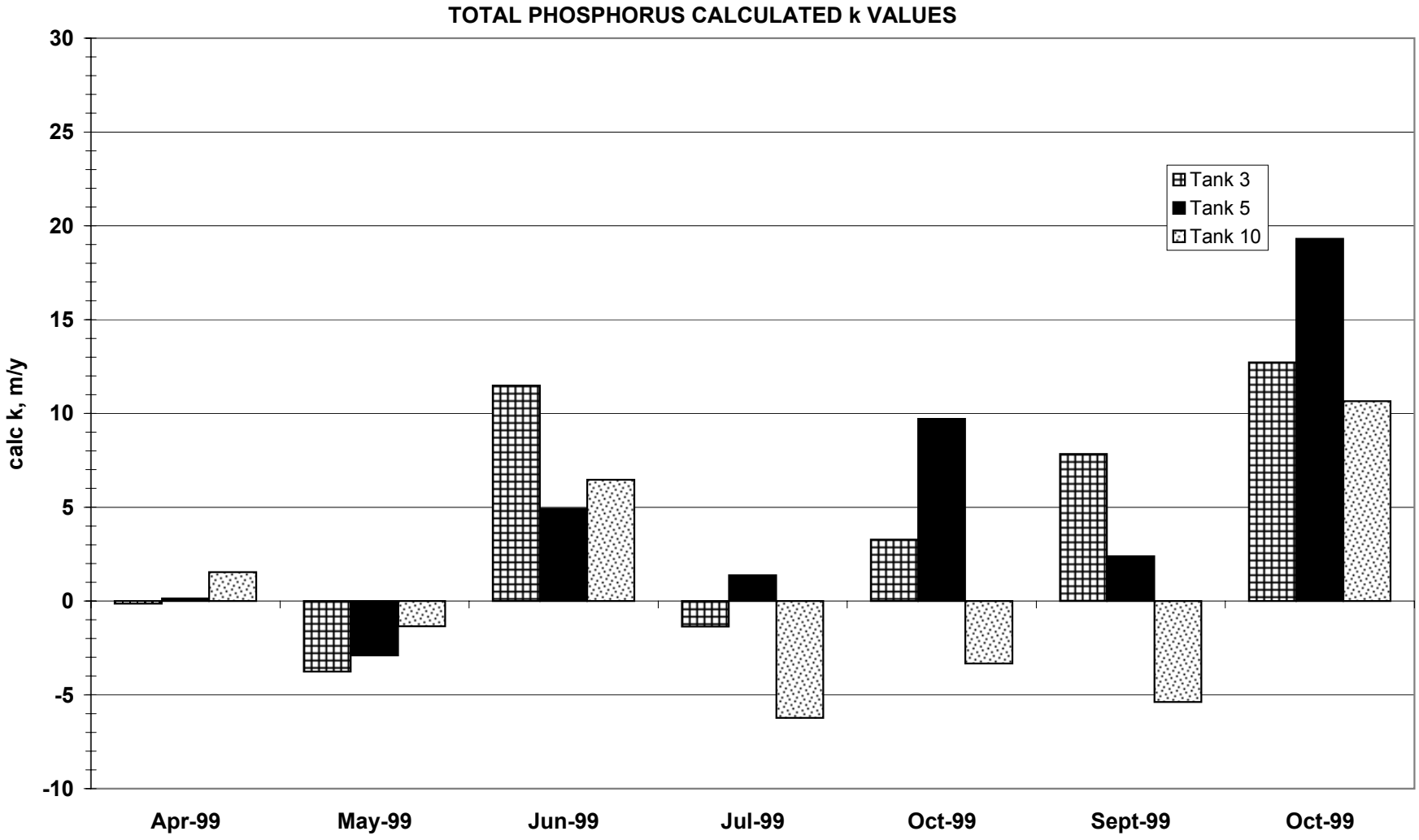
Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other:

Exhibit D-3
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 2, April - October 1999



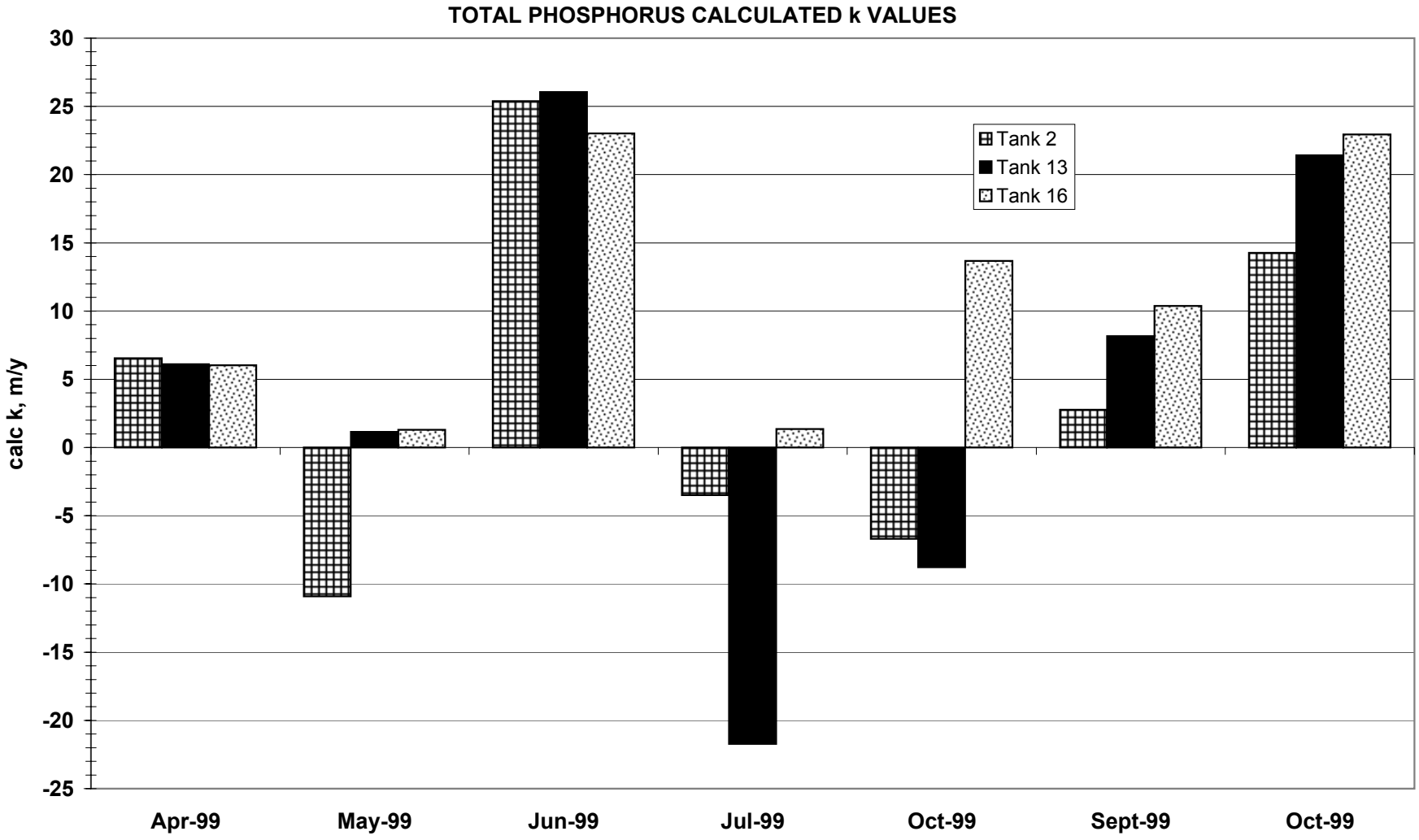
Key Conditions:
Substrate: Peat
Depth: 30 cm
HLR: 6 cm/day
Other:

Exhibit D-4
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 3, April - October 1999



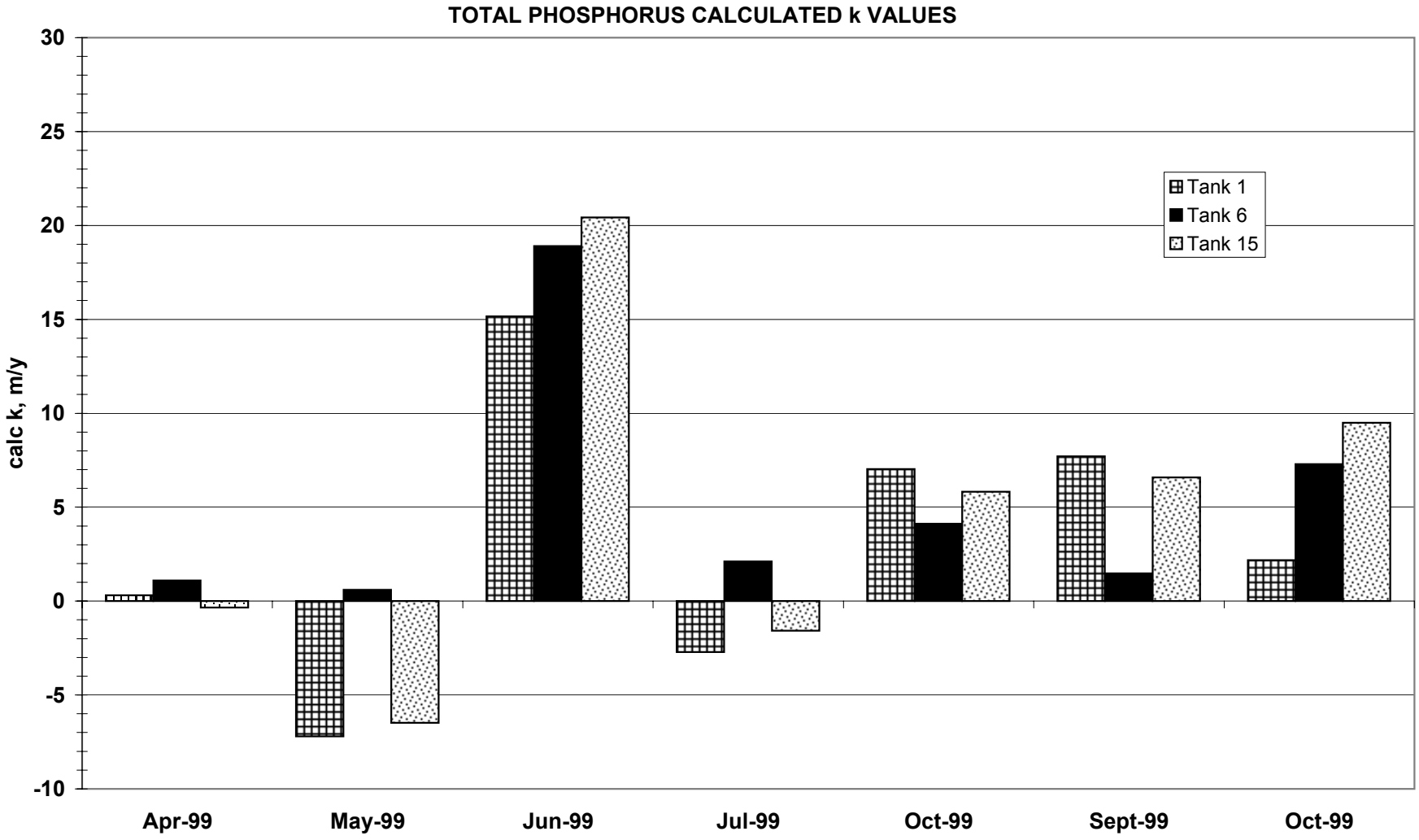
Key Conditions:
Substrate: Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other:

Exhibit D-5
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 4, April - October 1999



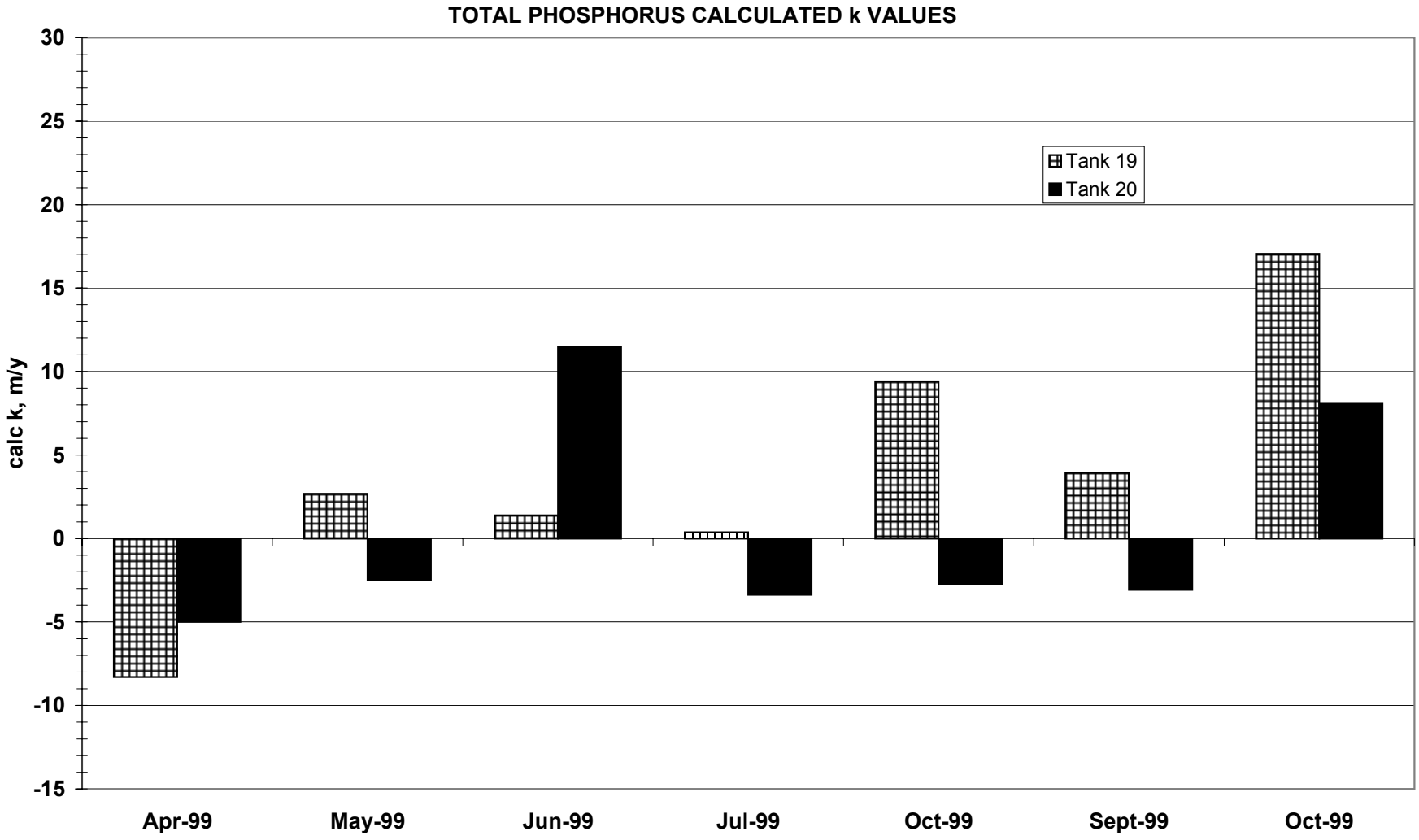
Key Conditions:
Substrate: Shellrock
Depth: 60 cm
HLR: 12 cm/day
Other:

Exhibit D-6
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 5, April - October 1999



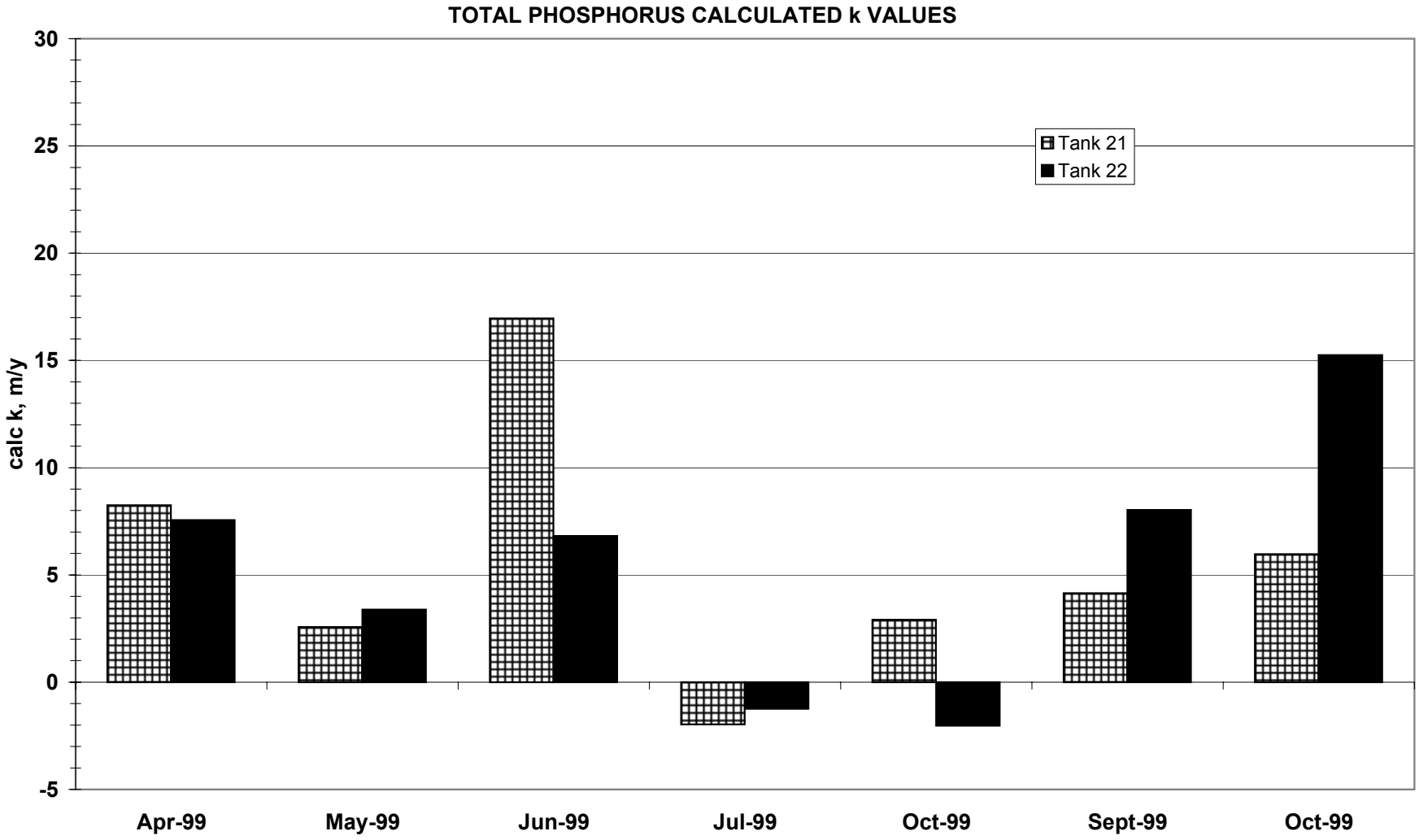
Key Conditions:
Substrate: Shellrock
Depth: Seasonal
HLR: 6 cm/day
Other:

Exhibit D-7
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment No. 6, April - October 1999



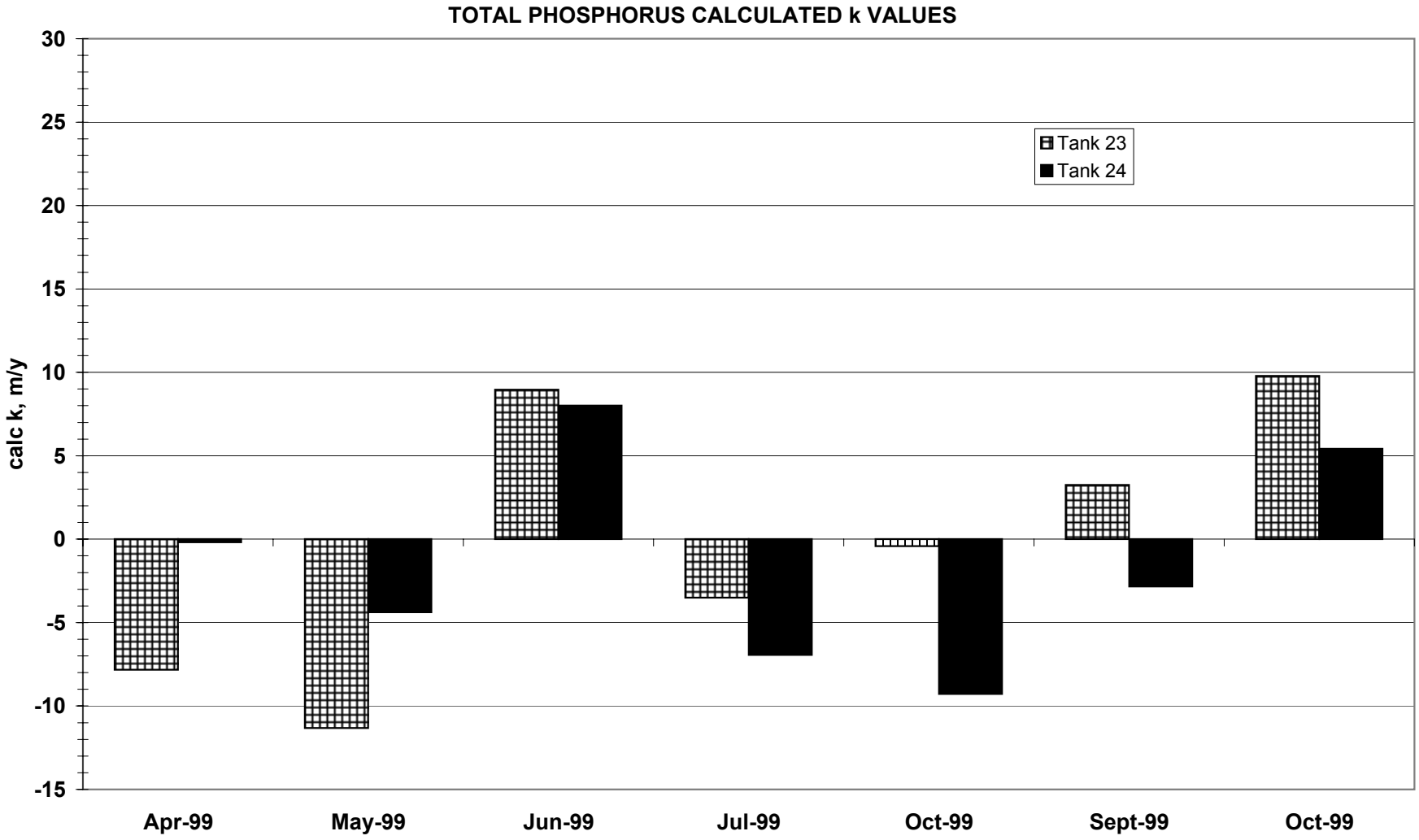
Key Conditions:
Substrate: Sand
Depth: 30/60 cm
HLR: 6 cm/day
Other:

Exhibit D-8
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment Nos. 7 and 8, April - October 1999



Key Conditions:
Substrate:
Peat/Shellrock
Depth: 60 cm
HLR: 6 cm/day
Other: Aquashade

Exhibit D-9
Monthly "k" values for Total Phosphorus for Porta-PSTA Treatment Nos. 9 and 10, April - October 1999



Key Conditions:
Substrate:
Peat/Shellrock
Depth: 30 cm
HLR: 6 cm/day
Other: 3 Meter Width

Exhibit D-10
Monthly "k" Values for Total Phosphorus for Porta-PSTA Treatment Nos. 11 and 12, April - October 1999

Exhibit D-11

SFWMD PSTA Research Project Phosphorus Data (TP Calculated k Values) for Replicated Porta-PSTA Treatments

Site	Treatment	Date	k (m/y)-A	k (m/y)-B	k (m/y)-C
			Tank 9	**Tank 11**	**Tank 18**
Porta	1	Apr-99	4.71	-6.41	11.54
Porta	1	May-99	3.73	0.63	0.51
Porta	1	Jun-99	12.95	14.09	10.82
Porta	1	Jul-99	0.71	-6.69	-7.80
Porta	1	Oct-99	3.08	-5.74	-4.14
Porta	1	Sept-99	7.91	-0.93	-6.17
Porta	1	Oct-99	21.28	3.74	5.25
			Tank 4	**Tank 7**	**Tank 8**
Porta	2	Apr-99	-1.01	7.56	-1.28
Porta	2	May-99	#N/A	-3.05	-2.95
Porta	2	Jun-99	22.47	6.74	1.50
Porta	2	Jul-99	1.48	3.09	-1.37
Porta	2	Oct-99	4.84	8.90	2.01
Porta	2	Sept-99	5.65	1.56	13.20
Porta	2	Oct-99	8.38	11.91	16.04
			Tank 12	**Tank 14**	**Tank 17**
Porta	3	Apr-99	1.15	6.24	4.97
Porta	3	May-99	-0.24	-0.28	2.45
Porta	3	Jun-99	8.30	14.34	12.84
Porta	3	Jul-99	-1.23	2.82	-6.14
Porta	3	Oct-99	-3.22	8.14	-4.53
Porta	3	Sept-99	3.03	2.83	-10.76
Porta	3	Oct-99	8.39	15.41	0.74
			Tank 3	**Tank 5**	**Tank 10**
Porta	4	Apr-99	-0.14	0.15	1.54
Porta	4	May-99	-3.76	-2.90	-1.35
Porta	4	Jun-99	11.48	4.92	6.46
Porta	4	Jul-99	-1.36	1.37	-6.22
Porta	4	Oct-99	3.27	9.71	-3.32
Porta	4	Sept-99	7.83	2.39	-5.39
Porta	4	Oct-99	12.71	19.31	10.65
			Tank 2	**Tank 13**	**Tank 16**
Porta	5	Apr-99	6.55	6.10	6.02
Porta	5	May-99	-10.91	1.14	1.30
Porta	5	Jun-99	25.38	26.06	23.02
Porta	5	Jul-99	-3.49	-21.73	1.35
Porta	5	Oct-99	-6.70	-8.78	13.68
Porta	5	Sept-99	2.76	8.17	10.37
Porta	5	Oct-99	14.27	21.41	22.94
			Tank 1	**Tank 6**	**Tank 15**
Porta	6	Apr-99	0.31	1.10	-0.34
Porta	6	May-99	-7.20	0.60	-6.49
Porta	6	Jun-99	15.16	18.90	20.42
Porta	6	Jul-99	-2.71	2.11	-1.58
Porta	6	Oct-99	7.03	4.12	5.83
Porta	6	Sept-99	7.71	1.48	6.59
Porta	6	Oct-99	2.18	7.29	9.49

Preliminary Statistical Analysis of Experimental Treatment Effects on PSTA Phosphorus Removal

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DATE: December 12, 1999

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Introduction

This Technical Memorandum summarizes the results of a preliminary statistical assessment of water quality performance data collected from Periphyton-Based Stormwater Treatment Area [PSTA] mesocosms in operation at the Supplemental Technology Site and the South Test Cells in the Everglades Nutrient Removal Project. Statistical analyses were performed on available sampling results for the period extending from June through October, 1999.

Results are presented on six subject areas:

- Data management and coding constraints
- Time series plots
- Comparison of parameter measures, including inflow, outflow, inflow-outflow differences and ratios for the different forms of phosphorus

- Evaluation of replicated experimental results
- Comparisons among treatment levels, and
- Point-interval estimates by treatment level.

Each subject summary includes the following:

- Description of evaluation procedure
- Why the evaluation was performed
- Where statistical results are found
- Interpretation of those results, and
- Brief summary of potential implications of those results in the context of the analysis as well as the experimental setup.

Data Management and Coding

Raw data from the project Access data base were organized in spreadsheet format, consisting of 741 records including fields for: site, treatment, cell, date, period, and inflow and outflow measures for total phosphorus (TP) total particulate phosphorus (TPP), total dissolved phosphorus (TDP), soluble reactive phosphorus (SRP) and dissolved organic phosphorus (DOP). Minor inconsistencies in the pairing of inflow and outflow exist in the file and somewhat limit the data which could be used to evaluate phosphorus removal efficiencies. Of the total, 129 records are observations taken from the three half-acre Test Cells, collected between February 23 and October 25, 1999. The remaining 612 records are observations taken from the 24 Porta-PSTA units, collected between April 13 and October 26, 1999. The three Test Cell mesocosms represent three different treatment conditions, performed as single experiments. The 24 portable mesocosms represent six different treatment conditions, performed in triplicate, plus an additional set of six treatment conditions which are being conducted as single experiments.

Experimental Factor Levels

The primary factors and their respective levels included in the PSTA experimental design consist of the following:

- Scale (test cell versus portable unit),
- Substrate (peat, shellrock and sand),
- Water depth (30 and 60 cm and variable water conditions for 3 possible levels),
- Loading (6 cm/day versus 12 cm/day),
- Presence or absence of periphyton (theoretically controlled by a blue colorant, Aquashade), and
- Depth to width ratio of the unit (0.02, 0.1, 0.3 and 0.6) and replication (between 0 and three per treatment condition).

Abbreviated codes to define experimental conditions, based upon these factor levels, were assigned as follows:

Factor	Condition/Level	Code
TestScale	TestCell	C
	Portable	P

Substrate	Peat	p
	Shellrock	r
	Sand	s
Depth	30cm=shallow	S
	60cm=deep	D
	0-60cm=variable	V
Loading	6=low	x [lo]
	12=high	X [hi]
Shading	Y	not in code
	N	not in code
Ratio	0.02	1
	0.1	2
	0.3	3
	0.6	4
Duplicate	None	0
	1 of 3	1
	2 of 3	2
	3 of 3	3

Codes were concatenated to establish a unique 6-digit alpha-numeric label for each treatment identifying test unit scale, substrate, depth, loading, depth-width ratio and duplicate. The objective in establishing an alpha-numeric code for each mesocosm is to provide a mnemonic device that summarizes the test conditions separate from simply identifying the mesocosm number. The resulting codes, based upon the above conventions and used throughout the remainder of this discussion are:

Block	Treatment	Cell	Code
ENR Test Cells	1	13	CpDx10
	2	8	CrDx10
	3	3	CrVx10
PortaPSTA	1	9	PpDx41
		11	PpDx42
		18	PpDx43
	2	4	PrDlo41 [*was* PrDx41]
		7	PrDxlo2 [*was* PrDx42]
		8	PrDlo43 [*was* PrDx43]
	3	12	PpSx31
		14	PpSx32
		17	PpSx33
	4	3	PrSx31
		5	PrSx32
	6	10	PrSx33
	5	2	PrDhi41 [*was* PrDX41]
		13	PrDhi42 [*was* PrDX42]
		16	PrDhi43 [*was* PrDX43]
	6	1	PrVx31
		6	PrVx32
		15	PrVx33

7	19	PsDx41
8	20	PsDx42
9	21	PpDx40
10	22	PrDx40
11	23	PrSx20
12	24	PpSx20

An inconsistency in the convention (x versus X for loading, which cannot be distinguished as unique by a software package used in the data management/analysis) resulted for the triplicate pairs which were conducted at the two levels of loading: PrDx41/2/3 and PrDX41/2/3. Subsequent to recognizing the problem, coding for these two sets of triplicates were modified to PrDlo41/2/3 and PrDhi41/2/3. The remaining test conditions performed at the lower loading, originally designated ‘ x ‘, were not changed.

Calculated Response Variables

The inflow and outflow measures were used to calculate two response variables: inflow-outflow difference in concentration and the inflow/outflow ratio of measured concentrations. These two additional fields were calculated for each set of paired inflow-outflow observations of the five phosphorus forms measured in the experimental units.

Date Limits

The major data management steps taken prior to analysis consisted of establishing experimental unit codes and calculating supplementary response variables. Additionally, for the purposes of this analysis, data have been limited to the five-month period from June 1999 through October 1999, which includes 513 of the original 741 records in the raw data file. This period is generally considered by the project team to be relatively stable compared to the startup phenomenon of substrate consolidation, algal community development, flow adjustments, and sampling technique refinement.

Final Files

The spreadsheet outputs included in Attachment A and Attachment B list the subset of data, June-October 1999, and include the variables described in the data management procedures. Formats differ in order to accommodate import requirements for specific statistical algorithms but contents are the same. Attachment C lists the count of paired inflow-outflow observations for each experimental condition and each of the five parameters and represents the data used in all the evaluations described below. Analyses were performed using Systat and S-Plus statistical software packages.

Time Series Plots

Prior to performing comparisons among treatment conditions, raw data were inspected to see if there are any unexpected trends in primary factors which could adversely effect the outcome from those comparisons. For example, differences in treatment responses could be masked if establishment of test conditions resulted in differential oscillations of discharge TP levels. Additionally, while experimental in nature, this is an “observational” study, i.e. influent levels are not controlled, but rather, “occur” as the result of upstream processes. Consequently, any trend in influent levels of phosphorus over time could differentially

affect test conditions, thereby obscuring any differences in relative phosphorus removal efficiencies.

Attachment D consists of a series of 13 plots for each of the four measures of TP: inflow and outflow, the difference (inflow-outflow), and the ratio (inflow/outflow), derived from the former. Each parameter set includes six individual plots for the six triplicate experimental conditions, a single plot for the three Test Cells, and an additional six individual plots for each of the remaining Porta-PSTAs which were performed as single units. Concentration, which is plotted on the ordinate (y-axis), has been set for each of the four parameters so that individual experimental conditions are plotted on the same scale for each parameter. Time, which is plotted on the abscissa (x-axis), has been "fixed" to the same range for all 48 PortaPSTA plots and fixed to the slightly longer range of time for the 3 Test Cells. The objective in fixing the ranges is to expedite interpretation of the visual cues such that relative levels (among or within individual plots) represent true differences in concentration throughout the entire set.

Four major generalizations follow from examination of the plots:

- Comparatively wide variation oscillation in inflow and outflow levels, apparent during the first months of some experimental conditions, appeared to have stabilized by June 1999, justifying the limitation to the subset of data evaluated.
- Inflow concentrations were virtually identical between experimental treatments. This corroborates the intent of the project to limit TP inflow variability and assign measured differences in performance to the different experimental treatments. Outflow concentrations are also comparable, suggesting that differences in phosphorus removal rates between experimental treatments are minor.
- The ranges of inflow and outflow TP, 0.00 – 0.080 mg/L and 0.010 and 0.140 mg/L, respectively, are basically the same, indicating that differences between inflow and outflow concentrations are marginal. Inflow TP levels are comparatively low given the variation from normal operating flows within the system. The majority of outflow levels exceed the 0.010 mg/L target discharge level.
- Within triplicate plots, occasional variations in levels are quite pronounced, indicating that within treatments (which ostensibly represent the same factor levels), individual mesocosms exhibit differences in small scale behaviors within treatments.

Examination of the time series plots does not suggest any obvious trends confounding comparisons among treatments. They do indicate that limiting the comparisons to the June-October period is reasonable. Finally, the duration of the study is not adequate to conclude anything about temporal variations in system effectiveness.

Parameter Measures

Two considerations for the statistical analysis arise given the phosphorus measures made in the experimental mesocosms. The first is the selection of the appropriate forms of phosphorus to be used to assess differences in phosphorus removal among treatments. The second is the actual measure of phosphorus form used. At least three different, simple measures are potential candidates: outflow concentrations, the difference between inflow and outflow and the ratio of inflow to outflow concentrations. This section describes evaluation of the parameter measures to be used in the comparisons.

Scatter Plot Matrix

Five separate forms of phosphorus are routinely being measured in the inflow and outflow from the experimental mesocosms. If measures are correlated such that a single measure adequately describes all parameters, then the statistical analysis is simplified. To assess the extent to which the individual parameters covary, a graphical device, called a SCatterPLOt Matrix [SPLOM] was generated. A SPLOM is graphically analogous to a correlation matrix where the correlation coefficients between all possible pairs of a set of variables is tabulated. In such a matrix, each variable is both a column and a row (in the same order going across the columns and down the rows), resulting in a p-by-p matrix of cells, where p is the number of variables being examined. In the correlation matrix, cell entries indicate the degree of correlation between the pairs of variables. Correlation of the variable to itself, which occurs along the diagonal of the matrix, is 1.0. Correlation of variable 1 to variable 2 is identical to variable 2 to variable 1 so the top and bottom halves of the matrix carry the same information, although in a mirrored image. By convention, only the lower half and the diagonal of the correlation is typically displayed.

The SPLOM applies the same concept except that, rather than containing the correlation coefficient, the cells contain two variable scatterplots for all possible pairs of variables. Supplemented with a correlation matrix, or a matrix which identifies statistically significant correlation coefficients, the SPLOM is a powerful visual device which displays both the distribution of the individual variables as boxplots along the identity diagonal and the relationships between all possible pairs of variables.

Attachment E (*BOXPLT.doc*) summarizes the generic components of boxplots. Boxplots used throughout this document are supplemented with dot plots representing each observation within the boxes. Boxplots defining single populations or data subsets are extremely powerful methods to understand the distribution of available observations, their central tendency, symmetry, skewness and related parameters.

In more common applications, boxplots of different data subsets are positioned side-by-side as graphical analogs to population comparisons, as in the explicit statistical tests such as t-tests or analysis of variance or their nonparametric analogues, the Mann-Whitney and Kruskal-Wallis tests. Boxplots comparing different treatment conditions are used later in this document for evaluating differences among replicates and factor levels.

Attachment F *(SPLOM.doc)* includes a set of four plots comparing inflow, outflow, and difference and ratio measures of TP, TPP, TDP, SRP and DOP. The graphical device is complemented with the correlation matrix which indicates the statistical significance of the correlation coefficient when the number of correlations performed has been accounted for. This adjustment (a.k.a. the Bonferroni adjustment) reflects the probability of incorrectly concluding that a statistically significant correlation for a fixed value of the coefficient increases with the number of correlations made. In other words, as the number of correlations calculated increases, the probability that one or more incorrectly identifies a relationship when none exists, also increases. The Bonferroni adjustment describes this relationship and results in a higher correlation coefficient being required to attain the same level of statistical significance as the number of correlations performed increases. The values in the matrix indicate the relative significance of the correlation, with 0 (meaning a

value less than 0.001) being the strongest correlation, and 1 (meaning a value greater than 0.999) being the weakest correlation. A probability of less than 0.05 is considered to reflect a statistically significant relationship for this analysis.

The following points summarize generalizations concluded from examination of the four exhibits:

- The strongest relationships are observed between TP and TPP, for intake, outflow, difference and ratio measures.
- SRP appears to act more independently and differently from the other species of phosphorus monitored.
- TDP and DOP correlate well, overall, with TP, but exhibit a slightly stronger relationship to each other than either to TP.

TP Removal Performance by Treatment

On the basis of these observations, and because the endpoint of the experimentation is to determine if a discharge of 0.010 mg/L TP can be achieved, TP was selected as the primary variable for evaluation. This does not preclude the potential utility of further evaluations of TDP and DOP, independently, at a later date.

A second issue requiring resolution concerned the selection of the appropriate TP measure to apply in the primary investigation. Three measures have been compared, independent of treatment groups: outflow concentration, inflow-outflow difference and ratio of inflow/outflow. The simplest evaluation consists of an across file comparison of treatments groups, regardless of confounding factors, as discussed below. Attachment G (*RESULTS.p.xls)* summarizes ANOVA and Kruskal-Wallis test results using the four TP measures to compare the 15 treatment groups. Replicate test units exposed to the same conditions were pooled. The top part of the table lists the mean rank per treatment condition for each of the measures, where the mean rank is simply the mean of all ranks associated with that treatment when all results are ordered from minimum (i.e., rank 1) to maximum (i.e., rank 513). The lower part displays the results from the ANOVA and the nonparametric analog, the Kruskal-Wallis test. The following observations summarize the results:

- As expected, neither test indicates that treatments differ in terms of TP inflow concentrations.
- The parametric test discerns statistically significant differences only when the response variable is the raw outflow concentration.
- The nonparametric test, probably more reliable in this instance, finds significant differences in all variations of the outflow response variables. However, based upon the relative probability of the test statistic, differences are most apparent when using the raw outflow concentration.
- Detailed contrasts have not yet been performed which would identify which treatments differed significantly. However, a rough set of comparisons, which identifies extremes in each of the outflow-based response variables suggest consistently good performance, as defined as low outflow TP, high TP difference and high TP ratio, is observed in mesocosms PSTA02, PSTA07 and TC01/02 (light shading in table). PSTA mesocosms with relatively poor performance include PSTA12, PSTA08 and PSTA01 (dark shading in table).

While not definitive by way of particular comparisons, these across-factor results have been used as a basis to prioritize analyses using TP outflow concentration as the first response measure.

Comparisons Among Replicates

Six sets of experimental conditions have been triplicates: PpDx41/2/3, PrDx41/2/3, PpSx31/2/3, PrSx31/2/3, PrDX41/2/3 [or PrDhi41/2/3] and PrVx31/2/3. In a full factorial experimental design, replicates would be the level against which differences among factor levels would be compared. Because most comparisons are limited to simple t-test comparisons of two treatment conditions, differences in variability within each of the samples paired for comparison could mask statistically significant differences. While differences would not be expected, given the amount of effort allocated to the replication, statistical comparisons between the three replicates within each of the six treatments were made using the TP inflow and TP outflow response variables.

Results are summarized in Attachment H, which documents ANOVA results, including the F-statistic and associated degrees of freedom and the probability of that F-statistic, and the Kruskal-Wallis test statistic and probability of occurrence. Highlighted rows indicate which replicates exhibit statistically significant differences. Boxplots displaying comparisons are found in Attachments I and J, displaying duplicates for TP outflow and inflow concentrations, respectively. Results from explicit statistical tests, comparing replicates, are summarized, as follows:

- TP inflow measures exhibited no statistically significant differences among replicates within the six treatments.
- TP outflow measures among replicates differed in three of the six sets, including: PpDx41/2/3, PpSx31/2/3 and PrSx31/2/3.
- Posteriori tests indicate that TP outflow concentrations in PpDx42 and PpDx43 (mesocosms 11 and 18, respectively) are comparable and are significantly greater than PpDx41 (mesocosm 9). Within PpSx3, PpSx31 (mesocosm 12) overlaps both PpSx32 (cell 14) which is significantly less than PpSx33 (mesocosm 17). PrSx33 (mesocosm 10) is significantly higher in TP outflow concentrations than either PrSx31 (mesocosm 3) or PrSx32 (mesocosm 5).

Potential causes for differences among replicates warrant evaluation through assessment of other biological factors, which may include relative coverage by submersed and emergent aquatic macrophytes, algal community composition and biomass, and effects of snail grazing. Exactly half of the conditions evaluated for significant differences among treatment replicates exhibit differences; the other half show no significant differences. Gaining control over the cause(s) of replicate differences would allow increased resource allocation to definitively differentiate treatment conditions, rather than continuing to monitor and sample redundant test units conducted at the same factor levels.

Comparisons Among Factor Levels

The key component of the statistical analysis of the PSTA data is comparison of outflow TP among different experimental units. During design of the sampling protocol for the test units, it was decided that replicate variability was a critical factor to include in the design. Consequently, given budgetary limits, a full factorial experimental design was not implemented. However, distinct experimental units were retained such that each of the factors could be compared with one or more pairs of test unit results, without confounding factors. The advantage of this design is the ability to discriminate statistically significant differences on a small scale while retaining the ability to test each of the primary factors. The disadvantage is that the relative impact of all factors cannot be quantitatively evaluated in a controlled experimental setting without performing comparisons where factors are confounded. The complete set of factorial comparisons which could be tested, given available test units, is summarized in Attachment K. The table is briefly summarized, by factor, as follows:

- Four comparisons can be made to examine the relative effects of substrate while holding all other factor levels the same in the two test units. These include three peat versus shellrock comparisons (i.e., two PortaPSTAs, one Test Cell) plus a single set of three portable units which can compare peat, shellrock and sand substrates. Two of the setups are being conducted at shallow water depths and two at deep water. Depth-to-width levels within the four setups cover the range of this factor.
- Two experimental conditions compare water depths. Both setups are based upon a shellrock substrate. One setup compares deep water with a test condition which varies in depth over time. The second setup compares shallow water with a test condition allowed to vary over time.
- Loading can be compared in a single pair of conditions: 6 vs. 12 cm/day in a shellrock substrate, deep water and fixed 0.6 depth:width ratio.
- Depth-to-width ratios [0.3 and 0.1] can be compared in two units: peat and shellrock units, both covered with shallow water.
- Finally, test unit scale and ratio are comparable in three setups. Two are being performed with shellrock substrate, one with deep water and one with water varying over time. The third comparison is based upon peat substrate, with deep water. Depth-to-width ratios include the minimum (0.02 in the Test Cells), per mid (0.3) and maximum (0.6) in the portable units.

Results from the fourteen sets of comparisons are graphically displayed using boxplots in Attachment L. Boxplots compare outflow TP concentrations among groups indicated in Attachment K. The vertical broken line in the plots cross the abscissa at the targeted discharge concentration of 0.010 mg/L. Explicit statistical results, including ANOVA and the nonparametric Kruskal-Wallis test results are tabulated in Attachment M. Posteriori comparisons for statistically significant differences are indicated in the line following the test results.

The following bullets summarize conclusions found in the graphical and tabular displays:

Significant Factors

Of the 14 comparisons performed, five comparisons exhibit statistically significant factors. Differences are not limited to a single factor. The single case, where more than one comparison is statistically significant among all possible comparisons within a single factor, is limited to the scale comparison of Test Cell to PortaPSTAs. The other three statistically significant results are: one of the four substrate comparisons, one of the two depth comparisons and one of the two depth-to-width ratio comparisons.

Effect of Substrate

The single comparison of substrate which exhibits significant differences is limited to the nonparametric test results. The comparison indicates that TP outflow concentrations are significantly lower in the shellrock substrate, as compared to either the sand or peat substrates. However, while the results are significantly different, results from all three setups exceed 0.010 mg/L on all but a single sampling date.

Effect of Depth

The single comparison which indicates differences as the function of deep and variable depths is detected by both the parametric and nonparametric tests. In this shellrock unit, TP outflow concentrations from the deep unit are significantly lower than the from the unit in which water depth was varied. As indicated in the boxplot comparing the two test cell units, statistical significance does not coincide with substantial TP decreases to levels less than 0.010 mg/L.

Effect of Depth-to-Width Ratio

A statistically significant depth-to-width ratio effect was detected with the nonparametric test method only in the shallow peat system. Comparison of the 0.3 and 0.1 depth-to-width ratios indicated lower TP outflow concentrations in the former.

Effect of Mesocosm Scale

Of the three scale comparisons which could be made, comparing only scale and depth-to-width ratios, two were statistically significant. The shellrock deep water system differences were detected with the nonparametric test only while the shellrock variable depth system was significant using both parametric and nonparametric methods. In both cases, comparatively lower TP outflow concentrations were found in the portable units, as compared to the more realistically scaled, half-acre Test Cells. Further, statistical significance of the comparison is limited by the lack of substantive reductions in the outflow levels, as compared to the target level.

Overall, while statistically significant differences were observed in multiple comparisons, results do not make a compelling argument for any factor definitively driving relative effectiveness of phosphorous uptake in any of the experimental systems. The lack of substance, in the face of marginal significance, is described further in the final section.

Point-Interval Estimates by Treatment Level

An overall summary of the data, partitioned by experimental unit, has been generated in order to gain perspective on the relative substance of the marginal differences among treatments found. Attachment N lists the 95 percent confidence interval about the mean of

the four TP measures for the 27 experimental conditions. The following bullets summarize the major features of the summary:

- In most cases, the intervals of TP inflow and TP outflow completely overlap.
- The interval about the mean difference of TP inflow minus TP outflow is centered about zero in most cases.
- The ratio intervals generally center around 1.

The marginal differences between inflow and outflow TP could simply reflect differences on the order of measurement error, rather than the result of any effective factors applied in the existing experimental units. The degree to which differences are real could be explicitly evaluated by (1) assuring that inflow measures are performed independently in all experimental units on all sampling dates, and (2) performing routine duplicate sample measures such that variability in small-scale spatial and temporal differences can be estimated and used to test against inflow-outflow differences.

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	1	9	10/11/99		D	0.02	0.013	0.007	1.5384615	0.007	0.003	0.004	2.3333333	0.013	0.01	0.003
PORTA	1	9	10/20/99		D	0.017	0.011	0.006	1.5454545	0.002	0.002	0	1	0.015	0.009	0.006
PORTA	1	9	10/26/99		D	0.027	0.01	0.017	2.7	0.017	0.004	0.013	4.25	0.01	0.006	0.004
PORTA	1	9	10/4/99		D	0.017	0.011	0.006	1.5454545	0.005	0.002	0.003	2.5	0.012	0.009	0.003
PORTA	1	9	6/23/99		D	0.0153601	0.0189848	-0.003625	0.8090765	0.0036246	0.0090616	-0.005437	0.4000001	0.0117355	0.0099232	0.0018123
PORTA	1	9	6/28/99		D	0.0161351	0.0152089	0.0009262	1.0608978	0.0074095	0.0083357	-0.000926	0.8888889	0.0087256	0.0068732	0.0018524
PORTA	1	9	6/9/99		D	0.0548182	0.0106589	0.0441594	5.1429715	0.042728	-0.003455	0.0461831	-12.36667	0.0120903	0.014114	-0.002024
PORTA	1	9	7/14/99		D	0.014432	0.0125971	0.0018348	1.1456561	0.0082568	0.006422	0.0018348	1.2857143	0.0061751	0.0061751	0
PORTA	1	9	7/19/99		D	0.0128416	0.0147008	-0.001859	0.8735291	0.0027888	0.0074369	-0.004648	0.3749999	0.0100528	0.0072639	0.0027888
PORTA	1	9	7/26/99		D	0.0117285	0.0108056	0.0009229	1.0854117	0.0027688	0.0046146	-0.001846	0.6	0.0089597	0.006191	0.0027688
PORTA	1	9	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.004656	-0.000931	0.8	0.0093792	0.0075168	0.0018624
PORTA	1	9	8/16/99		D	0.02	0.016	0.004	1.25	0.006	0.008	-0.002	0.75	0.014	0.008	0.006
PORTA	1	9	8/25/99		D	0.016	0.01	0.006	1.6	0.003	0.001	0.002	3	0.013	0.009	0.004
PORTA	1	9	8/3/99		D		0.022				0.013				0.009	
PORTA	1	9	8/30/99		D	0.018	0.012	0.006	1.5	0.006	0.004	0.002	1.5	0.012	0.008	0.004
PORTA	1	9	8/9/99		D	0.02	0.024	-0.004	0.8333333	0.005	0.011	-0.006	0.4545455	0.015	0.013	0.002
PORTA	1	9	9/28/99		D											
PORTA	1	9	9/29/99		D	0.015	0.01	0.005	1.5	0.003	0.002	0.001	1.5	0.012	0.008	0.004
PORTA	1	9	9/7/99		D	0.019	0.017	0.002	1.1176471	0.003	0.007	-0.004	0.4285714	0.016	0.01	0.006
PORTA	1	11	10/11/99		D	0.02	0.02	0	1	0.007	0.012	-0.005	0.5833333	0.013	0.008	0.005
PORTA	1	11	10/20/99		D	0.017	0.014	0.003	1.2142857	0.003	0.004	-0.001	0.75	0.014	0.01	0.004
PORTA	1	11	10/26/99		D	0.027	0.021	0.006	1.2857143	0.017	0.015	0.002	1.1333333	0.01	0.006	0.004
PORTA	1	11	10/4/99		D	0.017				0.005				0.012	0.013	-0.001
PORTA	1	11	6/23/99		D	0.0189848	0.0171725	0.0018123	1.1055365	0.0056283	0.0065945	-0.000966	0.8534794	0.0133565	0.0105779	0.0027786
PORTA	1	11	6/28/99		D	0.0161351	0.0142827	0.0018524	1.1296935	0.0074095	0.0064833	0.0009262	1.1428571	0.0087256	0.0077994	0.0009262
PORTA	1	11	6/9/99		D	0.0548182	0.0127319	0.0420863	4.3055748	0.042728	0.0039816	0.0387464	10.731403	0.0120903	0.0087503	0.0033399
PORTA	1	11	7/14/99		D	0.014432	0.0236062	-0.009174	0.6113633	0.0082568	0.017431	-0.009174	0.4736842	0.0061751	0.0061751	0
PORTA	1	11	7/19/99		D	0.0128416	0.0165601	-0.003718	0.7754565	0.0027888	0.0074369	-0.004648	0.3749999	0.0100528	0.0091232	0.0009296
PORTA	1	11	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0073834	-0.004615	0.3750001	0.0089597	0.006191	0.0027688
PORTA	1	11	7/6/99		D	0.013104	0.0214849	-0.008381	0.6099175	0.0037248	0.0148993	-0.011175	0.25	0.0093792	0.0065855	0.0027936
PORTA	1	11	8/16/99		D	0.02	0.018	0.002	1.1111111	0.006	0.011	-0.005	0.5454545	0.014	0.007	0.007
PORTA	1	11	8/2/99		D	0.022	0.018	0.004	1.2222222	0.011	0.007	0.004	1.5714286	0.011	0.011	0
PORTA	1	11	8/25/99		D	0.027	0.051	-0.024	0.5294118	0.014	0.043	-0.029	0.3255814	0.013	0.008	0.005
PORTA	1	11	8/30/99		D	0.018	0.016	0.002	1.125	0.006	0.007	-0.001	0.8571429	0.012	0.009	0.003
PORTA	1	11	8/9/99		D	0.02	0.033	-0.013	0.6060606	0.005	0.018	-0.013	0.2777778	0.015	0.015	0
PORTA	1	11	9/28/99		D											
PORTA	1	11	9/29/99		D	0.015	0.016	-0.001	0.9375	0.003	0.008	-0.005	0.375	0.012	0.008	0.004
PORTA	1	11	9/7/99		D	0.019	0.019	0	1	0.003	0.009	-0.006	0.3333333	0.016	0.01	0.006
PORTA	1	18	10/11/99		D	0.02	0.02	0	1	0.007	0.009	-0.002	0.7777778	0.013	0.011	0.002
PORTA	1	18	10/20/99		D	0.017	0.015	0.002	1.1333333	0.003	0.005	-0.002	0.6	0.014	0.01	0.004
PORTA	1	18	10/26/99		D	0.027	0.016	0.011	1.6875	0.017	0.011	0.006	1.5454545	0.01	0.005	0.005
PORTA	1	18	10/4/99		D	0.017	0.02	-0.003	0.85	0.005	0.012	-0.007	0.4166667	0.012	0.008	0.004
PORTA	1	18	6/23/99		D	0.0162663	0.0162663	0	1	0.003836	0.0056884	-0.001852	0.674358	0.0124303	0.0105779	0.0018524
PORTA	1	18	6/28/99		D	0.0161351	0.0170612	-0.000926	0.9457141	0.0074095	0.010188	-0.002779	0.7272728	0.0087256	0.0068732	0.0018524
PORTA	1	18	6/9/99		D	0.0548182	0.0147721	0.0400462	3.710938	0.042728	0.0056269	0.0371011	7.5935672	0.0120903	0.0091452	0.0029451
PORTA	1	18	7/14/99		D	0.014432	0.0153494	-0.000917	0.9402306	0.0082568	0.0082568	-1E-09	0.9999999	0.0061751	0.0070926	-0.000917
PORTA	1	18	7/19/99		D	0.0109824	0.0147008	-0.003718	0.7470583	0.0018592	0.0074369	-0.005578	0.2500001	0.0091232	0.0072639	0.0018592
PORTA	1	18	7/26/99		D	0.0117285	0.030187	-0.018458	0.3885286	0.0027688	0.0221502	-0.019381	0.125	0.0089597	0.0080368	0.0009229
PORTA	1	18	7/6/99		D	0.013104	0.0140352	-0.000931	0.933652	0.0037248	0.0055873	-0.001862	0.6666667	0.0093792	0.008448	0.0009312
PORTA	1	18	8/16/99		D	0.02	0.021	-0.001	0.952381	0.006	0.011	-0.005	0.5454545	0.014	0.01	0.004
PORTA	1	18	8/2/99		D	0.022	0.022	0	1	0.011	0.012	-0.001	0.9166667	0.011	0.01	0.001
PORTA	1	18	8/25/99		D	0.017	0.023	-0.006	0.7391304	-0.013	0.013	-0.026	-1	0.03	0.01	0.02
PORTA	1	18	8/30/99		D	0.018	0.028	-0.01	0.6428571	0.006	0.019	-0.013	0.3157895	0.012	0.009	0.003
PORTA	1	18	8/9/99		D	0.02	0.022	-0.002	0.9090909	0.005	0.01	-0.005	0.5	0.015	0.012	0.003
PORTA	1	18	9/28/99		D											
PORTA	1	18	9/29/99		D	0.015	0.016	-0.001	0.9375	0.002	0.007	-0.005	0.2857143	0.013	0.009	0.004
PORTA	1	18	9/7/99		D	0.019	0.025	-0.006	0.76	0.003	0.015	-0.012	0.2	0.016	0.01	0.006

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	2	4	10/11/99		D	0.02	0.017	0.003	1.1764706	0.007	0.009	-0.002	0.7777778	0.013	0.008	0.005
PORTA	2	4	10/19/99		D	0.016	0.012	0.004	1.3333333	0.002	0.004	-0.002	0.5	0.014	0.008	0.006
PORTA	2	4	10/26/99		D	0.027	0.013	0.014	2.0769231	0.017	0.006	0.011	2.8333333	0.01	0.007	0.003
PORTA	2	4	10/4/99		D	0.017	0.023	-0.006	0.7391304	0.005	0.007	-0.002	0.7142857	0.012	0.016	-0.004
PORTA	2	4	6/23/99		D	0.0733544	0.0189848	0.0543696	3.863853	0.0634313	0.0081554	0.0552758	7.7777778	0.0099232	0.0108293	-0.000906
PORTA	2	4	6/28/99		D	0.0161351	0.0179874	-0.001852	0.8970186	0.0074095	0.010188	-0.002779	0.7272727	0.0087256	0.0077994	0.0009262
PORTA	2	4	6/9/99		D	0.0548182	0.0122383	0.0425799	4.4792232	0.042728	0.0037183	0.0390096	11.49115	0.0120903	0.00852	0.0035703
PORTA	2	4	7/14/99		D	0.014432	0.0171842	-0.002752	0.8398375	0.0082568	0.0110091	-0.002752	0.75	0.0061751	0.0061751	0
PORTA	2	4	7/21/99		D	0.0154202	0.0089597	0.0064605	1.7210557	0.0055375	0.0027688	0.0027688	2.0000004	0.0098827	0.006191	0.0036917
PORTA	2	4	7/26/99		D	0.0117285	0.0126514	-0.000923	0.9270498	0.0027688	0.0055375	-0.002769	0.5	0.0089597	0.0071139	0.0018458
PORTA	2	4	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.0037248	0	1	0.0093792	0.008448	0.0009312
PORTA	2	4	8/16/99		D	0.02	0.016	0.004	1.25	0.006	0.005	0.001	1.2	0.014	0.011	0.003
PORTA	2	4	8/2/99		D	0.022	0.018	0.004	1.2222222	0.011	0.009	0.002	1.2222222	0.011	0.009	0.002
PORTA	2	4	8/24/99		D	0.022	0.015	0.007	1.4666667	0.008	0.005	0.003	1.6	0.014	0.01	0.004
PORTA	2	4	8/30/99		D	0.018	0.013	0.005	1.3846154	0.006	0.004	0.002	1.5	0.012	0.009	0.003
PORTA	2	4	8/9/99		D	0.02	0.021	-0.001	0.952381	0.005	0.007	-0.002	0.7142857	0.015	0.014	0.001
PORTA	2	4	9/27/99		D	0.019				0.004				0.015	0.01	0.005
PORTA	2	4	9/7/99		D	0.019	0.016	0.003	1.1875	0.003	0.005	-0.002	0.6	0.016	0.011	0.005
PORTA	2	7	10/11/99		D	0.02	0.014	0.006	1.4285714	0.007	0.006	0.001	1.1666667	0.013	0.008	0.005
PORTA	2	7	10/19/99		D	0.021	0.012	0.009	1.75	0.004	0.004	0	1	0.017	0.008	0.009
PORTA	2	7	10/26/99		D	0.027	0.011	0.016	2.4545455	0.017	0.001	0.016	17	0.01	0.01	0
PORTA	2	7	10/4/99		D	0.017	0.016	0.001	1.0625	0.005	0.006	-0.001	0.8333333	0.012	0.01	0.002
PORTA	2	7	6/23/99		D	0.014454	0.0307649	-0.016311	0.469821	0.0027185	0.0208417	-0.018123	0.1304348	0.0117355	0.0099232	0.0018123
PORTA	2	7	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0092619	-0.001852	0.8	0.0087256	0.0068732	0.0018524
PORTA	2	7	6/9/99		D	0.0548182	0.0124029	0.0424154	4.4198048	0.042728	0.0037841	0.0389438	11.291305	0.0120903	0.0086187	0.0034715
PORTA	2	7	7/14/99		D	0.014432	0.0116797	0.0027523	1.2356458	0.0082568	0.0055045	0.0027523	1.5000001	0.0061751	0.0061751	0
PORTA	2	7	7/21/99		D	0.0126514	0.0117285	0.0009229	1.0786907	0.0046146	0.0055375	-0.000923	0.8333334	0.0080368	0.006191	0.0018458
PORTA	2	7	7/26/99		D	0.0117285	0.0108056	0.0009229	1.0854117	0.0027688	0.0046146	-0.001846	0.6	0.0089597	0.006191	0.0027688
PORTA	2	7	7/6/99		D	0.013104	0.0103104	0.0027936	1.2709529	0.0037248	0.0009312	0.0027936	4.0000032	0.0093792	0.0093792	0
PORTA	2	7	8/16/99		D	0.02	0.013	0.007	1.5384615	0.006	0.006	0	1	0.014	0.007	0.007
PORTA	2	7	8/2/99		D	0.022	0.014	0.008	1.5714286	0.011	0.002	0.009	5.5	0.011	0.012	-0.001
PORTA	2	7	8/24/99		D	0.015	0.013	0.002	1.1538462	0.002	0.004	-0.002	0.5	0.013	0.009	0.004
PORTA	2	7	8/30/99		D	0.018	0.013	0.005	1.3846154	0.006	0.006	0	1	0.012	0.007	0.005
PORTA	2	7	8/9/99		D	0.02	0.014	0.006	1.4285714	0.005	0.001	0.004	5	0.015	0.013	0.002
PORTA	2	7	9/27/99		D	0.019				0.006				0.013	0.009	0.004
PORTA	2	7	9/7/99		D	0.019	0.018	0.001	1.0555556	0.003	0.008	-0.005	0.375	0.016	0.01	0.006
PORTA	2	8	10/11/99		D	0.02	0.013	0.007	1.5384615	0.007	0.006	0.001	1.1666667	0.013	0.007	0.006
PORTA	2	8	10/19/99		D	0.017	0.015	0.002	1.1333333	0.003	0.007	-0.004	0.4285714	0.014	0.008	0.006
PORTA	2	8	10/26/99		D	0.027	0.011	0.016	2.4545455	0.017	0.005	0.012	3.4	0.01	0.006	0.004
PORTA	2	8	10/4/99		D	0.017	0.012	0.005	1.4166667	0.005	0.005	0	1	0.012	0.007	0.005
PORTA	2	8	6/23/99		D	0.0153601	0.0452635	-0.029903	0.3393499	0.0036246	0.0135924	-0.009968	0.2666667	0.0117355	0.031671	-0.019936
PORTA	2	8	6/28/99		D	0.0161351	0.0189136	-0.002779	0.8530922	0.0074095	0.0120404	-0.004631	0.6153846	0.0087256	0.0068732	0.0018524
PORTA	2	8	6/9/99		D	0.0548182	0.0160554	0.0387628	3.4143198	0.042728	0.0074038	0.0353242	5.7711114	0.0120903	0.0086516	0.0034386
PORTA	2	8	7/14/99		D	0.014432	0.0153494	-0.000917	0.9402306	0.0082568	0.0082568	-1E-09	0.9999999	0.0061751	0.0070926	-0.000917
PORTA	2	8	7/21/99		D	0.0126514	0.0154202	-0.002769	0.8204452	0.0046146	0.0073834	-0.002769	0.6250001	0.0080368	0.0080368	0
PORTA	2	8	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0064605	-0.003692	0.4285715	0.0089597	0.0071139	0.0018458
PORTA	2	8	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.0055873	-0.001862	0.6666666	0.0093792	0.0065855	0.0027936
PORTA	2	8	8/16/99		D	0.02	0.014	0.006	1.4285714	0.006	0.005	0.001	1.2	0.014	0.009	0.005
PORTA	2	8	8/2/99		D	0.022	0.018	0.004	1.2222222	0.011	0.007	0.004	1.5714286	0.011	0.011	0
PORTA	2	8	8/24/99		D	0.016	0.012	0.004	1.3333333	0.003	0.003	0	1	0.013	0.009	0.004
PORTA	2	8	8/30/99		D	0.018	0.018	0	1	0.006	0.01	-0.004	0.6	0.012	0.008	0.004
PORTA	2	8	8/9/99		D	0.02	0.025	-0.005	0.8	0.005	0.012	-0.007	0.4166667	0.015	0.013	0.002
PORTA	2	8	9/27/99		D	0.019	0.011	0.008	1.7272727	0.006	0.002	0.004	3	0.013	0.009	0.004
PORTA	2	8	9/7/99		D	0.019	0.014	0.005	1.3571429	0.003	0.006	-0.003	0.5	0.016	0.008	0.008
PORTA	3	12	10/11/99		D	0.02	0.014	0.006	1.4285714	0.007	0.005	0.002	1.4	0.013	0.009	0.004
PORTA	3	12	10/20/99		D	0.016	0.014	0.002	1.1428571	0.002	0.004	-0.002	0.5	0.014	0.01	0.004
PORTA	3	12	10/26/99		D	0.027	0.015	0.012	1.8	0.017	0.009	0.008	1.8888889	0.01	0.006	0.004

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	3	12	10/4/99		D	0.017	0.021	-0.004	0.8095238	0.005	0.011	-0.006	0.4545455	0.012	0.01	0.002
PORTA	3	12	6/1/99		D	0.0210052	0.0254666	-0.004461	0.8248164	0.0072131	0.0154186	-0.008205	0.4678181	0.0137921	0.010048	0.0037442
PORTA	3	12	6/23/99		D	0.0162663				0.0019836				0.0142827		
PORTA	3	12	6/28/99		D	0.0161351	0.0133565	0.0027786	1.2080304	0.0074095	0.0046309	0.0027786	1.6000002	0.0087256	0.0087256	0
PORTA	3	12	6/9/99		D	0.0548182	0.0127648	0.0420534	4.2944759	0.042728	0.0039816	0.0387464	10.731405	0.0120903	0.0087832	0.003307
PORTA	3	12	7/14/99		D	0.014432	0.014432	0	1	0.0082568	0.0082568	0	1	0.0061751	0.0061751	0
PORTA	3	12	7/19/99		D	0.011912	0.0137712	-0.001859	0.8649918	0.0018592	0.0055777	-0.003718	0.3333332	0.0100528	0.0081935	0.0018592
PORTA	3	12	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0064605	-0.003692	0.4285715	0.0089597	0.0071139	0.0018458
PORTA	3	12	7/6/99		D	0.013104	0.013104	0	1	0.0037248	0.0065185	-0.002794	0.5714285	0.0093792	0.0065855	0.0027936
PORTA	3	12	8/16/99		D	0.02	0.022	-0.002	0.9090909	0.006	0.015	-0.009	0.4	0.014	0.007	0.007
PORTA	3	12	8/25/99		D	0.017	0.015	0.002	1.1333333	0.003	0.006	-0.003	0.5	0.014	0.009	0.005
PORTA	3	12	8/3/99		D		0.016				0.005				0.011	
PORTA	3	12	8/30/99		D	0.018	0.017	0.001	1.0588235	0.006	0.009	-0.003	0.6666667	0.012	0.008	0.004
PORTA	3	12	8/9/99		D	0.02	0.041	-0.021	0.4878049	0.005	0.028	-0.023	0.1785714	0.015	0.013	0.002
PORTA	3	12	9/28/99		D											
PORTA	3	12	9/29/99		D	0.015	0.013	0.002	1.1538462	0.002	-0.001	0.003	-2	0.013	0.014	-0.001
PORTA	3	12	9/7/99		D	0.019	0.018	0.001	1.0555556	0.003	0.007	-0.004	0.4285714	0.016	0.011	0.005
PORTA	3	14	10/11/99		D	0.02	0.013	0.007	1.5384615	0.007	0.001	0.006	7	0.013	0.012	0.001
PORTA	3	14	10/20/99		D	0.016	0.012	0.004	1.3333333	0.001	0.002	-0.001	0.5	0.015	0.01	0.005
PORTA	3	14	10/26/99		D	0.027	0.012	0.015	2.25	0.017	0.005	0.012	3.4	0.01	0.007	0.003
PORTA	3	14	10/4/99		D	0.017	0.014	0.003	1.2142857	0.005	0.005	0	1	0.012	0.009	0.003
PORTA	3	14	6/1/99		D	0.0210052	0.0147594	0.0062459	1.4231787	0.0072131	0.0047114	0.0025017	1.5309859	0.0137921	0.010048	0.0037442
PORTA	3	14	6/23/99		D	0.0226094				0.0092529				0.0133565		
PORTA	3	14	6/28/99		D	0.0161351	0.0142827	0.0018524	1.1296935	0.0074095	0.0046309	0.0027786	1.5999998	0.0087256	0.0096518	-0.000926
PORTA	3	14	6/9/99		D	0.0548182	0.009211	0.0456072	5.9513777	0.042728	0.0001974	0.0425305	216.41757	0.0120903	0.0090136	0.0030767
PORTA	3	14	7/14/99		D	0.014432	0.0107623	0.0036697	1.3409776	0.0082568	0.0036697	0.0045871	2.2499995	0.0061751	0.0070926	-0.000917
PORTA	3	14	7/19/99		D	0.011912	0.0100528	0.0018592	1.1849468	0.0018592	0.0009296	0.0009296	1.9999978	0.0100528	0.0091232	0.0009296
PORTA	3	14	7/26/99		D	0.0117285	0.0098827	0.0018458	1.1867764	0.0027688	0.0027688	0	1	0.0089597	0.0071139	0.0018458
PORTA	3	14	7/6/99		D	0.013104	0.013104	0	1	0.0037248	0.0055873	-0.001862	0.6666666	0.0093792	0.0075168	0.0018624
PORTA	3	14	8/16/99		D	0.02	0.016	0.004	1.25	0.006	0.009	-0.003	0.6666667	0.014	0.007	0.007
PORTA	3	14	8/2/99		D	0.022	0.015	0.007	1.4666667	0.011	0.005	0.006	2.2	0.011	0.01	0.001
PORTA	3	14	8/25/99		D	0.018	0.012	0.006	1.5	0.004	-0.001	0.005	-4	0.014	0.013	0.001
PORTA	3	14	8/30/99		D	0.018	0.012	0.006	1.5	0.006	0.003	0.003	2	0.012	0.009	0.003
PORTA	3	14	8/9/99		D	0.02	0.013	0.007	1.5384615	0.005	0.001	0.004	5	0.015	0.012	0.003
PORTA	3	14	9/28/99		D											
PORTA	3	14	9/29/99		D	0.014	0.013	0.001	1.0769231	0.001	0.003	-0.002	0.3333333	0.013	0.01	0.003
PORTA	3	14	9/7/99		D	0.019	0.017	0.002	1.1176471	0.003	0.006	-0.003	0.5	0.016	0.011	0.005
PORTA	3	17	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.007	0	1	0.013	0.008	0.005
PORTA	3	17	10/20/99		D	0.018	0.017	0.001	1.0588235	0.003	0.009	-0.006	0.3333333	0.015	0.008	0.007
PORTA	3	17	10/26/99		D	0.027	0.017	0.01	1.5882353	0.017	0.012	0.005	1.4166667	0.01	0.005	0.005
PORTA	3	17	10/4/99		D	0.017	0.031	-0.014	0.5483871	0.005	0.022	-0.017	0.2272727	0.012	0.009	0.003
PORTA	3	17	6/23/99		D	0.0171725				0.0047422				0.0124303		
PORTA	3	17	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0083357	-0.000926	0.8888888	0.0087256	0.0077994	0.0009262
PORTA	3	17	6/9/99		D	0.0548182	0.0120244	0.0427938	4.5588981	0.042728	0.004722	0.038006	9.0487804	0.0120903	0.0073025	0.0047878
PORTA	3	17	7/14/99		D	0.014432	0.0171842	-0.002752	0.8398375	0.0082568	0.0110091	-0.002752	0.75	0.0061751	0.0061751	0
PORTA	3	17	7/19/99		D	0.011912	0.0165601	-0.004648	0.7193206	0.0027888	0.0092961	-0.006507	0.3	0.0091232	0.0072639	0.0018592
PORTA	3	17	7/26/99		D	0.0117285	0.0191119	-0.007383	0.6136757	0.0027688	0.011998	-0.009229	0.2307693	0.0089597	0.0071139	0.0018458
PORTA	3	17	7/6/99		D	0.013104	0.0168288	-0.003725	0.7786636	0.0037248	0.0093121	-0.005587	0.4	0.0093792	0.0075168	0.0018624
PORTA	3	17	8/16/99		D	0.02	0.02	0	1	0.006	0.01	-0.004	0.6	0.014	0.01	0.004
PORTA	3	17	8/2/99		D	0.022	0.042	-0.02	0.5238095	0.011	0.033	-0.022	0.3333333	0.011	0.009	0.002
PORTA	3	17	8/25/99		D	0.017	0.016	0.001	1.0625	0.003	0.007	-0.004	0.4285714	0.014	0.009	0.005
PORTA	3	17	8/30/99		D	0.018	0.018	0	1	0.006	0.009	-0.003	0.6666667	0.012	0.009	0.003
PORTA	3	17	8/9/99		D	0.02	0.022	-0.002	0.9090909	0.005	0.01	-0.005	0.5	0.015	0.012	0.003
PORTA	3	17	9/28/99		D											
PORTA	3	17	9/29/99		D	0.016	0.028	-0.012	0.5714286	0.003	0.018	-0.015	0.1666667	0.013	0.01	0.003
PORTA	3	17	9/7/99		D	0.019	0.02	-0.001	0.95	0.003	0.009	-0.006	0.3333333	0.016	0.011	0.005
PORTA	4	3	10/11/99		D	0.02	0.014	0.006	1.4285714	0.007	0.005	0.002	1.4	0.013	0.009	0.004

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	4	3	10/18/99		D	0.018	0.01	0.008	1.8	0.005	0.002	0.003	2.5	0.013	0.008	0.005
PORTA	4	3	10/26/99		D	0.027	0.014	0.013	1.9285714	0.017	0.007	0.01	2.4285714	0.01	0.007	0.003
PORTA	4	3	10/4/99		D	0.017	0.02	-0.003	0.85	0.005	0.011	-0.006	0.4545455	0.012	0.009	0.003
PORTA	4	3	6/23/99		D	0.014454				0.0036246				0.0108293		
PORTA	4	3	6/28/99		D	0.0161351	0.0170612	-0.000926	0.9457141	0.0074095	0.0092619	-0.001852	0.8	0.0087256	0.0077994	0.0009262
PORTA	4	3	6/9/99		D	0.0548182	0.0140152	0.040803	3.9113303	0.042728	0.005594	0.037134	7.6382344	0.0120903	0.0084213	0.003669
PORTA	4	3	7/14/99		D	0.014432	0.0153494	-0.000917	0.9402306	0.0082568	0.0091742	-0.000917	0.9	0.0061751	0.0061751	0
PORTA	4	3	7/20/99		D	0.011912	0.0137712	-0.001859	0.8649918	0.0027888	-0.00093	0.0037185	-3.000001	0.0091232	0.0147008	-0.005578
PORTA	4	3	7/26/99		D	0.0117285	0.0108056	0.0009229	1.0854117	0.0027688	0.0046146	-0.001846	0.6	0.0089597	0.006191	0.0027688
PORTA	4	3	7/6/99		D	0.013104	0.0149664	-0.001862	0.8755603	0.0037248	0.0065185	-0.002794	0.5714286	0.0093792	0.008448	0.0009312
PORTA	4	3	8/16/99		D	0.02	0.013	0.007	1.5384615	0.006	0.006	0	1	0.014	0.007	0.007
PORTA	4	3	8/2/99		D	0.022	0.017	0.005	1.2941176	0.011	0.007	0.004	1.5714286	0.011	0.01	0.001
PORTA	4	3	8/24/99		D	0.015	0.012	0.003	1.25	0.002	0.004	-0.002	0.5	0.013	0.008	0.005
PORTA	4	3	8/30/99		D	0.018	0.015	0.003	1.2	0.006	0.006	0	1	0.012	0.009	0.003
PORTA	4	3	8/9/99		D	0.02	0.025	-0.005	0.8	0.005	0.012	-0.007	0.4166667	0.015	0.013	0.002
PORTA	4	3	9/20/99		D	0.018	0.017	0.001	1.0588235	0.004	0.008	-0.004	0.5	0.014	0.009	0.005
PORTA	4	3	9/27/99		D	0.019	0.012	0.007	1.5833333	0.006	0.004	0.002	1.5	0.013	0.008	0.005
PORTA	4	3	9/7/99		D	0.019	0.015	0.004	1.2666667	0.003	0.005	-0.002	0.6	0.016	0.01	0.006
PORTA	4	5	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.007	0	1	0.013	0.008	0.005
PORTA	4	5	10/18/99		D	0.018	0.01	0.008	1.8	0.005	0.003	0.002	1.6666667	0.013	0.007	0.006
PORTA	4	5	10/26/99		D	0.027	0.01	0.017	2.7	0.017	0.003	0.014	5.6666667	0.01	0.007	0.003
PORTA	4	5	10/4/99		D	0.017	0.013	0.004	1.3076923	0.005	0.004	0.001	1.25	0.012	0.009	0.003
PORTA	4	5	6/23/99		D	0.0171725				0.005437				0.0117355		
PORTA	4	5	6/28/99		D	0.0161351	0.0244707	-0.008336	0.6593615	0.0074095	0.0166713	-0.009262	0.4444444	0.0087256	0.0077994	0.0009262
PORTA	4	5	6/9/99		D	0.0548182	0.0222252	0.032593	2.4664904	0.042728	0.0136723	0.0290557	3.1251505	0.0120903	0.0085529	0.0035374
PORTA	4	5	7/14/99		D	0.014432	0.0135145	0.0009174	1.0678841	0.0082568	0.0073394	0.0009174	1.1249999	0.0061751	0.0061751	0
PORTA	4	5	7/20/99		D	0.0165601	0.0128416	0.0037185	1.289563	0.0065073	0.0046481	0.0018592	1.3999999	0.0100528	0.0081935	0.0018592
PORTA	4	5	7/26/99		D	0.0117285	0.0117285	0	1	0.0027688	0.0055375	-0.002769	0.5000001	0.0089597	0.006191	0.0027688
PORTA	4	5	7/6/99		D	0.013104	0.0140352	-0.000931	0.933652	0.0037248	0.0074497	-0.003725	0.5	0.0093792	0.0065855	0.0027936
PORTA	4	5	8/16/99		D	0.02	0.013	0.007	1.5384615	0.006	0.005	0.001	1.2	0.014	0.008	0.006
PORTA	4	5	8/2/99		D	0.022	0.014	0.008	1.5714286	0.011	0.005	0.006	2.2	0.011	0.009	0.002
PORTA	4	5	8/24/99		D	0.016	0.014	0.002	1.1428571	0.002	0.004	-0.002	0.5	0.014	0.01	0.004
PORTA	4	5	8/30/99		D	0.018	0.012	0.006	1.5	0.006	0.004	0.002	1.5	0.012	0.008	0.004
PORTA	4	5	8/9/99		D	0.02	0.012	0.008	1.6666667	0.005	-0.001	0.006	-5	0.015	0.013	0.002
PORTA	4	5	9/20/99		D	0.017	0.022	-0.005	0.7727273	0.002	0.01	-0.008	0.2	0.015	0.012	0.003
PORTA	4	5	9/27/99		D	0.019	0.01	0.009	1.9	0.006	0.001	0.005	6	0.013	0.009	0.004
PORTA	4	5	9/7/99		D	0.019	0.019	0	1	0.003	0.009	-0.006	0.3333333	0.016	0.01	0.006
PORTA	4	10	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.007	0	1	0.013	0.008	0.005
PORTA	4	10	10/18/99		D	0.02	0.014	0.006	1.4285714	0.007	0.007	0	1	0.013	0.007	0.006
PORTA	4	10	10/26/99		D	0.027	0.017	0.01	1.5882353	0.017	0.012	0.005	1.4166667	0.01	0.005	0.005
PORTA	4	10	10/4/99		D	0.017				0.005				0.012	0.009	0.003
PORTA	4	10	6/1/99		D	0.0210052	0.0263588	-0.005354	0.7968957	0.0072131	0.0144388	-0.007226	0.4995644	0.0137921	0.0119201	0.0018721
PORTA	4	10	6/23/99		D	0.0162663				0.0029098				0.0133565		
PORTA	4	10	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0074095	0	1	0.0087256	0.0087256	0
PORTA	4	10	6/9/99		D	0.0548182	0.0152163	0.0396019	3.6026005	0.042728	0.0083087	0.0344193	5.1425745	0.0120903	0.0069076	0.0051826
PORTA	4	10	7/14/99		D	0.014432	0.0181016	-0.00367	0.7972731	0.0082568	0.0119265	-0.00367	0.6923077	0.0061751	0.0061751	0
PORTA	4	10	7/20/99		D	0.0109824	0.0193489	-0.008367	0.5675971	0.0020226	0.0113121	-0.009289	0.1788039	0.0089597	0.0080368	0.0009229
PORTA	4	10	7/26/99		D	0.0117285	0.0172661	-0.005538	0.6792814	0.0027688	0.0110751	-0.008306	0.25	0.0089597	0.006191	0.0027688
PORTA	4	10	7/6/99		D	0.013104	0.0149664	-0.001862	0.8755603	0.0037248	0.0083809	-0.004656	0.4444444	0.0093792	0.0065855	0.0027936
PORTA	4	10	8/16/99		D	0.02	0.024	-0.004	0.8333333	0.006	0.018	-0.012	0.3333333	0.014	0.006	0.008
PORTA	4	10	8/2/99		D	0.022	0.023	-0.001	0.9565217	0.011	0.013	-0.002	0.8461538	0.011	0.01	0.001
PORTA	4	10	8/24/99		D	0.016	0.022	-0.006	0.7272727	0.002	0.014	-0.012	0.1428571	0.014	0.008	0.006
PORTA	4	10	8/30/99		D	0.018	0.019	-0.001	0.9473684	0.006	0.012	-0.006	0.5	0.012	0.007	0.005
PORTA	4	10	8/9/99		D	0.02	0.025	-0.005	0.8	0.005	0.013	-0.008	0.3846154	0.015	0.012	0.003
PORTA	4	10	9/20/99		D	0.017	0.015	0.002	1.1333333	0.004	0.007	-0.003	0.5714286	0.013	0.008	0.005
PORTA	4	10	9/27/99		D	0.019	0.017	0.002	1.1176471	0.006	0.01	-0.004	0.6	0.013	0.007	0.006
PORTA	4	10	9/7/99		D	0.019	0.034	-0.015	0.5588235	0.003	0.024	-0.021	0.125	0.016	0.01	0.006

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	5	2	10/11/99		D	0.02	0.017	0.003	1.1764706	0.007	0.009	-0.002	0.7777778	0.013	0.008	0.005
PORTA	5	2	10/19/99		D	0.017	0.013	0.004	1.3076923	0.003	0.003	0	1	0.014	0.01	0.004
PORTA	5	2	10/26/99		D	0.027	0.012	0.015	2.25	0.017	0.003	0.014	5.6666667	0.01	0.009	0.001
PORTA	5	2	10/4/99		D	0.017	0.024	-0.007	0.7083333	0.005	0.015	-0.01	0.3333333	0.012	0.009	0.003
PORTA	5	2	6/23/99		D	0.0153601				0.0027185				0.0126417		
PORTA	5	2	6/28/99		D	0.0161351	0.0142827	0.0018524	1.1296935	0.0074095	0.0074095	0	1	0.0087256	0.0068732	0.0018524
PORTA	5	2	6/9/99		D	0.0548182	0.0112676	0.0435506	4.8651125	0.042728	0.0028792	0.0398487	14.839996	0.0120903	0.0083884	0.0037019
PORTA	5	2	7/14/99		D	0.014432	0.0107623	0.0036697	1.3409776	0.0082568	0.0045871	0.0036697	1.7999999	0.0061751	0.0061751	0
PORTA	5	2	7/21/99		D	0.0117285	0.0172661	-0.005538	0.6792814	0.0036917	0.0101522	-0.00646	0.3636363	0.0080368	0.0071139	0.0009229
PORTA	5	2	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0073834	-0.004615	0.3750001	0.0089597	0.006191	0.0027688
PORTA	5	2	7/6/99		D	0.013104	0.0140352	-0.000931	0.933652	0.0037248	0.0055873	-0.001862	0.6666667	0.0093792	0.008448	0.0009312
PORTA	5	2	8/16/99		D	0.02	0.015	0.005	1.3333333	0.006	0.006	0	1	0.014	0.009	0.005
PORTA	5	2	8/2/99		D	0.022	0.018	0.004	1.2222222	0.011	0.007	0.004	1.5714286	0.011	0.011	0
PORTA	5	2	8/24/99		D	0.017	0.02	-0.003	0.85	0.003	0.011	-0.008	0.2727273	0.014	0.009	0.005
PORTA	5	2	8/30/99		D	0.018	0.041	-0.023	0.4390244	0.006	0.032	-0.026	0.1875	0.012	0.009	0.003
PORTA	5	2	8/9/99		D	0.02	0.021	-0.001	0.952381	0.005	0.009	-0.004	0.5555556	0.015	0.012	0.003
PORTA	5	2	9/27/99		D	0.019				0.006				0.013	0.008	0.005
PORTA	5	2	9/7/99		D	0.019	0.018	0.001	1.0555556	0.003	0.009	-0.006	0.3333333	0.016	0.009	0.007
PORTA	5	13	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.006	0.001	1.1666667	0.013	0.009	0.004
PORTA	5	13	10/19/99		D	0.021	0.013	0.008	1.6153846	0.007	0.004	0.003	1.75	0.014	0.009	0.005
PORTA	5	13	10/26/99		D	0.027	0.014	0.013	1.9285714	0.017	0.008	0.009	2.125	0.01	0.006	0.004
PORTA	5	13	10/4/99		D	0.017	0.021	-0.004	0.8095238	0.005	0.013	-0.008	0.3846154	0.012	0.008	0.004
PORTA	5	13	6/23/99		D	0.0217033				0.0083468				0.0133565		
PORTA	5	13	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0074095	0	1	0.0087256	0.0087256	0
PORTA	5	13	6/9/99		D	0.0548182	0.0118928	0.0429254	4.609353	0.042728	0.0029121	0.0398158	14.672316	0.0120903	0.0089807	0.0031096
PORTA	5	13	7/14/99		D	0.014432	0.0125971	0.0018348	1.1456561	0.0082568	0.006422	0.0018348	1.2857143	0.0061751	0.0061751	0
PORTA	5	13	7/19/99		D	0.0128416	0.0100528	0.0027888	1.2774201	0.0018592	0.0009296	0.0009296	1.9999978	0.0109824	0.0091232	0.0018592
PORTA	5	13	7/26/99		D	0.0117285	0.0477226	-0.035994	0.2457645	0.0027688	0.0415316	-0.038763	0.0666667	0.0089597	0.006191	0.0027688
PORTA	5	13	7/6/99		D	0.013104	0.0261409	-0.013037	0.5012831	0.0037248	0.0195554	-0.015831	0.1904762	0.0093792	0.0065855	0.0027936
PORTA	5	13	8/16/99		D	0.02	0.014	0.006	1.4285714	0.006	0.007	-0.001	0.8571429	0.014	0.007	0.007
PORTA	5	13	8/2/99		D	0.022	0.028	-0.006	0.7857143	0.011	0.019	-0.008	0.5789474	0.011	0.009	0.002
PORTA	5	13	8/24/99		D	0.015	0.022	-0.007	0.6818182	0.001	0.013	-0.012	0.0769231	0.014	0.009	0.005
PORTA	5	13	8/30/99		D	0.018	0.011	0.007	1.6363636	0.006	0.004	0.002	1.5	0.012	0.007	0.005
PORTA	5	13	8/9/99		D	0.02	0.046	-0.026	0.4347826	0.005	0.033	-0.028	0.1515152	0.015	0.013	0.002
PORTA	5	13	9/27/99		D	0.014	0.013	0.001	1.0769231	0	0.005	-0.005	0	0.014	0.008	0.006
PORTA	5	13	9/7/99		D	0.019	0.015	0.004	1.2666667	0.003	0.005	-0.002	0.6	0.016	0.01	0.006
PORTA	5	16	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.004	0.003	1.75	0.013	0.011	0.002
PORTA	5	16	10/18/99		D											
PORTA	5	16	10/19/99		D	0.016	0.014	0.002	1.1428571	0.002	0.005	-0.003	0.4	0.014	0.009	0.005
PORTA	5	16	10/26/99		D	0.027	0.013	0.014	2.0769231	0.017	0.008	0.009	2.125	0.01	0.005	0.005
PORTA	5	16	10/4/99		D	0.017	0.016	0.001	1.0625	0.005	0.006	-0.001	0.8333333	0.012	0.01	0.002
PORTA	5	16	6/23/99		D	0.0162663				0.003836				0.0124303		
PORTA	5	16	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0083357	-0.000926	0.8888888	0.0087256	0.0077994	0.0009262
PORTA	5	16	6/9/99		D	0.0548182	0.0147063	0.040112	3.7275446	0.042728	0.0011023	0.0416256	38.761189	0.0120903	0.0136039	-0.001514
PORTA	5	16	7/14/99		D	0.014432	0.0153494	-0.000917	0.9402306	0.0082568	0.0091742	-0.000917	0.9	0.0061751	0.0061751	0
PORTA	5	16	7/21/99		D	0.0135744	0.0108056	0.0027688	1.2562352	0.0055375	0.0046146	0.0009229	1.1999999	0.0080368	0.006191	0.0018458
PORTA	5	16	7/26/99		D	0.0117285	0.0117285	0	1	0.0027688	0.0036917	-0.000923	0.7500001	0.0089597	0.0080368	0.0009229
PORTA	5	16	7/6/99		D	0.013104	0.013104	0	1	0.0037248	0.0037248	0	1	0.0093792	0.0093792	0
PORTA	5	16	8/16/99		D	0.02	0.013	0.007	1.5384615	0.006	0.004	0.002	1.5	0.014	0.009	0.005
PORTA	5	16	8/2/99		D	0.022	0.02	0.002	1.1	0.011	0.011	0	1	0.011	0.009	0.002
PORTA	5	16	8/24/99		D	0.018	0.013	0.005	1.3846154	0.005	0.004	0.001	1.25	0.013	0.009	0.004
PORTA	5	16	8/30/99		D	0.018	0.01	0.008	1.8	0.006	0.003	0.003	2	0.012	0.007	0.005
PORTA	5	16	8/9/99		D	0.02	0.013	0.007	1.5384615	0.005	0.001	0.004	5	0.015	0.012	0.003
PORTA	5	16	9/27/99		D	0.015	0.014	0.001	1.0714286	0.002	0.005	-0.003	0.4	0.013	0.009	0.004
PORTA	5	16	9/7/99		D	0.019	0.014	0.005	1.3571429	0.003	0.004	-0.001	0.75	0.016	0.01	0.006
PORTA	6	1	10/11/99		D	0.02	0.029	-0.009	0.6896552	0.007	0.021	-0.014	0.3333333	0.013	0.008	0.005
PORTA	6	1	10/18/99		D	0.019	0.015	0.004	1.2666667	0.006	0.008	-0.002	0.75	0.013	0.007	0.006

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	6	1	10/26/99		D	0.027	0.013	0.014	2.0769231	0.017	0.007	0.01	2.4285714	0.01	0.006	0.004
PORTA	6	1	10/4/99		D	0.017	0.0176667	-0.000667	0.9622641	0.005	0.0096667	-0.004667	0.5172414	0.012	0.008	0.004
PORTA	6	1	6/23/99		D	0.014454				0.0027185				0.0117355		
PORTA	6	1	6/28/99		D	0.0161351	0.0179874	-0.001852	0.8970186	0.0074095	0.0111142	-0.003705	0.6666667	0.0087256	0.0068732	0.0018524
PORTA	6	1	6/9/99		D	0.0548182	0.0139494	0.0408688	3.9297836	0.042728	0.0028792	0.0398487	14.840001	0.0120903	0.0110702	0.0010201
PORTA	6	1	7/14/99		D	0.014432	0.0135145	0.0009174	1.0678841	0.0082568	0.0082568	-1E-09	0.9999999	0.0061751	0.0052577	0.0009174
PORTA	6	1	7/20/99		D	0.0147008	0.0147008	0	1	0.0055777	0.0074369	-0.001859	0.7500001	0.0091232	0.0072639	0.0018592
PORTA	6	1	7/26/99		D	0.0117285	0.0154202	-0.003692	0.7605936	0.0027688	0.0101522	-0.007383	0.2727273	0.0089597	0.005268	0.0036917
PORTA	6	1	7/6/99		D	0.013104	0.0149664	-0.001862	0.8755603	0.0037248	0.0055873	-0.001862	0.6666667	0.0093792	0.0093792	0
PORTA	6	1	8/16/99		D	0.02	0.015	0.005	1.3333333	0.006	0.007	-0.001	0.8571429	0.014	0.008	0.006
PORTA	6	1	8/2/99		D	0.022	0.018	0.004	1.2222222	0.011	0.008	0.003	1.375	0.011	0.01	0.001
PORTA	6	1	8/24/99		D	0.016	0.014	0.002	1.1428571	0.003	0.003	0	1	0.013	0.011	0.002
PORTA	6	1	8/30/99		D	0.018	0.016	0.002	1.125	0.006	0.008	-0.002	0.75	0.012	0.008	0.004
PORTA	6	1	8/9/99		D	0.02	0.016	0.004	1.25	0.005	0.005	0	1	0.015	0.011	0.004
PORTA	6	1	9/20/99		D	0.018	0.017	0.001	1.0588235	0.004	0.007	-0.003	0.5714286	0.014	0.01	0.004
PORTA	6	1	9/27/99		D	0.019	0.013	0.006	1.4615385	0.006	0.003	0.003	2	0.013	0.01	0.003
PORTA	6	1	9/7/99		D	0.019	0.016	0.003	1.1875	0.003	0.006	-0.003	0.5	0.016	0.01	0.006
PORTA	6	6	10/11/99		D	0.02	0.018	0.002	1.1111111	0.007	0.01	-0.003	0.7	0.013	0.008	0.005
PORTA	6	6	10/18/99		D	0.027	0.014	0.013	1.9285714	0.014	0.005	0.009	2.8	0.013	0.009	0.004
PORTA	6	6	10/26/99		D	0.027	0.019	0.008	1.4210526	0.017	0.014	0.003	1.2142857	0.01	0.005	0.005
PORTA	6	6	10/4/99		D	0.017	0.018	-0.001	0.9444444	0.005	0.009	-0.004	0.5555556	0.012	0.009	0.003
PORTA	6	6	6/23/99		D	0.0162663				0.005437				0.0108293		
PORTA	6	6	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0092619	-0.001852	0.8	0.0087256	0.0068732	0.0018524
PORTA	6	6	6/9/99		D	0.0548182	0.0132091	0.0416092	4.1500508	0.042728	0.0046232	0.0381047	9.241993	0.0120903	0.0085858	0.0035045
PORTA	6	6	7/14/99		D	0.014432	0.0116797	0.0027523	1.2356458	0.0082568	0.0055045	0.0027523	1.5000001	0.0061751	0.0061751	0
PORTA	6	6	7/20/99		D	0.0128416	0.0128416	0	1	0.0037185	0.0055777	-0.001859	0.6666667	0.0091232	0.0072639	0.0018592
PORTA	6	6	7/26/99		D	0.0117285	0.0117285	0	1	0.0027688	0.0073834	-0.004615	0.3750001	0.0089597	0.0043451	0.0046146
PORTA	6	6	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.0055873	-0.001862	0.6666666	0.0093792	0.0065855	0.0027936
PORTA	6	6	8/16/99		D	0.02	0.019	0.001	1.0526316	0.006	0.01	-0.004	0.6	0.014	0.009	0.005
PORTA	6	6	8/2/99		D	0.022	0.016	0.006	1.375	0.011	0.007	0.004	1.5714286	0.011	0.009	0.002
PORTA	6	6	8/24/99		D	0.017	0.015	0.002	1.1333333	0.004	0.006	-0.002	0.6666667	0.013	0.009	0.004
PORTA	6	6	8/30/99		D	0.018	0.015	0.003	1.2	0.006	0.007	-0.001	0.8571429	0.012	0.008	0.004
PORTA	6	6	8/9/99		D	0.02	0.02	0	1	0.005	0.007	-0.002	0.7142857	0.015	0.013	0.002
PORTA	6	6	9/20/99		D	0.017	0.016	0.001	1.0625	0.003	0.006	-0.003	0.5	0.014	0.01	0.004
PORTA	6	6	9/27/99		D	0.019	0.019	0	1	0.006	0.01	-0.004	0.6	0.013	0.009	0.004
PORTA	6	6	9/7/99		D	0.019	0.018	0.001	1.0555556	0.003	0.008	-0.005	0.375	0.016	0.01	0.006
PORTA	6	15	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.007	0	1	0.013	0.008	0.005
PORTA	6	15	10/18/99		D	0.017	0.009	0.008	1.8888889	0.004	0.001	0.003	4	0.013	0.008	0.005
PORTA	6	15	10/26/99		D	0.027	0.009	0.018	3	0.017	0.005	0.012	3.4	0.01	0.004	0.006
PORTA	6	15	10/4/99		D	0.017	0.016	0.001	1.0625	0.005	0.004	0.001	1.25	0.012	0.012	0
PORTA	6	15	6/23/99		D	0.0162663				0.0019836				0.0142827		
PORTA	6	15	6/28/99		D	0.0161351	0.0142827	0.0018524	1.1296935	0.0074095	0.0074095	0	1	0.0087256	0.0068732	0.0018524
PORTA	6	15	6/9/99		D	0.0548182	0.0128635	0.0419547	4.2615194	0.042728	0.0038171	0.0389109	11.193965	0.0120903	0.0090465	0.0030438
PORTA	6	15	7/14/99		D	0.014432	0.0116797	0.0027523	1.2356458	0.0082568	0.0055045	0.0027523	1.5000001	0.0061751	0.0061751	0
PORTA	6	15	7/20/99		D	0.0128416	0.0128416	0	1	0.002959	0.0057277	-0.002769	0.5166014	0.0098827	0.0071139	0.0027688
PORTA	6	15	7/26/99		D	0.0117285	0.018189	-0.00646	0.6448141	0.0027688	0.011998	-0.009229	0.2307693	0.0089597	0.006191	0.0027688
PORTA	6	15	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.0037248	0	1	0.0093792	0.008448	0.0009312
PORTA	6	15	8/16/99		D	0.02	0.013	0.007	1.5384615	0.006	0.005	0.001	1.2	0.014	0.008	0.006
PORTA	6	15	8/2/99		D	0.022	0.015	0.007	1.4666667	0.011	0.006	0.005	1.8333333	0.011	0.009	0.002
PORTA	6	15	8/24/99		D	0.016	0.014	0.002	1.1428571	0.003	0.004	-0.001	0.75	0.013	0.01	0.003
PORTA	6	15	8/30/99		D	0.018	0.013	0.005	1.3846154	0.006	0.006	0	1	0.012	0.007	0.005
PORTA	6	15	8/9/99		D	0.02	0.025	-0.005	0.8	0.005	0.011	-0.006	0.4545455	0.015	0.014	0.001
PORTA	6	15	9/20/99		D	0.016	0.014	0.002	1.1428571	0.003	0.005	-0.002	0.6	0.013	0.009	0.004
PORTA	6	15	9/27/99		D	0.019	0.012	0.007	1.5833333	0.006	0.003	0.003	2	0.013	0.009	0.004
PORTA	6	15	9/7/99		D	0.019	0.019	0	1	0.003	0.011	-0.008	0.2727273	0.016	0.008	0.008
PORTA	7	19	10/11/99		D	0.02	0.013	0.007	1.5384615	0.007	0.003	0.004	2.3333333	0.013	0.01	0.003
PORTA	7	19	10/18/99		D	0.016	0.01	0.006	1.6	0.003	0.003	0	1	0.013	0.007	0.006

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	7	19	10/26/99		D	0.027	0.01	0.017	2.7	0.017	0.004	0.013	4.25	0.01	0.006	0.004
PORTA	7	19	10/4/99		D	0.017	0.017	0	1	0.005	0.009	-0.004	0.5555556	0.012	0.008	0.004
PORTA	7	19	6/23/99		D	0.0171725				0.0065945				0.0105779		
PORTA	7	19	6/28/99		D	0.0161351	0.0179874	-0.001852	0.8970186	0.0074095	0.010188	-0.002779	0.7272727	0.0087256	0.0077994	0.0009262
PORTA	7	19	6/9/99		D	0.0548182	0.0365227	0.0182955	1.500936	0.042728	0.0282495	0.0144785	1.5125218	0.0120903	0.0082732	0.0038171
PORTA	7	19	7/14/99		D	0.014432	0.0116797	0.0027523	1.2356458	0.0082568	0.0055045	0.0027523	1.5000001	0.0061751	0.0061751	0
PORTA	7	19	7/20/99		D	0.0128416	0.0147008	-0.001859	0.8735291	0.002959	0.006664	-0.003705	0.4440183	0.0098827	0.0080368	0.0018458
PORTA	7	19	7/26/99		D	0.0117285	0.0117285	0	1	0.0027688	0.0055375	-0.002769	0.5000001	0.0089597	0.006191	0.0027688
PORTA	7	19	7/6/99		D	0.013104	0.013104	0	1	0.0037248	0.0074497	-0.003725	0.5	0.0093792	0.0056543	0.0037248
PORTA	7	19	8/16/99		D	0.02	0.016	0.004	1.25	0.006	0.006	0	1	0.014	0.01	0.004
PORTA	7	19	8/2/99		D	0.022	0.015	0.007	1.4666667	0.011	0.005	0.006	2.2	0.011	0.01	0.001
PORTA	7	19	8/24/99		D	0.044	0.014	0.03	3.1428571	0.03	0.003	0.027	10	0.014	0.011	0.003
PORTA	7	19	8/30/99		D	0.018	0.019	-0.001	0.9473684	0.006	0.01	-0.004	0.6	0.012	0.009	0.003
PORTA	7	19	8/9/99		D	0.02	0.016	0.004	1.25	0.005	0.003	0.002	1.6666667	0.015	0.013	0.002
PORTA	7	19	9/20/99		D	0.017	0.013	0.004	1.3076923	0.003	0.002	0.001	1.5	0.014	0.011	0.003
PORTA	7	19	9/27/99		D	0.019	0.018	0.001	1.0555556	0.006	0.01	-0.004	0.6	0.013	0.008	0.005
PORTA	7	19	9/7/99		D	0.019	0.017	0.002	1.1176471	0.003	0.006	-0.003	0.5	0.016	0.011	0.005
PORTA	8	20	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.003	0.004	2.3333333	0.013	0.012	0.001
PORTA	8	20	10/19/99		D	0.017	0.014	0.003	1.2142857	0.002	0.003	-0.001	0.6666667	0.015	0.011	0.004
PORTA	8	20	10/26/99		D	0.027	0.013	0.014	2.0769231	0.017	0.007	0.01	2.4285714	0.01	0.006	0.004
PORTA	8	20	10/4/99		D	0.017	0.023	-0.006	0.7391304	0.005	0.013	-0.008	0.3846154	0.012	0.01	0.002
PORTA	8	20	6/23/99		D	0.0162663	0.0126417	0.0036246	1.286722	0.003836	0.0029899	0.0008461	1.2829804	0.0124303	0.0096518	0.0027786
PORTA	8	20	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.010188	-0.002779	0.7272727	0.0087256	0.005947	0.0027786
PORTA	8	20	6/9/99		D	0.0548182	0.0293164	0.0255019	1.8698852	0.042728	0.0201053	0.0226226	2.1252045	0.0120903	0.009211	0.0028792
PORTA	8	20	7/14/99		D	0.014432	0.0199365	-0.005505	0.7238964	0.0082568	0.0137613	-0.005505	0.6	0.0061751	0.0061751	0
PORTA	8	20	7/21/99		D	0.0126514	0.0135744	-0.000923	0.9320098	0.0046146	0.0073834	-0.002769	0.6250001	0.0080368	0.006191	0.0018458
PORTA	8	20	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0064605	-0.003692	0.4285715	0.0089597	0.0071139	0.0018458
PORTA	8	20	7/6/99		D	0.013104	0.0140352	-0.000931	0.933652	0.0037248	0.0074497	-0.003725	0.5	0.0093792	0.0065855	0.0027936
PORTA	8	20	8/16/99		D	0.02	0.027	-0.007	0.7407407	0.006	0.018	-0.012	0.3333333	0.014	0.009	0.005
PORTA	8	20	8/2/99		D	0.022	0.024	-0.002	0.9166667	0.011	0.016	-0.005	0.6875	0.011	0.008	0.003
PORTA	8	20	8/24/99		D	0.017	0.016	0.001	1.0625	0.004	0.007	-0.003	0.5714286	0.013	0.009	0.004
PORTA	8	20	8/30/99		D	0.018	0.016	0.002	1.125	0.006	0.009	-0.003	0.6666667	0.012	0.007	0.005
PORTA	8	20	8/9/99		D	0.02	0.026	-0.006	0.7692308	0.005	0.013	-0.008	0.3846154	0.015	0.013	0.002
PORTA	8	20	9/27/99		D	0.014	0.015	-0.001	0.9333333	0.001	0.006	-0.005	0.1666667	0.013	0.009	0.004
PORTA	8	20	9/7/99		D	0.019	0.021	-0.002	0.9047619	0.003	0.012	-0.009	0.25	0.016	0.009	0.007
PORTA	9	21	10/11/99		D	0.02	0.015	0.005	1.3333333	0.007	0.005	0.002	1.4	0.013	0.01	0.003
PORTA	9	21	10/20/99		D	0.016	0.014	0.002	1.1428571	0.001	0.005	-0.004	0.2	0.015	0.009	0.006
PORTA	9	21	10/26/99		D	0.027	0.023	0.004	1.173913	0.017	0.018	-0.001	0.9444444	0.01	0.005	0.005
PORTA	9	21	10/4/99		D	0.017	0.014	0.003	1.2142857	0.005	0.005	0	1	0.012	0.009	0.003
PORTA	9	21	6/23/99		D	0.0171725	0.0117355	0.005437	1.463292	0.0065945	0.0011576	0.005437	5.6969063	0.0105779	0.0105779	0
PORTA	9	21	6/28/99		D	0.0161351	0.015	0.0011351	1.0756702	0.0074095	0.008	-0.000591	0.9261855	0.0087256	0.007	0.0017256
PORTA	9	21	6/9/99		D	0.0548182	0.0103463	0.044472	5.2983618	0.042728	0.0011023	0.0416256	38.761189	0.0120903	0.0092439	0.0028463
PORTA	9	21	7/14/99		D	0.014432	0.0162668	-0.001835	0.887203	0.0082568	0.0100916	-0.001835	0.8181818	0.0061751	0.0061751	0
PORTA	9	21	7/19/99		D	0.0109824	0.0109824	0	1	0.0018592	0.0037185	-0.001859	0.5000001	0.0091232	0.0072639	0.0018592
PORTA	9	21	7/26/99		D	0.0117285	0.0135744	-0.001846	0.8640195	0.0027688	0.0064605	-0.003692	0.4285715	0.0089597	0.0071139	0.0018458
PORTA	9	21	7/6/99		D	0.013104	0.0149664	-0.001862	0.8755603	0.0037248	0.0065185	-0.002794	0.5714286	0.0093792	0.008448	0.0009312
PORTA	9	21	8/16/99		D	0.02	0.015	0.005	1.3333333	0.006	0.006	0	1	0.014	0.009	0.005
PORTA	9	21	8/2/99		D	0.022	0.028	-0.006	0.7857143	0.011	0.009	0.002	1.2222222	0.011	0.019	-0.008
PORTA	9	21	8/25/99		D	0.016	0.011	0.005	1.4545455	0.002	0.002	0	1	0.014	0.009	0.005
PORTA	9	21	8/30/99		D	0.018	0.012	0.006	1.5	0.006	0.005	0.001	1.2	0.012	0.007	0.005
PORTA	9	21	8/9/99		D	0.02	0.018	0.002	1.1111111	0.005	0.005	0	1	0.015	0.013	0.002
PORTA	9	21	9/28/99		D											
PORTA	9	21	9/29/99		D	0.015	0.015	0	1	0.002	0.007	-0.005	0.2857143	0.013	0.008	0.005
PORTA	9	21	9/7/99		D	0.019	0.015	0.004	1.2666667	0.003	0.005	-0.002	0.6	0.016	0.01	0.006
PORTA	10	22	10/11/99		D	0.02	0.013	0.007	1.5384615	0.007	0.003	0.004	2.3333333	0.013	0.01	0.003
PORTA	10	22	10/18/99		D	0.017	0.01	0.007	1.7	0.004	0.003	0.001	1.3333333	0.013	0.007	0.006
PORTA	10	22	10/26/99		D	0.027	0.017	0.01	1.5882353	0.017	0.012	0.005	1.4166667	0.01	0.005	0.005

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
PORTA	10	22	10/4/99		D	0.017	0.014	0.003	1.2142857	0.005	0.005	0	1	0.012	0.009	0.003
PORTA	10	22	6/23/99		D	0.0162663	0.0280464	-0.01178	0.5799785	0.003836	0.0174685	-0.013632	0.2195956	0.0124303	0.0105779	0.0018524
PORTA	10	22	6/28/99		D	0.0161351	0.0161351	0	1	0.0074095	0.0092619	-0.001852	0.8	0.0087256	0.0068732	0.0018524
PORTA	10	22	6/9/99		D	0.0548182	0.0167135	0.0381047	3.2798771	0.042728	0.0074367	0.0352913	5.7455752	0.0120903	0.0092768	0.0028134
PORTA	10	22	7/14/99		D	0.014432	0.0171842	-0.002752	0.8398375	0.0082568	0.0119265	-0.00367	0.6923076	0.0061751	0.0052577	0.0009174
PORTA	10	22	7/20/99		D	0.0137712	0.011912	0.0018592	1.1560803	0.0048115	0.0047981	1.338E-05	1.0027886	0.0089597	0.0071139	0.0018458
PORTA	10	22	7/26/99		D	0.0117285	0.0154202	-0.003692	0.7605936	0.0027688	0.0092292	-0.00646	0.3000001	0.0089597	0.006191	0.0027688
PORTA	10	22	7/6/99		D	0.013104	0.0121728	0.0009312	1.0764992	0.0037248	0.0037248	0	1	0.0093792	0.008448	0.0009312
PORTA	10	22	8/16/99		D	0.02	0.017	0.003	1.1764706	0.006	0.008	-0.002	0.75	0.014	0.009	0.005
PORTA	10	22	8/24/99		D	0.019	0.012	0.007	1.5833333	0.006	0.004	0.002	1.5	0.013	0.008	0.005
PORTA	10	22	8/3/99		D		0.018				0.009				0.009	
PORTA	10	22	8/30/99		D	0.018	0.01	0.008	1.8	0.006	0.002	0.004	3	0.012	0.008	0.004
PORTA	10	22	8/9/99		D	0.02	0.051	-0.031	0.3921569	0.005	0.039	-0.034	0.1282051	0.015	0.012	0.003
PORTA	10	22	9/20/99		D	0.017	0.011	0.006	1.5454545	0.004	0.003	0.001	1.3333333	0.013	0.008	0.005
PORTA	10	22	9/27/99		D	0.019	0.019	0	1	0.006	0.011	-0.005	0.5454545	0.013	0.008	0.005
PORTA	10	22	9/7/99		D	0.019	0.012	0.007	1.5833333	0.003	0.003	0	1	0.016	0.009	0.007
PORTA	11	23	10/11/99		D	0.02	0.014	0.006	1.4285714	0.007	0.006	0.001	1.1666667	0.013	0.008	0.005
PORTA	11	23	10/19/99		D	0.016	0.011	0.005	1.4545455	-0.001	0.001	-0.002	-1	0.017	0.01	0.007
PORTA	11	23	10/26/99		D	0.027	0.02	0.007	1.35	0.017	0.015	0.002	1.1333333	0.01	0.005	0.005
PORTA	11	23	10/4/99		D	0.017	0.014	0.003	1.2142857	0.005	0.008	-0.003	0.625	0.012	0.006	0.006
PORTA	11	23	6/1/99		D	0.0210052	0.0308201	-0.009815	0.6815423	0.0072131	0.0198361	-0.012623	0.363634	0.0137921	0.010984	0.0028081
PORTA	11	23	6/23/99		D	0.0162663	0.0126417	0.0036246	1.286722	0.0047622	0.0020637	0.0026985	2.3075673	0.0115041	0.0105779	0.0009262
PORTA	11	23	6/28/99		D	0.0161351	0.0152089	0.0009262	1.0608978	0.0074095	0.0064833	0.0009262	1.1428572	0.0087256	0.0087256	0
PORTA	11	23	6/9/99		D	0.0548182	0.0122219	0.0425963	4.485253	0.042728	0.0038171	0.0389109	11.193965	0.0120903	0.0084048	0.0036854
PORTA	11	23	7/14/99		D	0.014432	0.0116797	0.0027523	1.2356458	0.0082568	0.0055045	0.0027523	1.5000001	0.0061751	0.0061751	0
PORTA	11	23	7/19/99		D	0.0128416	0.0137712	-0.00093	0.9324959	0.0018592	0.0046481	-0.002789	0.3999998	0.0109824	0.0091232	0.0018592
PORTA	11	23	7/26/99		D	0.0117285	0.0255724	-0.013844	0.4586399	0.0027688	-0.025842	0.0286107	-0.107143	0.0089597	0.0514143	-0.042455
PORTA	11	23	7/6/99		D	0.013104	0.0112416	0.0018624	1.1656721	0.0037248	0.0027936	0.0009312	1.3333335	0.0093792	0.008448	0.0009312
PORTA	11	23	8/16/99		D	0.02	0.018	0.002	1.1111111	0.006	0.008	-0.002	0.75	0.014	0.01	0.004
PORTA	11	23	8/2/99		D	0.022	0.022	0	1	0.011	0.014	-0.003	0.7857143	0.011	0.008	0.003
PORTA	11	23	8/24/99		D	0.016	0.015	0.001	1.0666667	0.003	0.006	-0.003	0.5	0.013	0.009	0.004
PORTA	11	23	8/30/99		D	0.018	0.021	-0.003	0.8571429	0.006	0.014	-0.008	0.4285714	0.012	0.007	0.005
PORTA	11	23	8/9/99		D	0.02	0.022	-0.002	0.9090909	0.005	0.01	-0.005	0.5	0.015	0.012	0.003
PORTA	11	23	9/27/99		D	0.014	0.011	0.003	1.2727273	0.001	0.003	-0.002	0.3333333	0.013	0.008	0.005
PORTA	11	23	9/7/99		D	0.019	0.018	0.001	1.0555556	0.003	0.009	-0.006	0.3333333	0.016	0.009	0.007
PORTA	12	24	10/11/99		D	0.02	0.016	0.004	1.25	0.007	0.007	0	1	0.013	0.009	0.004
PORTA	12	24	10/20/99		D	0.016	0.014	0.002	1.1428571	0	0.003	-0.003	0	0.016	0.011	0.005
PORTA	12	24	10/26/99		D	0.027	0.021	0.006	1.2857143	0.017	0.016	0.001	1.0625	0.01	0.005	0.005
PORTA	12	24	10/4/99		D	0.017	0.017	0	1	0.005	0.008	-0.003	0.625	0.012	0.009	0.003
PORTA	12	24	6/1/99		D	0.0210052	0.0210052	0	1	0.0072131	0.0100212	-0.002808	0.7197821	0.0137921	0.010984	0.0028081
PORTA	12	24	6/23/99		D	0.0153601	0.0180786	-0.002718	0.8496301	0.0047822	0.0075007	-0.002718	0.637569	0.0105779	0.0105779	0
PORTA	12	24	6/28/99		D	0.0161351	0.0170612	-0.000926	0.9457141	0.0074095	0.0092619	-0.001852	0.8	0.0087256	0.0077994	0.0009262
PORTA	12	24	6/9/99		D	0.0548182	0.0167793	0.0380389	3.2670129	0.042728	0.0083416	0.0343864	5.122288	0.0120903	0.0084377	0.0036525
PORTA	12	24	7/14/99		D	0.014432	0.014432	0	1	0.0082568	0.0082568	0	1	0.0061751	0.0061751	0
PORTA	12	24	7/19/99		D	0.0109824	0.0184193	-0.007437	0.5962434	0.0027888	0.0102258	-0.007437	0.2727273	0.0081935	0.0081935	0
PORTA	12	24	7/26/99		D	0.0117285	0.0200348	-0.008306	0.5854061	0.0027688	0.011998	-0.009229	0.2307693	0.0089597	0.0080368	0.0009229
PORTA	12	24	7/6/99		D	0.013104	0.0177601	-0.004656	0.7378362	0.0037248	0.004656	-0.000931	0.8000001	0.0093792	0.013104	-0.003725
PORTA	12	24	8/16/99		D	0.02	0.022	-0.002	0.9090909	0.006	0.012	-0.006	0.5	0.014	0.01	0.004
PORTA	12	24	8/2/99		D	0.022	0.069	-0.047	0.3188406	0.011	0.059	-0.048	0.1864407	0.011	0.01	0.001
PORTA	12	24	8/25/99		D	0.016	0.016	0	1	0.002	0.007	-0.005	0.2857143	0.014	0.009	0.005
PORTA	12	24	8/30/99		D	0.018	0.02	-0.002	0.9	0.006	0.011	-0.005	0.5454545	0.012	0.009	0.003
PORTA	12	24	8/9/99		D	0.02	0.022	-0.002	0.9090909	0.005	0.009	-0.004	0.5555556	0.015	0.013	0.002
PORTA	12	24	9/27/99		D	0.015	0.017	-0.002	0.8823529	0.001	0.007	-0.006	0.1428571	0.014	0.01	0.004
PORTA	12	24	9/7/99		D	0.019	0.021	-0.002	0.9047619	0.003	0.011	-0.008	0.2727273	0.016	0.01	0.006
STC	1	13	10/11/99		D		0.022				0.01				0.012	
STC	1	13	10/18/99		D		0.019				0.012				0.007	
STC	1	13	10/25/99		D	0.017	0.012	0.005	1.4166667	0.007	0.005	0.002	1.4	0.01	0.007	0.003

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TRTMT	CELL	DATE	InOut	PD	TPi	TPo	TPd	TPr	TPPi	TPPo	TPPd	TPPr	TDPi	TDPo	TDPd
STC	1	13	10/4/99		D		0.023				0.014				0.009	
STC	1	13	6/1/99		D		0.0194084				0.0056162				0.0137921	
STC	1	13	6/14/99		D	0.0207971	0.0207971	0	1	0.0063431	0.0099678	-0.003625	0.6363636	0.014454	0.0108293	0.0036246
STC	1	13	6/21/99		D		0.0162663				0.0081554				0.0081109	
STC	1	13	6/28/99		D		0.0161351				0.0074095				0.0087256	
STC	1	13	6/9/99		D		0.0187866				0.0055611				0.0132255	
STC	1	13	7/14/99		D	0.0181016	0.0116797	0.006422	1.5498401	0.0055045	0.0036697	0.0018348	1.5	0.0125971	0.00801	0.0045871
STC	1	13	7/19/99		D		0.0137712				0.0037185				0.0100528	
STC	1	13	7/26/99		D		0.0144973				0.0064605				0.0080368	
STC	1	13	7/6/99		D		0.0121728				0.0050802				0.0070926	
STC	1	13	8/16/99		D	0.043	0.021	0.022	2.047619	0.03	0.009	0.021	3.3333333	0.013	0.012	0.001
STC	1	13	8/2/99		D		0.102				0.091				0.011	
STC	1	13	8/25/99		D		0.022				0.012				0.01	
STC	1	13	8/31/99		D	0.0373333	0.018	0.0193333	2.0740741	-0.026	0.009	-0.035	-2.888889	0.0633333	0.009	0.0543333
STC	1	13	8/9/99		D		0.019				0.006				0.013	
STC	1	13	9/29/99		D	0.023	0.023	0	1	0.01	0.011	-0.001	0.9090909	0.013	0.012	0.001
STC	1	13	9/7/99		D		0.019				0.01				0.009	
STC	2	8	10/11/99		D		0.017				0.007				0.01	
STC	2	8	10/18/99		D		0.015				0.009				0.006	
STC	2	8	10/25/99		D	0.019	0.014	0.005	1.3571429	0.008	0.008	0	1	0.011	0.006	0.005
STC	2	8	10/4/99		D		0.016				0.008				0.008	
STC	2	8	6/1/99		D		0.0240886				0.0112325				0.0128561	
STC	2	8	6/14/99		D	0.0217033	0.0207971	0.0009062	1.0435715	0.0081554	0.0099678	-0.001812	0.8181819	0.0135478	0.0108293	0.0027185
STC	2	8	6/21/99		D		0.0180786				0.0099678				0.0081109	
STC	2	8	6/28/99		D		0.0152089				0.0074095				0.0077994	
STC	2	8	6/9/99		D		0.0241831				0.0128003				0.0113828	
STC	2	8	7/14/99		D	0.0181016	0.0125971	0.0055045	1.4369683	0.006422	0.0045871	0.0018348	1.4	0.0116797	0.00801	0.0036697
STC	2	8	7/19/99		D		0.0137712				0.0009296				0.0128416	
STC	2	8	7/26/99		D		0.0144973				0.0064605				0.0080368	
STC	2	8	7/6/99		D		0.0140352				-0.008381				0.0224161	
STC	2	8	8/16/99		D	0.036	0.018	0.018	2	0.021	0.007	0.014	3	0.015	0.011	0.004
STC	2	8	8/2/99		D		0.02				0.009				0.011	
STC	2	8	8/25/99		D		0.017				0.008				0.009	
STC	2	8	8/31/99		D	0.0373333	0.016	0.0213333	2.3333333	-0.026	0.007	-0.033	-3.714286	0.0633333	0.009	0.0543333
STC	2	8	8/9/99		D		0.016				0.003				0.013	
STC	2	8	9/29/99		D	0.022	0.015	0.007	1.4666667	0.008	0.006	0.002	1.3333333	0.014	0.009	0.005
STC	2	8	9/7/99		D		0.015				0.006				0.009	
STC	3	3	10/11/99		D		0.029				0.019				0.01	
STC	3	3	10/18/99		D		0.015				0.008				0.007	
STC	3	3	10/25/99		D	0.019	0.015	0.004	1.2666667	0.008	0.006	0.002	1.3333333	0.011	0.009	0.002
STC	3	3	10/4/99		D		0.017				0.008				0.009	
STC	3	3	6/1/99		D		0.023682				0.0098899				0.0137921	
STC	3	3	6/14/99		D	0.0262341	0.031671	-0.005437	0.8283301	0.0135924	0.0217479	-0.008155	0.625	0.0126417	0.0099232	0.0027185
STC	3	3	6/21/99		D		0.019891				0.0117801				0.0081109	
STC	3	3	6/28/99		D		0.0179874				0.0092619				0.0087256	
STC	3	3	6/9/99		D		0.0295796				0.0182297				0.0113499	
STC	3	3	7/14/99		D	0.0181016	0.0153494	0.0027523	1.1793081	0.0082568	0.0091742	-0.000917	0.9	0.0098448	0.0061751	0.0036697
STC	3	3	7/19/99		D		0.0165601				0.0065073				0.0100528	
STC	3	3	7/26/99		D		0.0172661				0.0101522				0.0071139	
STC	3	3	7/6/99		D		0.0196225				0.0102433				0.0093792	
STC	3	3	8/16/99		D	0.029	0.02	0.009	1.45	0.015	0.009	0.006	1.6666667	0.014	0.011	0.003
STC	3	3	8/2/99		D		0.031				0.02				0.011	
STC	3	3	8/25/99		D		0.018				0.009				0.009	
STC	3	3	8/31/99		D	0.0373333	0.017	0.0203333	2.1960784	-0.026	0.009	-0.035	-2.888889	0.0633333	0.008	0.0553333
STC	3	3	8/9/99		D		0.02				0.006				0.014	
STC	3	3	9/29/99		D	0.022	0.028	-0.006	0.7857143	0.008	0.017	-0.009	0.4705882	0.014	0.011	0.003
STC	3	3	9/7/99		D		0.019				0.01				0.009	

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.3									PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.6666667	0.005	0.001	0.004	5	0.01	0.008	0.002	1.25	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.6666667									PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.3333333									PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.1826351	0.0026	0.0017	0.0009	1.5294118	0.0091355	0.0082232	0.0009123	1.110945	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.2695064	0.0027	0.001	0.0017	2.7	0.0060256	0.0058732	0.0001524	1.0259434	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	0.8566174	0.0042	0.0022	0.002	1.9090909	0.0078903	0.011914	-0.004024	0.6622703	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1	0.0024	0.0036	-0.0012	0.6666667	0.0037751	0.0025751	0.0012	1.4659928	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.3839303	0.0045	0.003	0.0015	1.5	0.0055528	0.0042639	0.0012888	1.3022664	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.4472279	0.0043	0.0015	0.0028	2.8666667	0.0046597	0.004691	-3.12E-05	0.9933432	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.2477689	0.0025	0.0027	-0.0002	0.9259259	0.0068792	0.0048168	0.0020624	1.4281759	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.75									PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.4444444	0.007	0.002	0.005	3.5	0.006	0.007	-0.001	0.8571429	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA			0.003				0.006			PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.5	0.007	0.001	0.006	7	0.005	0.007	-0.002	0.7142857	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.1538462	0.004	0.002	0.002	2	0.011	0.011	0	1	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA										PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.5	0.008	0.003	0.005	2.6666667	0.004	0.005	-0.001	0.8	PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.6									PRTA01	PpDx41	04PpDx41	PORTABLE	PEAT	Y	D
PORTA	1.625									PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.4	0.006	0.001	0.005	6	0.008	0.009	-0.001	0.8888889	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.6666667									PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	0.9230769									PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.2626746	0.0031	0.0018	0.0013	1.7222222	0.0102565	0.0087779	0.0014786	1.16844	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.1187512	0.0027	0.0025	0.0002	1.08	0.0060256	0.0052994	0.0007262	1.1370322	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.3816908	0.0042	0.0018	0.0024	2.3333333	0.0078903	0.0069503	0.0009399	1.1352342	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1	0.0024	0.0017	0.0007	1.4117647	0.0037751	0.0044751	-0.0007	0.8435806	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.1018962	0.0045	0.0027	0.0018	1.6666667	0.0055528	0.0064232	-0.00087	0.8644927	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.4472279	0.0043	0.0017	0.0026	2.5294118	0.0046597	0.004491	0.0001688	1.0375805	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.4242059	0.0025	0.0018	0.0007	1.3888889	0.0068792	0.0047855	0.0020936	1.4374898	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	2									PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1	0.003	0.002	0.001	1.5	0.008	0.009	-0.001	0.8888889	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.625	0.006	0.002	0.004	3	0.007	0.006	0.001	1.1666667	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1	0.004	0.003	0.001	1.3333333	0.011	0.012	-0.001	0.9166667	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA										PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.5	0.007	0.005	0.002	1.4	0.005	0.003	0.002	1.6666667	PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.6									PRTA01	PpDx42	05PpDx42	PORTABLE	PEAT	Y	D
PORTA	1.1818182									PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.4	0.005	0.001	0.004	5	0.009	0.009	0	1	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	2									PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.5									PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.1751164	0.0034	0.0024	0.001	1.4166667	0.0090303	0.0081779	0.0008524	1.1042281	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.2695064	0.0027	0.0024	0.0003	1.125	0.0060256	0.0044732	0.0015524	1.3470383	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.3220327	0.0042	0.0018	0.0024	2.3333333	0.0078903	0.0073452	0.0005451	1.0742056	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	0.8706503	0.0024	0.0031	-0.0007	0.7741935	0.0037751	0.0039926	-0.000217	0.9455433	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.2559534	0.0046	0.0024	0.0022	1.9166667	0.0045232	0.0048639	-0.000341	0.929939	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.114837	0.0043	0.0015	0.0028	2.8666667	0.0046597	0.0065368	-0.001877	0.7128455	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.1102288	0.0025	0.0031	-0.0006	0.8064516	0.0068792	0.005348	0.0015312	1.2863163	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.4									PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.1	0.003	0.002	0.001	1.5	0.008	0.008	0	1	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	3	0.012	0.002	0.01	6	0.018	0.008	0.01	2.25	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.25	0.004	0.003	0.001	1.3333333	0.011	0.009	0.002	1.2222222	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA										PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.4444444	0.005	0.003	0.002	1.6666667	0.008	0.006	0.002	1.3333333	PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D
PORTA	1.6									PRTA01	PpDx43	06PpDx43	PORTABLE	PEAT	Y	D

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.625									PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.75	0.004	0.001	0.003	4	0.01	0.007	0.003	1.4285714	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.4285714									PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	0.75									PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	0.9163235	0.0048	0.0026	0.0022	1.8461538	0.0051232	0.0082293	-0.003106	0.6225505	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.1187512	0.0027	0.0027	0	1	0.0060256	0.0050994	0.0009262	1.1816271	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.419045	0.0042	0.0022	0.002	1.9090909	0.0078903	0.00632	0.0015703	1.2484593	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0039751	-0.0002	0.9496874	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.5963039	0.003	0.0019	0.0011	1.5789474	0.0068827	0.004291	0.0025917	1.6039893	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.2594711	0.0043	0.0009	0.0034	4.7777778	0.0046597	0.0062139	-0.001554	0.7498908	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.1102288	0.0025	0.0036	-0.0011	0.6944444	0.0068792	0.004848	0.0020312	1.418982	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.2727273									PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.4	0.006	0.002	0.004	3	0.008	0.008	0	1	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.0714286	0.004	0.001	0.003	4	0.011	0.013	-0.002	0.8461538	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.5	0.006	0.002	0.004	3	0.009	0.008	0.001	1.125	PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.4545455									PRTA02	PrDx41	07PrDx41	PORTABLE	ROCK	Y	D
PORTA	1.625									PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	2.125	0.005	0.001	0.004	5	0.012	0.007	0.005	1.7142857	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1									PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.2									PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.1826351	0.0024	0.0026	-0.0002	0.9230769	0.0093355	0.0073232	0.0020123	1.2747878	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.2695064	0.0027	0.0029	-0.0002	0.9310345	0.0060256	0.0039732	0.0020524	1.5165539	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.4027915	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0064187	0.0014715	1.2292585	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1	0.0024	0.0021	0.0003	1.1428571	0.0037751	0.0040751	-0.0003	0.926383	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.298152	0.0032	0.0015	0.0017	2.1333333	0.0048368	0.004691	0.0001458	1.0310915	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.4472279	0.0043	0.0008	0.0035	5.375	0.0046597	0.005391	-0.000731	0.8643607	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1	0.0025	0.0025	0	1	0.0068792	0.0068792	0	1	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	2									PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	0.9166667	0.003	0.002	0.001	1.5	0.008	0.01	-0.002	0.8	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.006	0.001	0.005	6	0.007	0.008	-0.001	0.875	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.1538462	0.004	0.002	0.002	2	0.011	0.011	0	1	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.008	0.002	0.006	4	0.005	0.007	-0.002	0.7142857	PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.6									PRTA02	PrDx42	08PrDx42	PORTABLE	ROCK	Y	D
PORTA	1.8571429									PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.75	0.004	0.001	0.003	4	0.01	0.007	0.003	1.4285714	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.6666667									PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.7142857									PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	0.3705436	0.0027	0.0193	-0.0166	0.1398964	0.0090355	0.012371	-0.003336	0.7303753	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.2695064	0.0027	0.0028	-1E-04	0.9642857	0.0060256	0.0040732	0.0019524	1.4793214	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.3974561	0.0042	0.0034	0.0008	1.2352941	0.0078903	0.0052516	0.0026386	1.5024429	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	0.8706503	0.0024	0.0027	-0.0003	0.8888889	0.0037751	0.0043926	-0.000617	0.8594394	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1	0.003	0.0019	0.0011	1.5789474	0.0050368	0.0061368	-0.0011	0.820754	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.2594711	0.0043	0.0011	0.0032	3.9090909	0.0046597	0.0060139	-0.001354	0.7748295	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.4242059	0.0025	0.0024	0.0001	1.0416667	0.0068792	0.0041855	0.0026936	1.6435547	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.5555556									PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1	0.003	0.002	0.001	1.5	0.008	0.009	-0.001	0.8888889	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.006	0.002	0.004	3	0.007	0.007	0	1	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.5	0.007	0.002	0.005	3.5	0.005	0.006	-0.001	0.8333333	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.1538462	0.004	0.002	0.002	2	0.011	0.011	0	1	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.008	0.003	0.005	2.6666667	0.005	0.006	-0.001	0.8333333	PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	2									PRTA02	PrDx43	09PrDx43	PORTABLE	ROCK	Y	D
PORTA	1.4444444									PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.4	0.004	0.002	0.002	2	0.01	0.008	0.002	1.25	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.6666667									PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.2									PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.3726289	0.0002				0.0135921				PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA		0.003				0.0112827				PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1	0.0027	0.0024	0.0003	1.125	0.0060256	0.0063256	-0.0003	0.9525734	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.3765144	0.0042	0.0027	0.0015	1.5555556	0.0078903	0.0060832	0.001807	1.2970484	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1	0.0024	0.0031	-0.0007	0.7741935	0.0037751	0.0030751	0.0007	1.2276314	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.2269139	0.0045	0.0024	0.0021	1.875	0.0055528	0.0057935	-0.000241	0.9584415	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.2594711	0.0043	0.0014	0.0029	3.0714286	0.0046597	0.0057139	-0.001054	0.8155108	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.4242059	0.0025	0.0035	-0.001	0.7142857	0.0068792	0.0030855	0.0037936	2.2294836	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	2									PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.5555556	0.006	0.002	0.004	3	0.008	0.007	0.001	1.1428571	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA			0.003				0.008			PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.5	0.007	0.003	0.004	2.3333333	0.005	0.005	0	1	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.1538462	0.004	0.002	0.002	2	0.011	0.011	0	1	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA										PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	0.9285714	0.006	0.005	0.001	1.2	0.007	0.009	-0.002	0.7777778	PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.4545455									PRTA03	PpSx31	10PpSx31	PORTABLE	PEAT	Y	S
PORTA	1.0833333									PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.5	0.005	0.002	0.003	2.5	0.01	0.008	0.002	1.25	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.4285714									PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.3333333									PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.3726289	0.0002	0.0003	-0.0001	0.6666667	0.0135921	0.009748	0.0038442	1.3943553	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA		0.0027				0.0106565				PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	0.9040397	0.0027	0.0024	0.0003	1.125	0.0060256	0.0072518	-0.001226	0.8309119	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.3413379	0.0042	0.0018	0.0024	2.3333333	0.0078903	0.0072136	0.0006767	1.093806	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	0.8706503	0.0024	0.0018	0.0006	1.3333333	0.0037751	0.0052926	-0.001517	0.713292	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.1018962	0.0045	0.002	0.0025	2.25	0.0055528	0.0071232	-0.00157	0.7795381	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.2594711	0.0043	0.0017	0.0026	2.5294118	0.0046597	0.0054139	-0.000754	0.8607007	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.2477689	0.0025	0.002	0.0005	1.25	0.0068792	0.0055168	0.0013624	1.2469601	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	2									PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.1	0.003	0.002	0.001	1.5	0.008	0.008	0	1	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.0769231	0.006	0.002	0.004	3	0.008	0.011	-0.003	0.7272727	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.3333333	0.007	0.003	0.004	2.3333333	0.005	0.006	-0.001	0.8333333	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.25	0.004	0.001	0.003	4	0.011	0.011	0	1	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA										PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.3	0.006	0.003	0.003	2	0.007	0.007	0	1	PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.4545455									PRTA03	PpSx32	11PpSx32	PORTABLE	PEAT	Y	S
PORTA	1.625									PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.875	0.005	0.002	0.003	2.5	0.01	0.006	0.004	1.6666667	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	2									PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.3333333									PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA		0.0025				0.0099303				PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.1187512	0.0027	0.0016	0.0011	1.6875	0.0060256	0.0061994	-0.000174	0.9719627	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.6556356	0.0042	0.0033	0.0009	1.2727273	0.0078903	0.0040025	0.0038878	1.9713386	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1	0.0024	0.0016	0.0008	1.5	0.0037751	0.0045751	-0.0008	0.8251422	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.2559534	0.0041	0.0022	0.0019	1.8636364	0.0050232	0.0050639	-4.08E-05	0.9919485	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.2594711	0.0043	0.0032	0.0011	1.34375	0.0046597	0.0039139	0.0007458	1.1905646	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.2477689	0.0025	0.0024	0.0001	1.0416667	0.0068792	0.0051168	0.0017624	1.3444406	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.4									PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.2222222	0.003	0.003	0	1	0.008	0.006	0.002	1.3333333	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.5555556	0.007	0.002	0.005	3.5	0.007	0.007	0	1	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.3333333	0.007	0.003	0.004	2.3333333	0.005	0.006	-0.001	0.8333333	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.25	0.004	0.002	0.002	2	0.011	0.01	0.001	1.1	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA										PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.3	0.005	0.004	0.001	1.25	0.008	0.006	0.002	1.3333333	PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.4545455									PRTA03	PpSx33	12PpSx33	PORTABLE	PEAT	Y	S
PORTA	1.4444444									PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.625	0.003	0.001	0.002	3	0.01	0.007	0.003	1.4285714	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.4285714									PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.3333333									PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA		0.0047				0.0061293				PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.1187512	0.0027	0.0024	0.0003	1.125	0.0060256	0.0053994	0.0006262	1.1159736	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.4356795	0.0042	0.0023	0.0019	1.826087	0.0078903	0.0061213	0.001769	1.2889884	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1	0.0024	0.0018	0.0006	1.3333333	0.0037751	0.0043751	-0.0006	0.8628618	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	0.6205874	0.0033	0.003	0.0003	1.1	0.0058232	0.0117008	-0.005878	0.49767	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.4472279	0.0043	0.0009	0.0034	4.7777778	0.0046597	0.005291	-0.000631	0.8806972	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.1102288	0.0025	0.0039	-0.0014	0.6410256	0.0068792	0.004548	0.0023312	1.5125831	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	2									PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.1	0.003	0.001	0.002	3	0.008	0.009	-0.001	0.8888889	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.625	0.005	0.002	0.003	2.5	0.008	0.006	0.002	1.3333333	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.5555556	0.006	0.001	0.005	6	0.008	0.008	0	1	PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.625	0.009				0.004				PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.6									PRTA04	PrSx31	13PrSx31	PORTABLE	ROCK	Y	S
PORTA	1.625									PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.8571429	0.005	0.001	0.004	5	0.008	0.006	0.002	1.3333333	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4285714									PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.3333333									PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA		0.0035				0.0082355				PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.1187512	0.0027	0.0027	0	1	0.0060256	0.0050994	0.0009262	1.1816271	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4135854	0.0042	0.0024	0.0018	1.75	0.0078903	0.0061529	0.0017374	1.2823636	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0039751	-0.0002	0.9496874	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.2269139	0.0053	0.0031	0.0022	1.7096774	0.0047528	0.0050935	-0.000341	0.9330975	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4472279	0.0043	0.001	0.0033	4.3	0.0046597	0.005191	-0.000531	0.8976632	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4242059	0.0025	0.0045	-0.002	0.5555556	0.0068792	0.0020855	0.0047936	3.2985009	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.75									PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4	0.005	0.002	0.003	2.5	0.009	0.008	0.001	1.125	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.5	0.007	0.001	0.006	7	0.005	0.007	-0.002	0.7142857	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.25	0.007	0.002	0.005	3.5	0.008	0.01	-0.002	0.8	PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.4444444	0.009				0.004				PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.6									PRTA04	PrSx32	14PrSx32	PORTABLE	ROCK	Y	S
PORTA	1.625									PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.8571429	0.003	0.001	0.002	3	0.01	0.006	0.004	1.6666667	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	2									PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.3333333									PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.1570531	0.0002	0.0009	-0.0007	0.2222222	0.0135921	0.0110201	0.0025721	1.2334001	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA		0.0027				0.0106565				PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1	0.0027	0.002	0.0007	1.35	0.0060256	0.0067256	-0.0007	0.8959196	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.7502783	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0047076	0.0031826	1.6760608	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1	0.0024	0.0026	-0.0002	0.9230769	0.0037751	0.0035751	0.0002	1.0559418	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.114837	0.005	0.003	0.002	1.6666667	0.0039597	0.0050368	-0.001077	0.7861594	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.4472279	0.0043	0.002	0.0023	2.15	0.0046597	0.004191	0.0004688	1.1118532	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.4242059	0.0025	0.0027	-0.0002	0.9259259	0.0068792	0.0038855	0.0029936	1.7704523	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	2.3333333									PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.1	0.003	0.002	0.001	1.5	0.008	0.008	0	1	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.75	0.004	0.001	0.003	4	0.01	0.007	0.003	1.4285714	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.25	0.004	0.001	0.003	4	0.011	0.011	0	1	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.625	0.006	0.001	0.005	6	0.007	0.007	0	1	PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.8571429	0.009				0.004				PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S
PORTA	1.6									PRTA04	PrSx33	15PrSx33	PORTABLE	ROCK	Y	S

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.625									PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.4	0.004	0.001	0.003	4	0.01	0.009	0.001	1.1111111	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.1111111									PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.3333333									PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA		0.0023				0.0103417				PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.2695064	0.0027	0.0028	-1E-04	0.9642857	0.0060256	0.0040732	0.0019524	1.4793214	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.4413114	0.0042	0.0025	0.0017	1.68	0.0078903	0.0058884	0.0020019	1.3399725	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1	0.0024	0.0016	0.0008	1.5	0.0037751	0.0045751	-0.0008	0.8251422	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.1297356	0.003	0.0014	0.0016	2.1428571	0.0050368	0.0057139	-0.000677	0.8815037	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.4472279	0.0043	0.0009	0.0034	4.7777778	0.0046597	0.005291	-0.000631	0.8806972	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.1102288	0.0025	0.004	-0.0015	0.625	0.0068792	0.004448	0.0024312	1.5465893	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.5555556									PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1	0.003	0.002	0.001	1.5	0.008	0.009	-0.001	0.8888889	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.5555556	0.007	0.002	0.005	3.5	0.007	0.007	0	1	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.25	0.004	0.002	0.002	2	0.011	0.01	0.001	1.1	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.625	0.008	0.003	0.005	2.6666667	0.005	0.005	0	1	PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.7777778									PRTA05	PrDX41	16PrDX41	PORTABLE	ROCK	Y	D
PORTA	1.4444444									PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.5555556	0.005	0.001	0.004	5	0.009	0.008	0.001	1.125	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.6666667									PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.5									PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA		0.0028				0.0105565				PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1	0.0027	0.002	0.0007	1.35	0.0060256	0.0067256	-0.0007	0.8959196	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.3462527	0.0042	0.0018	0.0024	2.3333333	0.0078903	0.0071807	0.0007096	1.0988184	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0039751	-0.0002	0.9496874	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.2037922	0.0046	0.002	0.0026	2.3	0.0063824	0.0071232	-0.000741	0.8960053	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.4472279	0.0043	0.0011	0.0032	3.9090909	0.0046597	0.005091	-0.000431	0.9152957	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.4242059	0.0025	0.0025	0	1	0.0068792	0.0040855	0.0027936	1.6837832	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	2									PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.2222222	0.003	0.001	0.002	3	0.008	0.008	0	1	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.5555556	0.007	0.002	0.005	3.5	0.007	0.007	0	1	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.75	0.01	0.003	0.007	3.3333333	0.004	0.005	-0.001	0.8	PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.6									PRTA05	PrDX42	17PrDX42	PORTABLE	ROCK	Y	D
PORTA	1.1818182									PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA										PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.5555556	0.005	0.002	0.003	2.5	0.009	0.007	0.002	1.2857143	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	2									PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.2									PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA		0.0028				0.0096303				PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.1187512	0.0027	0.0025	0.0002	1.08	0.0060256	0.0052994	0.0007262	1.1370322	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	0.8887336	0.0042	0.0021	0.0021	2	0.0078903	0.0115039	-0.003614	0.6858758	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1	0.0024	0.0018	0.0006	1.3333333	0.0037751	0.0043751	-0.0006	0.8628618	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.298152	0.0036	0.0019	0.0017	1.8947368	0.0044368	0.004291	0.0001458	1.0339898	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.114837	0.0043	0.0011	0.0032	3.9090909	0.0046597	0.0069368	-0.002277	0.6717405	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1	0.0025	0.0023	0.0002	1.0869565	0.0068792	0.0070792	-0.0002	0.9717481	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.5555556									PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.007	0.002	0.005	3.5	0.006	0.007	-0.001	0.8571429	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.7142857	0.007	0.002	0.005	3.5	0.005	0.005	0	1	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.25	0.004	0.001	0.003	4	0.011	0.011	0	1	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.4444444	0.009	0.001	0.008	9	0.004	0.008	-0.004	0.5	PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.6									PRTA05	PrDX43	18PrDX43	PORTABLE	ROCK	Y	D
PORTA	1.625									PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.8571429	0.005	0.001	0.004	5	0.008	0.006	0.002	1.3333333	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.6666667									PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.5									PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA		0.0029				0.0088355				PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.2695064	0.0027	0.0025	0.0002	1.08	0.0060256	0.0043732	0.0016524	1.3778404	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.0921462	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0088702	-0.00098	0.889526	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.1744905	0.0024	0.0017	0.0007	1.4117647	0.0037751	0.0035577	0.0002174	1.0611129	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.2559534	0.0044	0.002	0.0024	2.2	0.0047232	0.0052639	-0.000541	0.8972684	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.7007723	0.0043	0.0016	0.0027	2.6875	0.0046597	0.003668	0.0009917	1.2703617	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1	0.0025	0.0027	-0.0002	0.9259259	0.0068792	0.0066792	0.0002	1.0299438	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.75									PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.1	0.003	0.002	0.001	1.5	0.008	0.008	0	1	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.1818182	0.002	0.019	-0.017	0.1052632	0.011	-0.008	0.019	-1.375	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.5	0.007	0.001	0.006	7	0.005	0.007	-0.002	0.7142857	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.3636364	0.004	0.001	0.003	4	0.011	0.01	0.001	1.1	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.4	0.006	0.002	0.004	3	0.008	0.008	0	1	PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.3	0.009				0.004				PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.6									PRTA06	PrVx31	19PrVx31	PORTABLE	ROCK	Y	V
PORTA	1.625									PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4444444	0.004	0.001	0.003	4	0.009	0.008	0.001	1.125	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	2									PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.3333333									PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA		0.0027				0.0081293				PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.2695064	0.0027	0.0022	0.0005	1.2272727	0.0060256	0.0046732	0.0013524	1.2893888	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4081679	0.0042	0.0027	0.0015	1.5555556	0.0078903	0.0058858	0.0020045	1.3405566	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1	0.0024	0.0015	0.0009	1.6	0.0037751	0.0046751	-0.0009	0.8074927	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.2559534	0.0034	0.003	0.0004	1.1333333	0.0057232	0.0042639	0.0014592	1.342226	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	2.0620246	0.0043	0.0007	0.0036	6.1428571	0.0046597	0.0036451	0.0010146	1.2783509	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4242059	0.0025	0.0039	-0.0014	0.6410256	0.0068792	0.0026855	0.0041936	2.5615553	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.5555556									PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4444444	0.003	0.001	0.002	3	0.01	0.008	0.002	1.25	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.5	0.007	0.001	0.006	7	0.005	0.007	-0.002	0.7142857	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4	0.005	0.003	0.002	1.6666667	0.009	0.007	0.002	1.2857143	PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.4444444	0.009				0.004				PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.6									PRTA06	PrVx32	20PrVx32	PORTABLE	ROCK	Y	V
PORTA	1.625									PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.625	0.005	0.001	0.004	5	0.008	0.007	0.001	1.1428571	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	2.5									PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1									PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA		0.0025				0.0117827				PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.2695064	0.0027	0.0028	-1E-04	0.9642857	0.0060256	0.0040732	0.0019524	1.4793214	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.336459	0.0042	0.002	0.0022	2.1	0.0078903	0.0070465	0.0008438	1.1197436	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1	0.0024	0.003	-0.0006	0.8	0.0037751	0.0031751	0.0006	1.1889676	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.3892067	0.0036	0.0026	0.001	1.3846154	0.0062827	0.0045139	0.0017688	1.3918513	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.4472279	0.0043	0.0009	0.0034	4.7777778	0.0046597	0.005291	-0.000631	0.8806972	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.1102288	0.0025	0.003	-0.0005	0.8333333	0.0068792	0.005448	0.0014312	1.2627053	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.75									PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.3	0.006	0.003	0.003	2	0.007	0.007	0	1	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.7142857	0.007	0.002	0.005	3.5	0.005	0.005	0	1	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.0714286	0.004	0.002	0.002	2	0.011	0.012	-0.001	0.9166667	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.4444444	0.006	0.002	0.004	3	0.007	0.007	0	1	PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.4444444	0.009				0.004				PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	2									PRTA06	PrVx33	21PrVx33	PORTABLE	ROCK	Y	V
PORTA	1.3									PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.8571429	0.005	0.001	0.004	5	0.008	0.006	0.002	1.3333333	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.6666667									PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.5									PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA		0.0026				0.0079779				PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.1187512	0.0027	0.0022	0.0005	1.2272727	0.0060256	0.0055994	0.0004262	1.076113	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.4613755	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0060732	0.0018171	1.2991919	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1	0.0024	0.0017	0.0007	1.4117647	0.0037751	0.0044751	-0.0007	0.8435806	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.2296742	0.0042	0.002	0.0022	2.1	0.0056827	0.0060368	-0.000354	0.9413348	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.4472279	0.0043	0.0009	0.0034	4.7777778	0.0046597	0.005291	-0.000631	0.8806972	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.6587572	0.0025	0.0034	-0.0009	0.7352941	0.0068792	0.0022543	0.0046248	3.0515278	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.4									PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.1	0.003	0.001	0.002	3	0.008	0.009	-0.001	0.8888889	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.2727273	0.005	0.002	0.003	2.5	0.009	0.009	0	1	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.3333333	0.007	0.001	0.006	7	0.005	0.008	-0.003	0.625	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.2727273	0.008	0.001	0.007	8	0.006	0.01	-0.004	0.6	PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.625	0.009				0.004				PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.4545455									PRTA07	PsDx41	22PsDx41	PORTABLE	SAND	Y	D
PORTA	1.0833333									PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.3636364	0.007	0.002	0.005	3.5	0.008	0.009	-0.001	0.8888889	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.6666667									PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.2									PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.287881	0.003	0.0022	0.0008	1.3636364	0.0094303	0.0074518	0.0019786	1.2655156	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.467219	0.0027	0.0028	-1E-04	0.9642857	0.0060256	0.003147	0.0028786	1.9146953	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.312587	0.0042	0.0022	0.002	1.9090909	0.0078903	0.007011	0.0008792	1.1254089	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0039751	-0.0002	0.9496874	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.298152	0.0032	0.0013	0.0019	2.4615385	0.0048368	0.004891	-5.42E-05	0.9889284	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.2594711	0.0043	0.002	0.0023	2.15	0.0046597	0.0051139	-0.000454	0.9111927	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.4242059	0.0025	0.0029	-0.0004	0.862069	0.0068792	0.0036855	0.0031936	1.8665277	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.5555556									PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.375	0.003	0.002	0.001	1.5	0.008	0.006	0.002	1.3333333	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.4444444	0.006	0.003	0.003	2	0.007	0.006	0.001	1.1666667	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.4444444	0.008	0.003	0.005	2.6666667	0.005	0.006	-0.001	0.8333333	PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.7777778									PRTA08	PsDx42	23PsDx42	PORTABLE	SAND	Y	D
PORTA	1.3									PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.6666667	0.005	0.002	0.003	2.5	0.01	0.007	0.003	1.4285714	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	2									PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.3333333									PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1	0.0026	0.0022	0.0004	1.1818182	0.0079779	0.0083779	-0.0004	0.9522556	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.2465099	0.0027	0.0024	0.0003	1.125	0.0060256	0.0046	0.0014256	1.3099063	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.3079146	0.0042	0.0038	0.0004	1.1052632	0.0078903	0.0054439	0.0024463	1.4493706	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1	0.0024	0.0023	1E-04	1.0434783	0.0037751	0.0038751	-1E-04	0.9741945	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.2559534	0.0041	0.0019	0.0022	2.1578947	0.0050232	0.0053639	-0.000341	0.9364697	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.2594711	0.0043	0.0011	0.0032	3.9090909	0.0046597	0.0060139	-0.001354	0.7748295	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.1102288	0.0025	0.0047	-0.0022	0.5319149	0.0068792	0.003748	0.0031312	1.8354429	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.5555556									PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	0.5789474	0.003	0.008	-0.005	0.375	0.008	0.011	-0.003	0.7272727	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.5555556	0.006	0.001	0.005	6	0.008	0.008	0	1	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.1538462	0.004	0.001	0.003	4	0.011	0.012	-0.001	0.9166667	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA										PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.625	0.007	0.003	0.004	2.3333333	0.006	0.005	0.001	1.2	PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.6									PRTA09	PpDx40	24PpDx40	PORTABLE	PEAT	N	D
PORTA	1.3									PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.8571429	0.003	0.002	0.001	1.5	0.01	0.005	0.005	2	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	2									PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
PORTA	1.3333333									PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.1751164	0.0033	0.0022	0.0011	1.5	0.0091303	0.0083779	0.0007524	1.0898038	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.2695064	0.0027	0.0019	0.0008	1.4210526	0.0060256	0.0049732	0.0010524	1.2116085	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.3032752	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0070768	0.0008134	1.114943	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.1744905	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0030577	0.0007174	1.2346265	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.2594711	0.0037	0.0024	0.0013	1.5416667	0.0052597	0.0047139	0.0005458	1.1157958	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.4472279	0.0043	0.0014	0.0029	3.0714286	0.0046597	0.004791	-0.000131	0.9726095	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.1102288	0.0025	0.0024	0.0001	1.0416667	0.0068792	0.006048	0.0008312	1.1374362	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.5555556									PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.625	0.005	0.001	0.004	5	0.008	0.007	0.001	1.1428571	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA			0.002				0.007			PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.5	0.007	0.001	0.006	7	0.005	0.007	-0.002	0.7142857	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.25	0.004	0.001	0.003	4	0.011	0.011	0	1	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.625	0.006	0.001	0.005	6	0.007	0.007	0	1	PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.625	0.009				0.004				PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.7777778									PRTA10	PrDx40	25PrDx40	PORTABLE	ROCK	N	D
PORTA	1.625									PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.7	0.005	0.001	0.004	5	0.012	0.009	0.003	1.3333333	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	2									PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	2									PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.2556555	0.0002	0.0002	0	1	0.0135921	0.010784	0.0028081	1.2603969	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.0875582	0.0031	0.0028	0.0003	1.1071429	0.0084041	0.0077779	0.0006262	1.0805078	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1	0.0027	0.0025	0.0002	1.08	0.0060256	0.0062256	-0.0002	0.9678744	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.4384899	0.0042	0.0022	0.002	1.9090909	0.0078903	0.0062048	0.0016854	1.2716324	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1	0.0024	0.0049	-0.0025	0.4897959	0.0037751	0.0012751	0.0025	2.9605583	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.2037922	0.0043	0.0028	0.0015	1.5357143	0.0066824	0.0063232	0.0003592	1.0568116	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	0.1742656	0.0043	0.0015	0.0028	2.8666667	0.0046597	0.0499143	-0.045255	0.0933549	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.1102288	0.0025	0.0021	0.0004	1.1904762	0.0068792	0.006348	0.0005312	1.0836818	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.4									PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.375	0.003	0.002	0.001	1.5	0.008	0.006	0.002	1.3333333	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.4444444	0.007	0.002	0.005	3.5	0.006	0.007	-0.001	0.8571429	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.7142857	0.007	0.001	0.006	7	0.005	0.006	-0.001	0.8333333	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.25	0.004	0.001	0.003	4	0.011	0.011	0	1	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.625	0.009	0.002	0.007	4.5	0.004	0.006	-0.002	0.6666667	PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.7777778									PRTA11	PrSx20	26PrSx20	PORTABLE	ROCK	Y	S
PORTA	1.4444444									PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.4545455	0.004	0.001	0.003	4	0.012	0.01	0.002	1.2	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	2									PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.3333333									PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.2556555	0.0002				0.0135921				PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1	0.0033	0.0022	0.0011	1.5	0.0072779	0.0083779	-0.0011	0.8687028	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.1187512	0.0027	0.002	0.0007	1.35	0.0060256	0.0057994	0.0002262	1.0390017	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.43288	0.0042	0.0019	0.0023	2.2105263	0.0078903	0.0065377	0.0013525	1.20688	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1	0.0024	0.0022	0.0002	1.0909091	0.0037751	0.0039751	-0.0002	0.9496874	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1	0.004	0.0029	0.0011	1.3793103	0.0041935	0.0052935	-0.0011	0.7921997	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.114837	0.0043	0.0018	0.0025	2.3888889	0.0046597	0.0062368	-0.001577	0.7471344	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	0.7157484	0.0025	0.0036	-0.0011	0.6944444	0.0068792	0.009504	-0.002625	0.7238181	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.4									PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.1	0.003	0.002	0.001	1.5	0.008	0.008	0	1	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.5555556	0.007	0.002	0.005	3.5	0.007	0.007	0	1	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.3333333	0.007	0.002	0.005	3.5	0.005	0.007	-0.002	0.7142857	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.1538462	0.004	0.003	0.001	1.3333333	0.011	0.01	0.001	1.1	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.4	0.009	0.003	0.006	3	0.005	0.007	-0.002	0.7142857	PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
PORTA	1.6									PRTA12	PpSx20	27PpSx20	PORTABLE	PEAT	Y	S
STC										STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.002				0.005			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	1.4285714	0.005	0.001	0.004	5	0.005	0.006	-0.001	0.8333333	STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	TDPr	SRPi	SRPo	SRPd	SRPr	DOPi	DOPo	DOPd	DOPr	UNIT	Code	Header	SCALE	Substrate	Shade	Depth
STC										STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0002				0.0135921			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	1.3347057	0.0057	0.003	0.0027	1.9	0.008754	0.0078293	0.0009246	1.1180997	STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0009				0.0072109			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0027				0.0060256			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0027				0.0105255			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	1.5726739	0.0064	0.0023	0.0041	2.7826087	0.0061971	0.00571	0.0004871	1.0853089	STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0022				0.0078528			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0009				0.0071368			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.0025				0.0045926			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	1.0833333									STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.001				0.01			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC										STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	7.037037	0.002	0.003	-0.001	0.6666667	0.0613333	0.006	0.0553333	10.222222	STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC			0.001				0.012			STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC	1.0833333	0.004	0.002	0.002	2	0.009	0.01	-0.001	0.9	STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC										STC1	CpDx10	01CpDx10	TESTCELL	PEAT	Y	D
STC										STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.002				0.004			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	1.8333333	0.005	0.001	0.004	5	0.006	0.005	0.001	1.2	STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC										STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC										STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	1.2510293	0.0049	0.0024	0.0025	2.0416667	0.0086478	0.0084293	0.0002185	1.0259192	STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0007				0.0074109			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0022				0.0055994			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0029				0.0084828			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	1.458139	0.0043	0.0044	-0.0001	0.9772727	0.0073797	0.00361	0.0037697	2.0442378	STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0028				0.0100416			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0011				0.0069368			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.0034				0.0190161			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	1.3636364									STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.001				0.01			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC										STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	7.037037	0.002	0.002	0	1	0.0613333	0.007	0.0543333	8.7619048	STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC			0.001				0.012			STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC	1.5555556	0.002	0.002	0	1	0.012	0.007	0.005	1.7142857	STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC										STC2	CrDx10	02CrDx10	TESTCELL	ROCK	Y	D
STC										STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.003				0.004			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	1.2222222	0.003	0.002	0.001	1.5	0.008	0.007	0.001	1.1428571	STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC										STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0005				0.0132921			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	1.2739526	0.0034	0.0026	0.0008	1.3076923	0.0092417	0.0073232	0.0019185	1.2619738	STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0011				0.0070109			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0027				0.0060256			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0028				0.0085499			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	1.5942676	0.0035	0.0022	0.0013	1.5909091	0.0063448	0.0039751	0.0023697	1.5961264	STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0023				0.0077528			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.001				0.0061139			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.0028				0.0065792			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	1.2727273									STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.002				0.009			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC										STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	7.9166667	0.002	0.002	0	1	0.0613333	0.006	0.0553333	10.222222	STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC			0.001				0.013			STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC	1.2727273	0.003	0.002	0.001	1.5	0.011	0.009	0.002	1.2222222	STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V
STC										STC3	CrVx10	03CrVx10	TESTCELL	ROCK	Y	V

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	1			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	2			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	
PORTA	06	4	3			Y					Y				Y			Y	

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	1			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	2			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	4	3			Y				Y		Y				Y			Y
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	1		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	2		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	3		Y								Y						
PORTA	06	3	1		Y				Y					Y					

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	1		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	2		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					
PORTA	06	3	3		Y				Y					Y					

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	1							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	2							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	12	4	3							Y									
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	1						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	2						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	3	3						Y								Y		
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	1			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	2			Y													
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0								Y								
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	4	0									Y							
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
PORTA	06	2	0				Y							Y					
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	

ATTACHMENT A.
PSTA DATA ANALYSIS
RAW DATA

SITE	Loading	D_W_Ratio	Rep	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y											Y			Y	
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0	Y				Y								Y			Y
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		
STC	06	1	0					Y									Y		

ATTACHMENT B.
PSTA ANALYSIS: RAW DATA

DATE	CpDx10	Q1	CrDx10	Q2	CrVx10	Q3	PpDx41	Q4	PpDx42	Q5	PpDx43
10/11/99	0.022		0.017		0.029		0.013	0.02	0.02	0.02	0.02
10/18/99	0.019		0.015		0.015						
10/19/99											
10/20/99							0.011	0.017	0.014	0.017	0.015
10/25/99	0.012	0.017	0.014	0.019	0.015	0.019					
10/26/99							0.01	0.027	0.021	0.027	0.016
10/4/99	0.023		0.016		0.017		0.011	0.017		0.017	0.02
6/1/99	0.0194084		0.0240886		0.023682						
6/14/99	0.0207971	0.0207971	0.0207971	0.0217033	0.031671	0.0262341					
6/21/99	0.0162663		0.0180786		0.019891						
6/23/99							0.0189848	0.0153601	0.0171725	0.0189848	0.0162663
6/28/99	0.0161351		0.0152089		0.0179874		0.0152089	0.0161351	0.0142827	0.0161351	0.0170612
6/9/99	0.0187866		0.0241831		0.0295796		0.0106589	0.0548182	0.0127319	0.0548182	0.0147721
7/14/99	0.0116797	0.0181016	0.0125971	0.0181016	0.0153494	0.0181016	0.0125971	0.014432	0.0236062	0.014432	0.0153494
7/19/99	0.0137712		0.0137712		0.0165601		0.0147008	0.0128416	0.0165601	0.0128416	0.0147008
7/20/99											
7/21/99											
7/26/99	0.0144973		0.0144973		0.0172661		0.0108056	0.0117285	0.0135744	0.0117285	0.030187
7/6/99	0.0121728		0.0140352		0.0196225		0.0121728	0.013104	0.0214849	0.013104	0.0140352
8/16/99	0.021	0.043	0.018	0.036	0.02	0.029	0.016	0.02	0.018	0.02	0.021
8/2/99	0.102		0.02		0.031				0.018	0.022	0.022
8/24/99											
8/25/99	0.022		0.017		0.018		0.01	0.016	0.051	0.027	0.023
8/3/99							0.022				
8/30/99							0.012	0.018	0.016	0.018	0.028
8/31/99	0.018	0.0373333	0.016	0.0373333	0.017	0.0373333					
8/9/99	0.019		0.016		0.02		0.024	0.02	0.033	0.02	0.022
9/20/99											
9/27/99											
9/28/99											
9/29/99	0.023	0.023	0.015	0.022	0.028	0.022	0.01	0.015	0.016	0.015	0.016
9/7/99	0.019		0.015		0.019		0.017	0.019	0.019	0.019	0.025

ATTACHMENT B.
PSTA ANALYSIS: RAW DATA

DATE	Q6	PrDlo41	Q7	PrDlo42	Q8	PrDlo43	Q9	PpSx31	Q10	PpSx32	Q11
10/11/99	0.02	0.017	0.02	0.014	0.02	0.013	0.02	0.014	0.02	0.013	0.02
10/18/99											
10/19/99		0.012	0.016	0.012	0.021	0.015	0.017				
10/20/99	0.017							0.014	0.016	0.012	0.016
10/25/99											
10/26/99	0.027	0.013	0.027	0.011	0.027	0.011	0.027	0.015	0.027	0.012	0.027
10/4/99	0.017	0.023	0.017	0.016	0.017	0.012	0.017	0.021	0.017	0.014	0.017
6/1/99								0.0254666	0.0210052	0.0147594	0.0210052
6/14/99											
6/21/99											
6/23/99	0.0162663	0.0189848	0.0733544	0.0307649	0.014454	0.0452635	0.0153601		0.0162663		0.0226094
6/28/99	0.0161351	0.0179874	0.0161351	0.0161351	0.0161351	0.0189136	0.0161351	0.0133565	0.0161351	0.0142827	0.0161351
6/9/99	0.0548182	0.0122383	0.0548182	0.0124029	0.0548182	0.0160554	0.0548182	0.0127648	0.0548182	0.009211	0.0548182
7/14/99	0.014432	0.0171842	0.014432	0.0116797	0.014432	0.0153494	0.014432	0.014432	0.014432	0.0107623	0.014432
7/19/99	0.0109824							0.0137712	0.011912	0.0100528	0.011912
7/20/99											
7/21/99		0.0089597	0.0154202	0.0117285	0.0126514	0.0154202	0.0126514				
7/26/99	0.0117285	0.0126514	0.0117285	0.0108056	0.0117285	0.0135744	0.0117285	0.0135744	0.0117285	0.0098827	0.0117285
7/6/99	0.013104	0.0121728	0.013104	0.0103104	0.013104	0.0121728	0.013104	0.013104	0.013104	0.013104	0.013104
8/16/99	0.02	0.016	0.02	0.013	0.02	0.014	0.02	0.022	0.02	0.016	0.02
8/2/99	0.022	0.018	0.022	0.014	0.022	0.018	0.022			0.015	0.022
8/24/99		0.015	0.022	0.013	0.015	0.012	0.016				
8/25/99	0.017							0.015	0.017	0.012	0.018
8/3/99								0.016			
8/30/99	0.018	0.013	0.018	0.013	0.018	0.018	0.018	0.017	0.018	0.012	0.018
8/31/99											
8/9/99	0.02	0.021	0.02	0.014	0.02	0.025	0.02	0.041	0.02	0.013	0.02
9/20/99											
9/27/99			0.019		0.019	0.011	0.019				
9/28/99											
9/29/99	0.015							0.013	0.015	0.013	0.014
9/7/99	0.019	0.016	0.019	0.018	0.019	0.014	0.019	0.018	0.019	0.017	0.019

ATTACHMENT B.
PSTA ANALYSIS: RAW DATA

DATE	PpSx33	Q12	PrSx31	Q13	PrSx32	Q14	PrSx33	Q15	PrDhi41	Q16	PrDhi42
10/11/99	0.015	0.02	0.014	0.02	0.015	0.02	0.015	0.02	0.017	0.02	0.015
10/18/99			0.01	0.018	0.01	0.018	0.014	0.02			
10/19/99									0.013	0.017	0.013
10/20/99	0.017	0.018									
10/25/99											
10/26/99	0.017	0.027	0.014	0.027	0.01	0.027	0.017	0.027	0.012	0.027	0.014
10/4/99	0.031	0.017	0.02	0.017	0.013	0.017		0.017	0.024	0.017	0.021
6/1/99							0.0263588	0.0210052			
6/14/99											
6/21/99											
6/23/99		0.0171725		0.014454		0.0171725		0.0162663		0.0153601	
6/28/99	0.0161351	0.0161351	0.0170612	0.0161351	0.0244707	0.0161351	0.0161351	0.0161351	0.0142827	0.0161351	0.0161351
6/9/99	0.0120244	0.0548182	0.0140152	0.0548182	0.0222252	0.0548182	0.0152163	0.0548182	0.0112676	0.0548182	0.0118928
7/14/99	0.0171842	0.014432	0.0153494	0.014432	0.0135145	0.014432	0.0181016	0.014432	0.0107623	0.014432	0.0125971
7/19/99	0.0165601	0.011912									0.0100528
7/20/99			0.0137712	0.011912	0.0128416	0.0165601	0.0193489	0.0109824			
7/21/99									0.0172661	0.0117285	
7/26/99	0.0191119	0.0117285	0.0108056	0.0117285	0.0117285	0.0117285	0.0172661	0.0117285	0.0135744	0.0117285	0.0477226
7/6/99	0.0168288	0.013104	0.0149664	0.013104	0.0140352	0.013104	0.0149664	0.013104	0.0140352	0.013104	0.0261409
8/16/99	0.02	0.02	0.013	0.02	0.013	0.02	0.024	0.02	0.015	0.02	0.014
8/2/99	0.042	0.022	0.017	0.022	0.014	0.022	0.023	0.022	0.018	0.022	0.028
8/24/99			0.012	0.015	0.014	0.016	0.022	0.016	0.02	0.017	0.022
8/25/99	0.016	0.017									
8/3/99											
8/30/99	0.018	0.018	0.015	0.018	0.012	0.018	0.019	0.018	0.041	0.018	0.011
8/31/99											
8/9/99	0.022	0.02	0.025	0.02	0.012	0.02	0.025	0.02	0.021	0.02	0.046
9/20/99			0.017	0.018	0.022	0.017	0.015	0.017			
9/27/99			0.012	0.019	0.01	0.019	0.017	0.019		0.019	0.013
9/28/99											
9/29/99	0.028	0.016									
9/7/99	0.02	0.019	0.015	0.019	0.019	0.019	0.034	0.019	0.018	0.019	0.015

ATTACHMENT B.
PSTA ANALYSIS: RAW DATA

DATE	Q17	PrDhi43	Q18	PrVx31	Q19	PrVx32	Q20	PrVx33	Q21	PsDx41	Q22
10/11/99	0.02	0.015	0.02	0.029	0.02	0.018	0.02	0.015	0.02	0.013	0.02
10/18/99				0.015	0.019	0.014	0.027	0.009	0.017	0.01	0.016
10/19/99	0.021	0.014	0.016								
10/20/99											
10/25/99											
10/26/99	0.027	0.013	0.027	0.013	0.027	0.019	0.027	0.009	0.027	0.01	0.027
10/4/99	0.017	0.016	0.017	0.0176667	0.017	0.018	0.017	0.016	0.017	0.017	0.017
6/1/99											
6/14/99											
6/21/99											
6/23/99	0.0217033		0.0162663		0.014454		0.0162663		0.0162663		0.0171725
6/28/99	0.0161351	0.0161351	0.0161351	0.0179874	0.0161351	0.0161351	0.0161351	0.0142827	0.0161351	0.0179874	0.0161351
6/9/99	0.0548182	0.0147063	0.0548182	0.0139494	0.0548182	0.0132091	0.0548182	0.0128635	0.0548182	0.0365227	0.0548182
7/14/99	0.014432	0.0153494	0.014432	0.0135145	0.014432	0.0116797	0.014432	0.0116797	0.014432	0.0116797	0.014432
7/19/99	0.0128416										
7/20/99				0.0147008	0.0147008	0.0128416	0.0128416	0.0128416	0.0128416	0.0147008	0.0128416
7/21/99		0.0108056	0.0135744								
7/26/99	0.0117285	0.0117285	0.0117285	0.0154202	0.0117285	0.0117285	0.0117285	0.018189	0.0117285	0.0117285	0.0117285
7/6/99	0.013104	0.013104	0.013104	0.0149664	0.013104	0.0121728	0.013104	0.0121728	0.013104	0.013104	0.013104
8/16/99	0.02	0.013	0.02	0.015	0.02	0.019	0.02	0.013	0.02	0.016	0.02
8/2/99	0.022	0.02	0.022	0.018	0.022	0.016	0.022	0.015	0.022	0.015	0.022
8/24/99	0.015	0.013	0.018	0.014	0.016	0.015	0.017	0.014	0.016	0.014	0.044
8/25/99											
8/3/99											
8/30/99	0.018	0.01	0.018	0.016	0.018	0.015	0.018	0.013	0.018	0.019	0.018
8/31/99											
8/9/99	0.02	0.013	0.02	0.016	0.02	0.02	0.02	0.025	0.02	0.016	0.02
9/20/99				0.017	0.018	0.016	0.017	0.014	0.016	0.013	0.017
9/27/99	0.014	0.014	0.015	0.013	0.019	0.019	0.019	0.012	0.019	0.018	0.019
9/28/99											
9/29/99											
9/7/99	0.019	0.014	0.019	0.016	0.019	0.018	0.019	0.019	0.019	0.017	0.019

ATTACHMENT B.
PSTA ANALYSIS: RAW DATA

DATE	PsDx42	Q23	PpDx40	Q24	PrDx40	Q25	PrSx20	Q26	PpSx20	Q27
10/11/99	0.015	0.02	0.015	0.02	0.013	0.02	0.014	0.02	0.016	0.02
10/18/99					0.01	0.017				
10/19/99	0.014	0.017					0.011	0.016		
10/20/99			0.014	0.016					0.014	0.016
10/25/99										
10/26/99	0.013	0.027	0.023	0.027	0.017	0.027	0.02	0.027	0.021	0.027
10/4/99	0.023	0.017	0.014	0.017	0.014	0.017	0.014	0.017	0.017	0.017
6/1/99							0.0308201	0.0210052	0.0210052	0.0210052
6/14/99										
6/21/99										
6/23/99	0.0126417	0.0162663	0.0117355	0.0171725	0.0280464	0.0162663	0.0126417	0.0162663	0.0180786	0.0153601
6/28/99	0.0161351	0.0161351	0.015	0.0161351	0.0161351	0.0161351	0.0152089	0.0161351	0.0170612	0.0161351
6/9/99	0.0293164	0.0548182	0.0103463	0.0548182	0.0167135	0.0548182	0.0122219	0.0548182	0.0167793	0.0548182
7/14/99	0.0199365	0.014432	0.0162668	0.014432	0.0171842	0.014432	0.0116797	0.014432	0.014432	0.014432
7/19/99			0.0109824	0.0109824			0.0137712	0.0128416	0.0184193	0.0109824
7/20/99					0.011912	0.0137712				
7/21/99	0.0135744	0.0126514								
7/26/99	0.0135744	0.0117285	0.0135744	0.0117285	0.0154202	0.0117285	0.0255724	0.0117285	0.0200348	0.0117285
7/6/99	0.0140352	0.013104	0.0149664	0.013104	0.0121728	0.013104	0.0112416	0.013104	0.0177601	0.013104
8/16/99	0.027	0.02	0.015	0.02	0.017	0.02	0.018	0.02	0.022	0.02
8/2/99	0.024	0.022	0.028	0.022			0.022	0.022	0.069	0.022
8/24/99	0.016	0.017			0.012	0.019	0.015	0.016		
8/25/99			0.011	0.016					0.016	0.016
8/3/99					0.018					
8/30/99	0.016	0.018	0.012	0.018	0.01	0.018	0.021	0.018	0.02	0.018
8/31/99										
8/9/99	0.026	0.02	0.018	0.02	0.051	0.02	0.022	0.02	0.022	0.02
9/20/99					0.011	0.017				
9/27/99	0.015	0.014			0.019	0.019	0.011	0.014	0.017	0.015
9/28/99										
9/29/99			0.015	0.015						
9/7/99	0.021	0.019	0.015	0.019	0.012	0.019	0.018	0.019	0.021	0.019

ATTACHMENT C.

PSTA FILE STRUCTURE: OBSERVATIONS LIMITED TO JUN-OCT99
TREE.xls

CODE	TP	TPP	TDP	SRP	DOP	SITE	TRTMT	CELL	UNIT
PpDx41	17	17	17	12	12	PORTA	1	9	PRTA01
PpDx42	17	17	18	13	13	PORTA	1	11	PRTA01
PpDx43	18	18	18	13	13	PORTA	1	18	PRTA01
PrDx41	17	17	18	13	13	PORTA	2	4	PRTA02
PrDx42	17	17	18	13	13	PORTA	2	7	PRTA02
PrDx43	18	18	18	13	13	PORTA	2	8	PRTA02
PpSx31	17	17	17	11	11	PORTA	3	12	PRTA03
PpSx32	18	18	18	13	13	PORTA	3	14	PRTA03
PpSx33	17	17	17	12	12	PORTA	3	17	PRTA03
PrSx31	18	18	18	12	12	PORTA	4	3	PRTA04
PrSx32	18	18	18	12	12	PORTA	4	5	PRTA04
PrSx33	18	18	19	13	13	PORTA	4	10	PRTA04
PrDX41	16	16	17	12	12	PORTA	5	2	PRTA05
PrDX42	17	17	17	12	12	PORTA	5	13	PRTA05
PrDX43	17	17	17	12	12	PORTA	5	16	PRTA05
PrVx31	18	18	18	12	12	PORTA	6	1	PRTA06
PrVx32	18	18	18	12	12	PORTA	6	6	PRTA06
PrVx33	18	18	18	12	12	PORTA	6	15	PRTA06
PsDx41	18	18	18	12	12	PORTA	7	19	PRTA07
PsDx42	18	18	18	13	13	PORTA	8	20	PRTA08
PpDx4	18	18	18	13	13	PORTA	9	21	PRTA09
PrDx4	18	18	18	12	12	PORTA	10	22	PRTA10
PrSx20	19	19	19	14	14	PORTA	11	23	PRTA11
PpSx20	19	19	19	13	13	PORTA	12	24	PRTA12
CpDx10	6	6	6	5	5	STC	1	13	STC1
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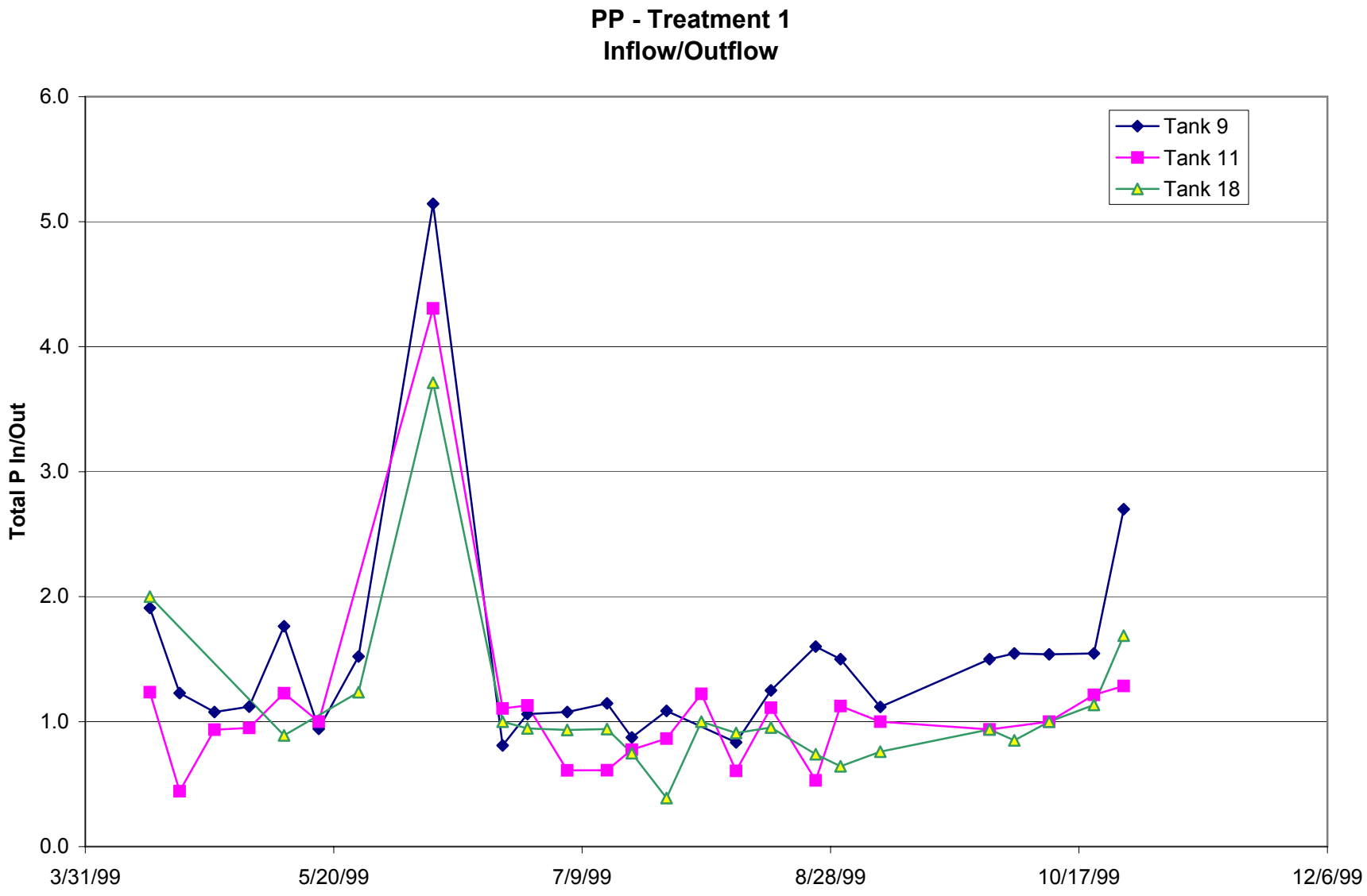

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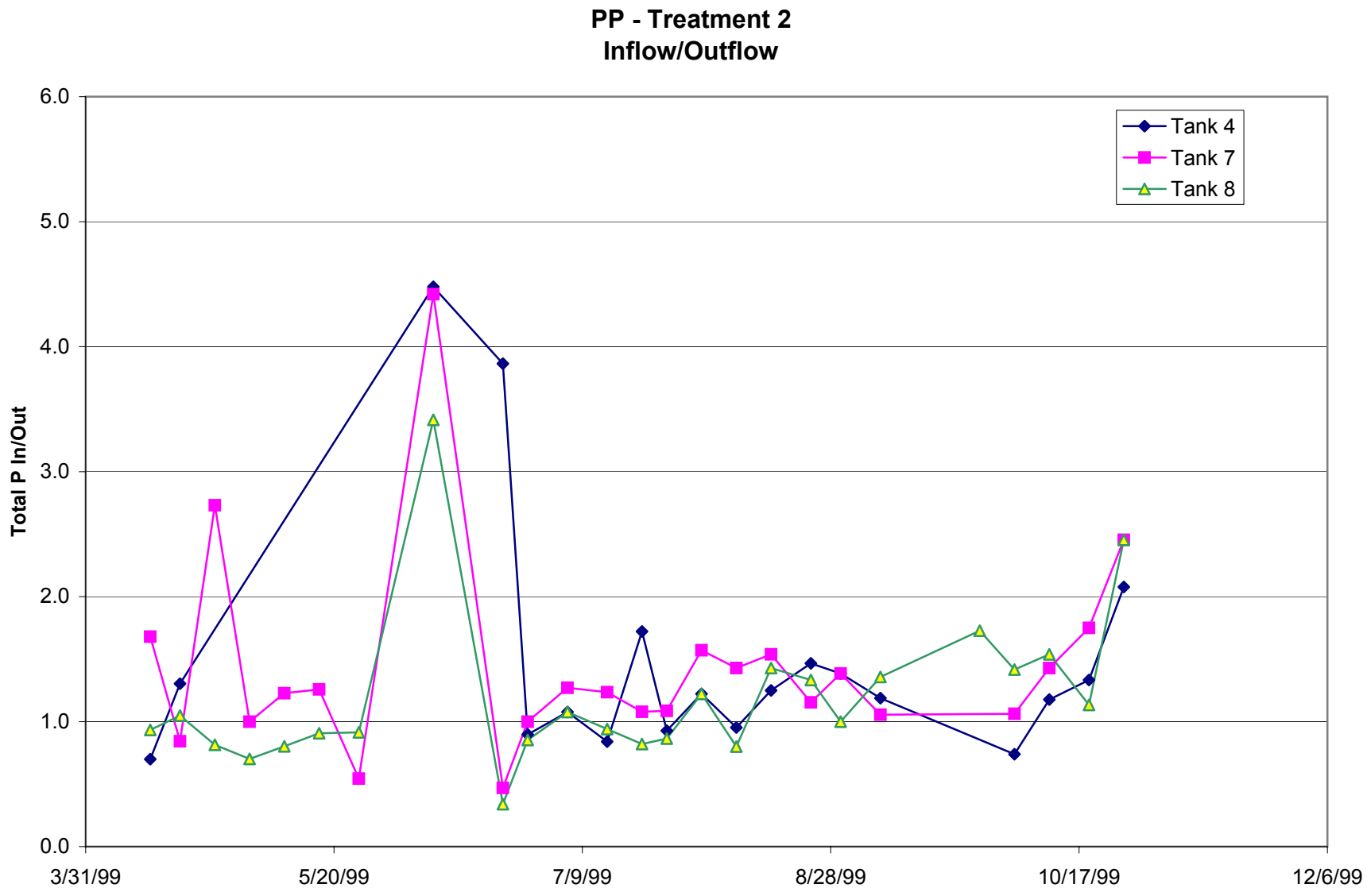

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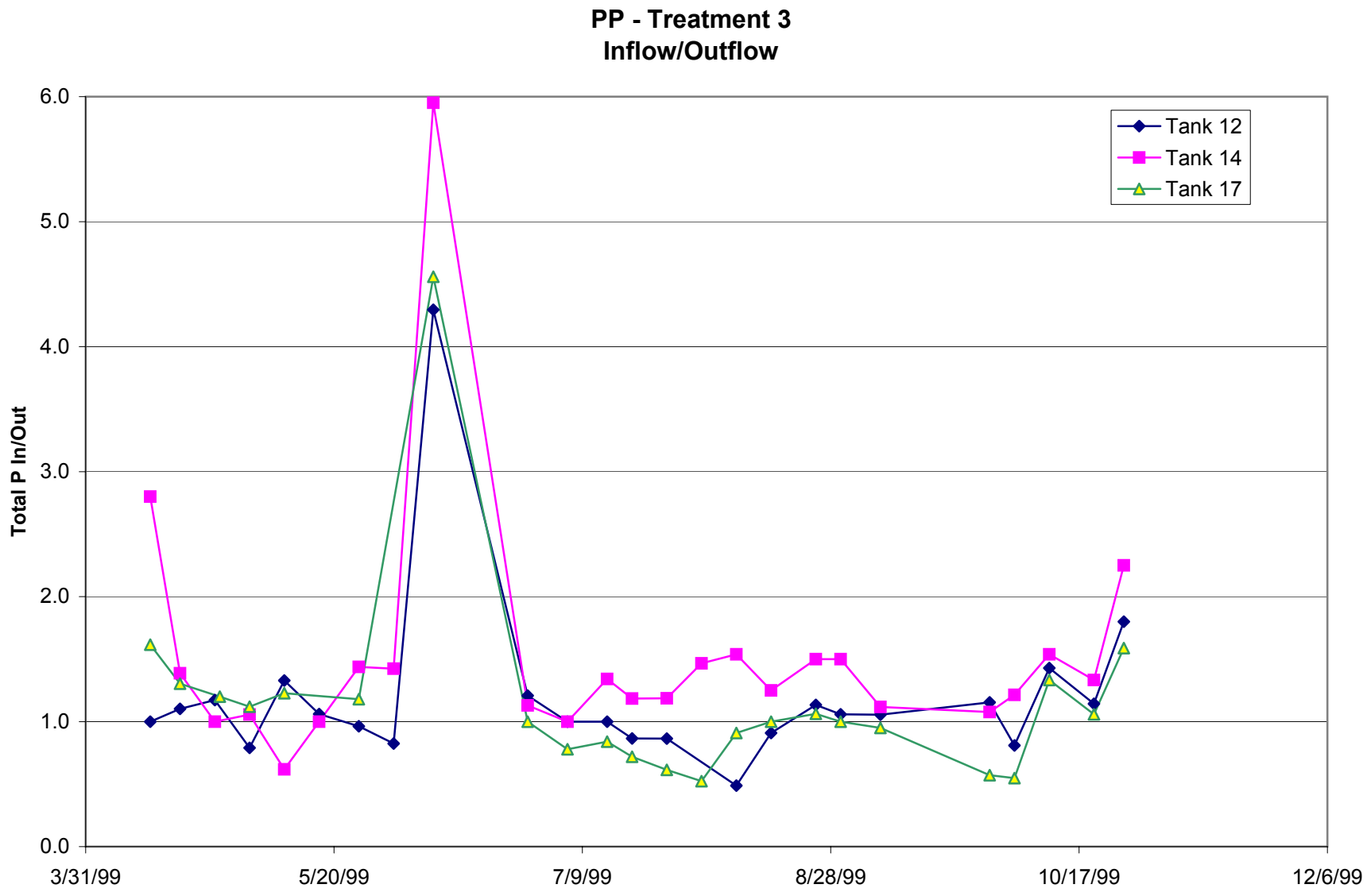

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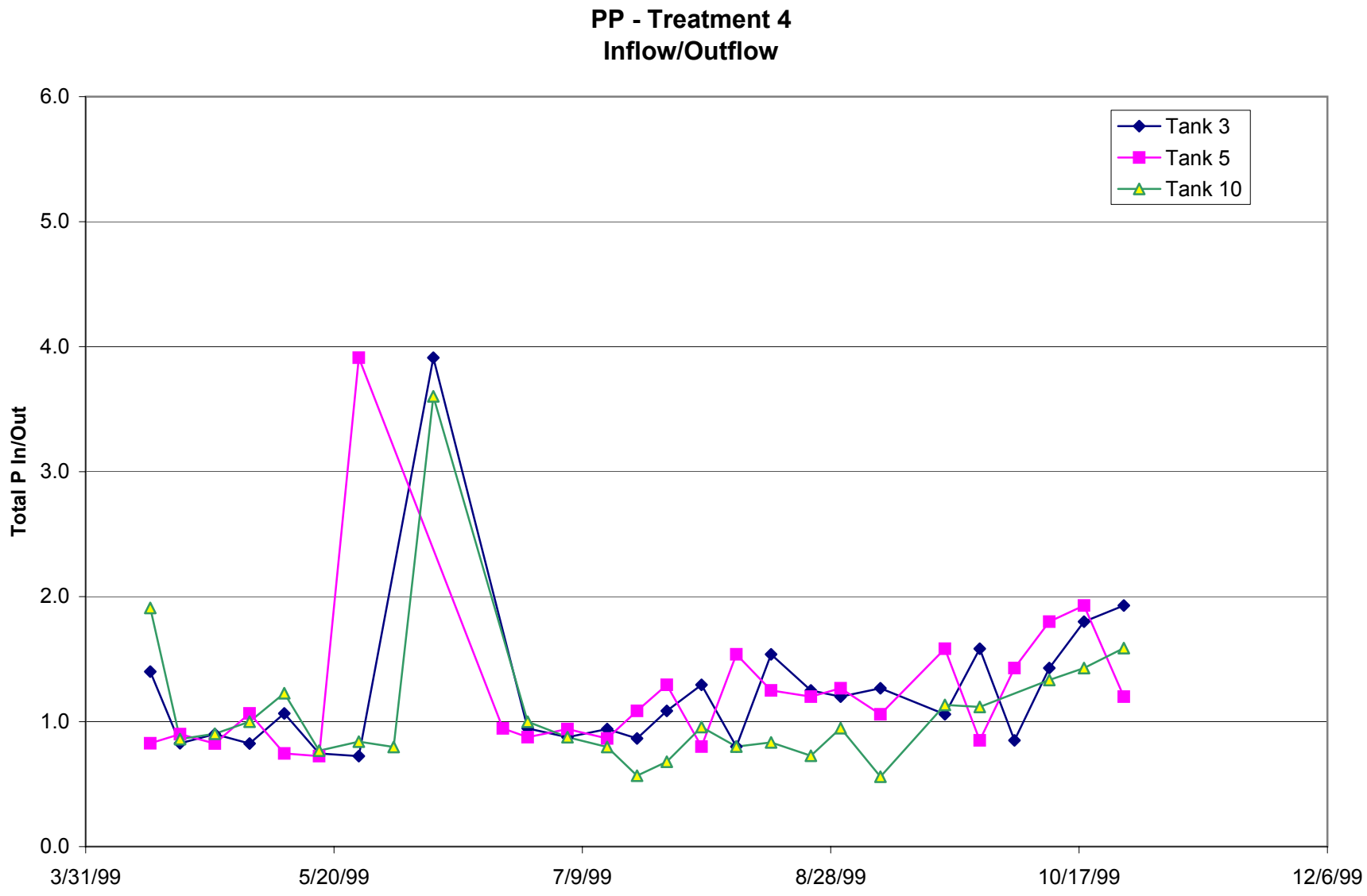

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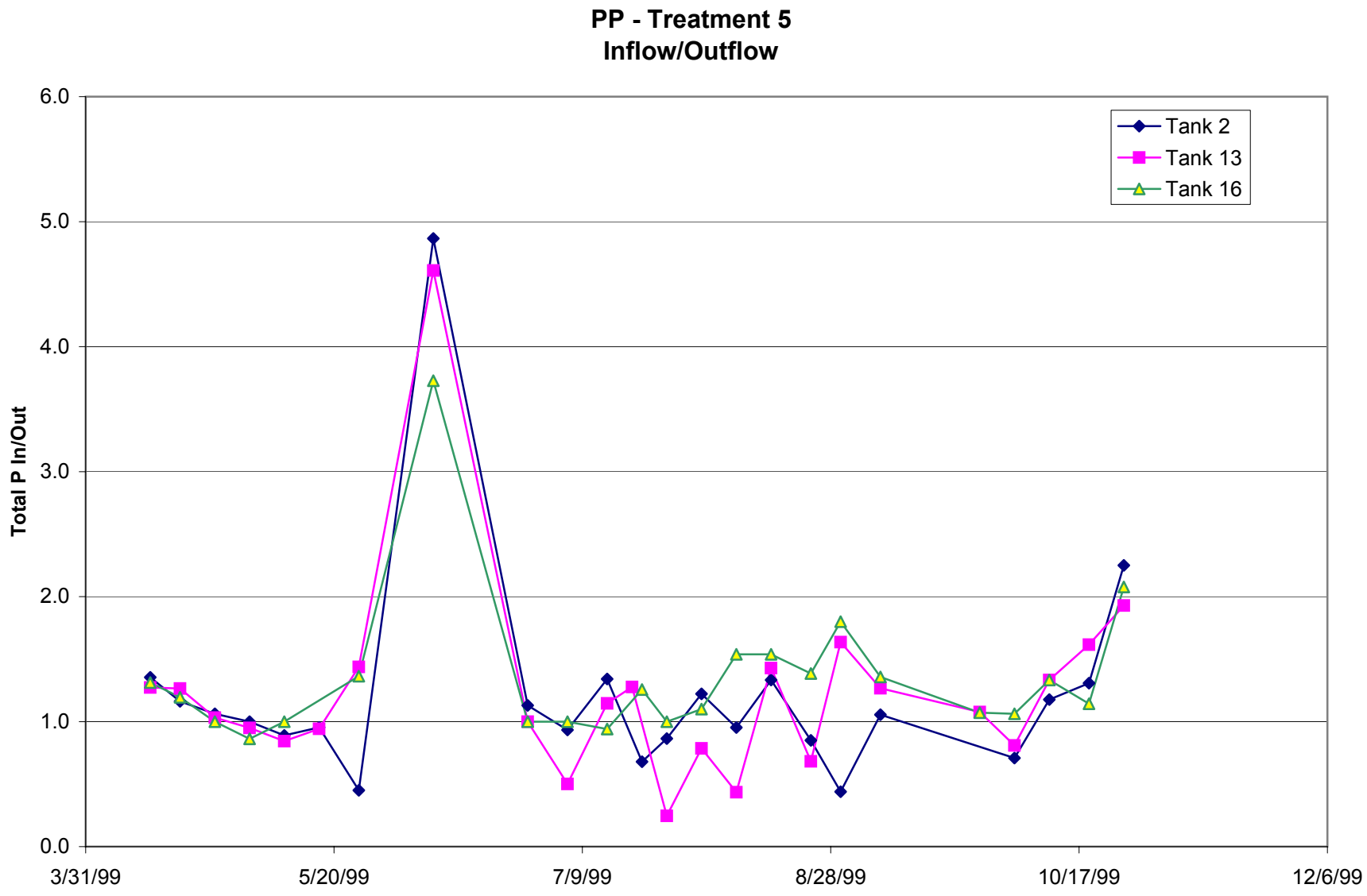

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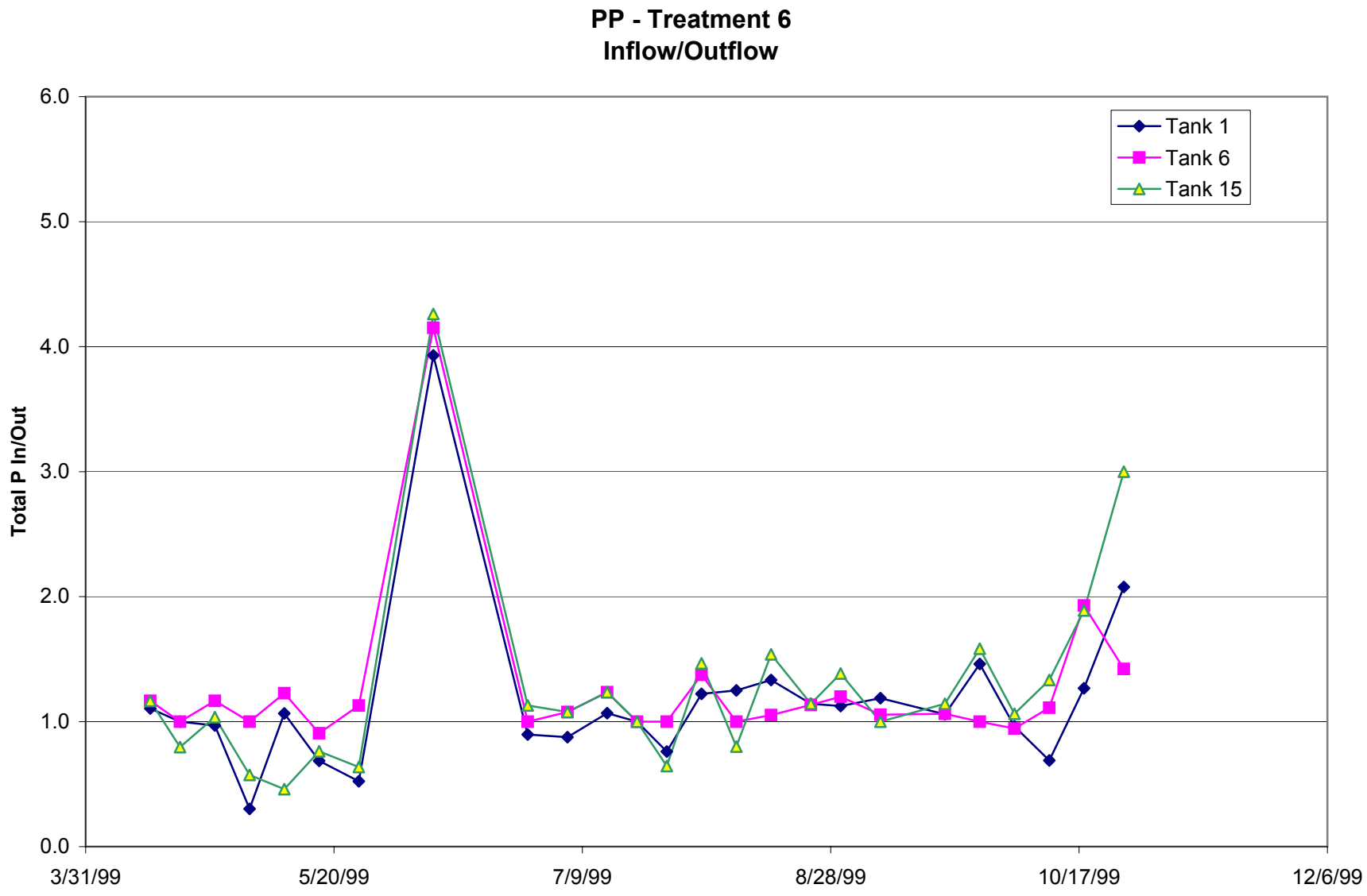

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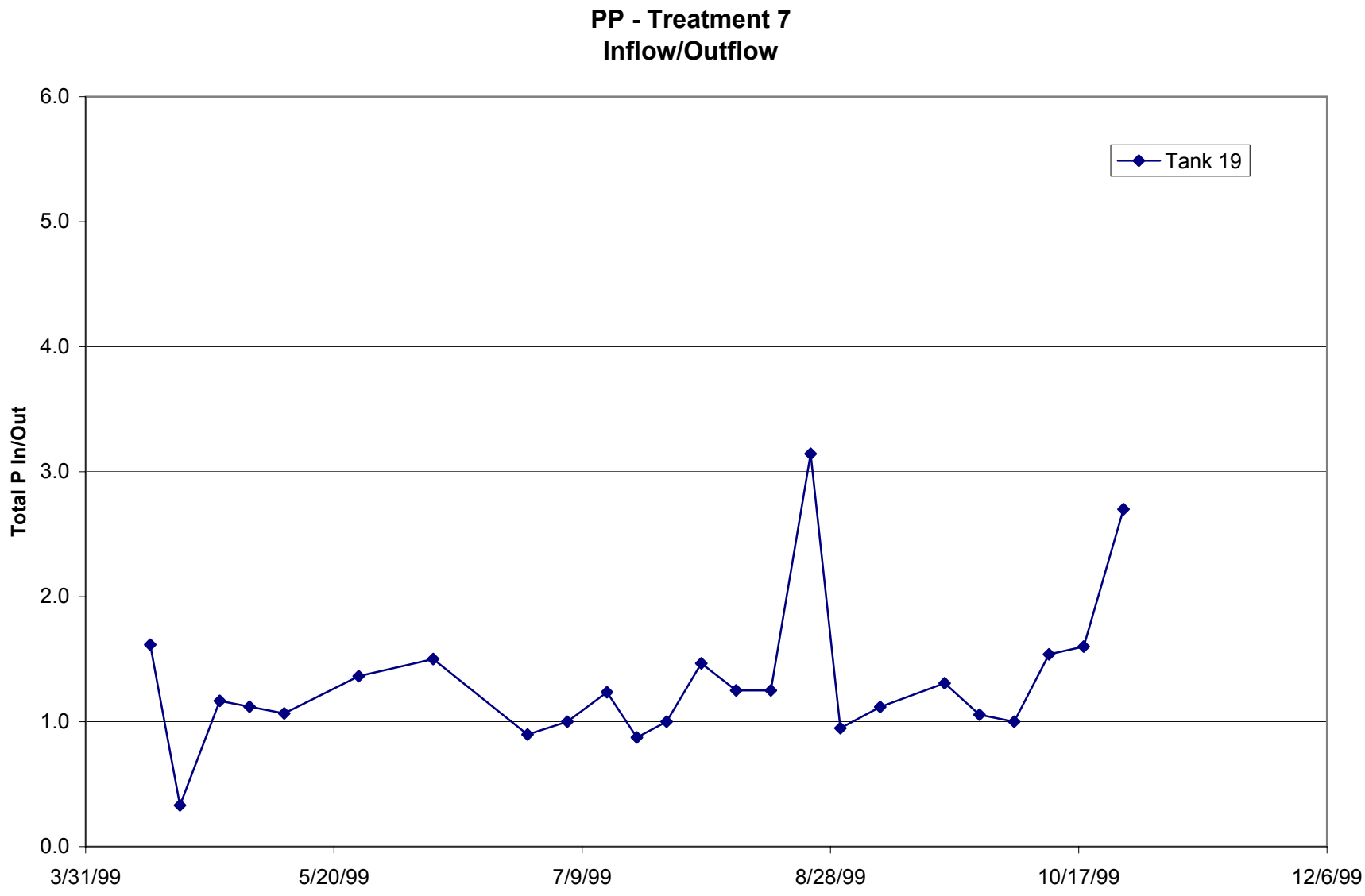

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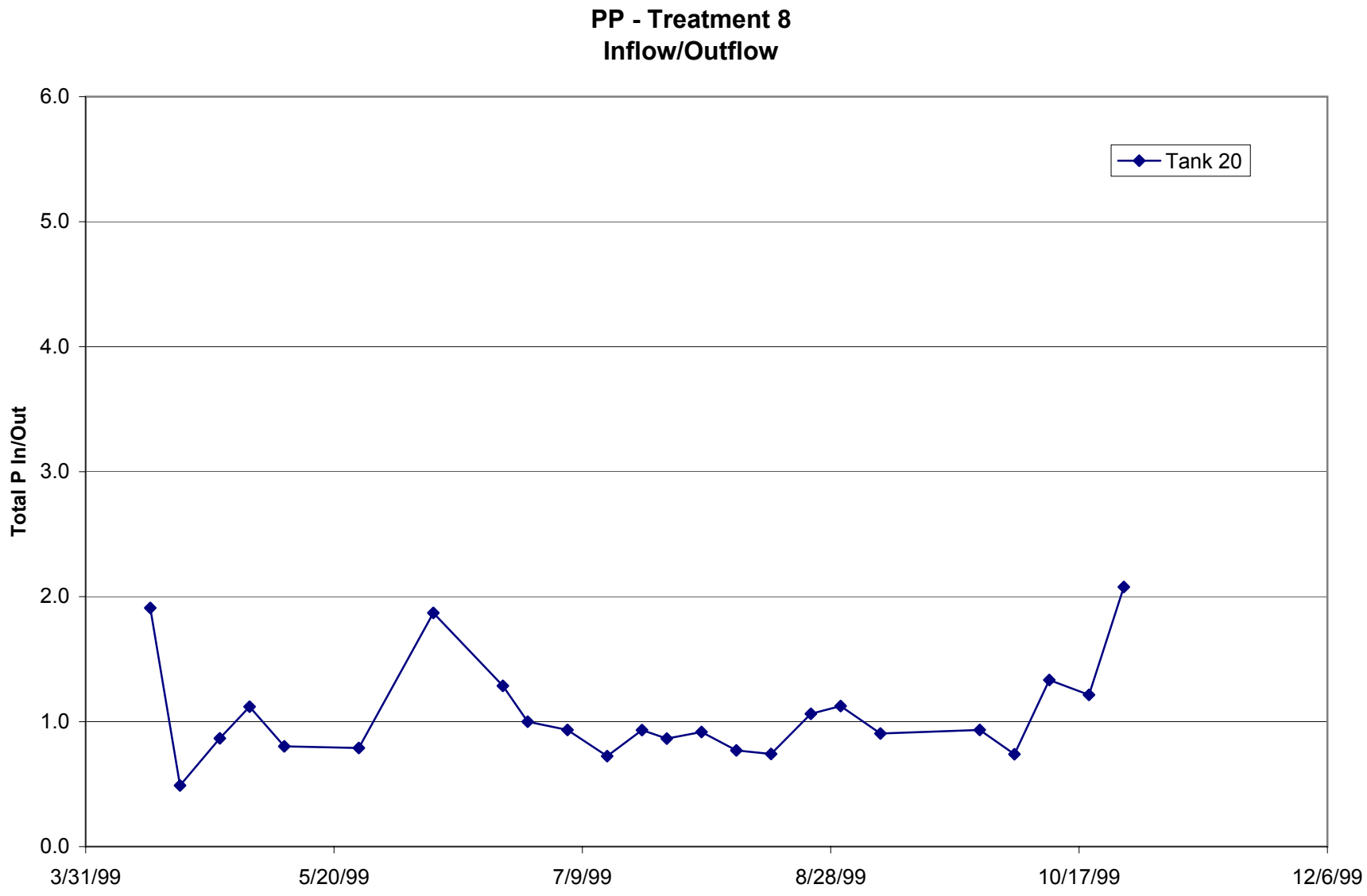

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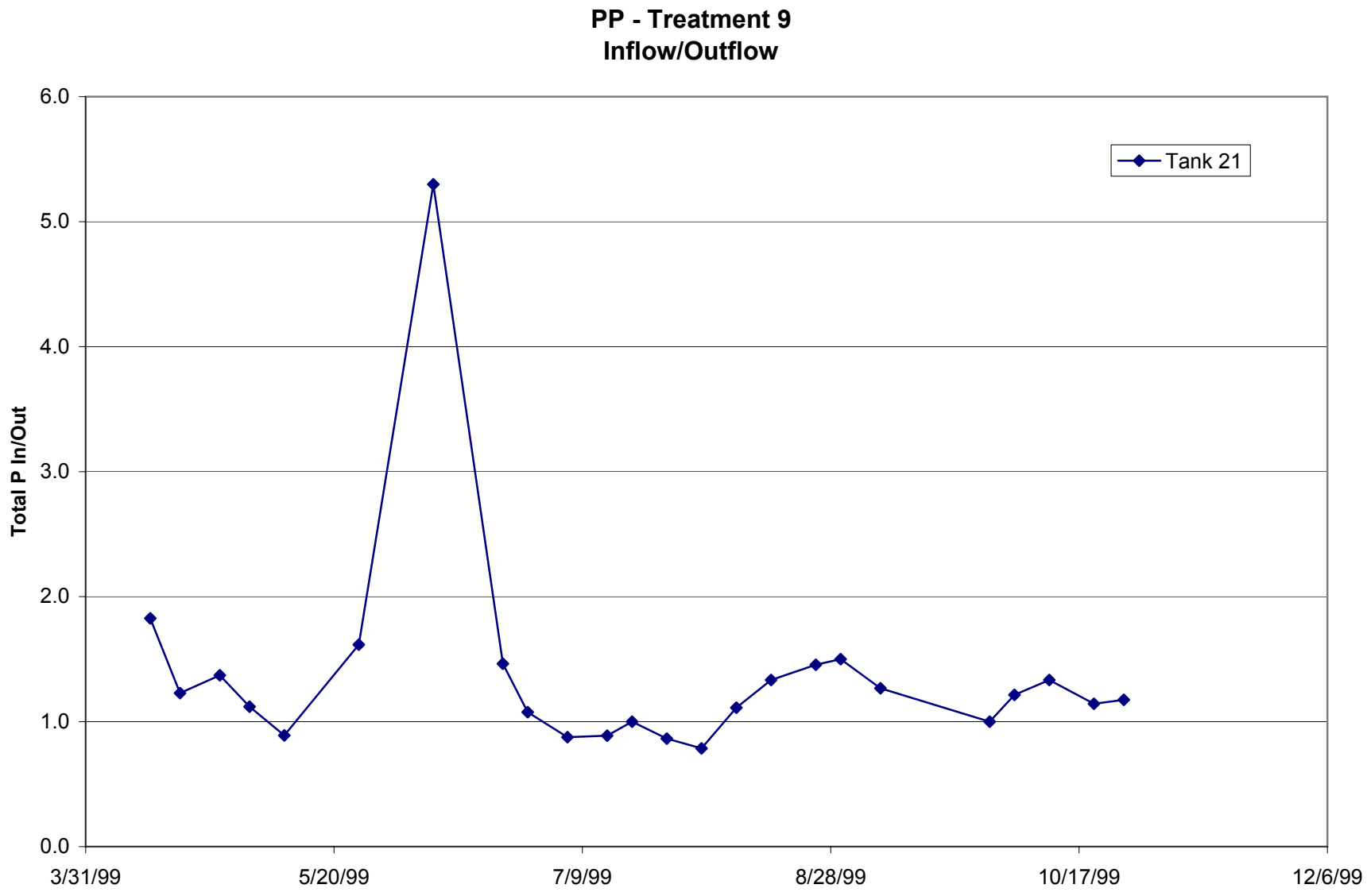

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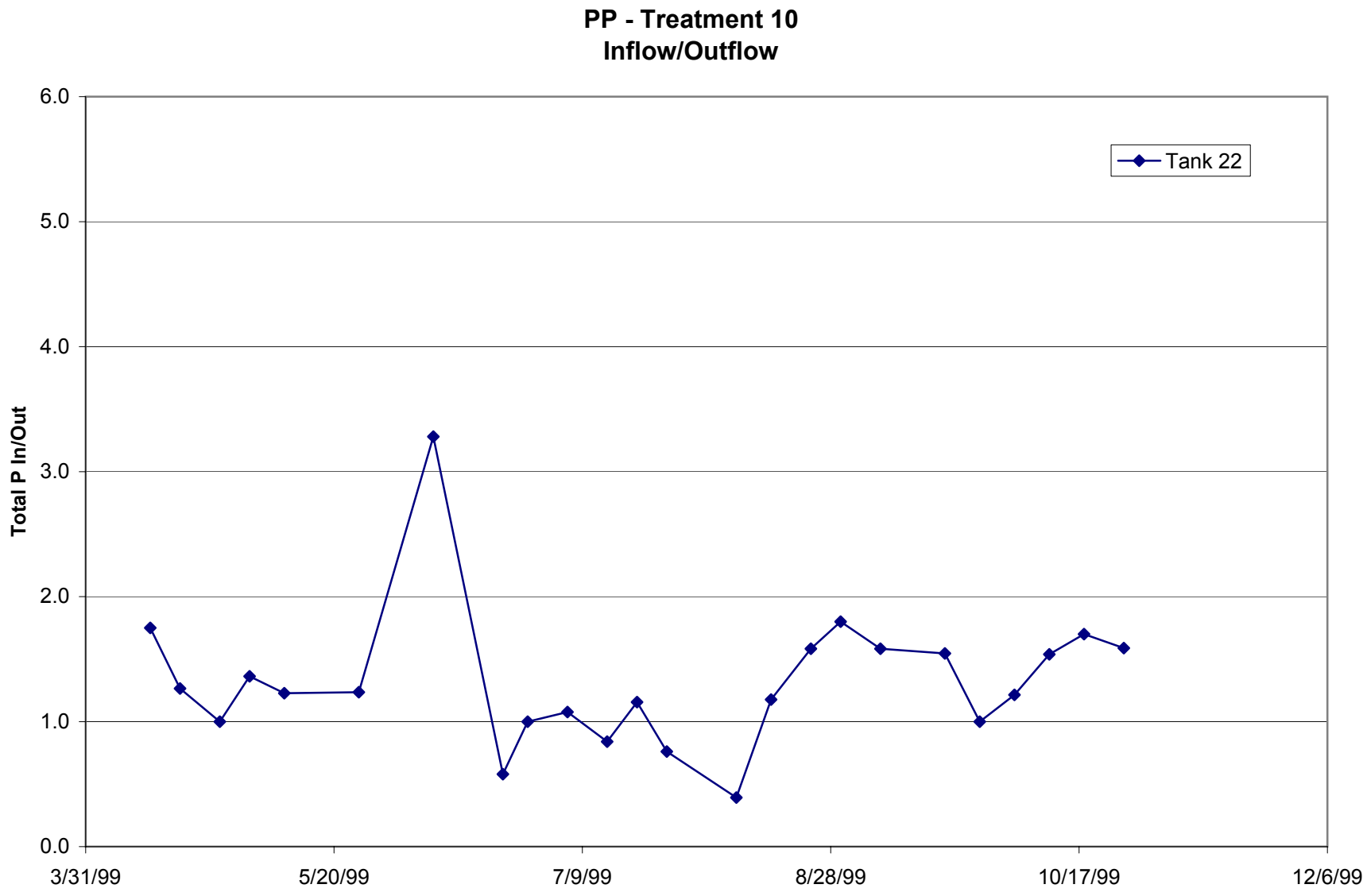

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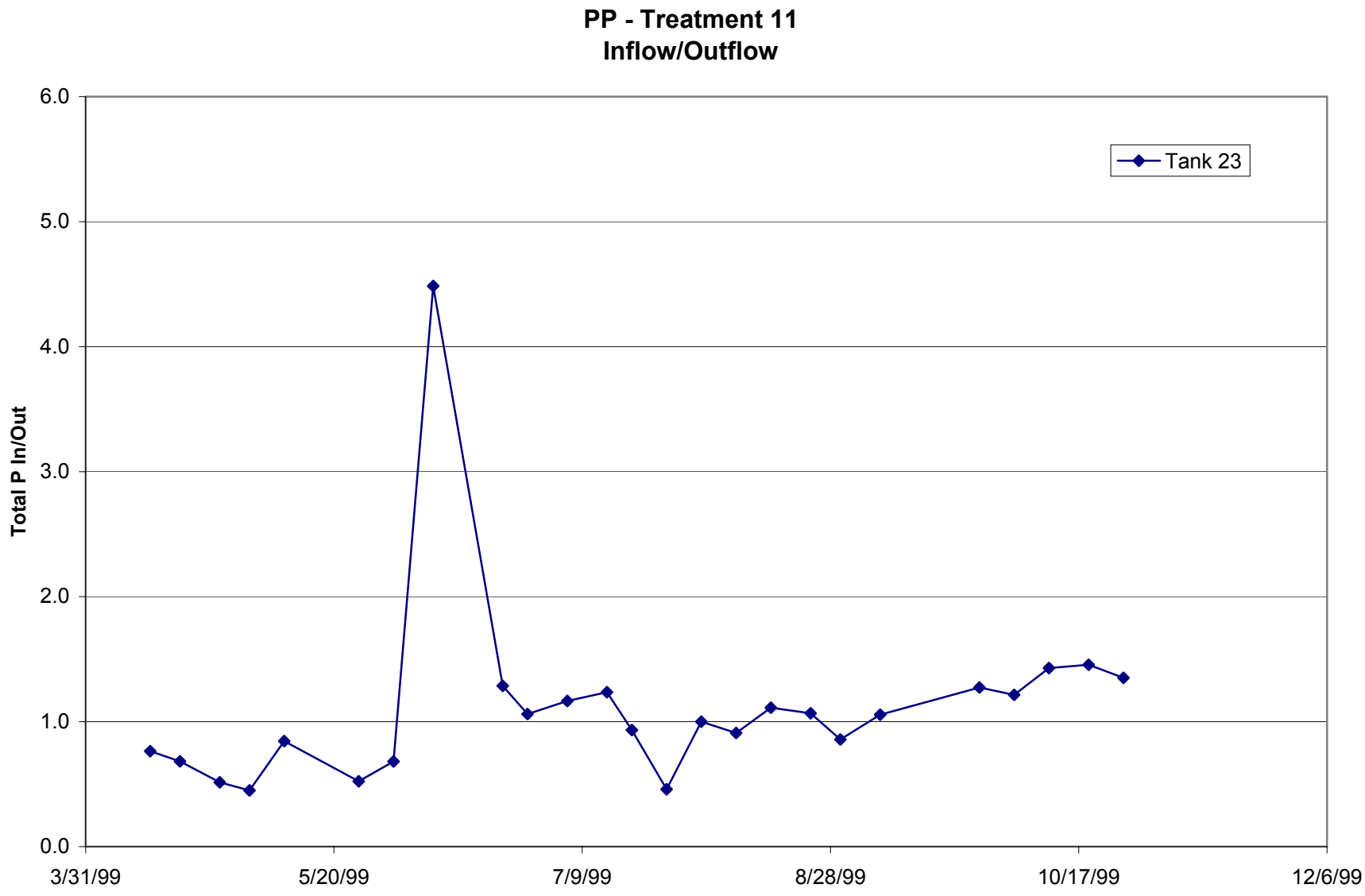

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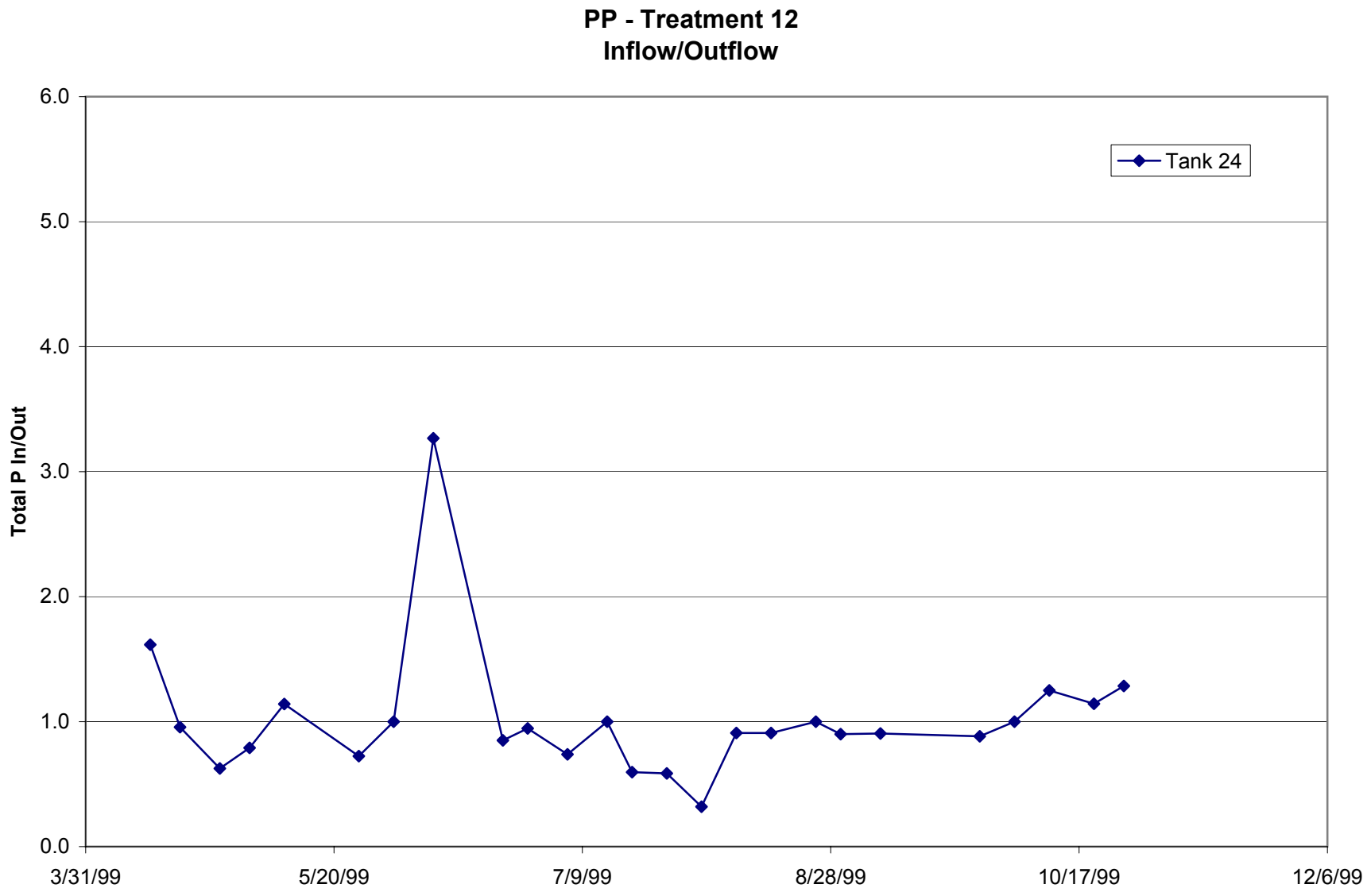

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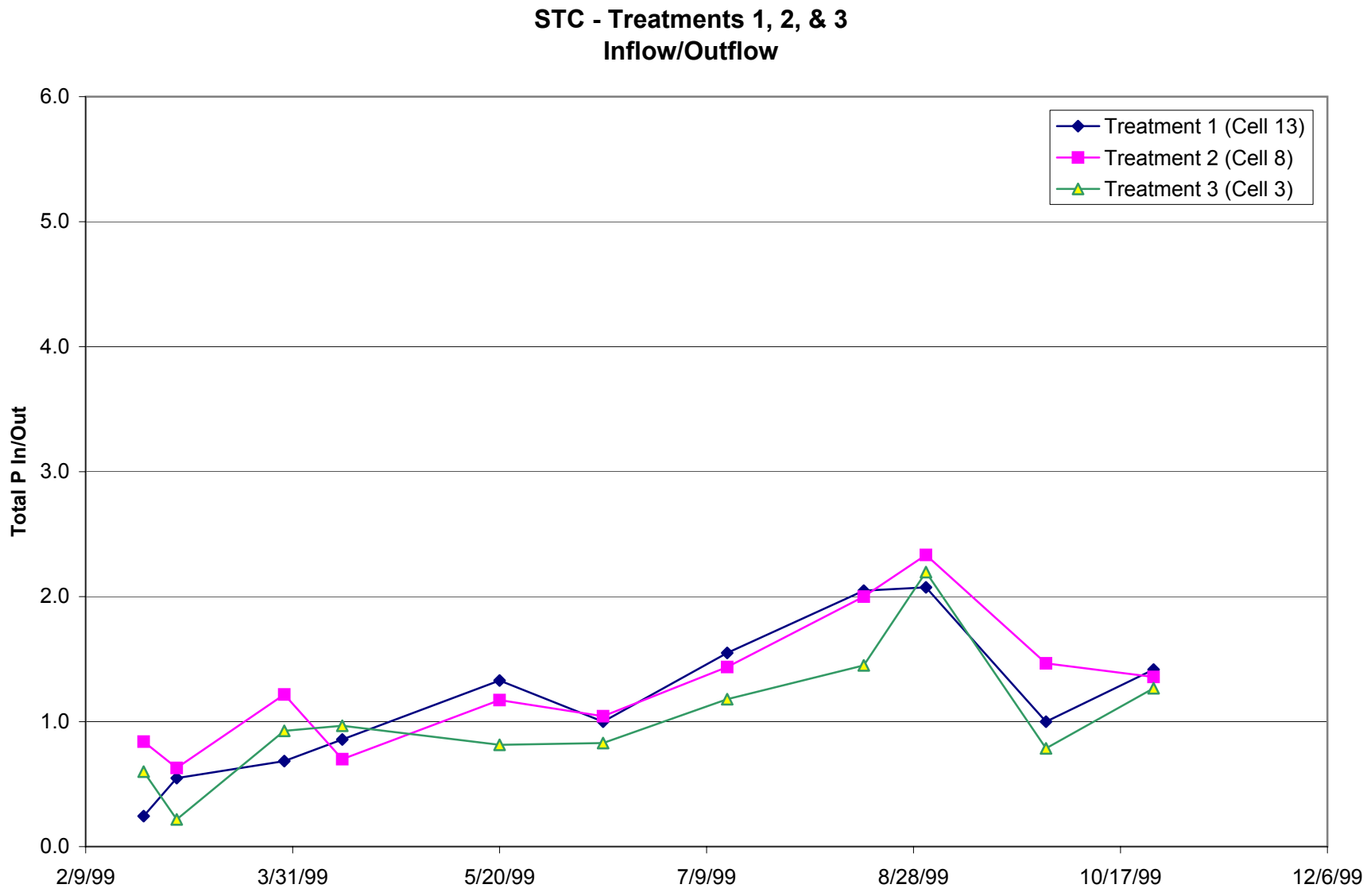

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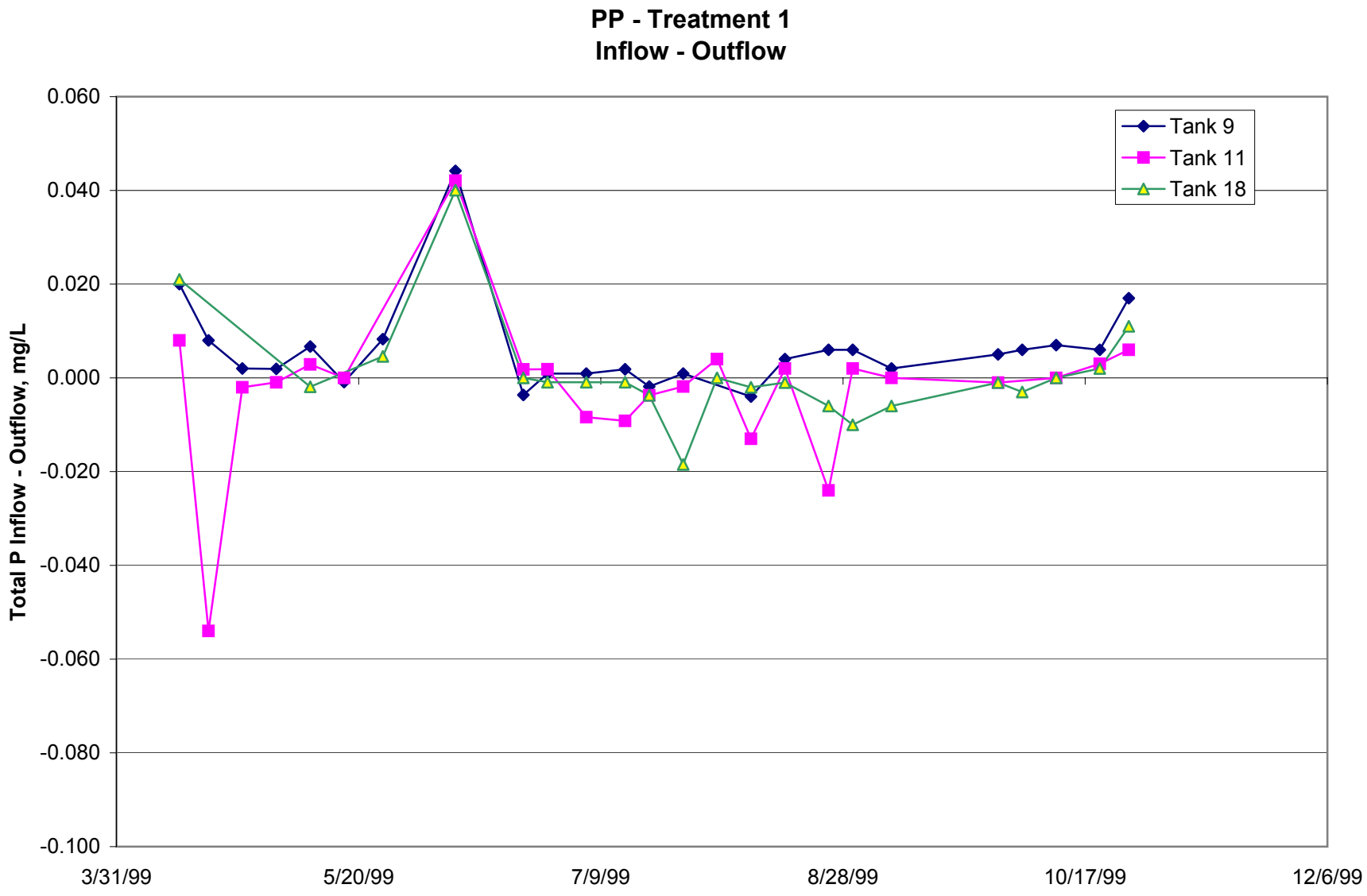

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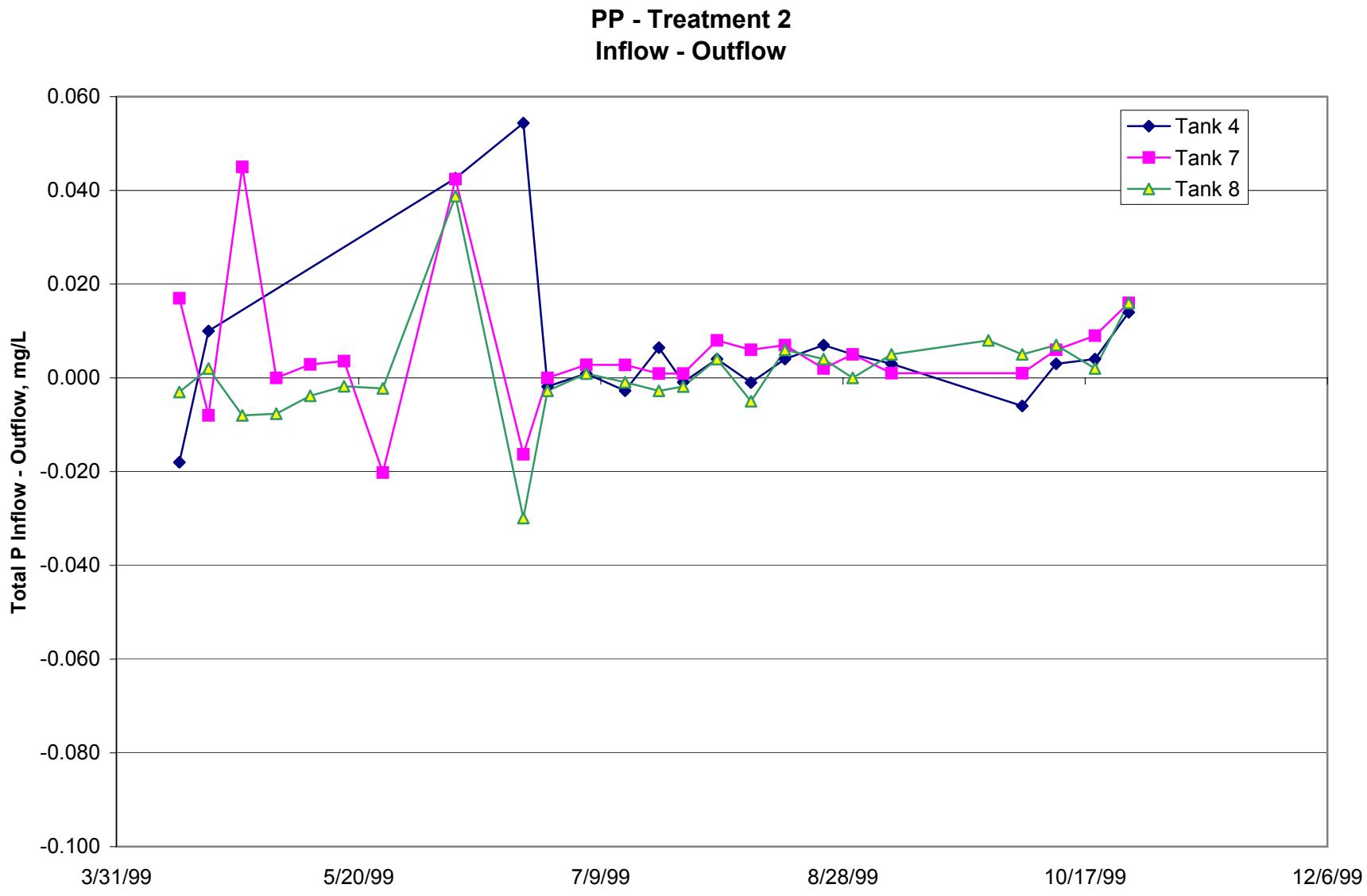

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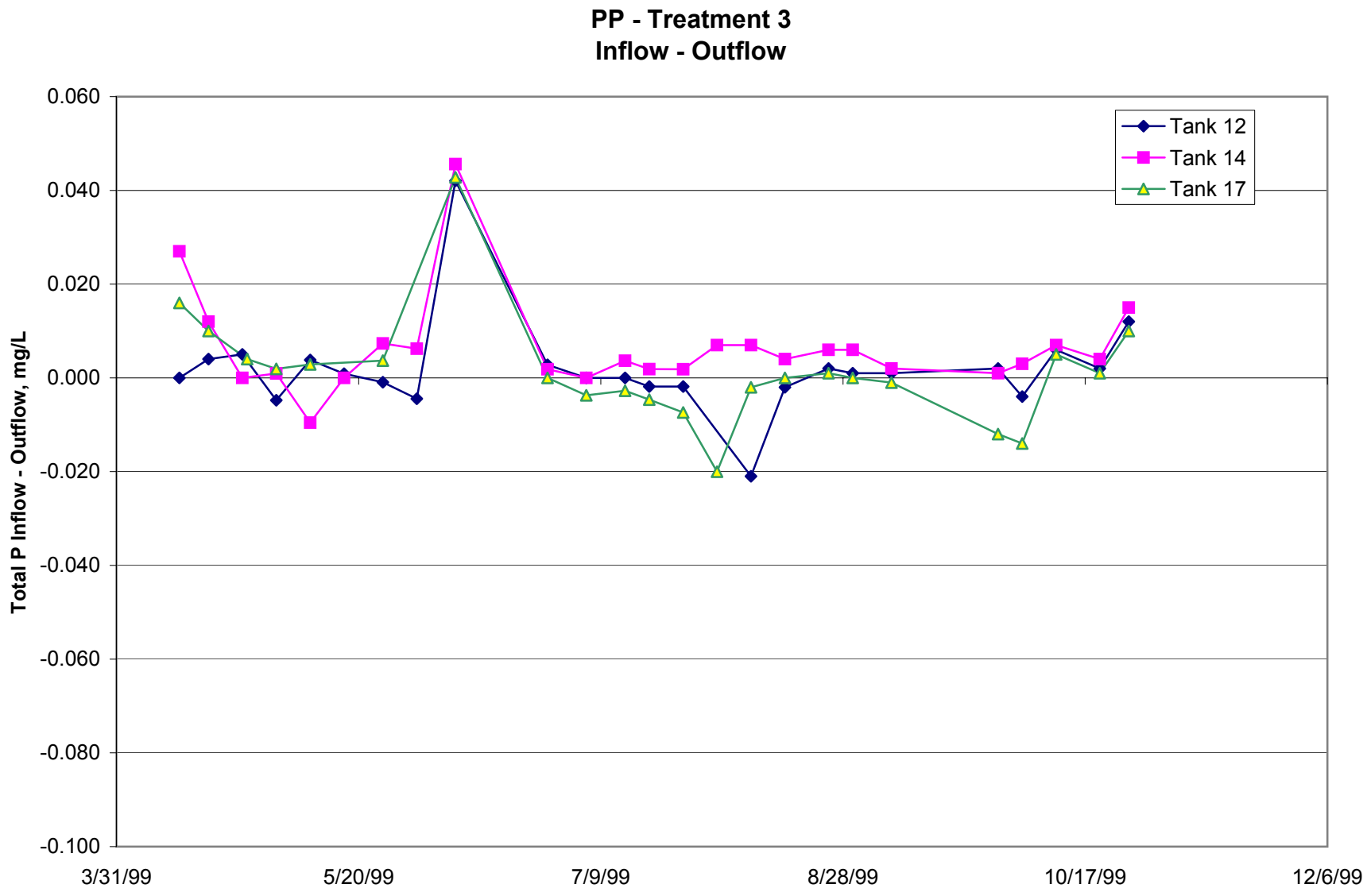

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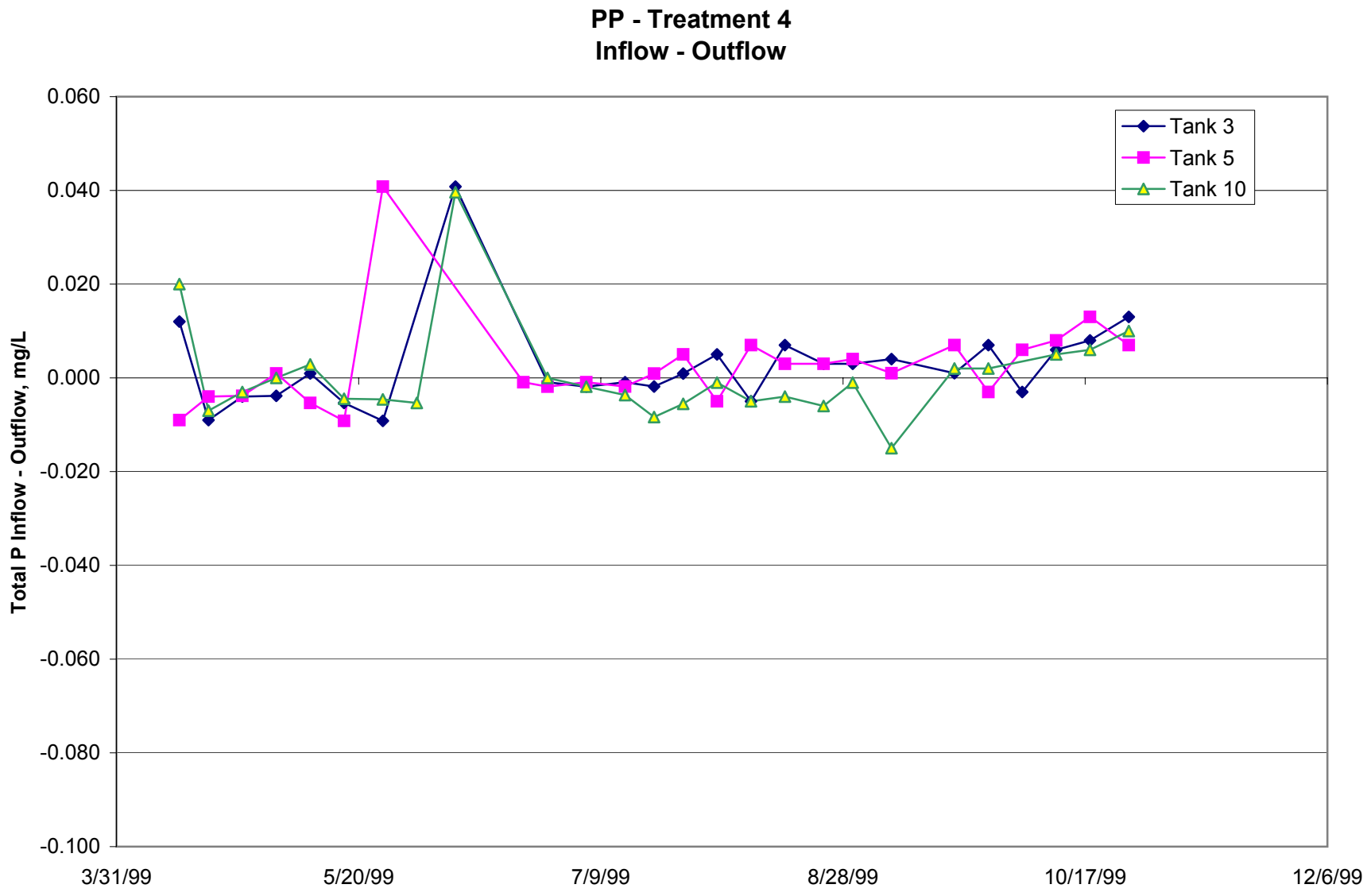

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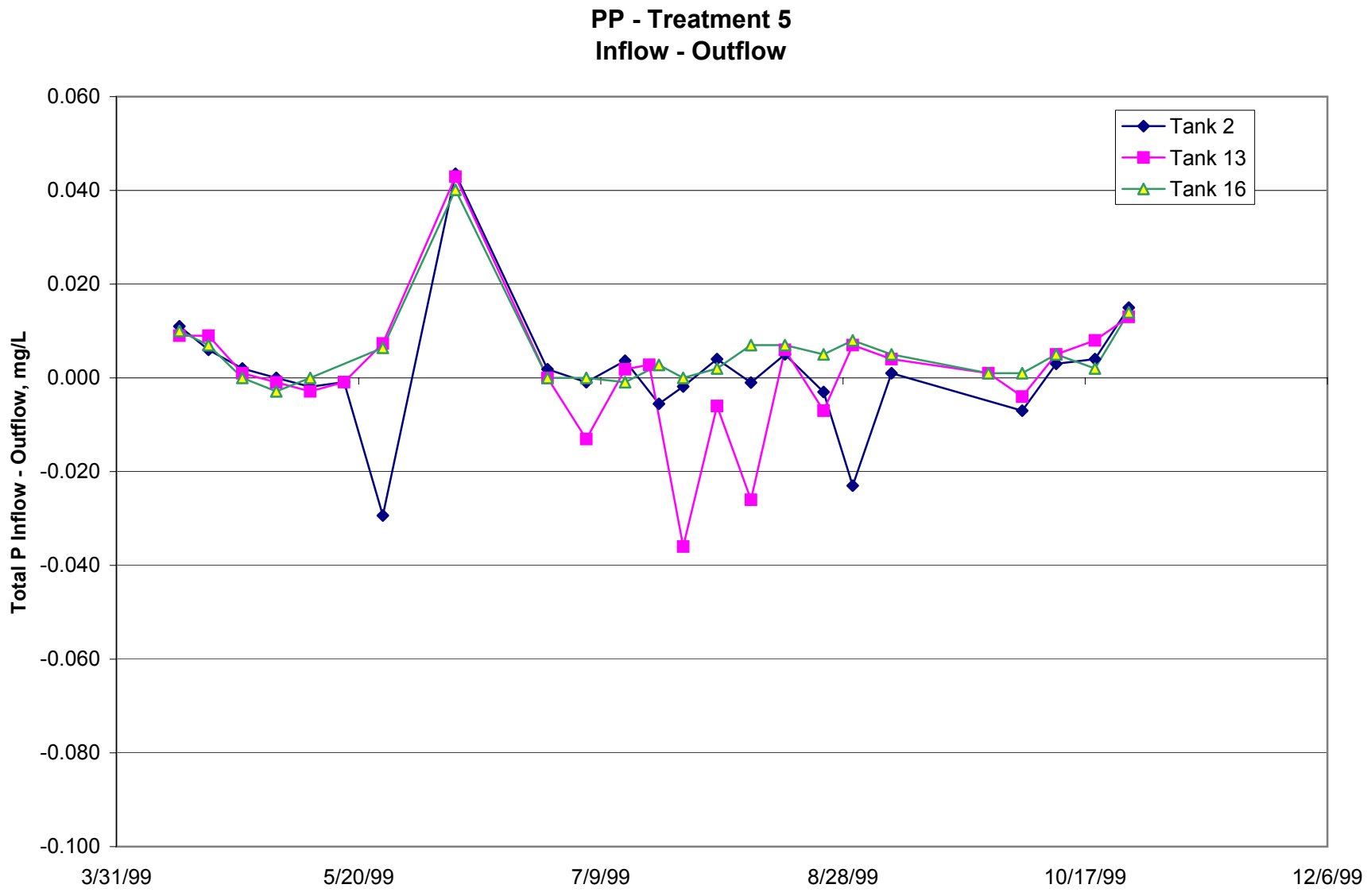

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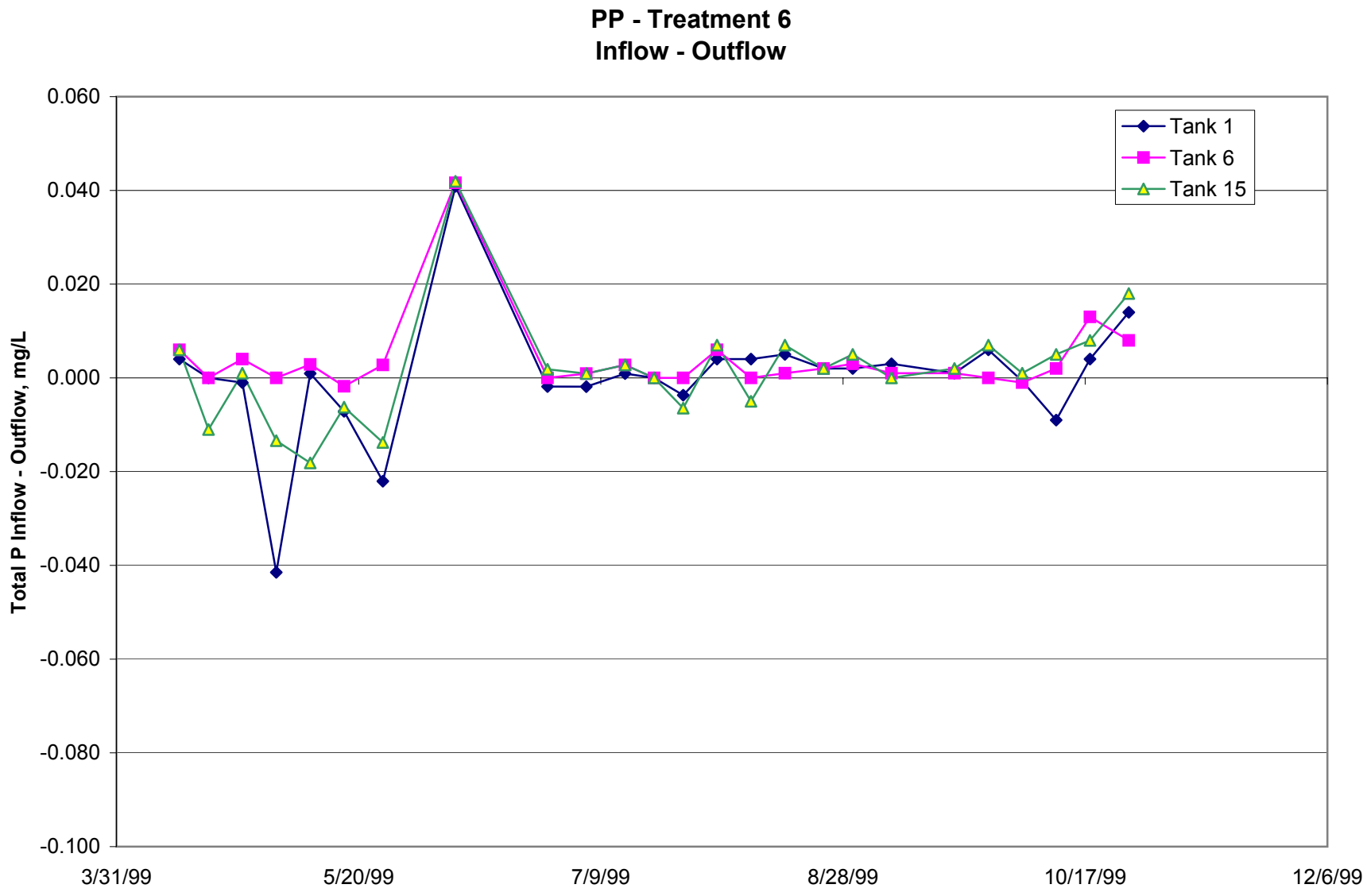

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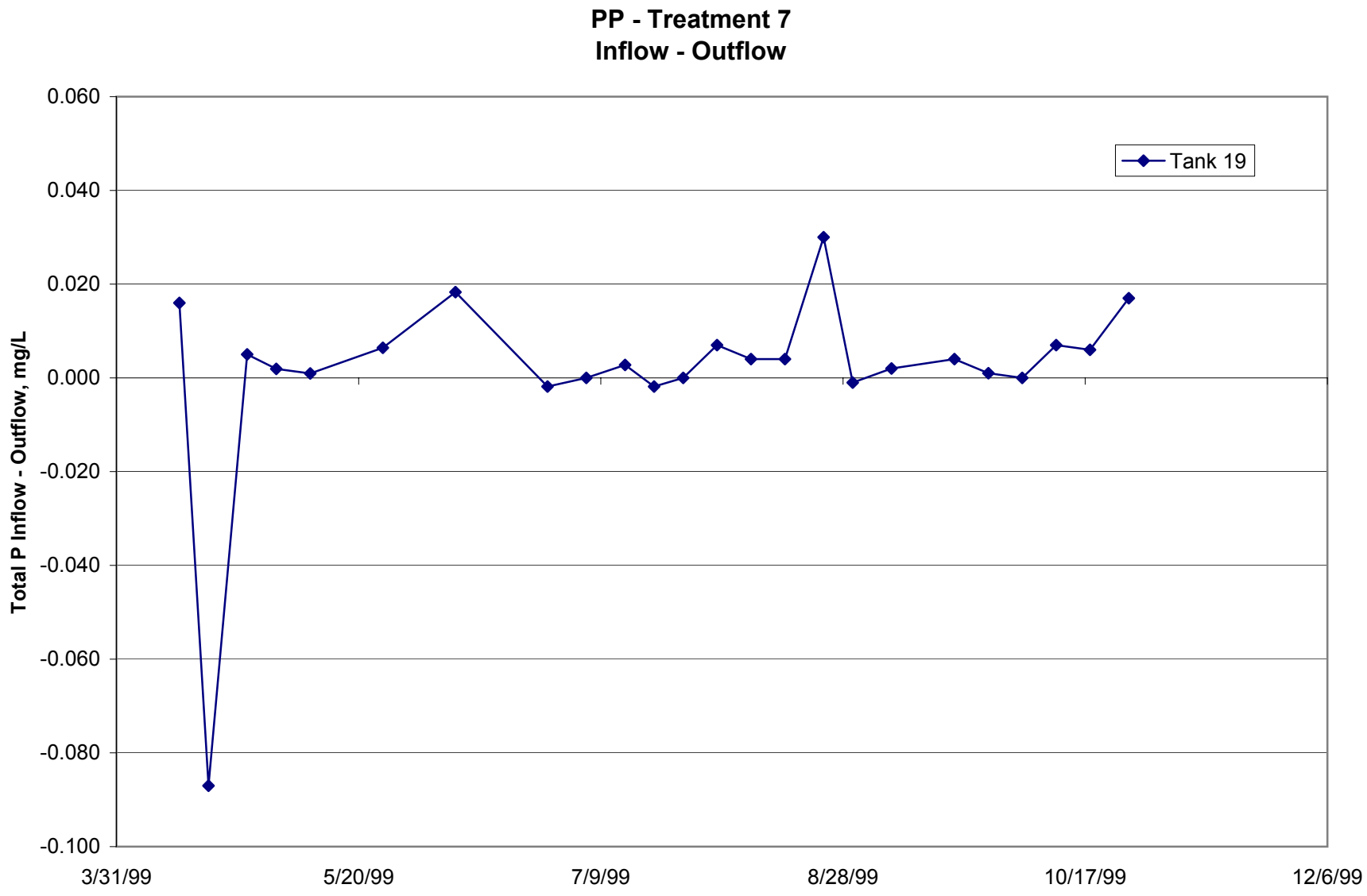

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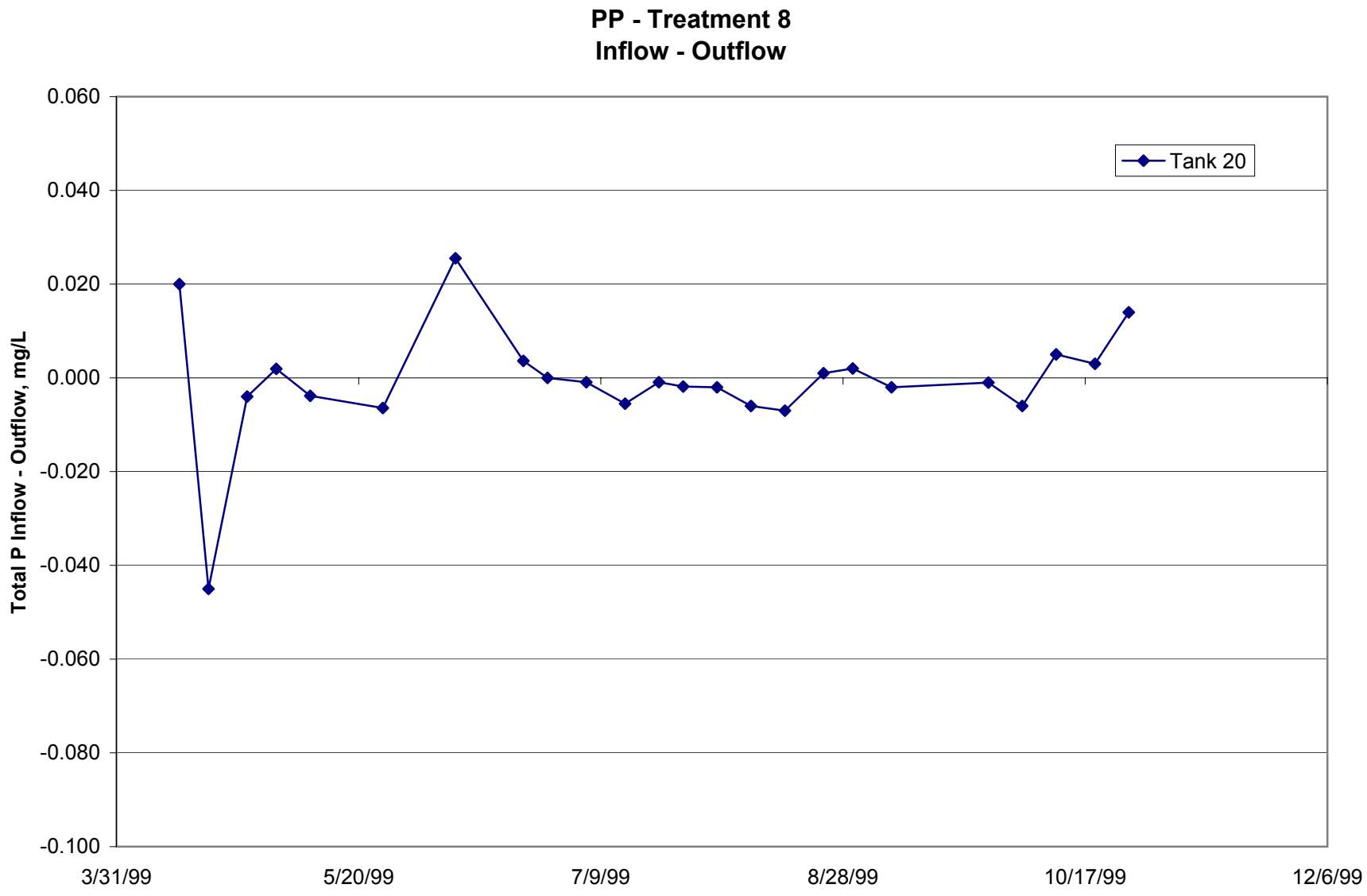

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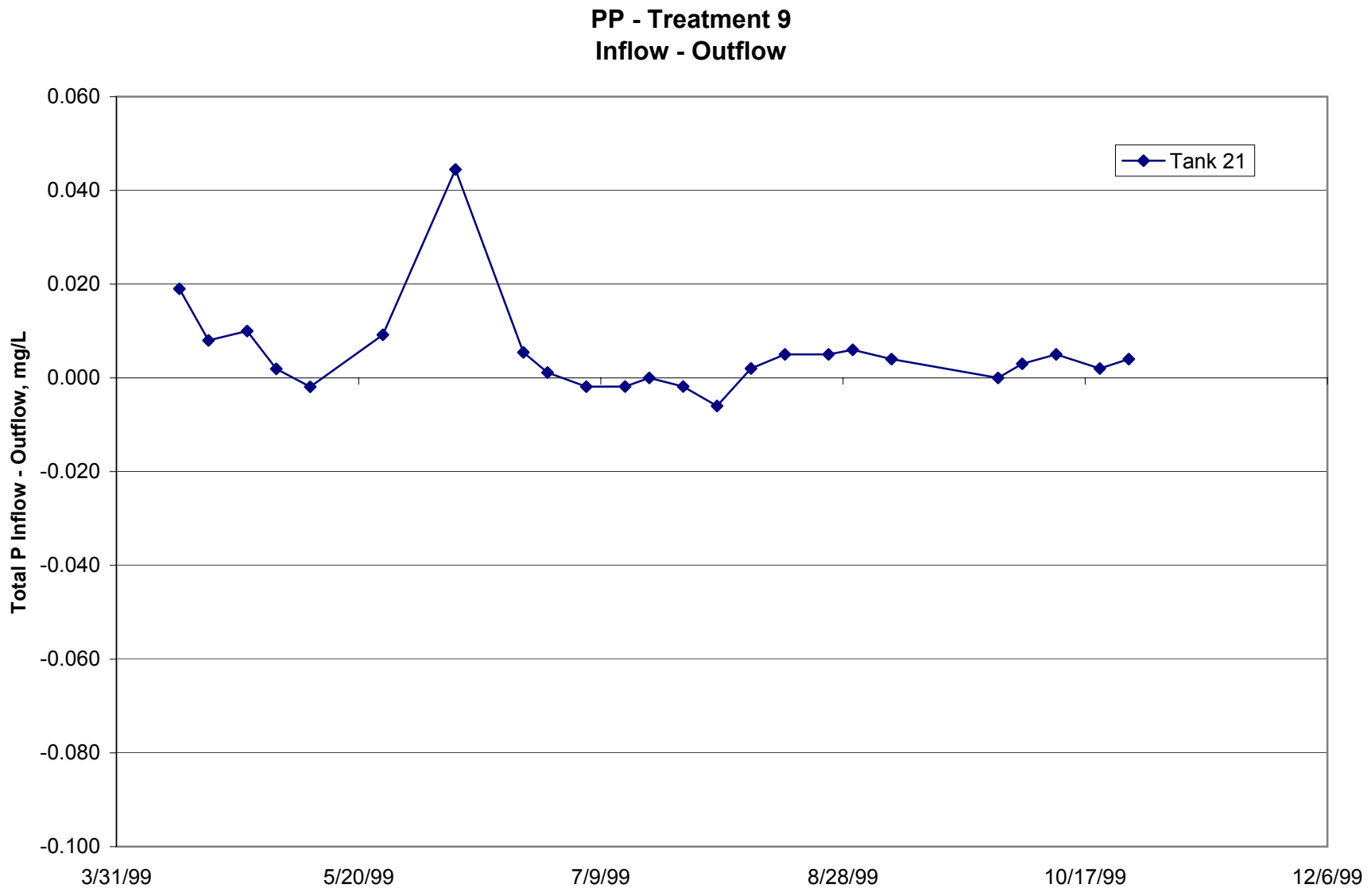

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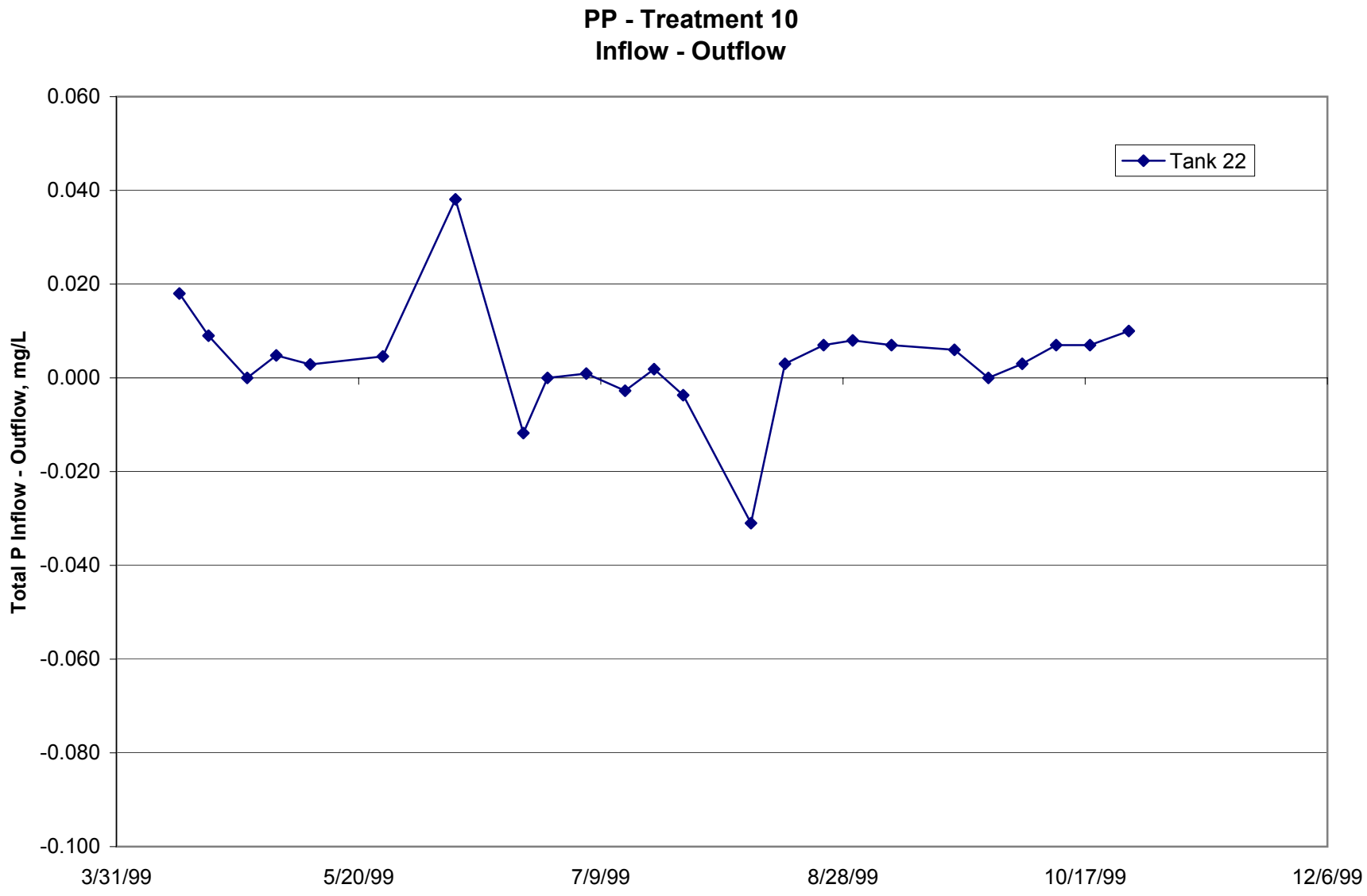

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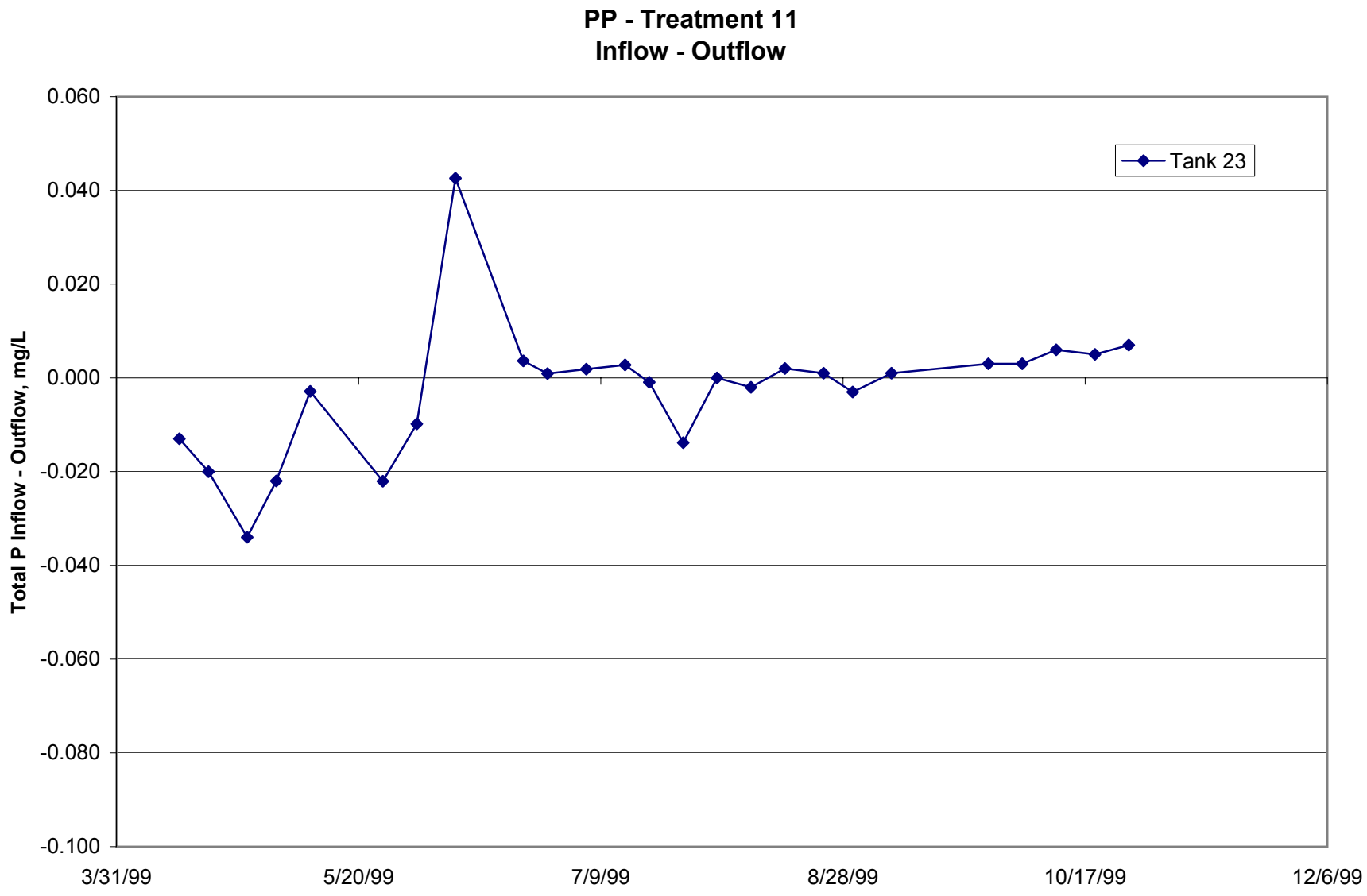

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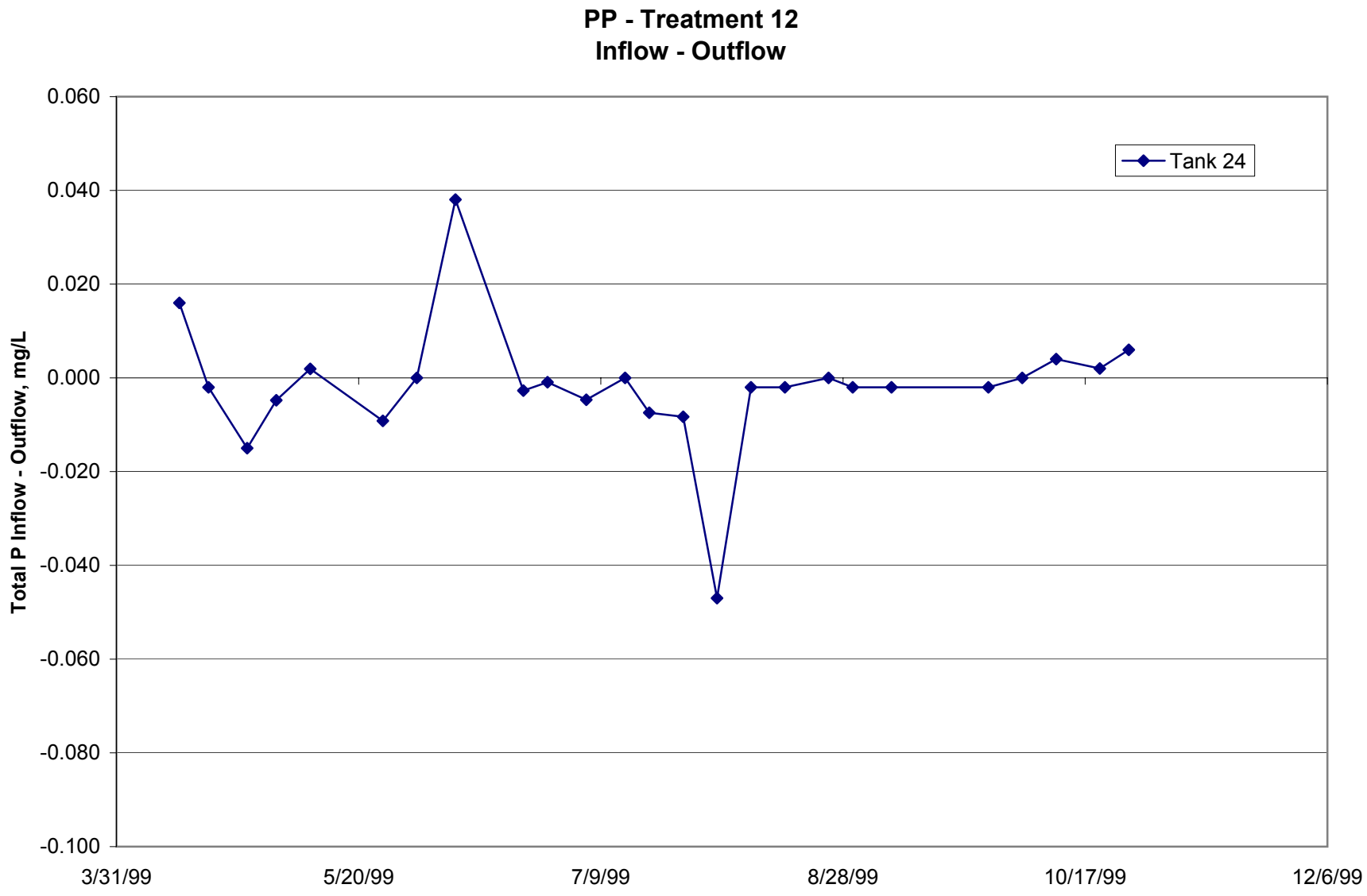

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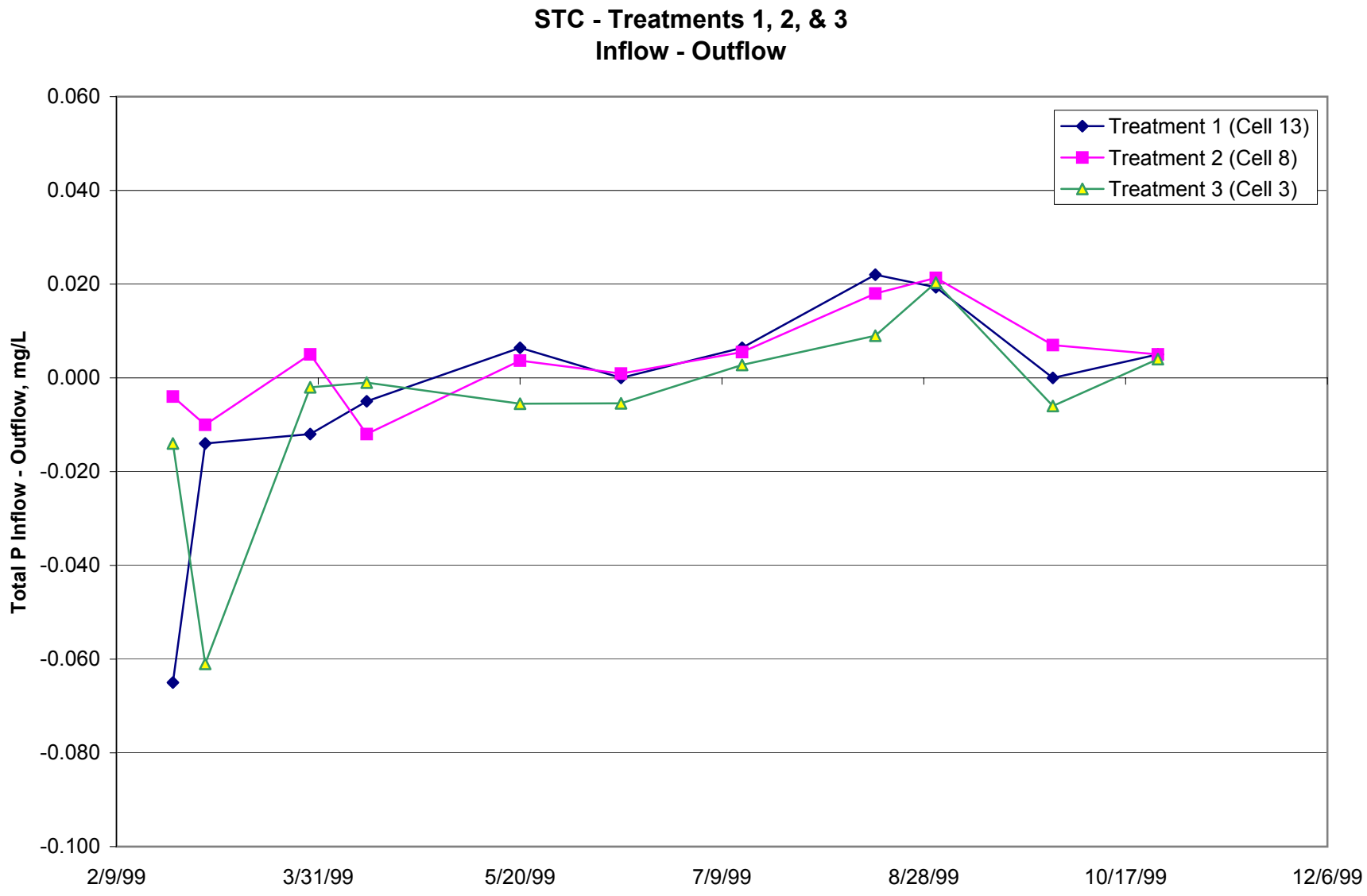

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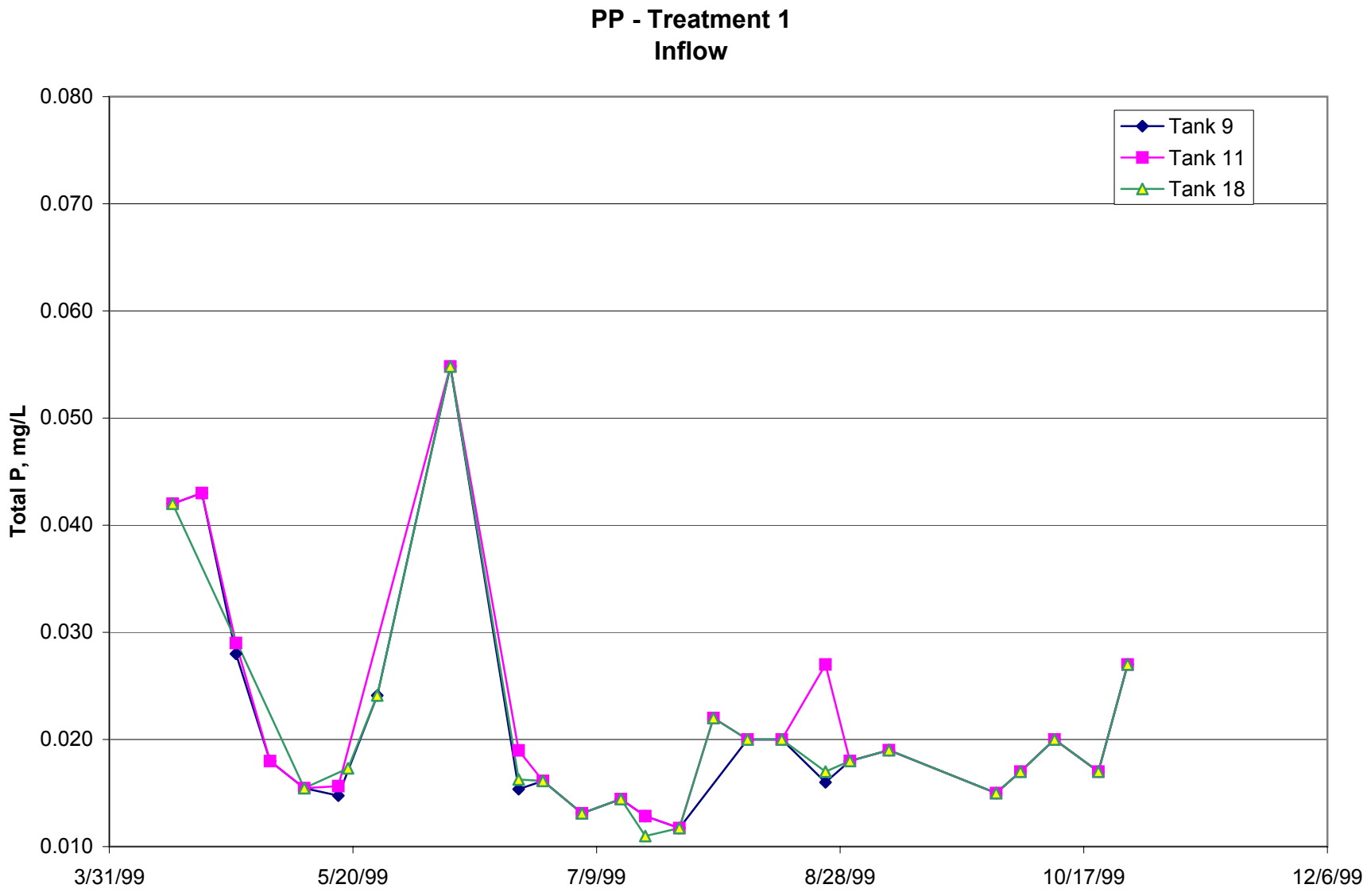

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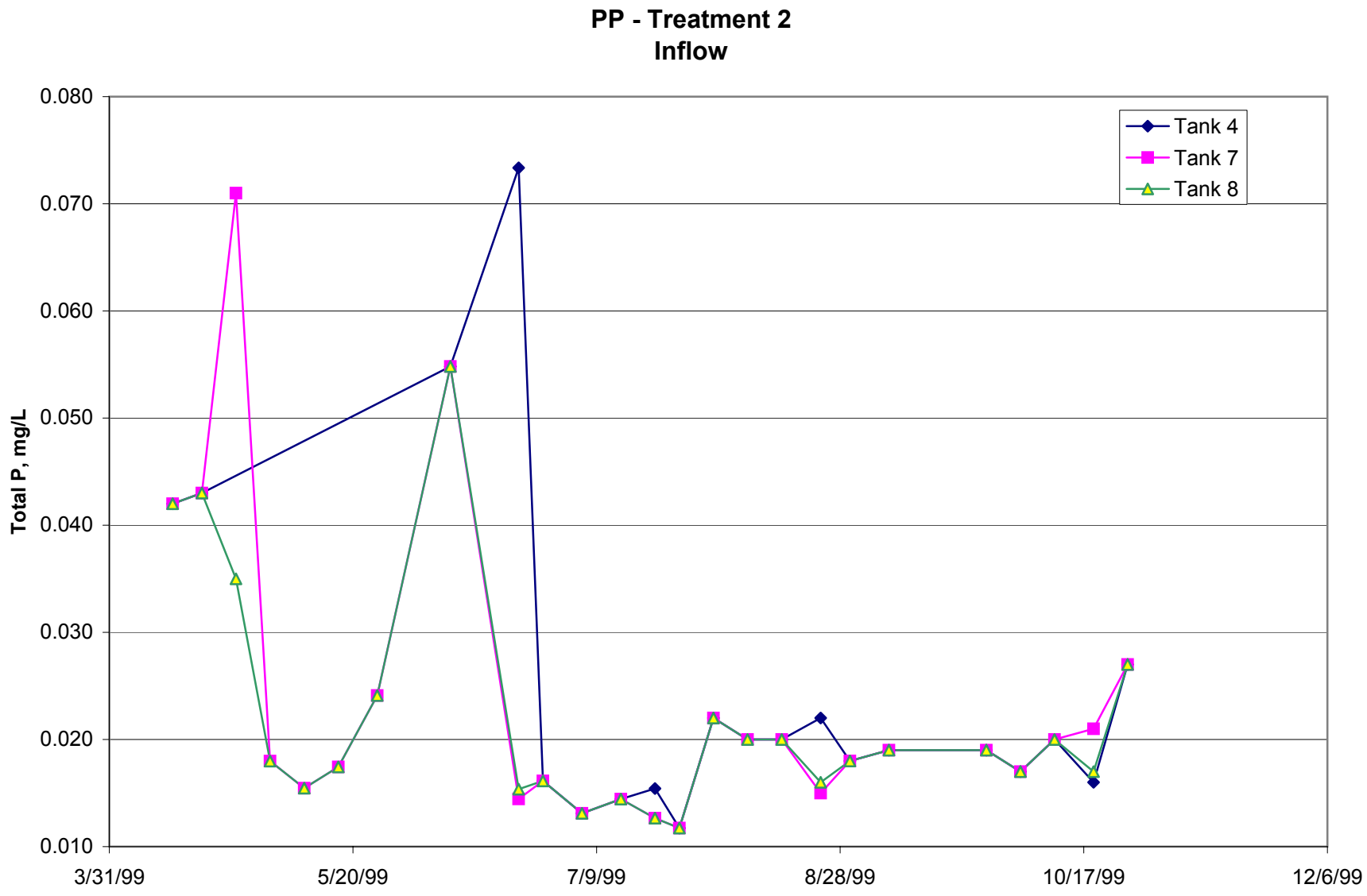

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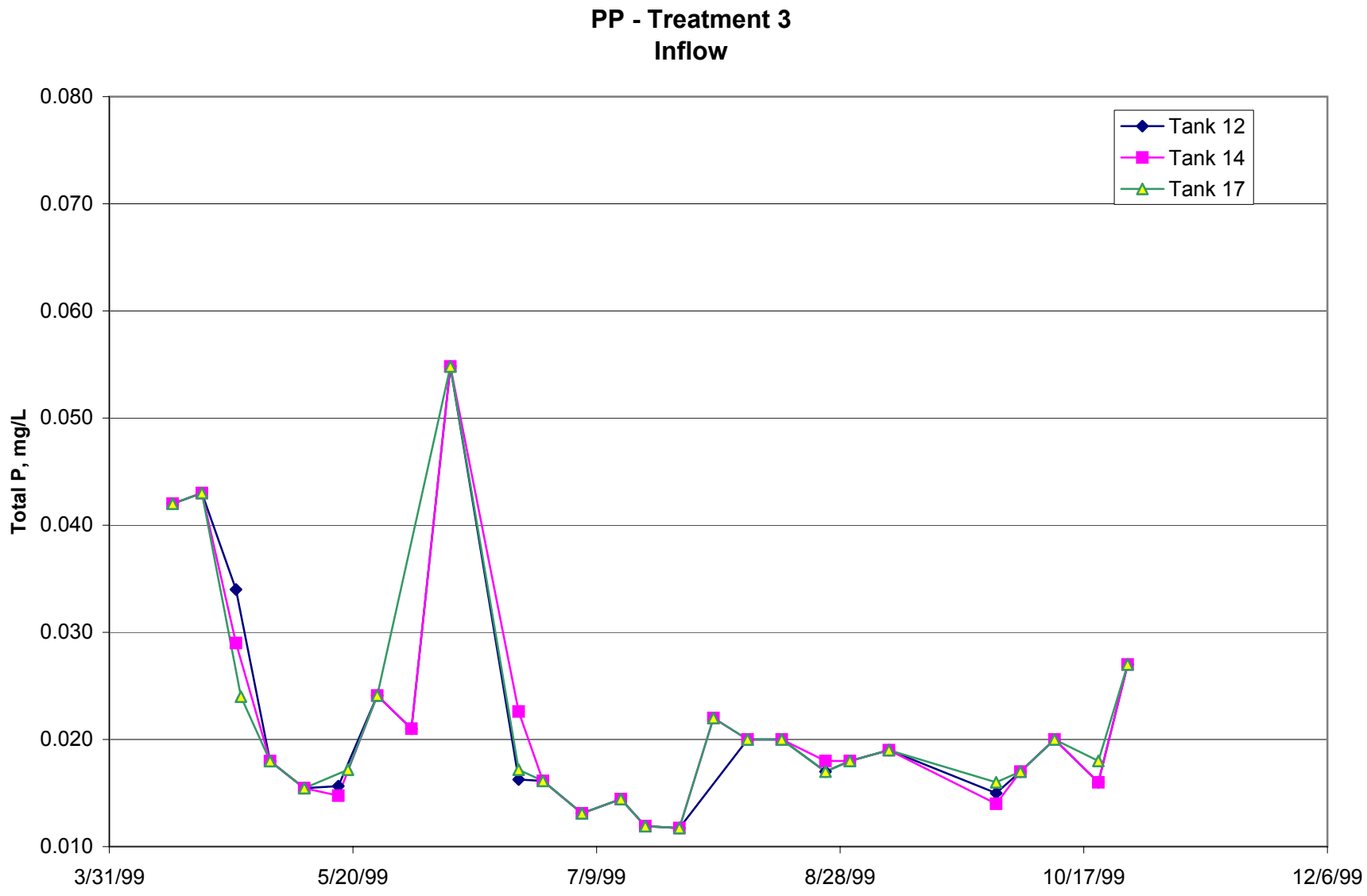

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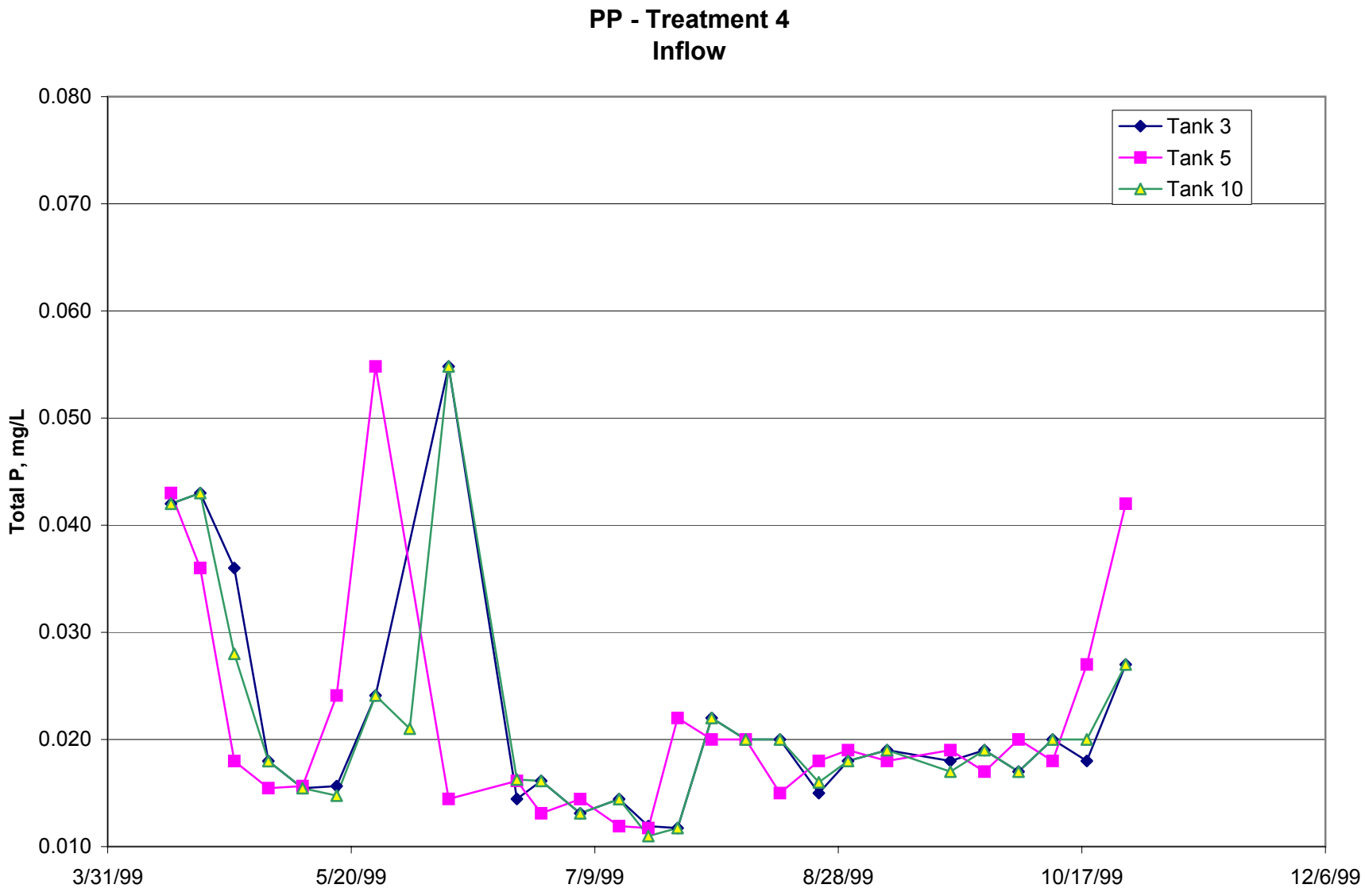

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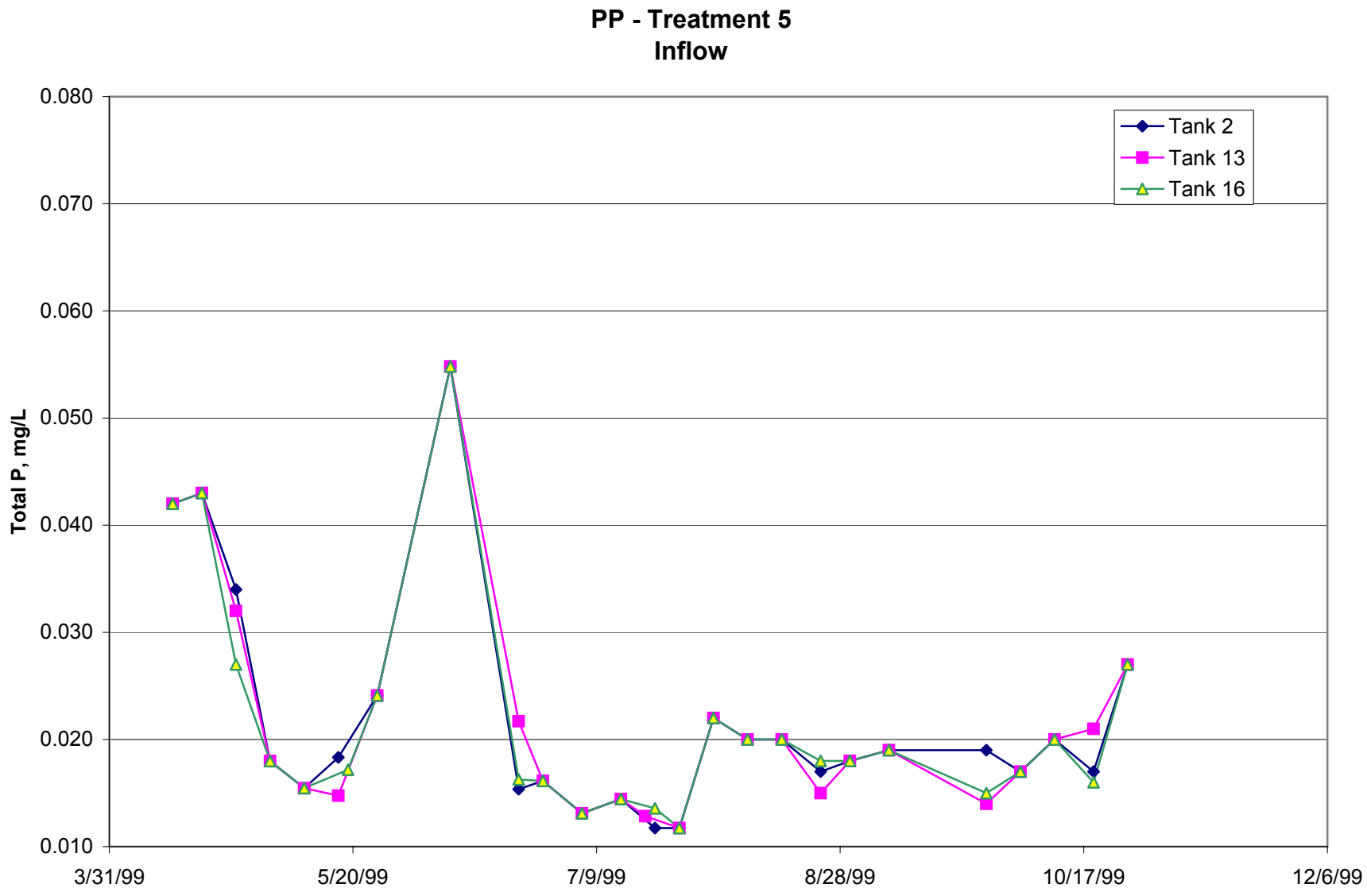

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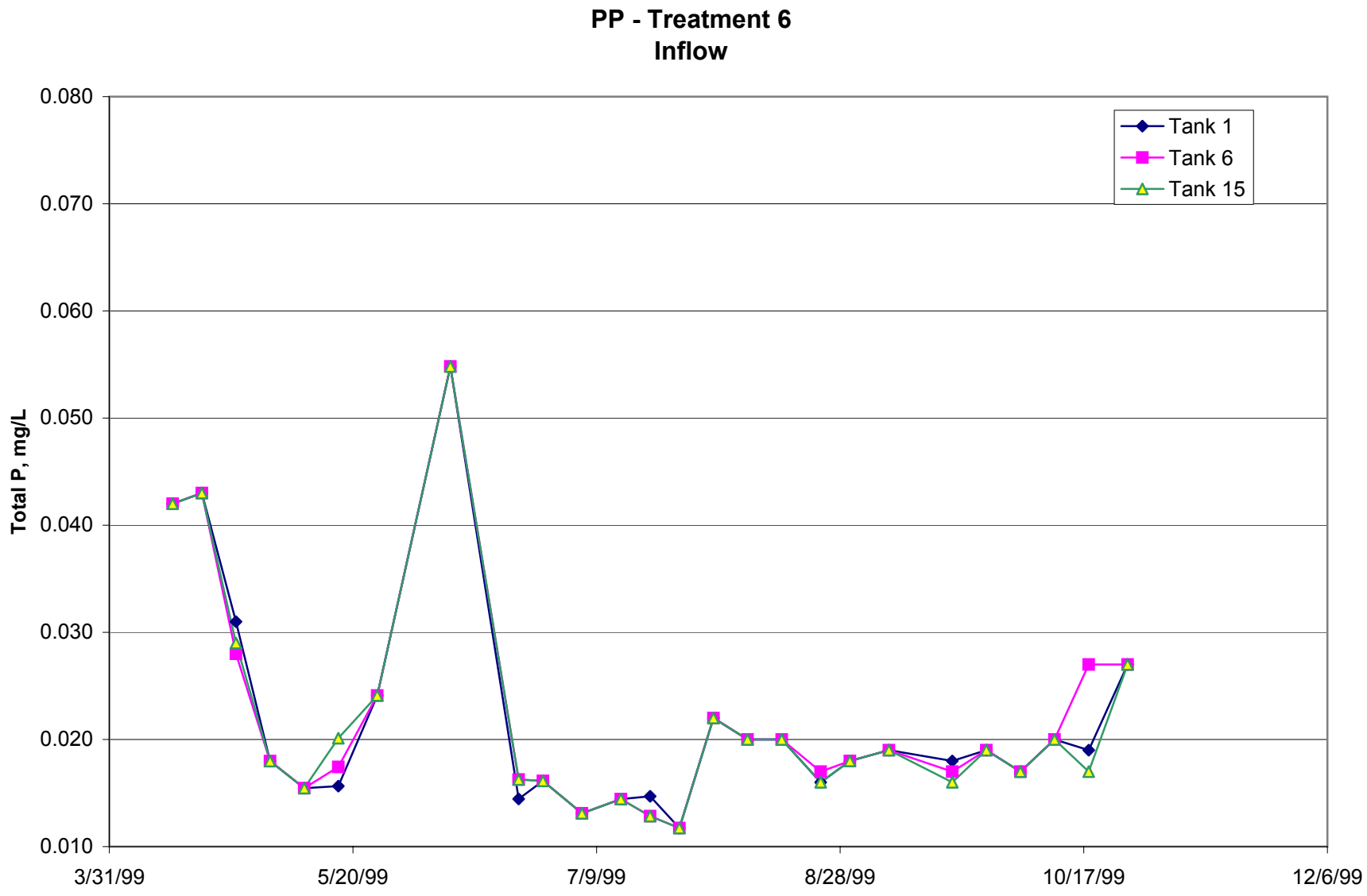

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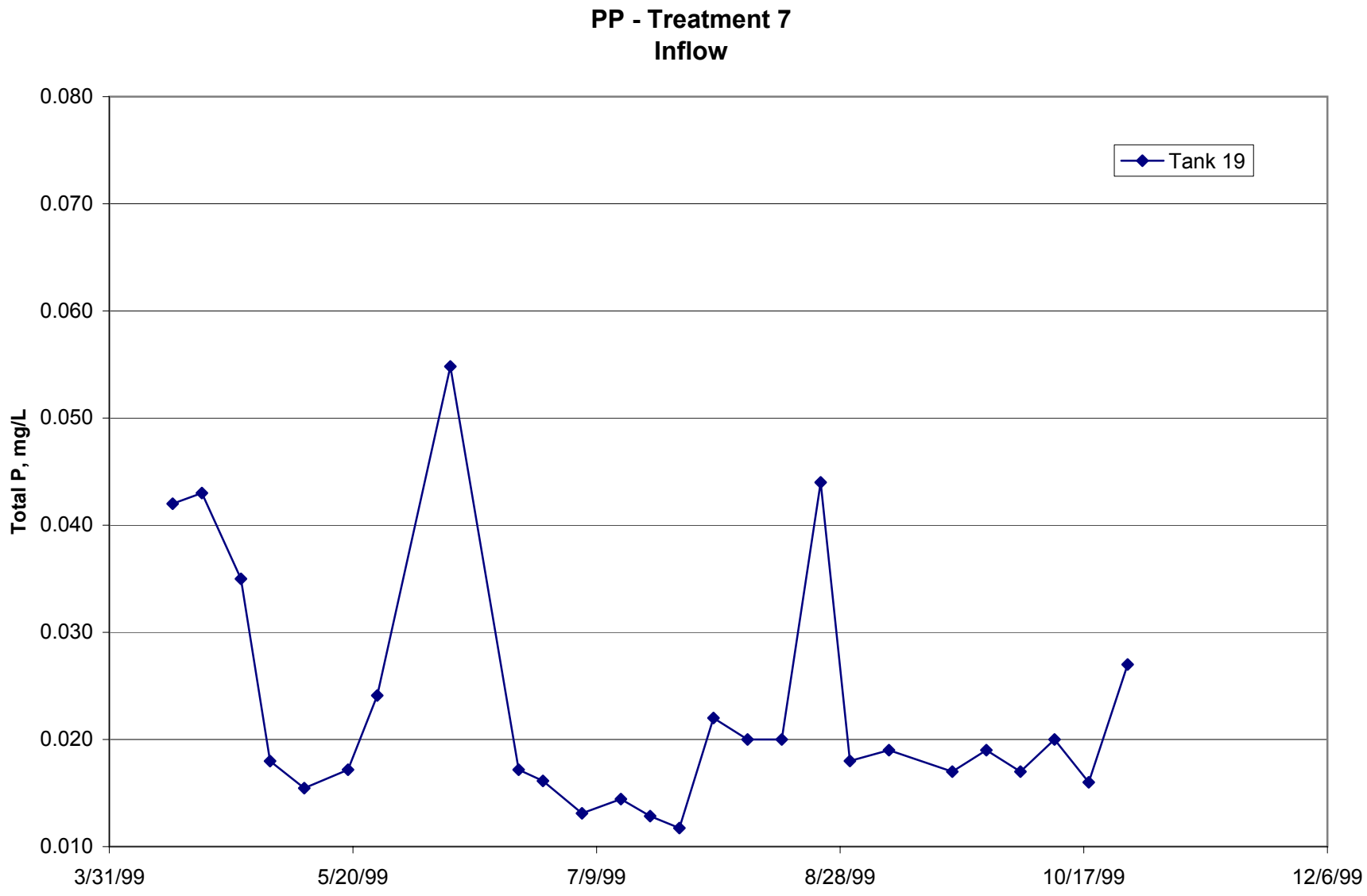

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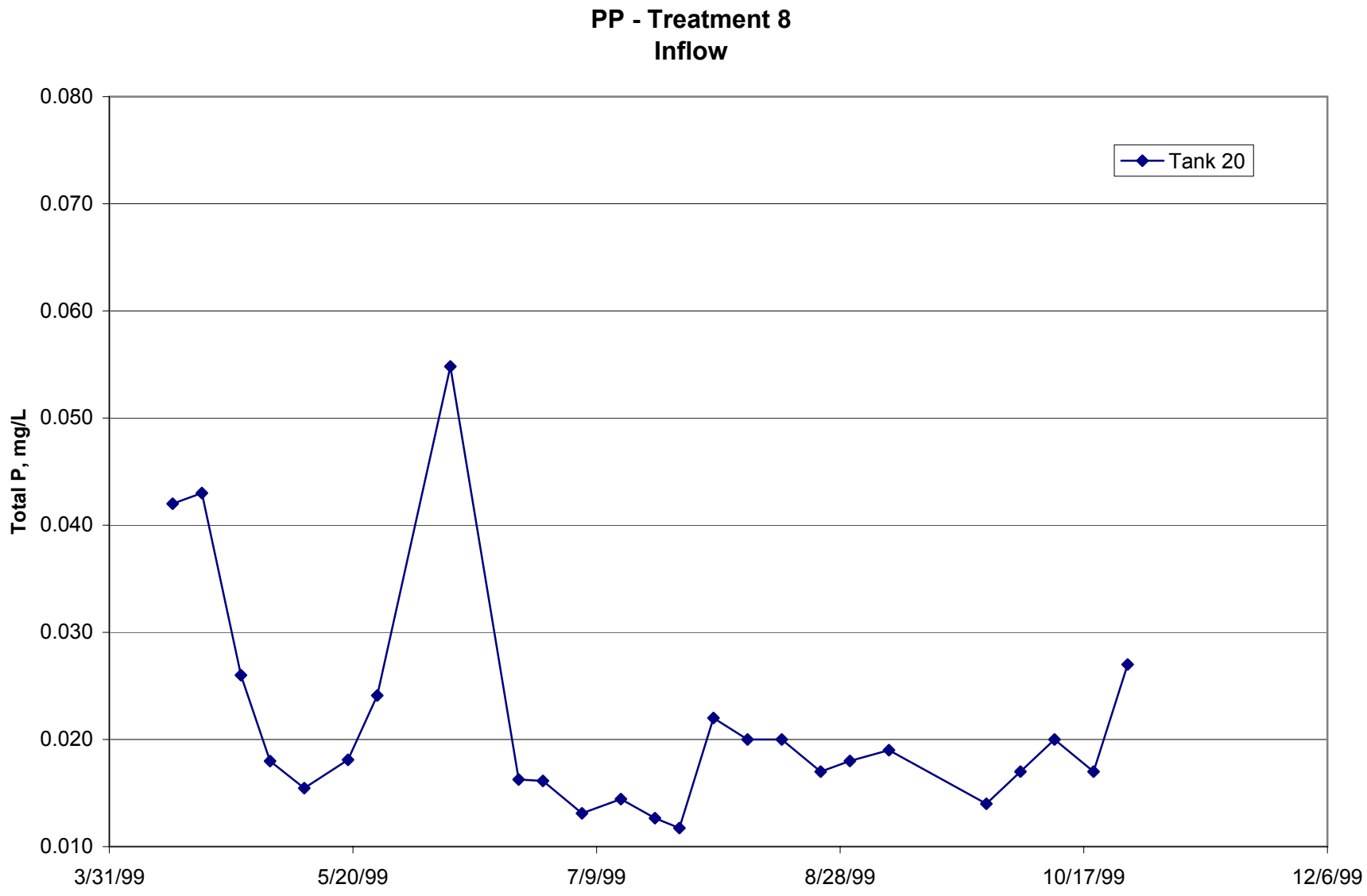

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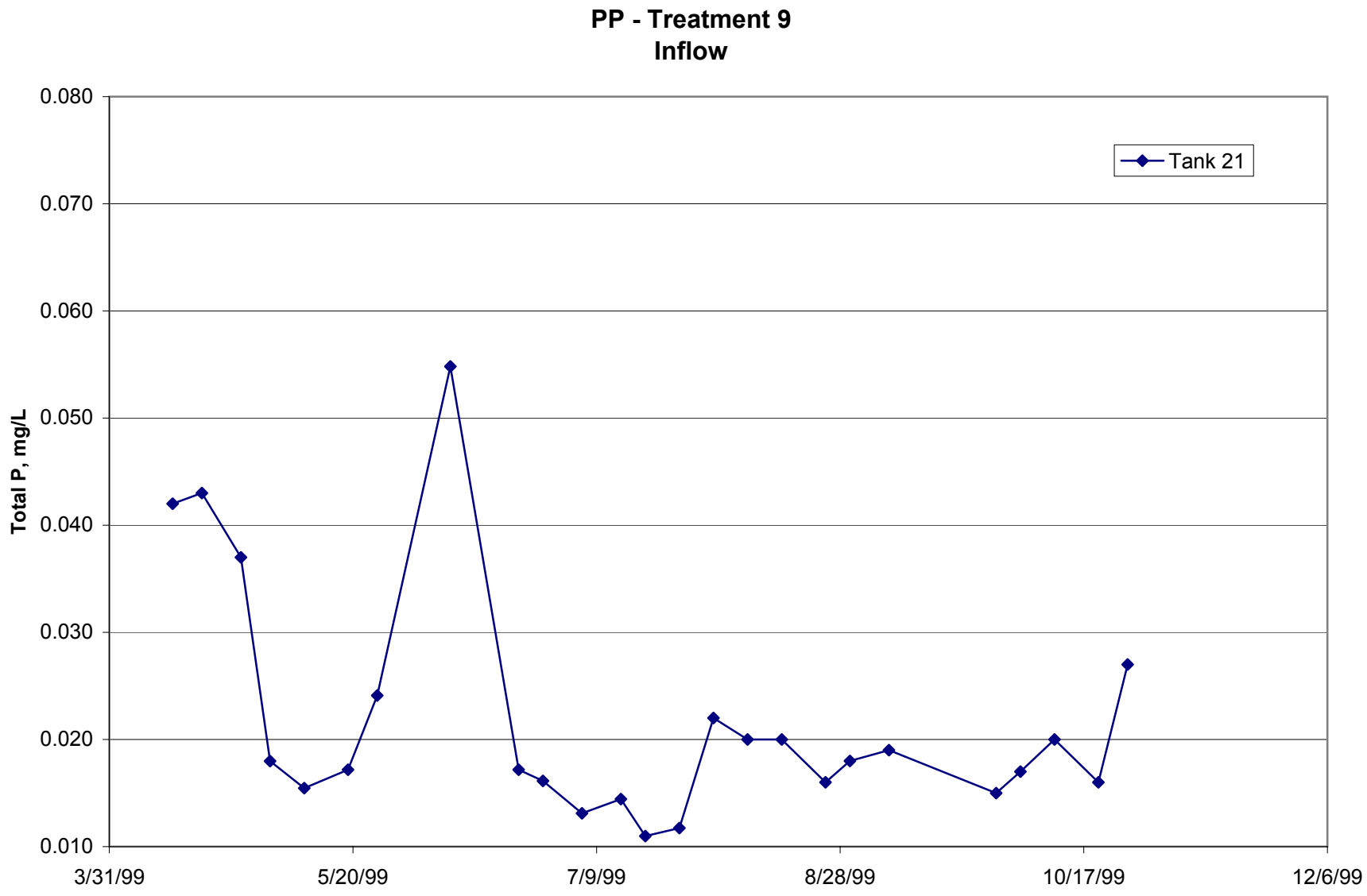

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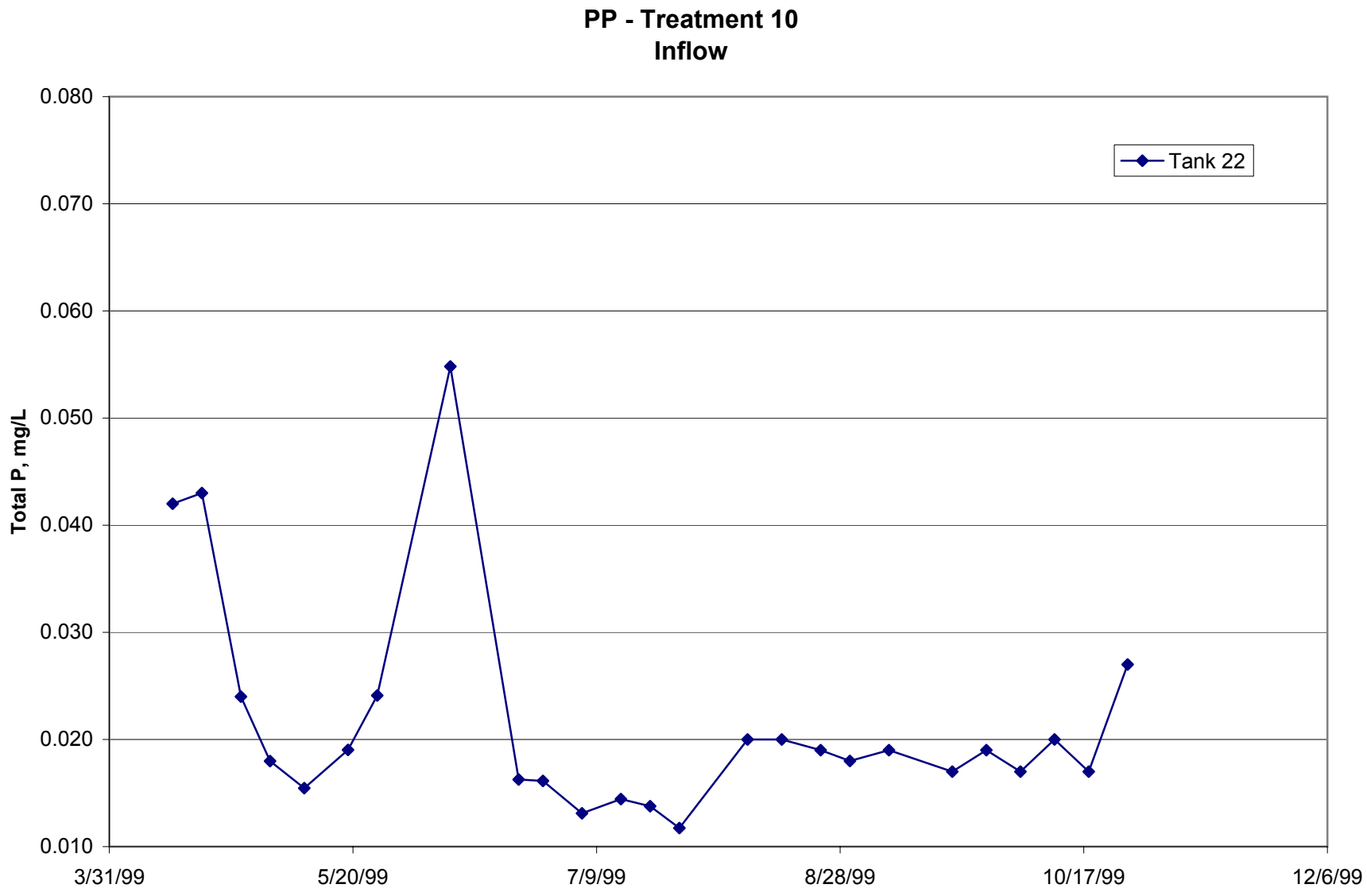

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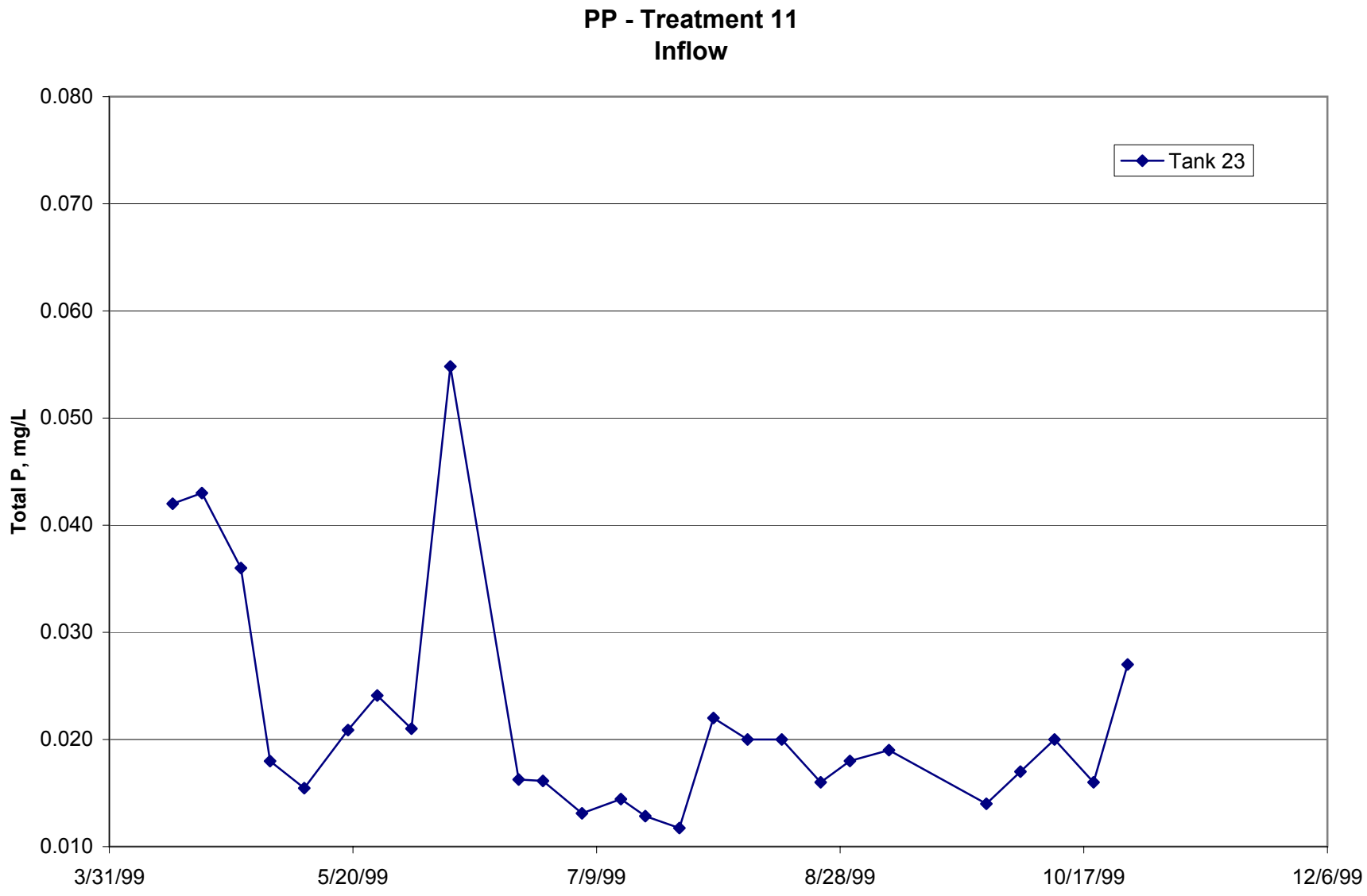

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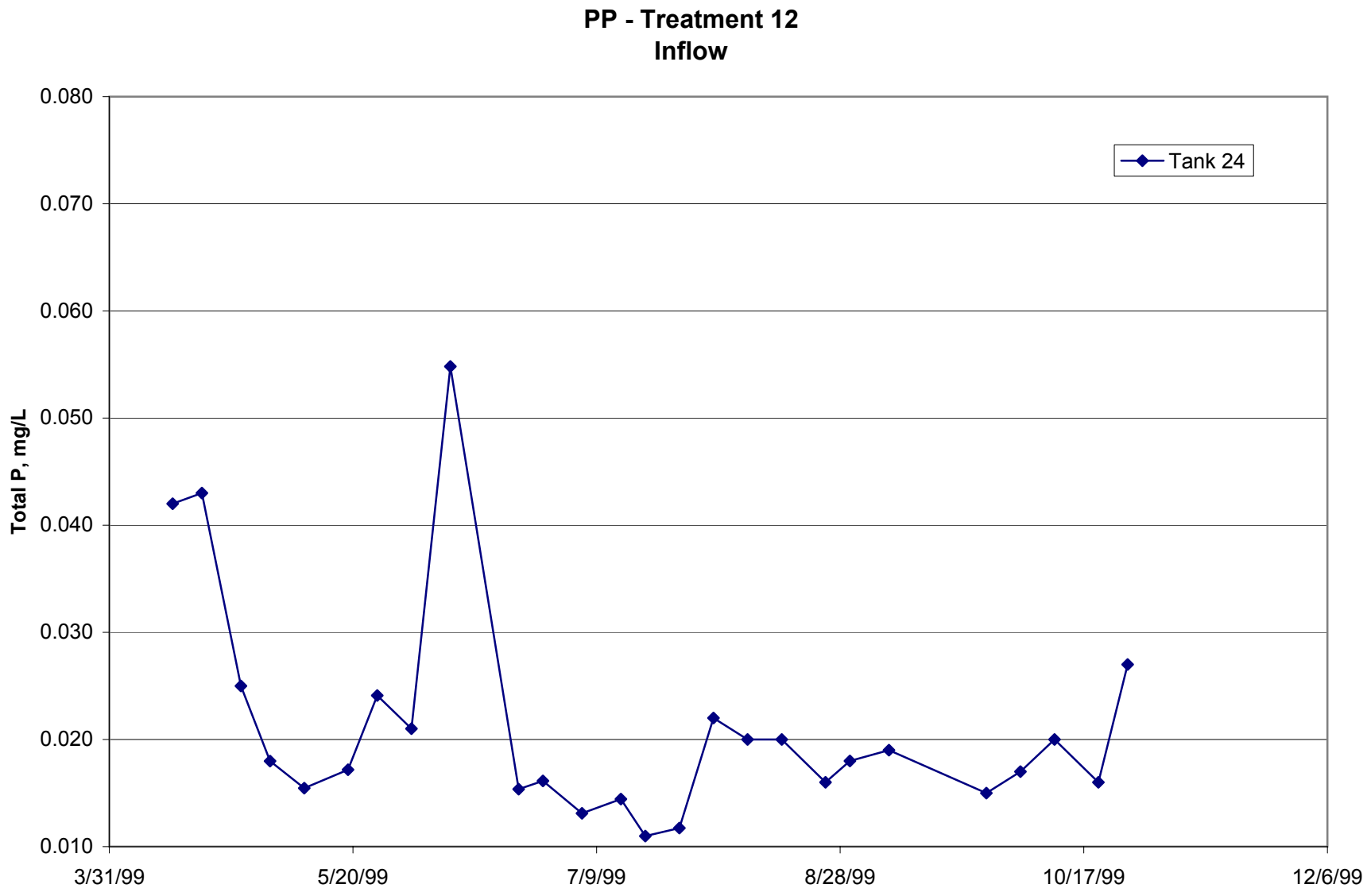

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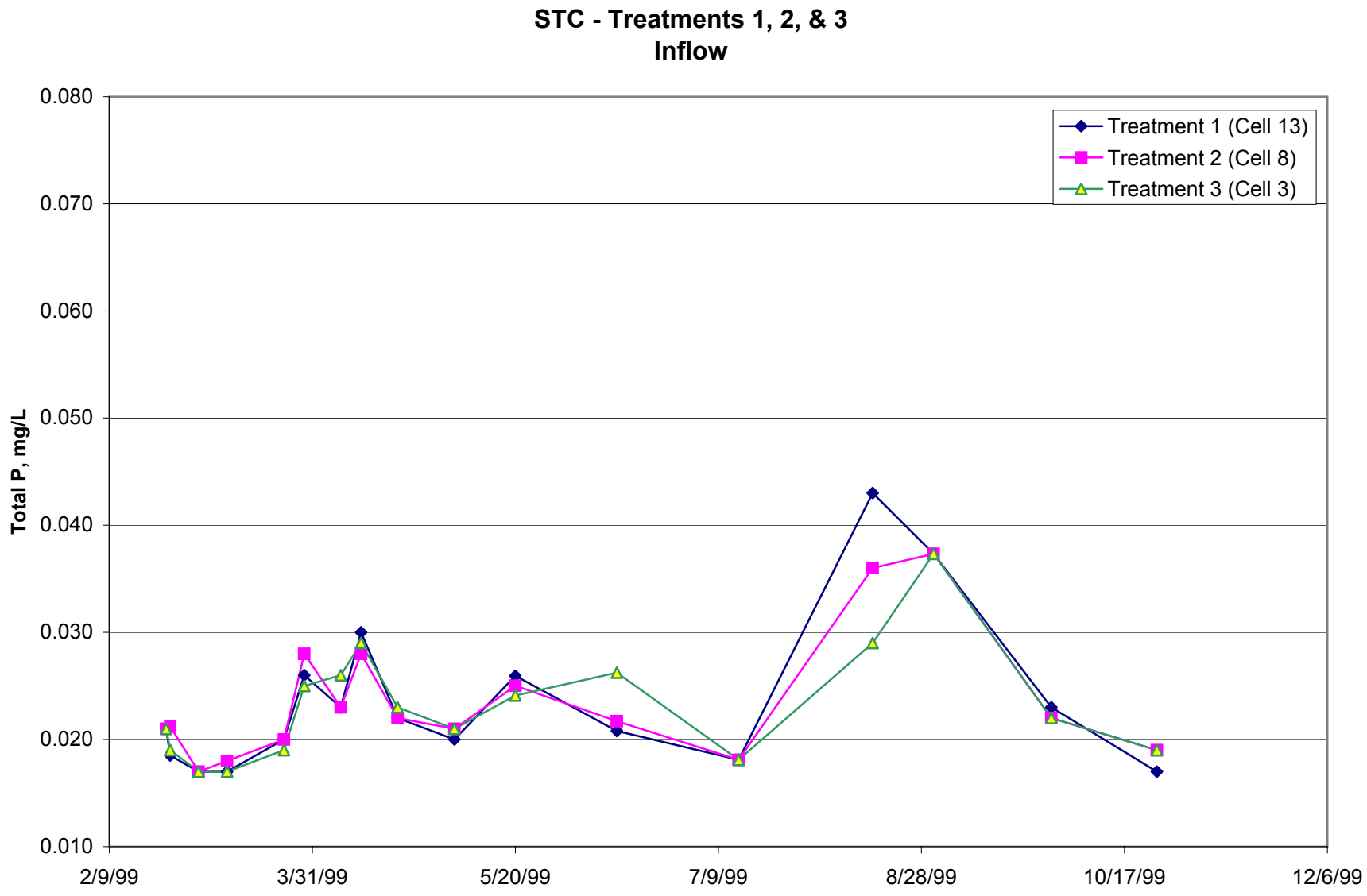

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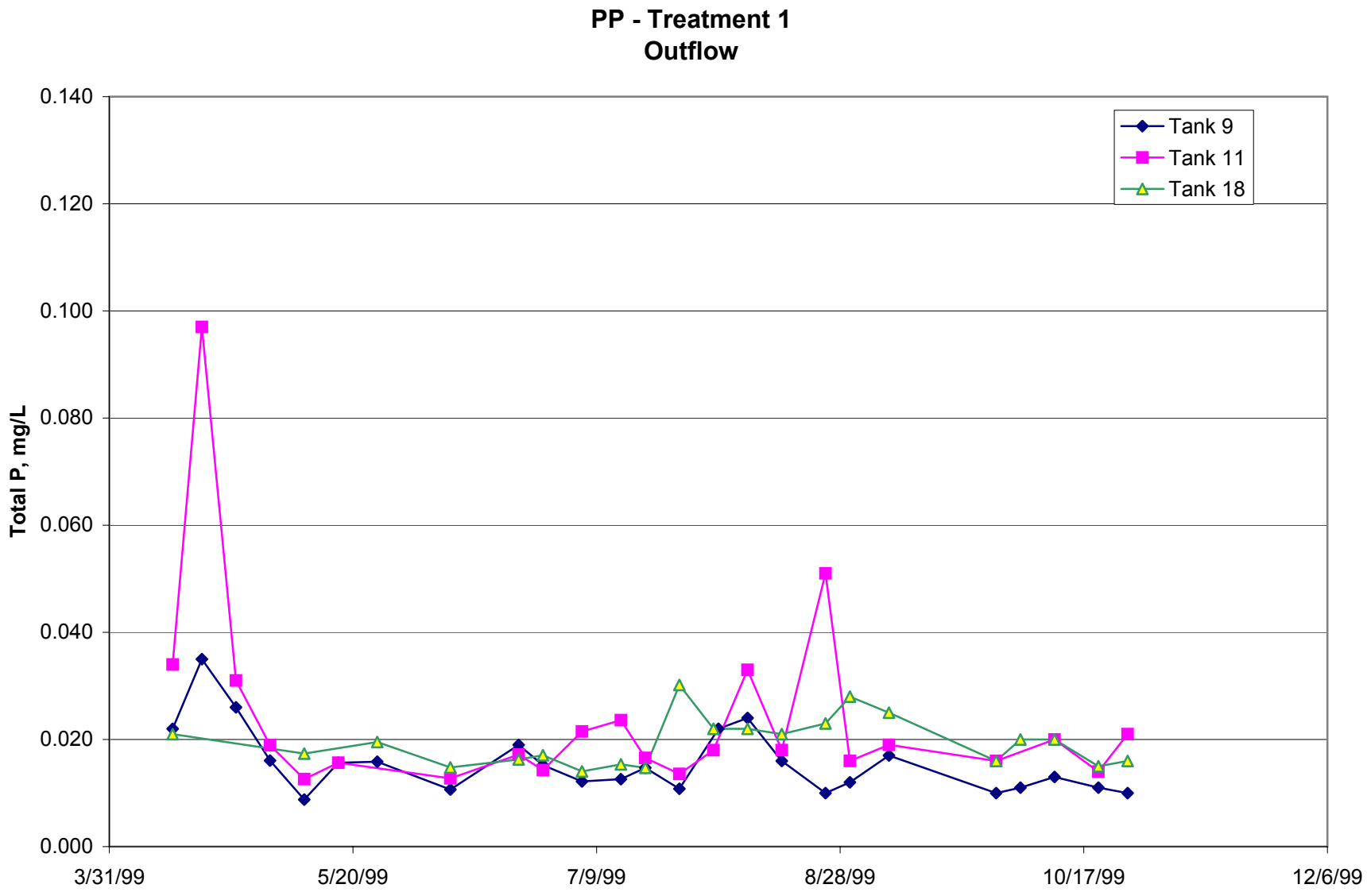

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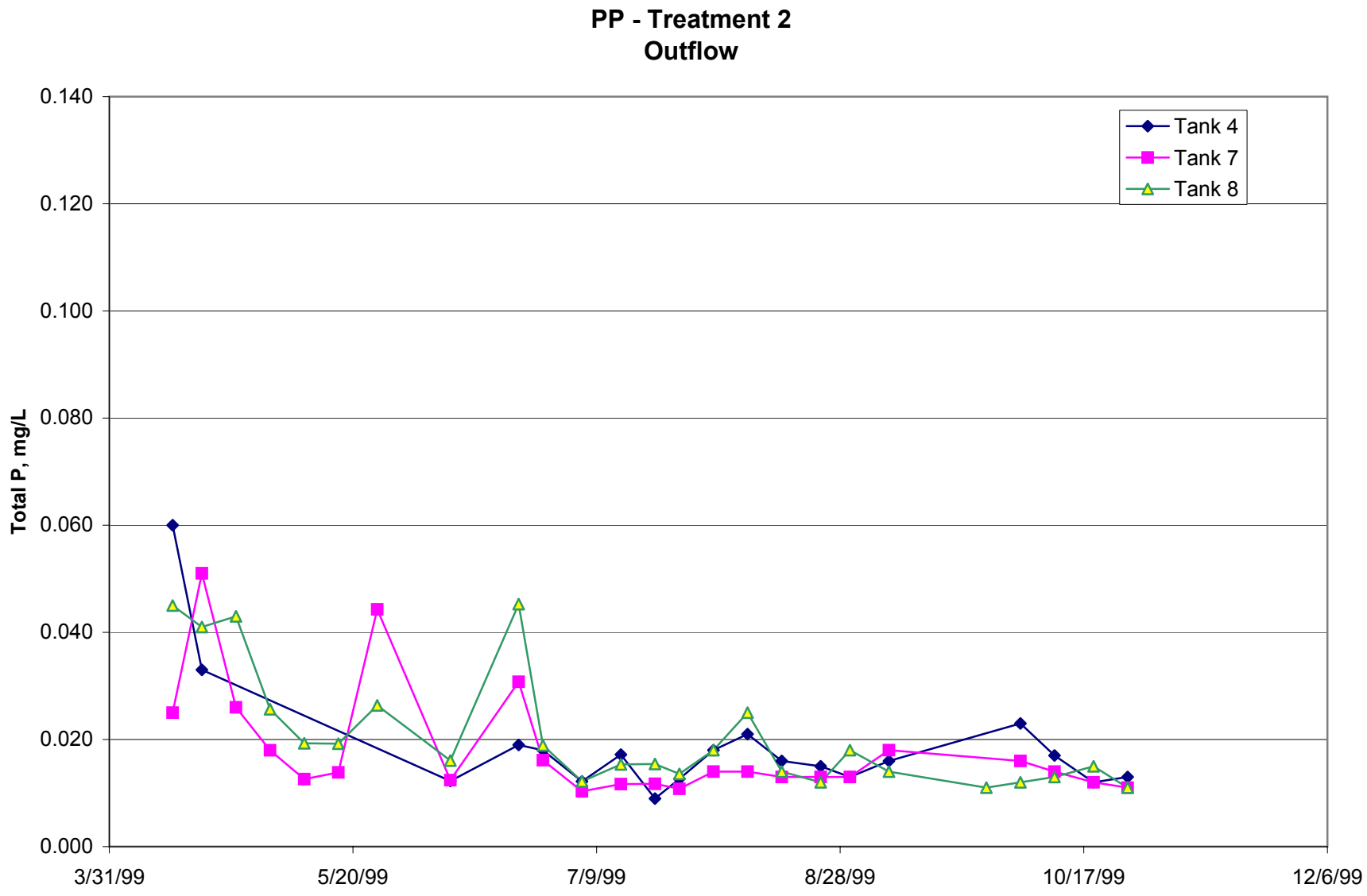

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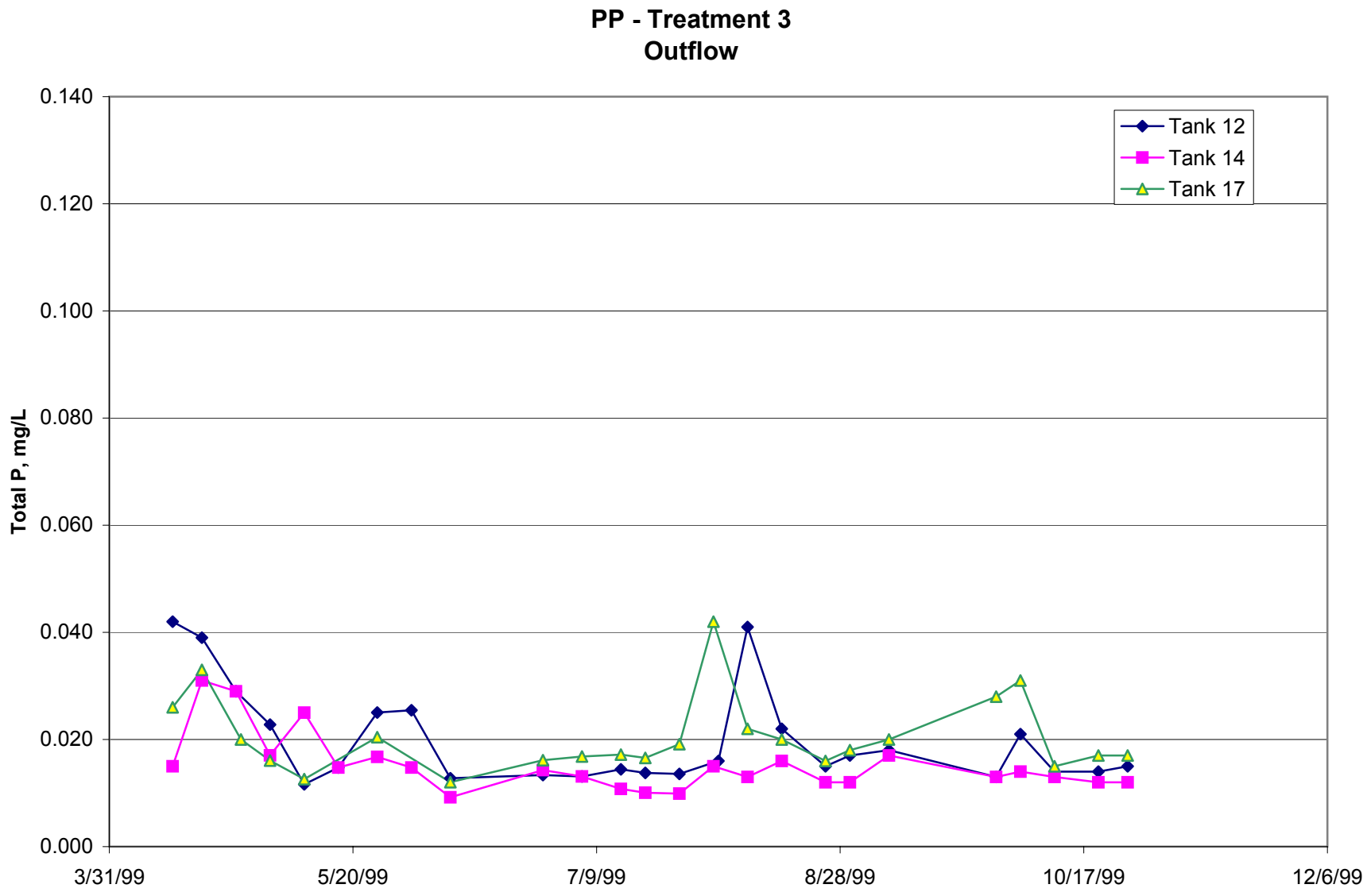

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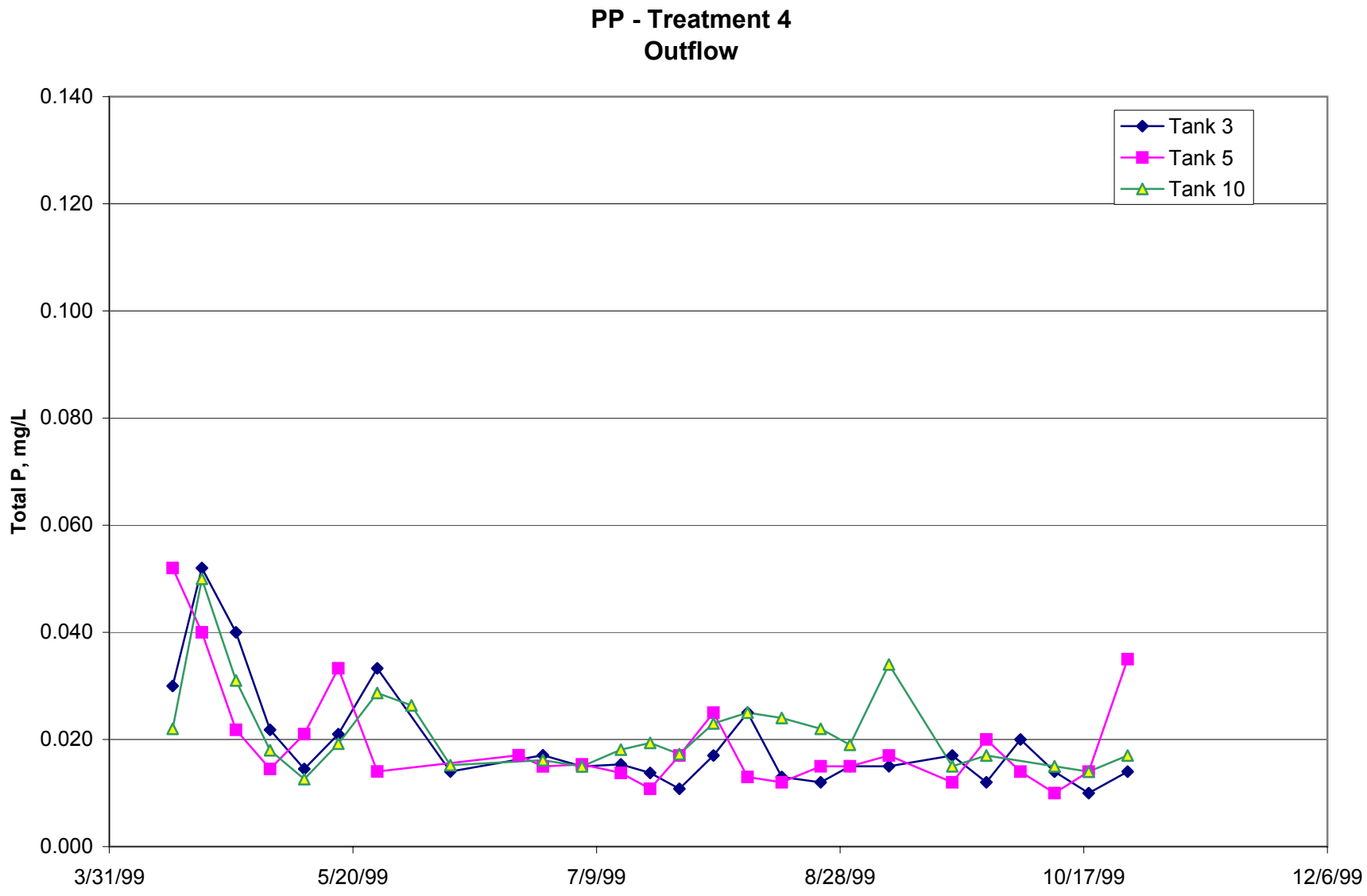

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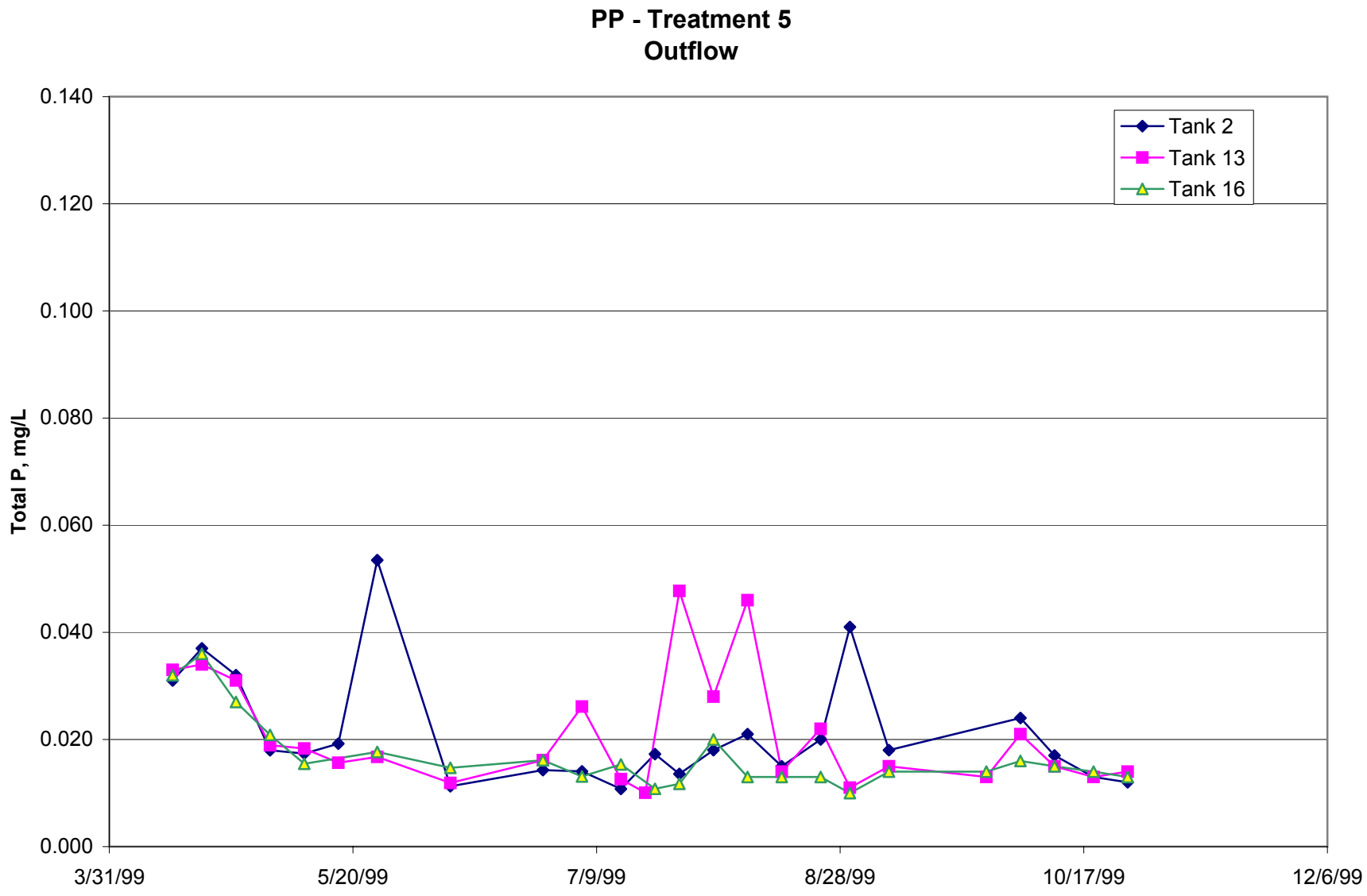

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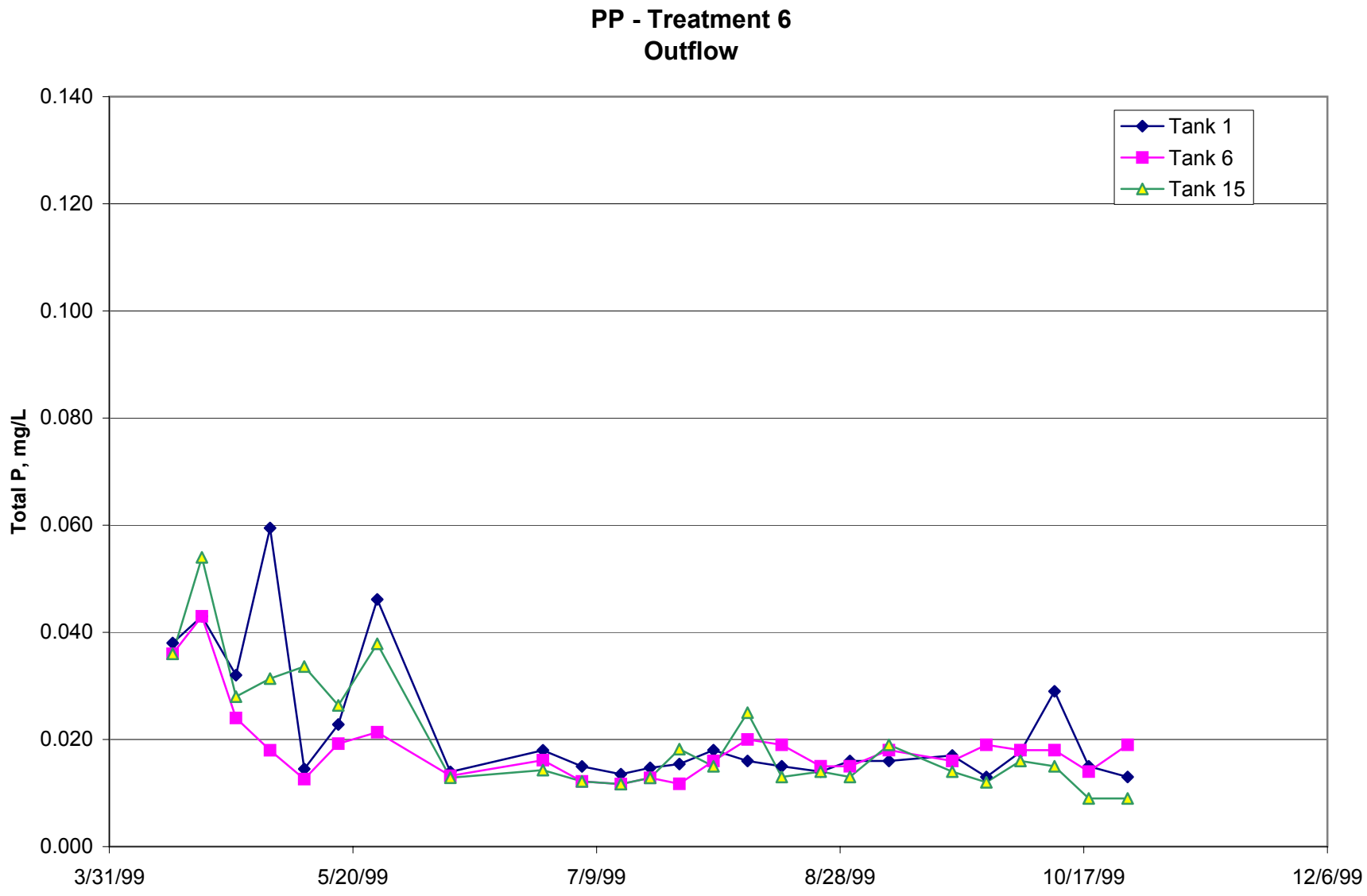

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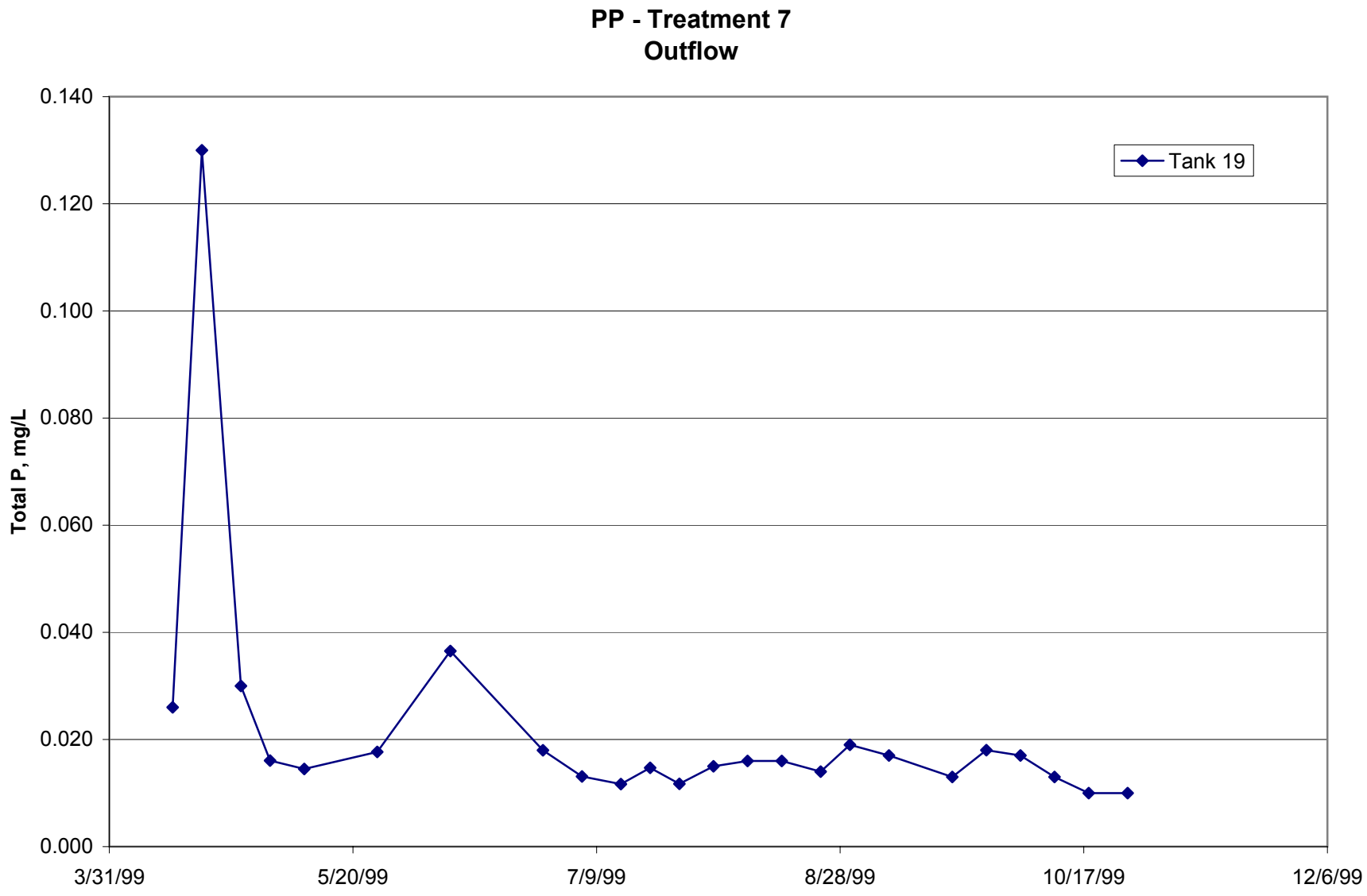

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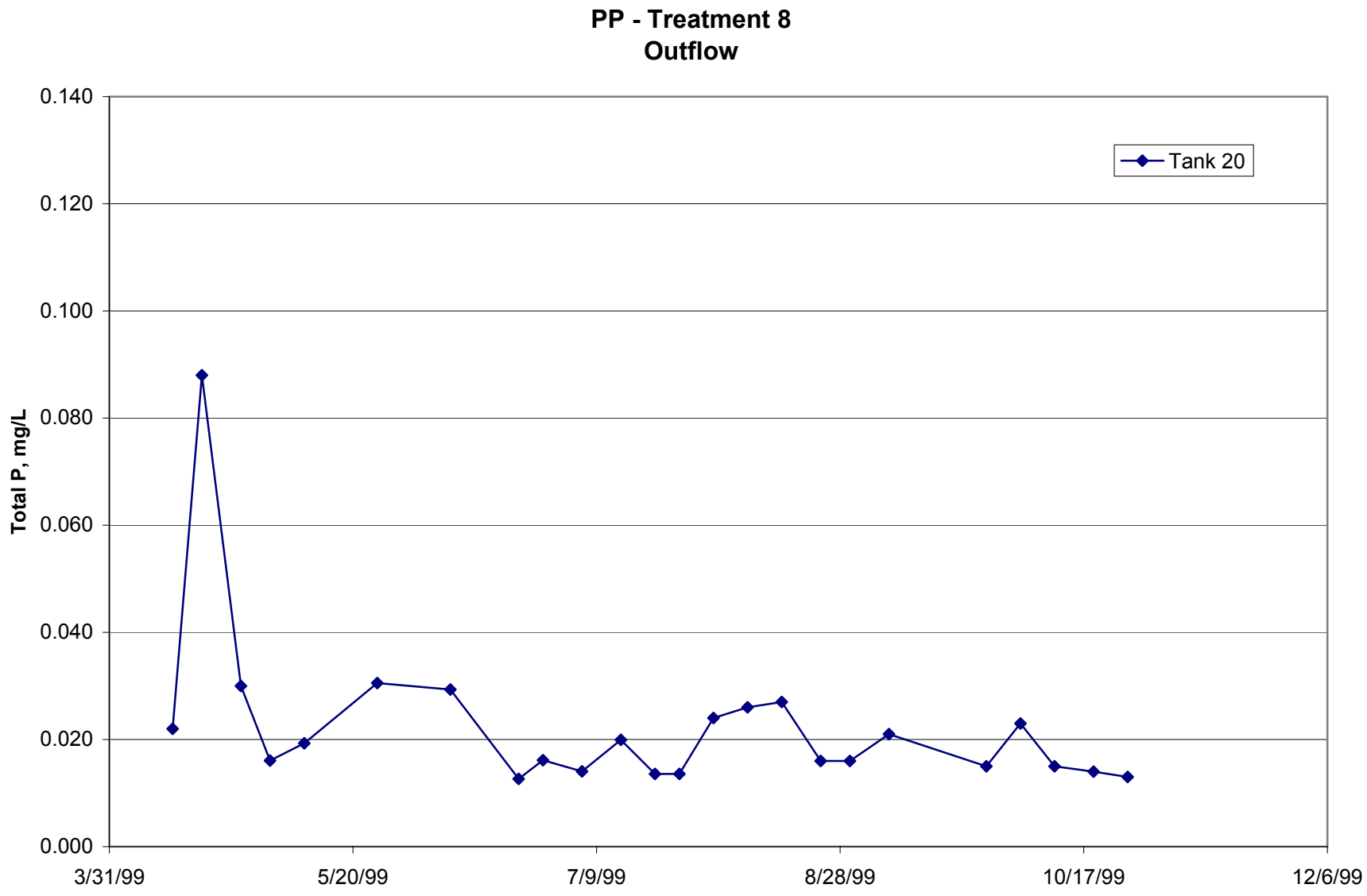

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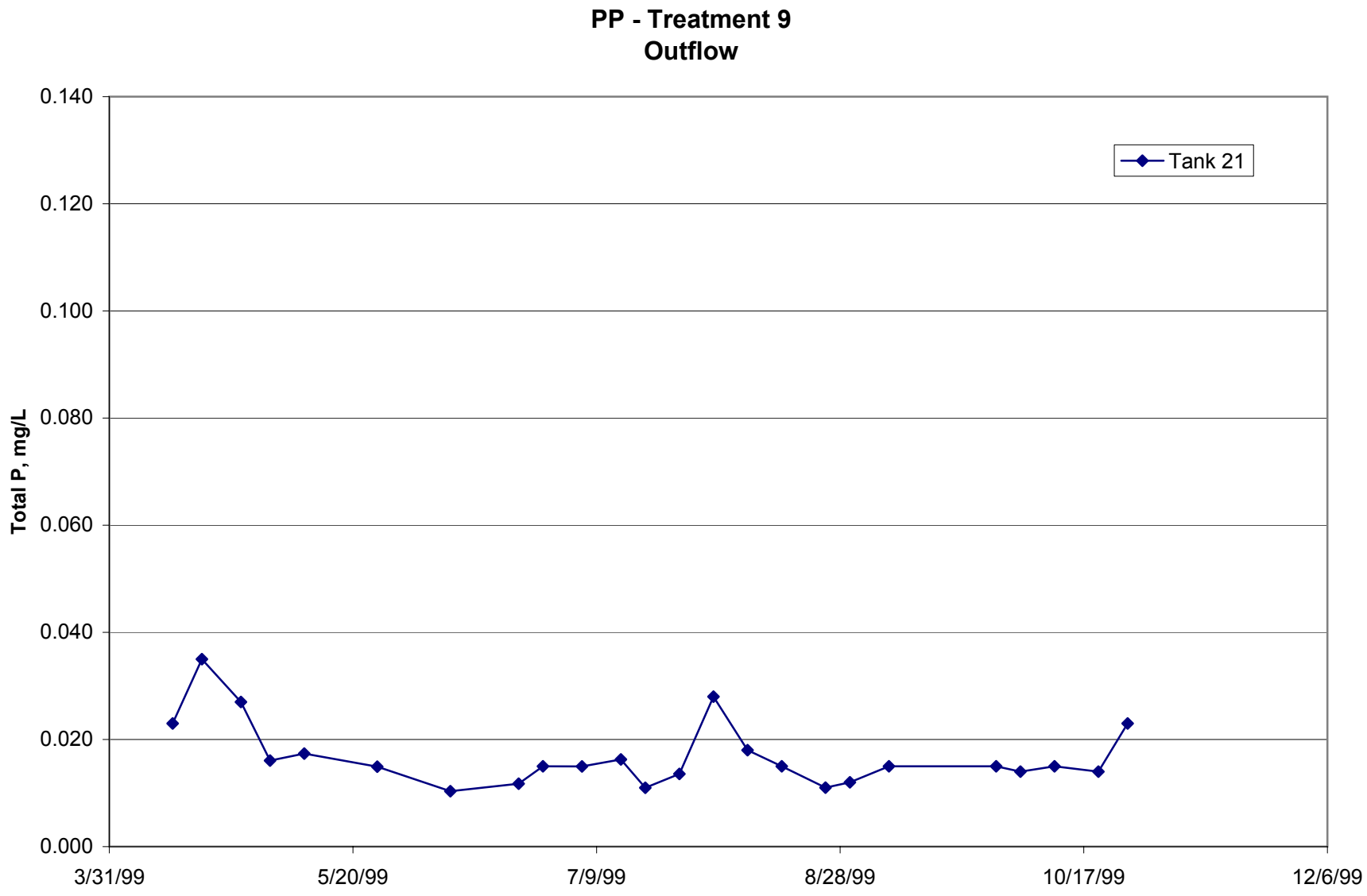

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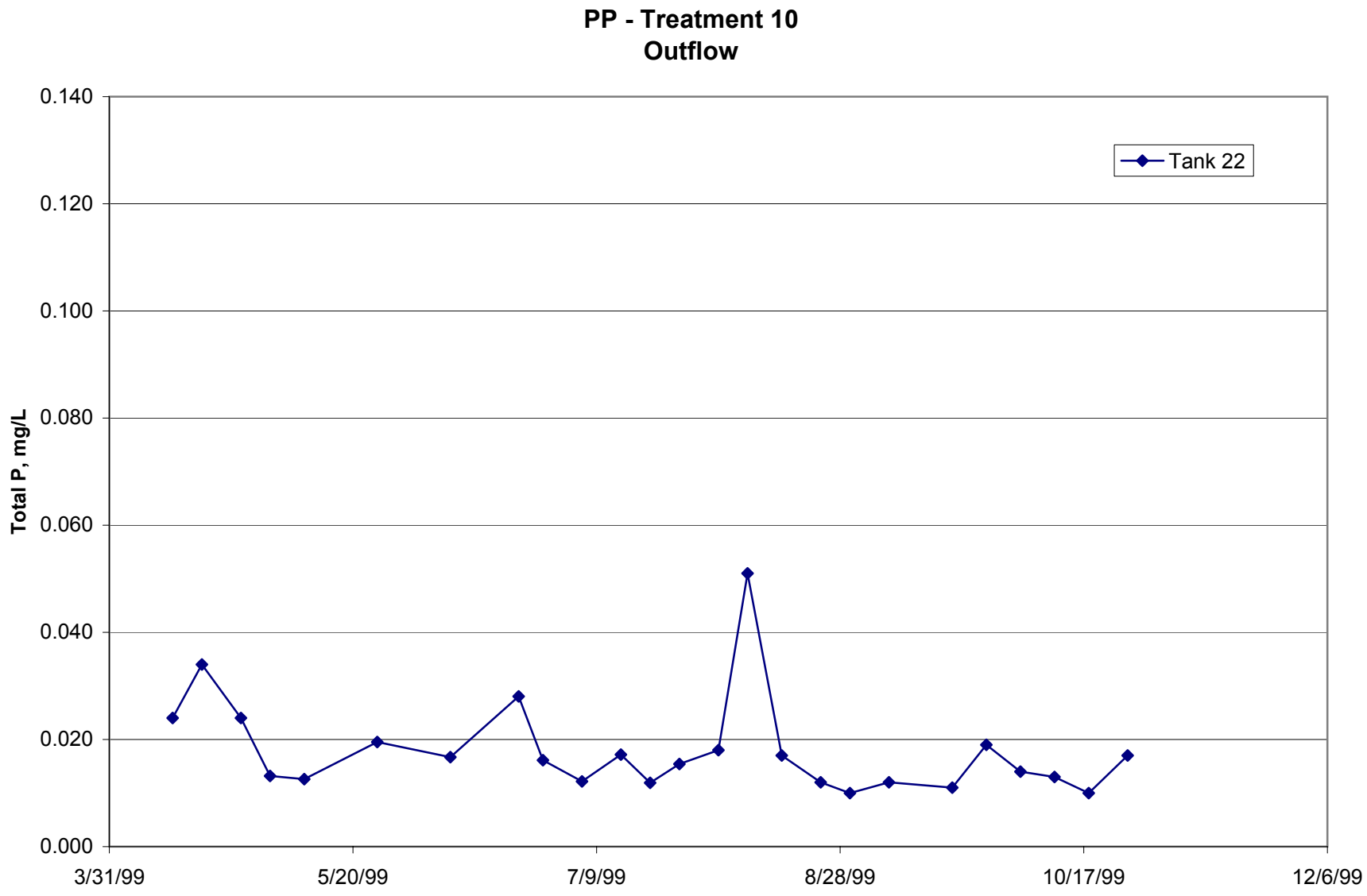

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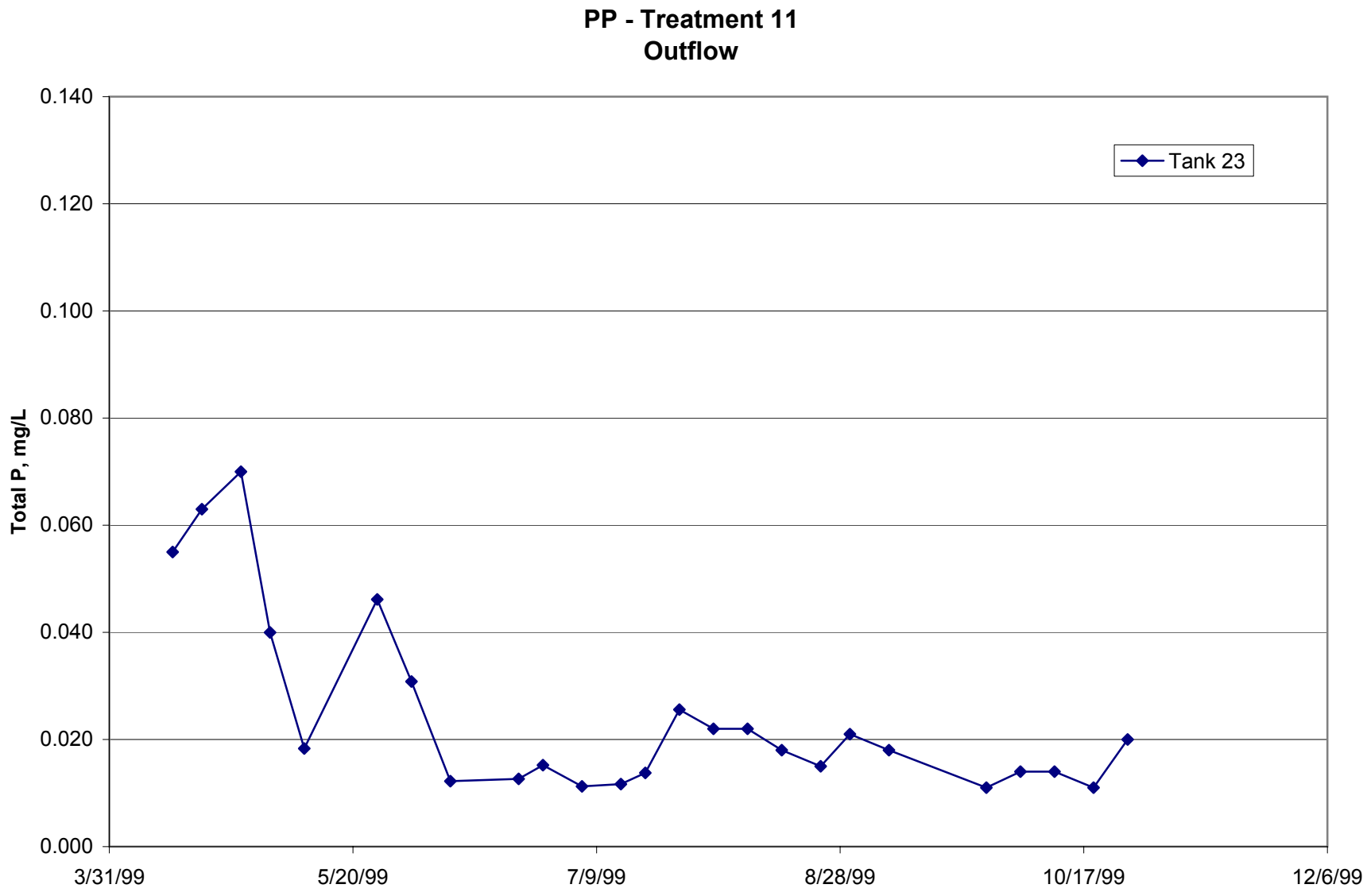

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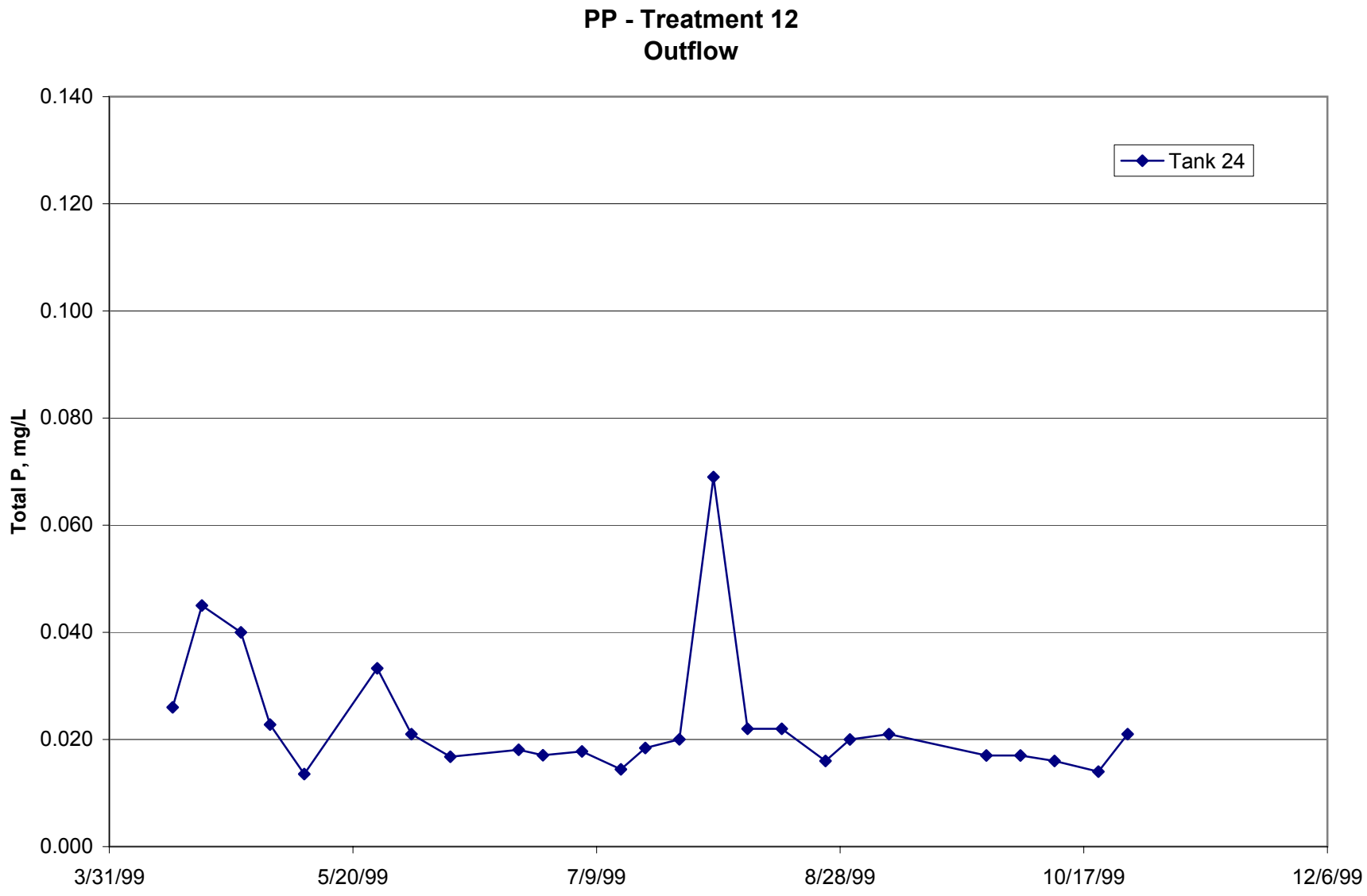

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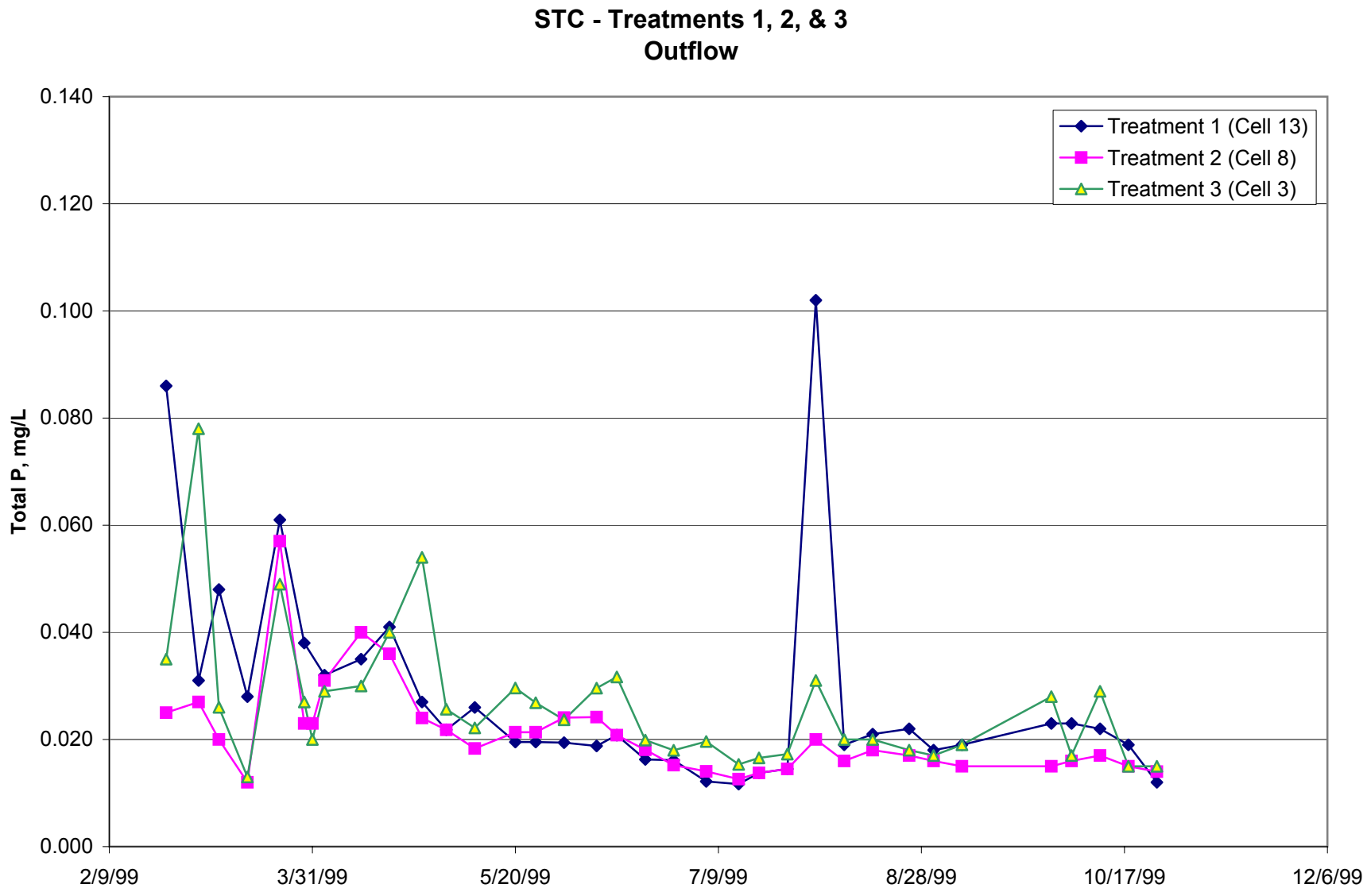

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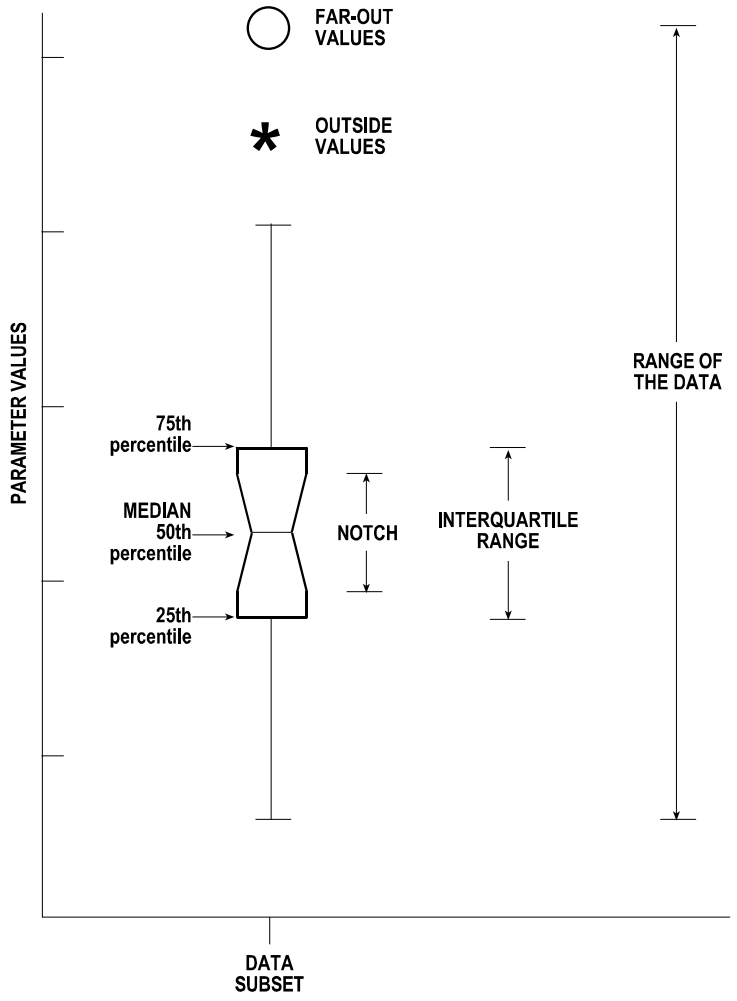
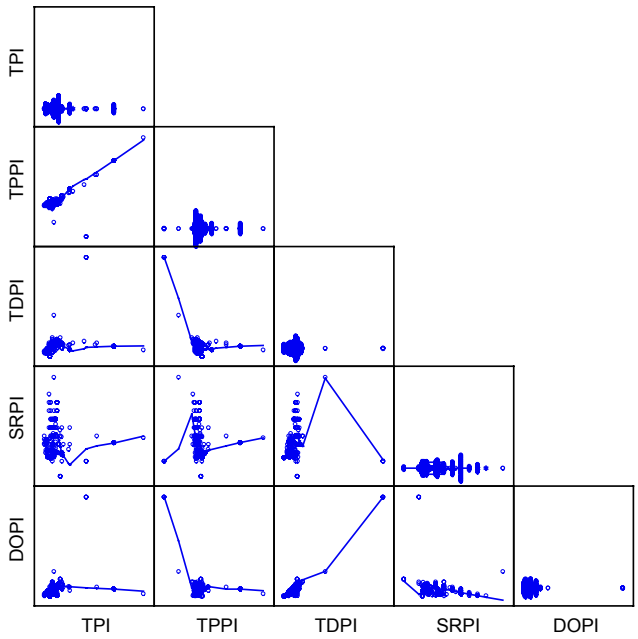
ATTACHMENT E.
TYPICAL BOX PLOT COMPONENTS



Components. **A BOX PLOT** identifies the **MEDIAN**, (50th percentile), the lower and upper quartiles **(25th and 75th PERCENTILES)**, and the **RANGE** (extreme spread of the data). The edges of the box demarcate the 25th and 75th percentiles, and so represent the middle 50 percent **(INTERQUARTILE RANGE)** of the parameter values for the data subset. The line inside the box is the **MEDIAN**. The lines, or whiskers, extend outward from the box through the range of data, excluding outliers. Two outliers are defined, based on their distance from the nearest edge of the box, relative to the range of the box. **OUTSIDE VALUES** lie 1.5 to 3 interquartile ranges away from the nearest box edge, and **FAR-OUT VALUES** lie three or more interquartile ranges away form the nearest box edge. The **NOTCH** represents the approximate 95 percent confidence interval around the median.

Interpretation. If notches from different subsets of data overlap completely, one can conclude with 95% confidence that the groups have been sampled from a common population. If notches do not overlap at all, one can conclude (with 95% confidence) that the groups represent different populations. Cases of partial overlap require explicit tests (e.g., t-Test, ANOVA, Mann-Whitney, or Kruskal-Wallis) to specify significance of differences among groups.

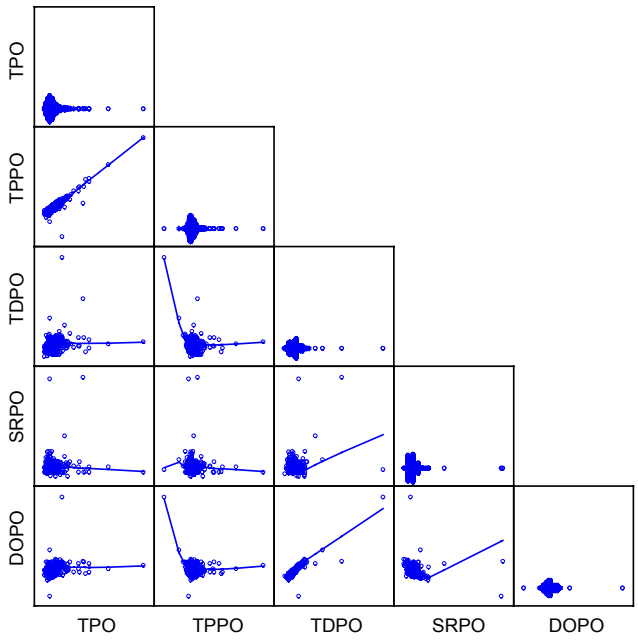
Generic Box Plot



TP*TPP*TDP*SRP*DOP: INFLOW MEASURES

BONFERONNI ADJUSTED CORRELATION COEFFICIENTS

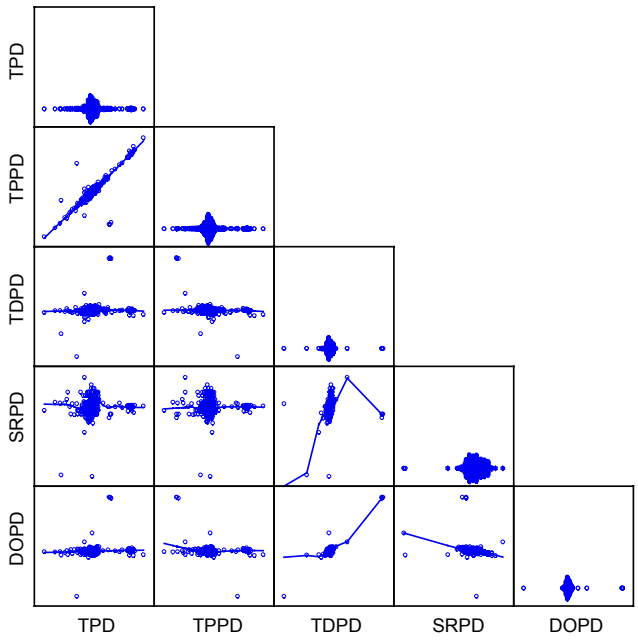
	TP	TPP	TDP	SRP	DOP
TP	0				
TPP	0	0			
TDP	0	0	0		
SRP	1	1	.135	0	
DOP	0	0	0	.002	0



TP*TPP*TDP*SRP*DOP: OUTFLOW MEASURES

BONFERONNI ADJUSTED CORRELATION COEFFICIENTS

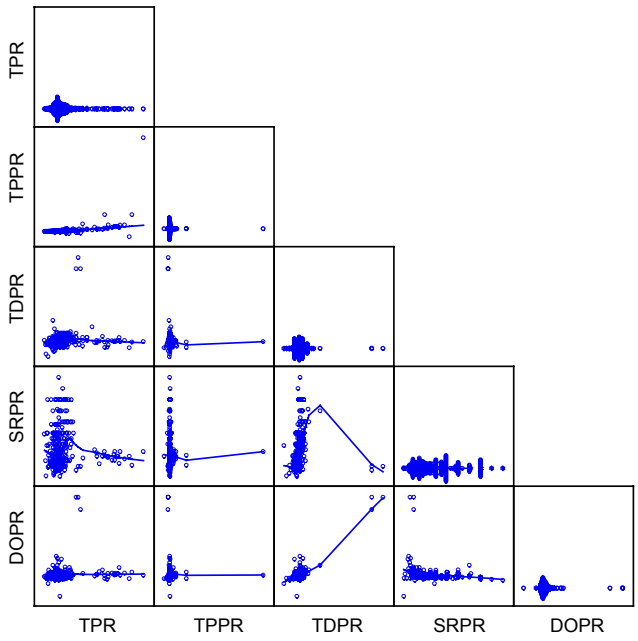
	TP	TPP	TDP	SRP	DOP
TP	0				
TPP	0	0			
TDP	0	.01	0		
SRP	1	1	0	0	
DOP	0	.18	0	0	0



TP*TPP*TDP*SRP*DOP: INFLOW – OUTFLOW DIFFERENCES

BONFERONNI ADJUSTED CORRELATION COEFFICIENTS

	TP	TPP	TDP	SRP	DOP
TP	0				
TPP	0	0			
TDP	.001	0	0		
SRP	1	1	.008	0	
DOP	.03	0	0	.001	0



TP*TPP*TDP*SRP*DOP: INFLOW/OUTFLOW RATIO

BONFERONNI ADJUSTED CORRELATION COEFFICIENTS

	TP	TPP	TDP	SRP	DOP
TP	0				
TPP	0	0			
TDP	.03	1	0		
SRP	1	1	.22	0	
DOP	.31	1	0	.001	0

ATTACHMENT G.

PSTA PARAMETER COMPARISONS

RESULTS.P.xls // 10DEC.rtf

MEAN RANK PER TREATMENT CONDITION FOR ALL MEASURES

TREATMENT		TP:inflow	TP:outflow	TP:in-out	TP:in/out
PSTA01	PEAT	218	268	186	187
PSTA02	ROCK	236	196	252	253
PSTA03		225	231	211	212
PSTA04		230	237	221	222
PSTA05		225	220	225	210
PSTA06		228	218	238	236
PSTA07	SAND	238	208	257	254
PSTA08	SAND	216	285	168	166
PSTA09	PEAT	212	195	234	230
PSTA10		223	213	244	248
PSTA11		218	238	211	212
PSTA12	PEAT	215	344	137	136
STC01	PEAT	346	317	300	301
STC02	ROCK	358	275	335	332
STC03		362	366	238	233

TEST FOR DIFFERENCES IN MEASURES BETWEEN TREATMENT MEANS

ANOVA F [df]	0.561 [14,445]	2.123 [14,472]	0.807 [14,427]	0.558 [14,427]
P	0.895	0.01	0.662	0.897
KRUSKALL-WALLIS	17.837	48.515	29.211	28.661
P	0.214	<0.001	0.01	0.012

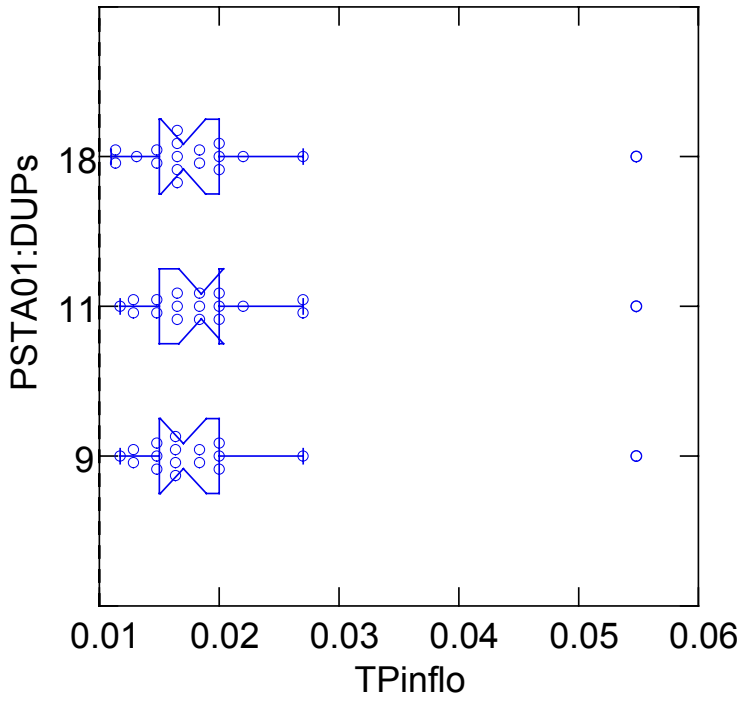
ATTACHMENT H.

PSTA REPLICATE EVALUATIONS

RESULTS.REPS.xls//10DEC.rtf

MEASURE [a]	F	df	P	KW	P	Mesocosm Ranking
TOTAL P: IN						
PSTA1: PpDx41/2/3	0.051	2,50	0.951	0.531	0.767	
PSTA2: PrDx41/2/3	0.548	2,51	0.582	0.682	0.711	
PSTA3: PpSx31/2/3	0.012	2,52	0.988	0.26	0.878	
PSTA4: PrSx31/2/3	0.009	2,55	0.991	0.099	0.952	
PSTA5: PrDX41/2/3	0.005	2,51	0.995	0.096	0.45	
PSTA6: PrVx31/2/3	0.023	2,54	0.997	0.899	0.213	
TOTAL P: OUT						
PSTA1: PpDx41/2/3	5.281	2,50	0.009	14.036	0.001	11,18>9
PSTA2: PrDx41/2/3	0.771	2,49	0.468	3.0	0.21	
PSTA3: PpSx31/2/3	7.066	2,50	0.002	22.73	<0.001	17>12>14
PSTA4: PrSx31/2/3	7.03	2,51	0.002	14.687	<0.001	10>5,3
PSTA5: PrDX41/2/3	2.356	2,47	0.106	3.083	0.214	
PSTA6: PrVx31/2/3	1.637	2,51	0.21	5.016	0.081	

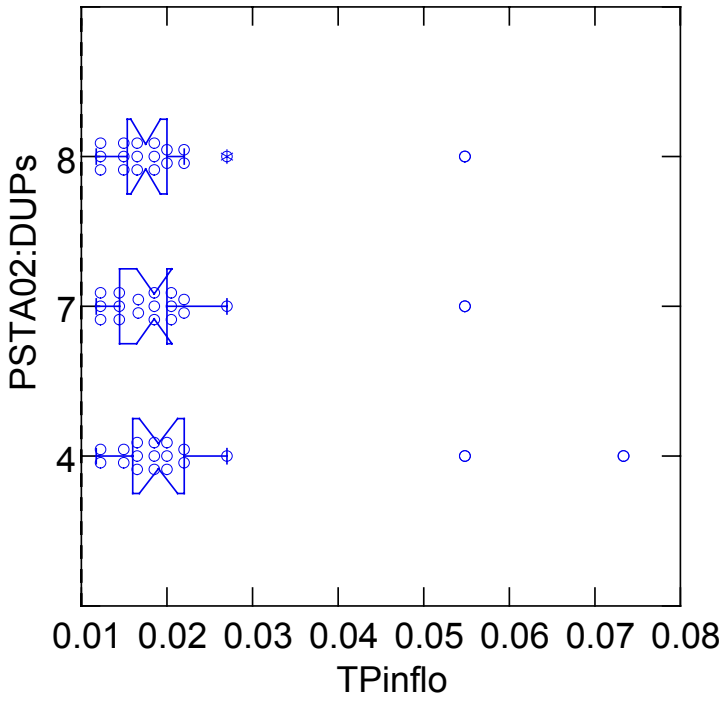
a Experimental Treatment:Treatment Code



PSTA01 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.50} = 0.51$ P = 0.951

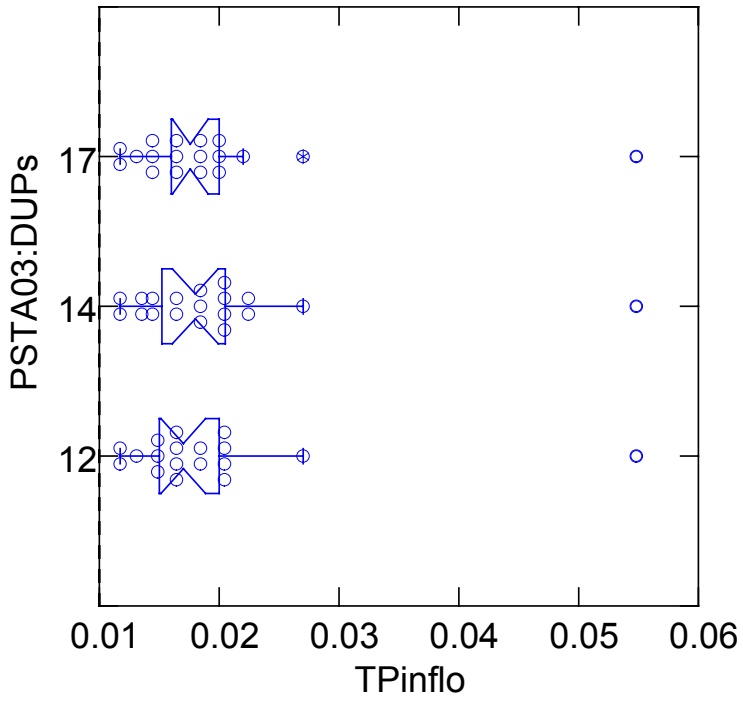
KW = 0.531 P = 0.767



PSTA02 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.51} = 0.548$ $P = 0.582$

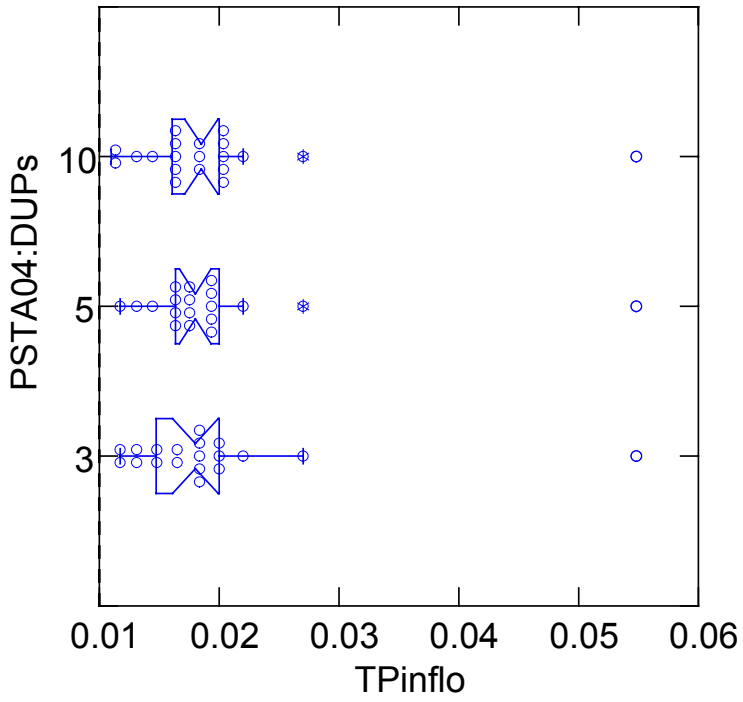
KW = 0.682 P = 0.711



PSTA03 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.52} = 0.012$ P = 0.988

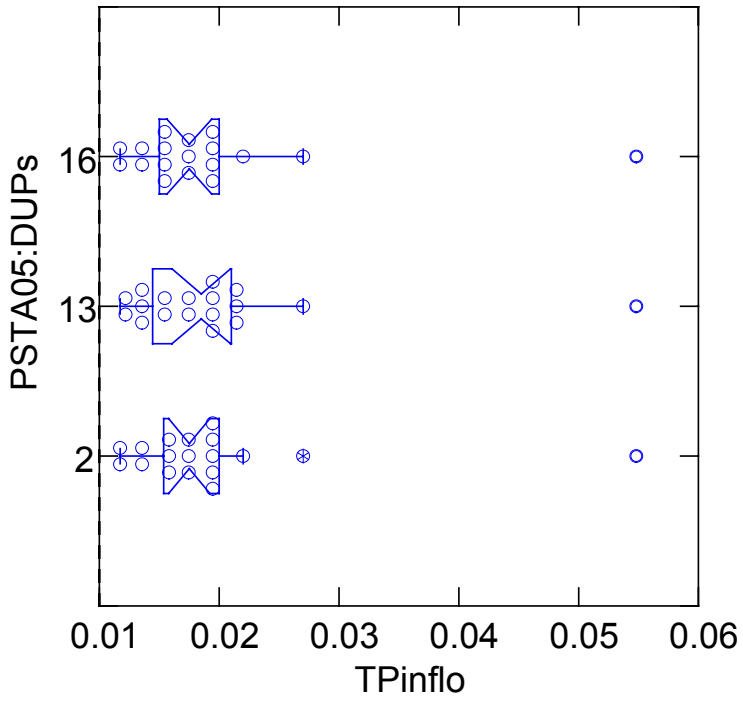
KW = 0.260 P = 0.878



PSTA04 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.55} = 0.009$ $P = 0.991$

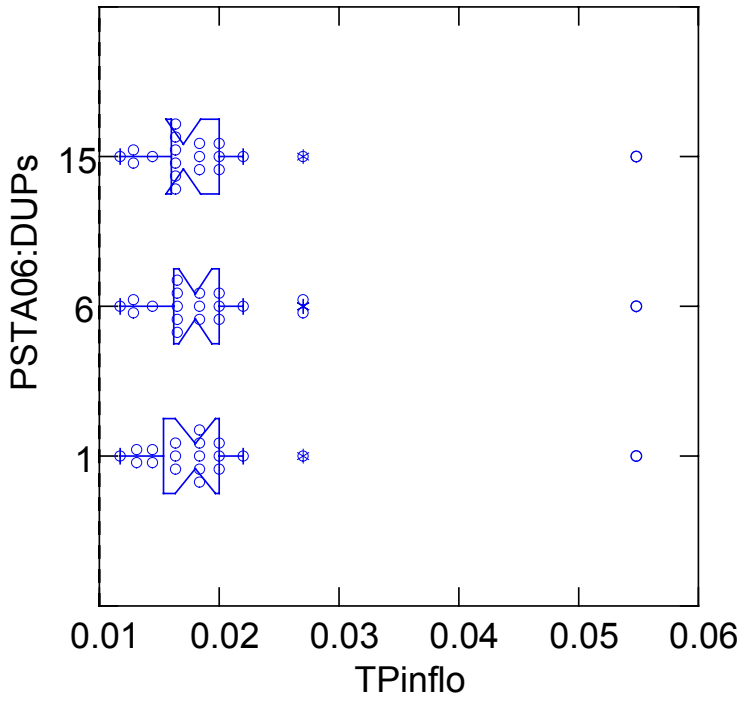
KW = 0.099 P = 0.952



PSTA05 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.51} = 0.005$ $P = 0.995$

KW = 0.096 P = 0.95

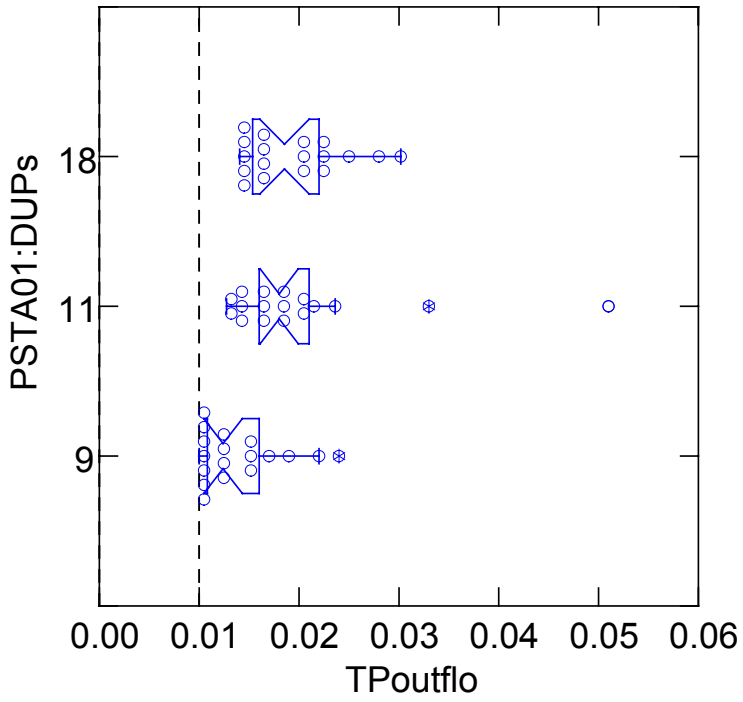


PSTA06 TotalP INFLOW: DUPLICATE COMPARISONS

$F_{2.54} = 0.023$ P = 0.977

KW = 0.899 P = 0.213

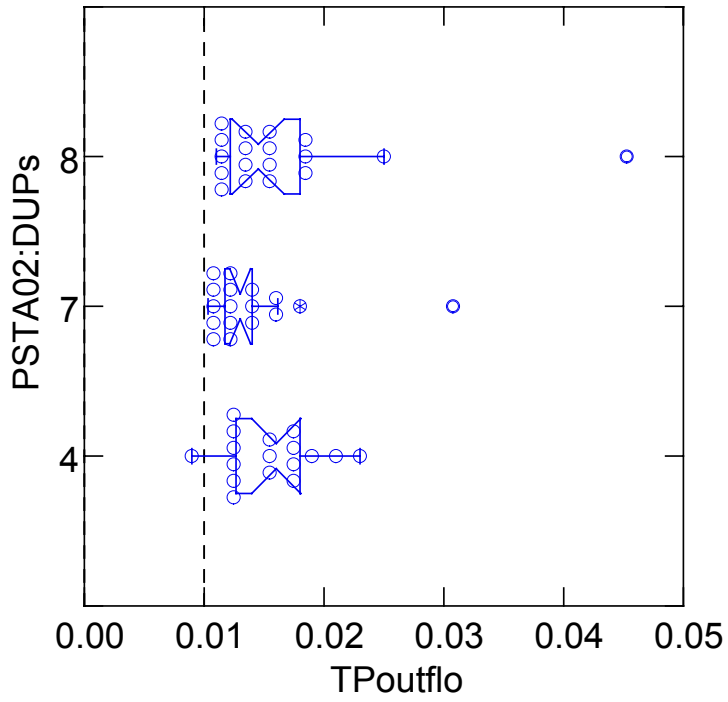
ATTACHMENT J.
OUTFLOW TP BOX PLOTS



PSTA01 TotalP OUTFLOW: DUPLICATE COMPARISONS

$F_{2.50} = 5.128$ $P = 0.009$ 11, 18 > 9

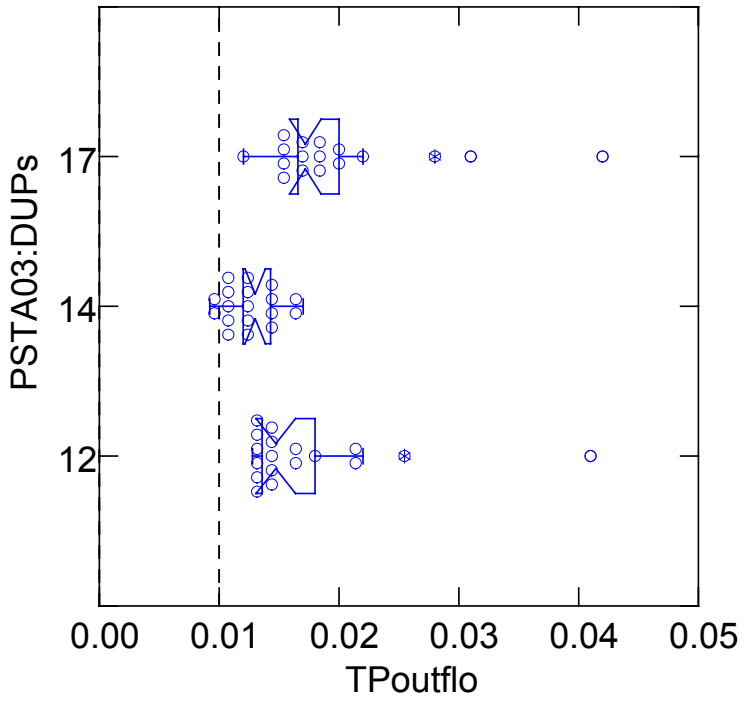
KW = 14.036 $P < 0.001$



PSTA02 TotalP OUTFLOW: DUPLICATE COMPARISONS

$F_{2.49} = 0.771$ P = 0.468

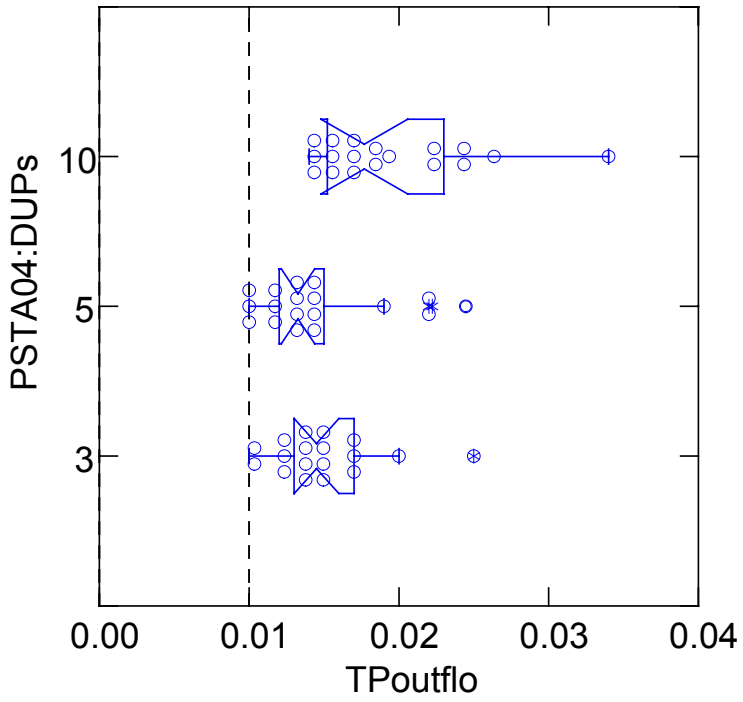
KW = 3.0 P = 0.21



PSTA03 TotalP OUTFLOW: DUPLICATE COMPARISONS

$F_{2.50} = 7.066$ P = 0.002 17 > 12, 14

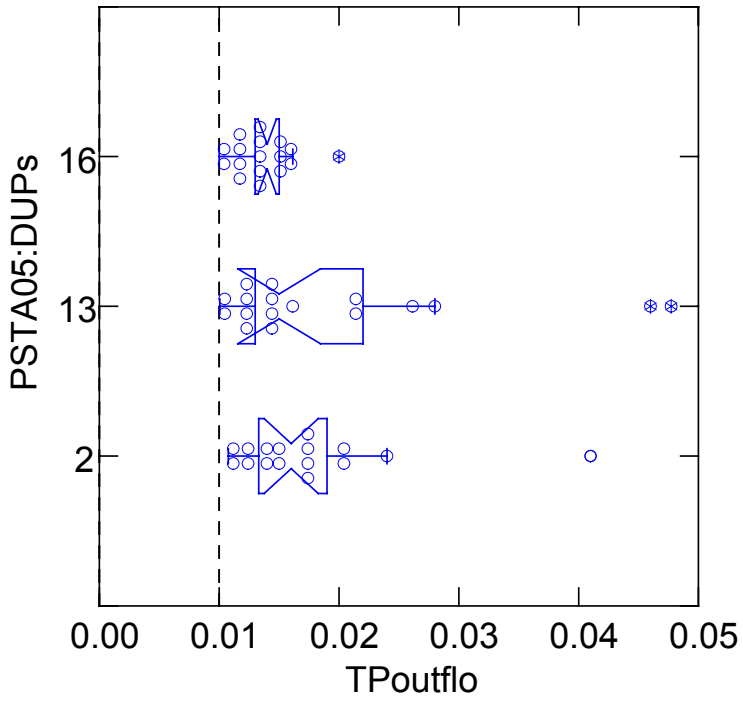
KW = 22.73 P < 0.001



PSTA04 TotalP OUTFLOW: DUPLICATE COMPARISONS

$F_{2.51} = 7.03$ $P = 0.002$ $10 > 3, 5$

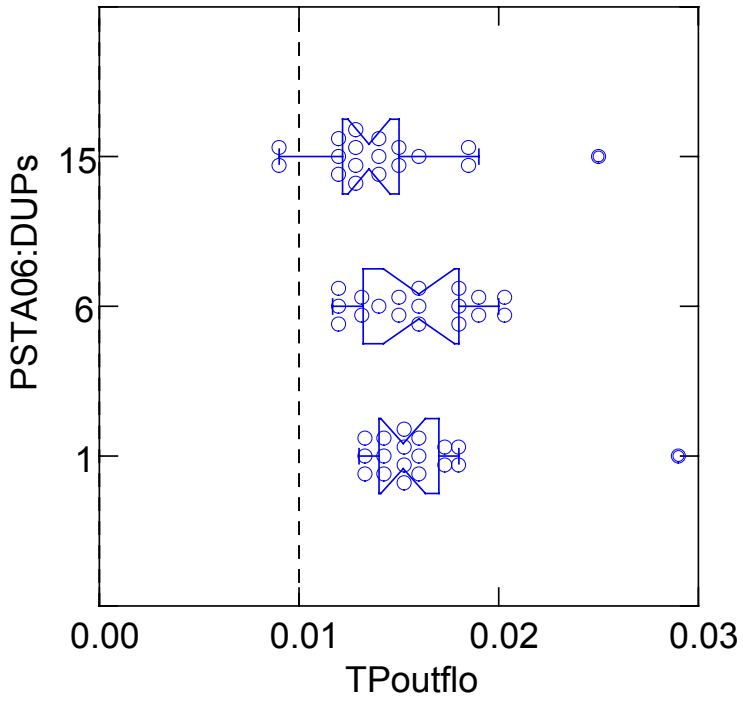
KW = 14.687 $P < 0.001$



PSTA05 TotalP OUTFLOW: DUPLICATE COMPARISONS

$F_{2.47} = 2.356$ P = 0.106

KW = 3.083 P = 0.214

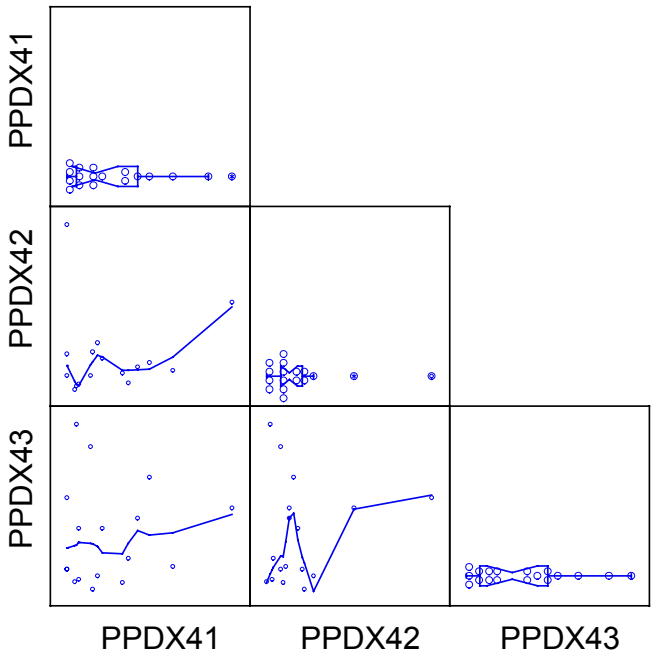


PSTA01 TotalP OUTFLOW: DUPLICATE COMPARISONS

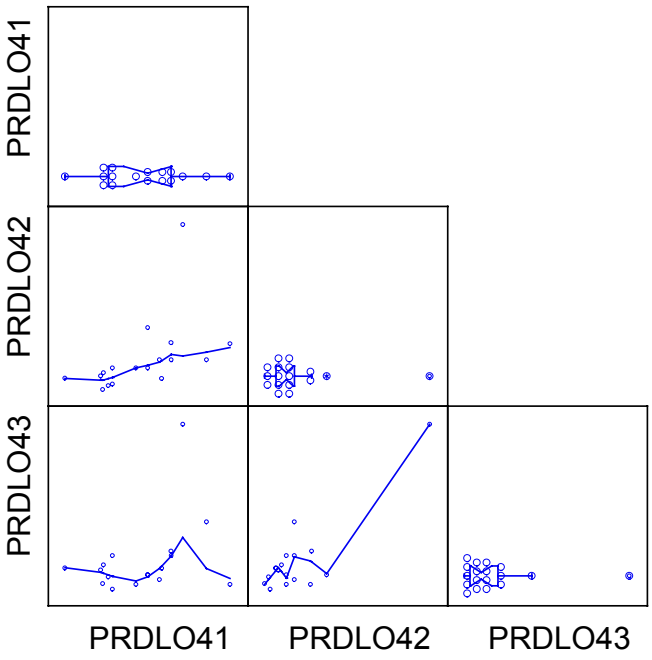
$F_{2.51} = 1.637$ P = 0.21

KW = 5.016 P = 0.081

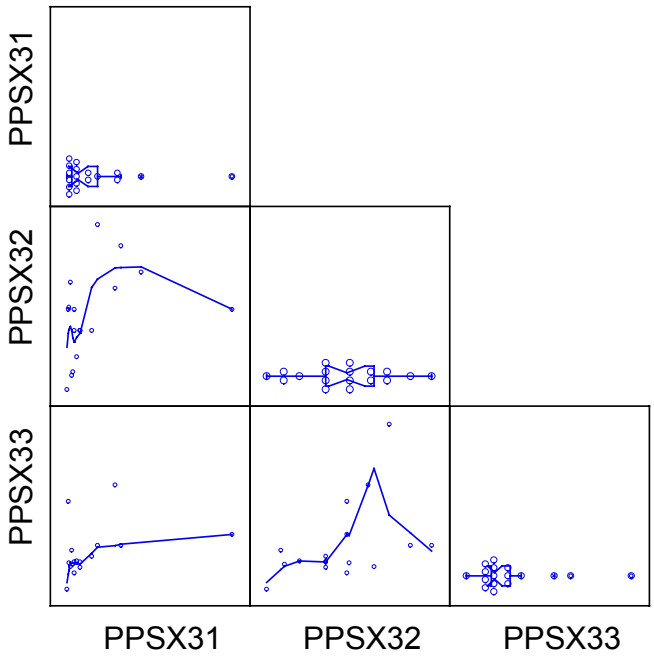
ATTACHMENT J.
OUTFLOW TP BOXPLOTS



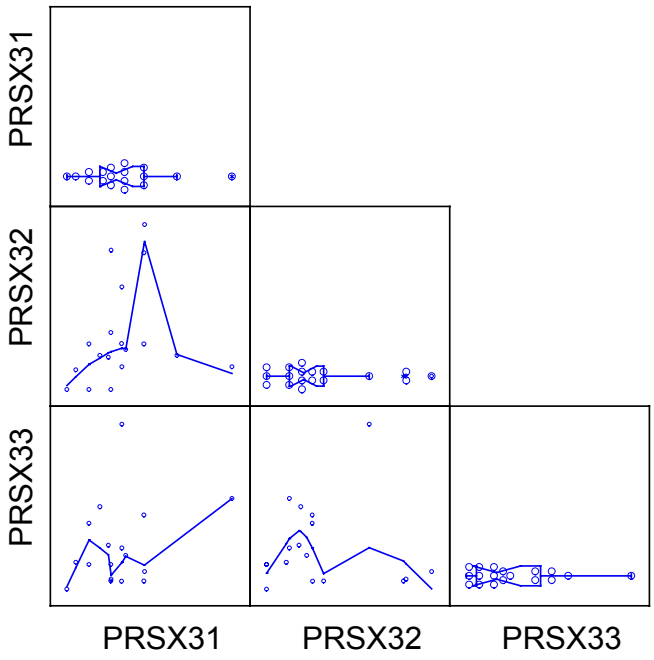
ATTACHMENT J.
OUTFLOW TP BOXPLOTS



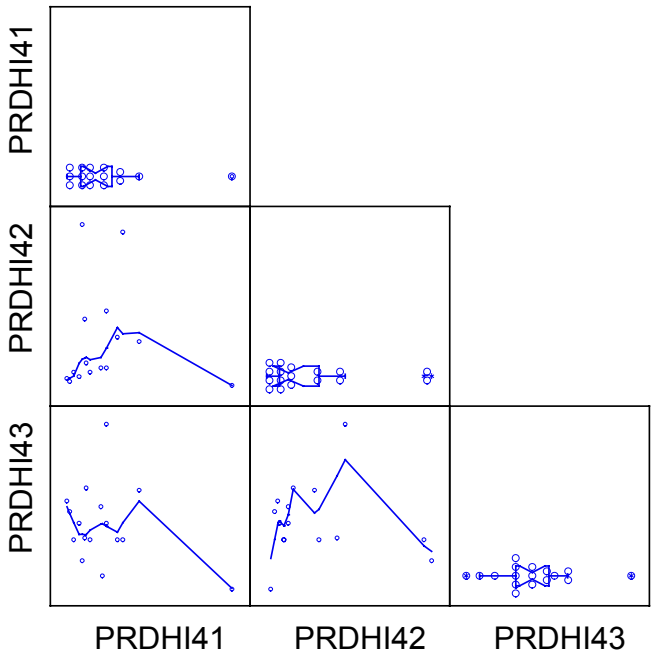
ATTACHMENT J.
OUTFLOW TP BOXPLOTS



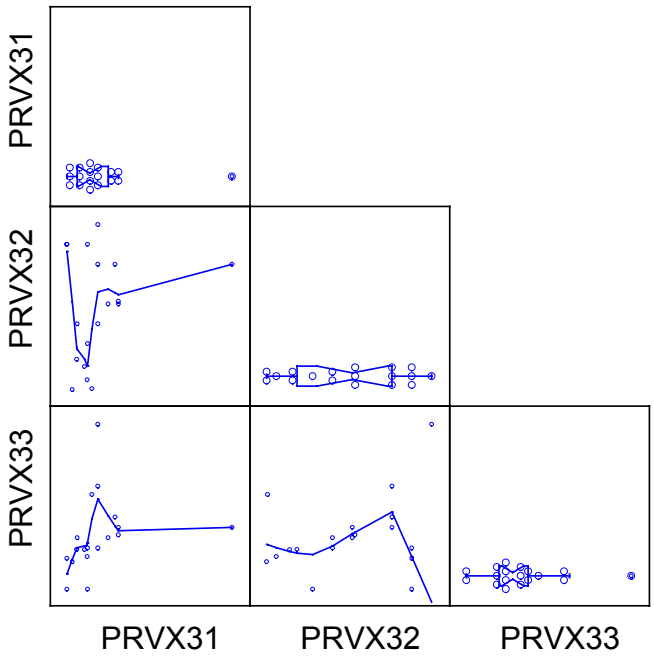
ATTACHMENT J.
OUTFLOW TP BOXPLOTS



ATTACHMENT J.
OUTFLOW TP BOXPLOTS



ATTACHMENT J.
OUTFLOW TP BOXPLOTS

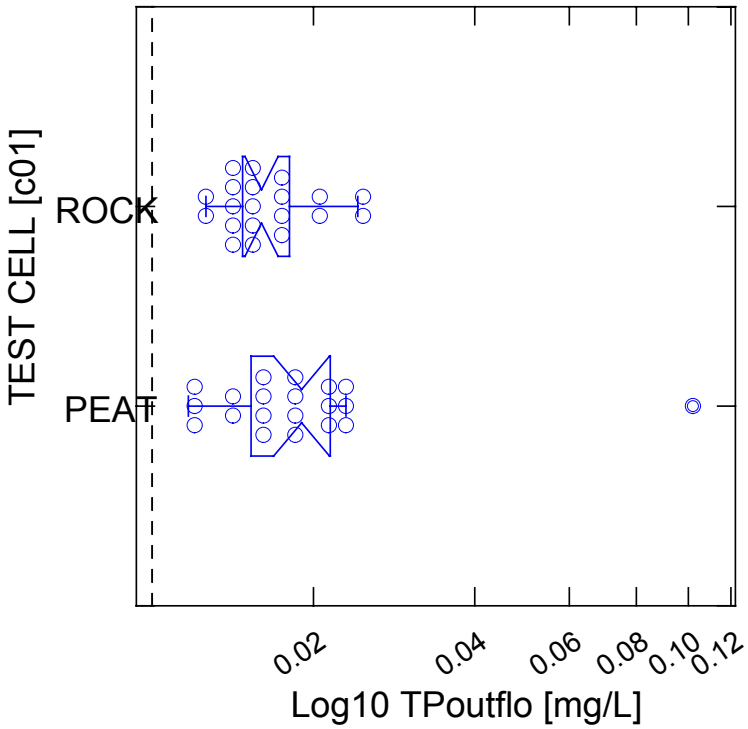


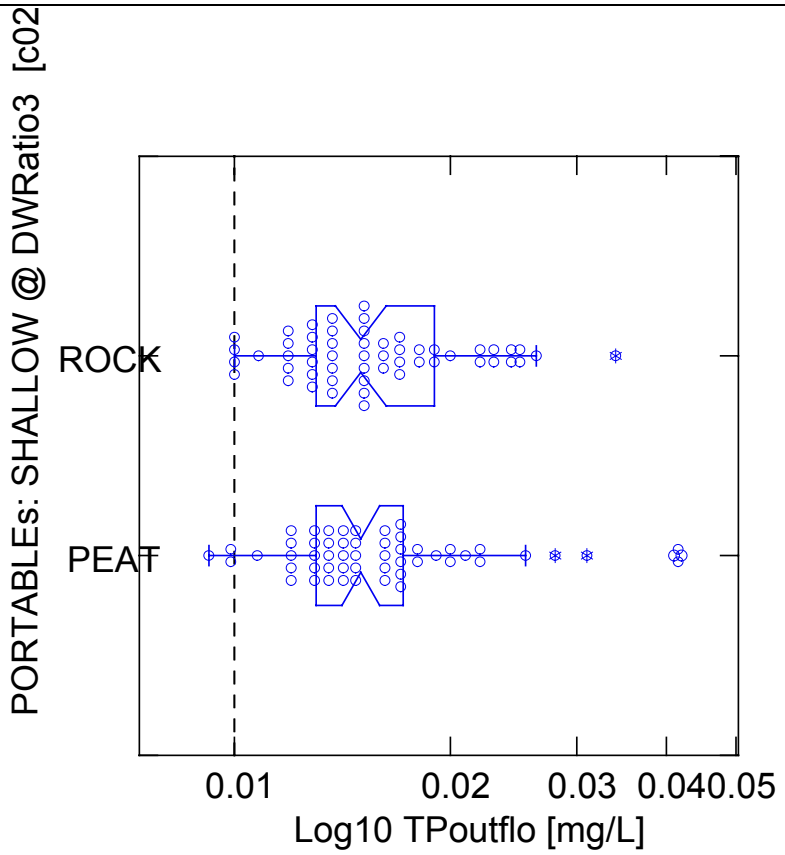
ATTACHMENT K.

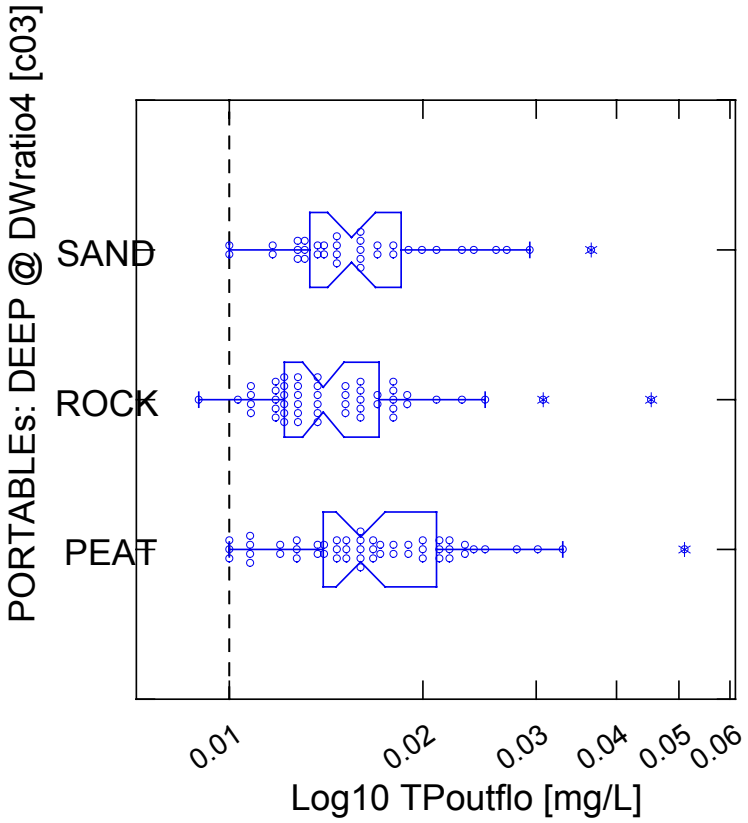
PSTA TEST CONDITIONS SUMMARY: UNCONFOUNDED COMPARISONS
COMPARES.xls

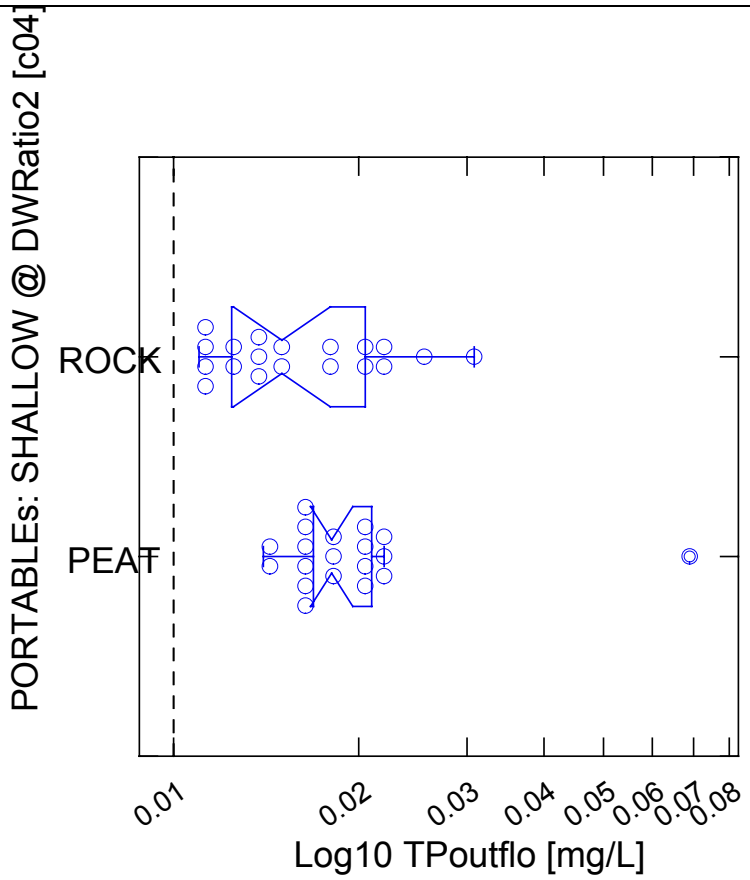
CODE	SCALE	SUB	AQUA	Z	LOAD	D_W	REP	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	N
CpDx10	TESTCELL	PEAT	Y	D	06	1	0	Y											Y			20
CrDx10	TESTCELL	ROCK	Y	D	06	1	0	Y				Y								Y		20
CrVx10	TESTCELL	ROCK	Y	V	06	1	0					Y									Y	20
PpDx41	PORTABLE	PEAT	Y	D	06	4	1			Y					Y				Y			19
PpDx42	PORTABLE	PEAT	Y	D	06	4	2			Y					Y				Y			19
PpDx43	PORTABLE	PEAT	Y	D	06	4	3			Y					Y				Y			19
PrDx41	PORTABLE	ROCK	Y	D	06	4	1			Y				Y		Y				Y		18
PrDx42	PORTABLE	ROCK	Y	D	06	4	2			Y				Y		Y				Y		18
PrDx43	PORTABLE	ROCK	Y	D	06	4	3			Y				Y		Y				Y		18
PpSx31	PORTABLE	PEAT	Y	S	06	3	1		Y								Y					20
PpSx32	PORTABLE	PEAT	Y	S	06	3	2		Y								Y					20
PpSx33	PORTABLE	PEAT	Y	S	06	3	3		Y								Y					19
PrSx31	PORTABLE	ROCK	Y	S	06	3	1		Y				Y					Y				19
PrSx32	PORTABLE	ROCK	Y	S	06	3	2		Y				Y					Y				19
PrSx33	PORTABLE	ROCK	Y	S	06	3	3		Y				Y					Y				20
PrDX41	PORTABLE	ROCK	Y	D	12	4	1							Y								18
PrDX42	PORTABLE	ROCK	Y	D	12	4	2							Y								18
PrDX43	PORTABLE	ROCK	Y	D	12	4	3							Y								19
PrVx31	PORTABLE	ROCK	Y	V	06	3	1						Y								Y	19
PrVx32	PORTABLE	ROCK	Y	V	06	3	2						Y								Y	19
PrVx33	PORTABLE	ROCK	Y	V	06	3	3						Y								Y	19
PsDx41	PORTABLE	SAND	Y	D	06	4	1			Y												19
PsDx42	PORTABLE	SAND	Y	D	06	4	2			Y												18
PpDx40	PORTABLE	PEAT	N	D	06	4	0								Y							19
PrDx40	PORTABLE	ROCK	N	D	06	4	0									Y						19
PrSx20	PORTABLE	ROCK	Y	S	06	2	0				Y							Y				19
PpSx20	PORTABLE	PEAT	Y	S	06	2	0				Y						Y					19

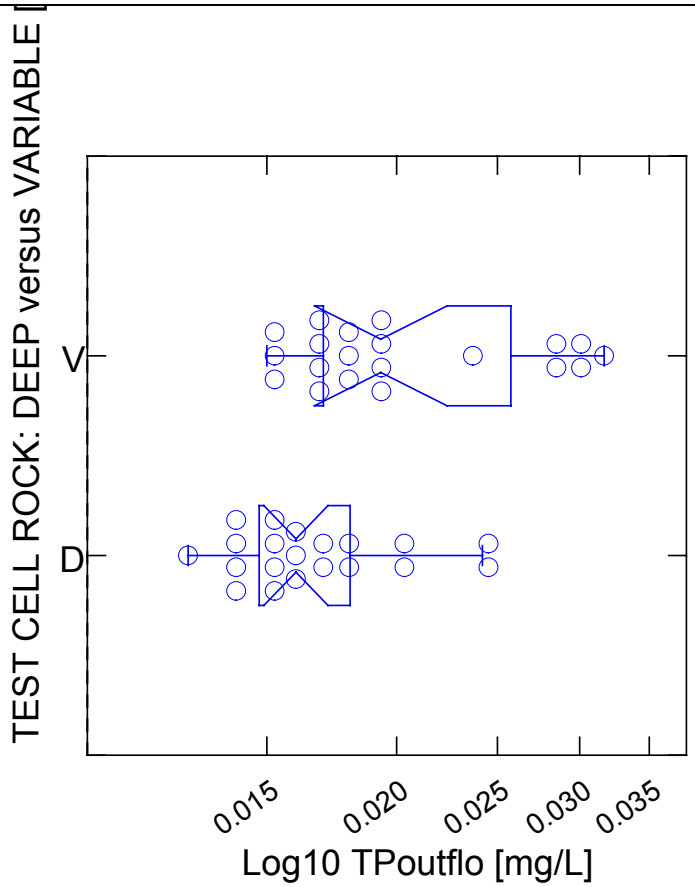
ATTACHMENT L.
OUTFLOW TP BOXPLOTS BY TREATMENT



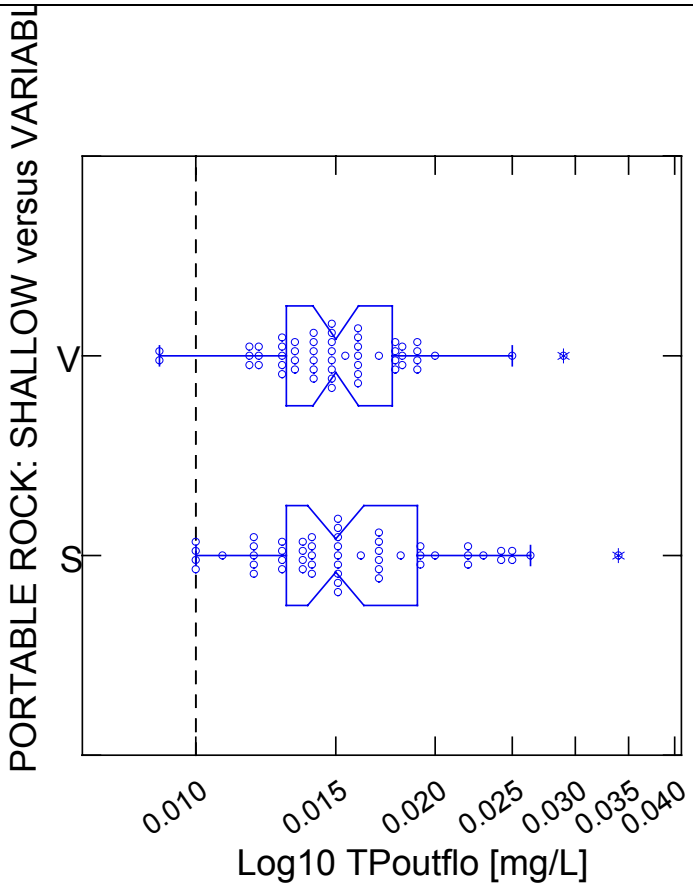

PORTABLEs: SHALLOW @ DWRatio3 [c02
ROCK
PEAT
0.01
0.02
0.03
0.04
0.05
Log10 TPoutflo [mg/L]

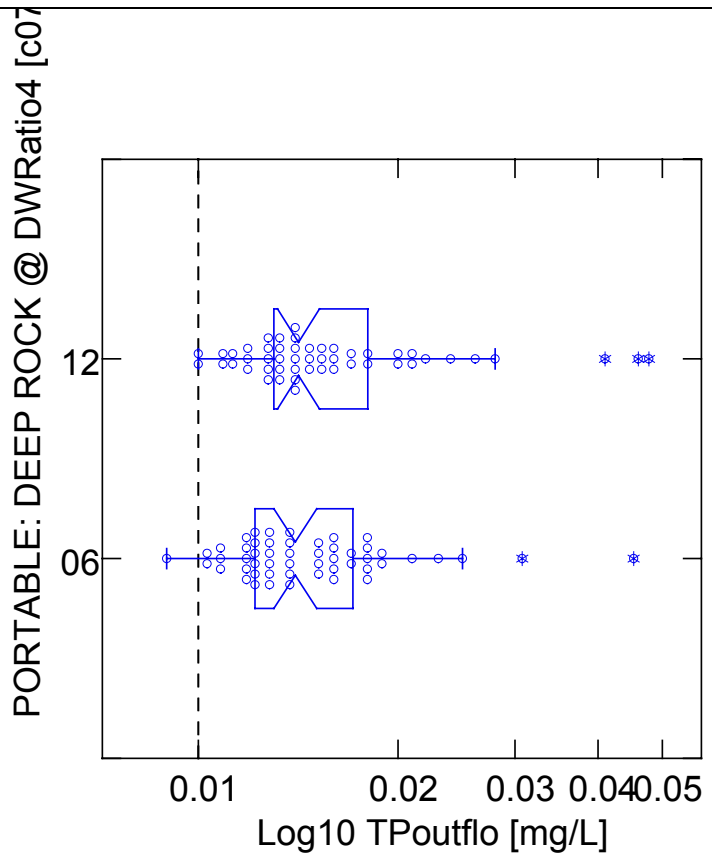

PORTABLEs: DEEP @ DWratio4 [c03]
SAND
ROCK
PEAT
0.01
0.02
0.03
0.04
0.05
0.06
Log10 TPoutflo [mg/L]

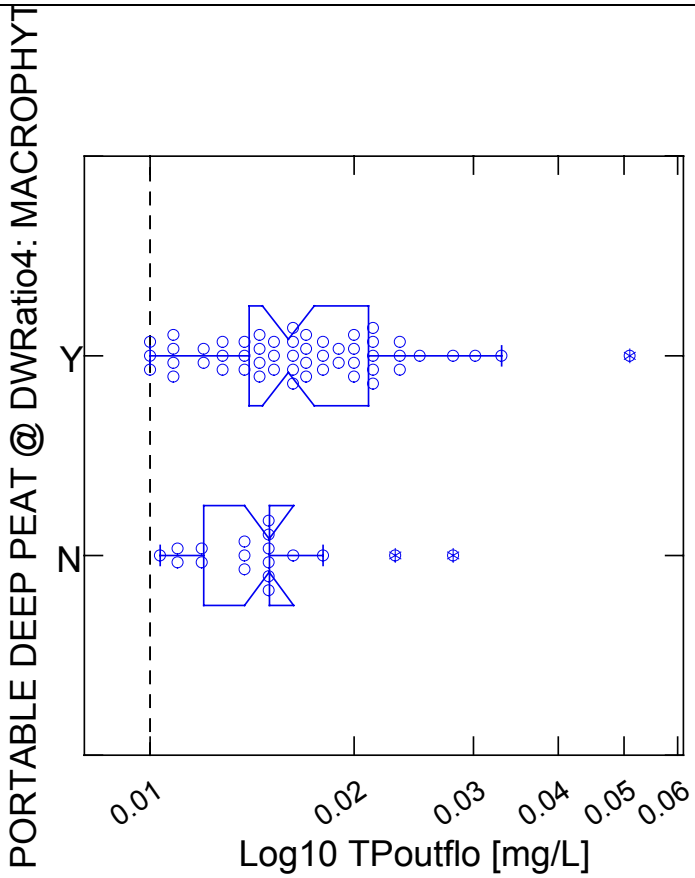

PORTABLEs: SHALLOW @ DWRatio2 [c04]
ROCK
PEAT
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Log10 TPoutflo [mg/L]

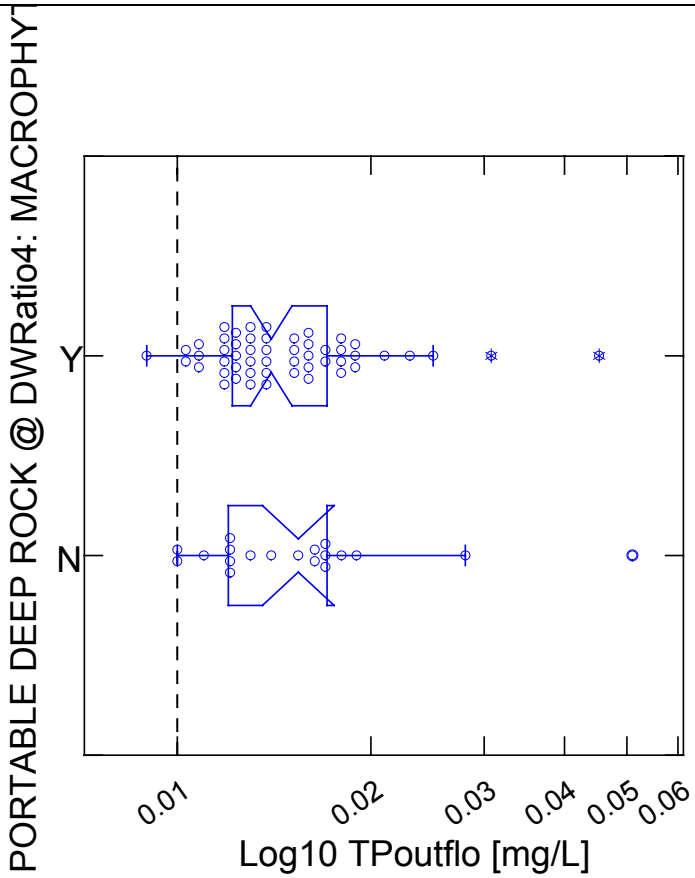

TEST CELL ROCK: DEEP versus VARIABLE [
V
D
0.015
0.020
0.025
0.030
0.035
Log10 TPoutflo [mg/L]

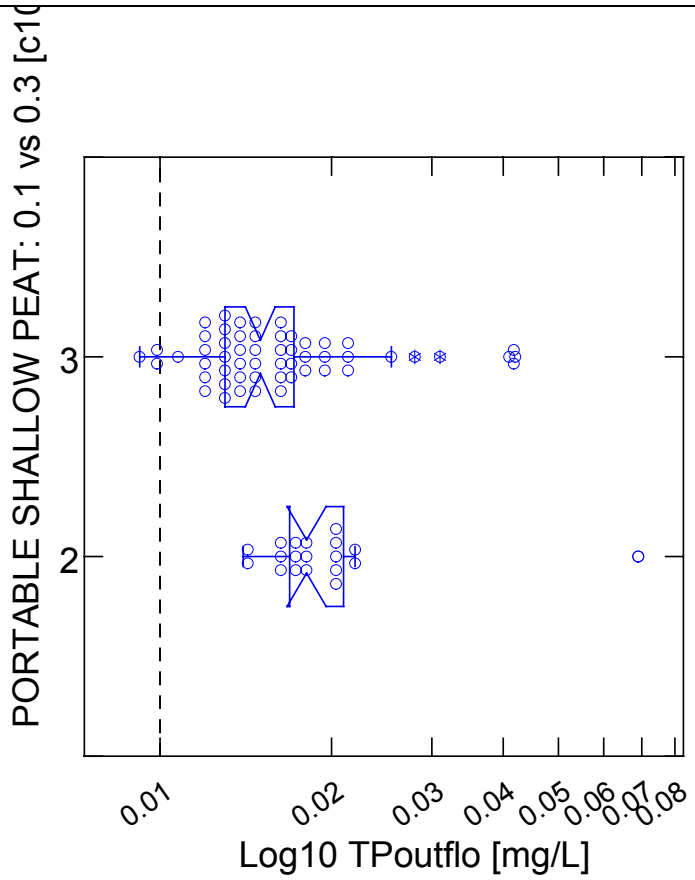
ATTACHMENT L.
OUTFLOW TP BOXPLOTS BY TREATMENT

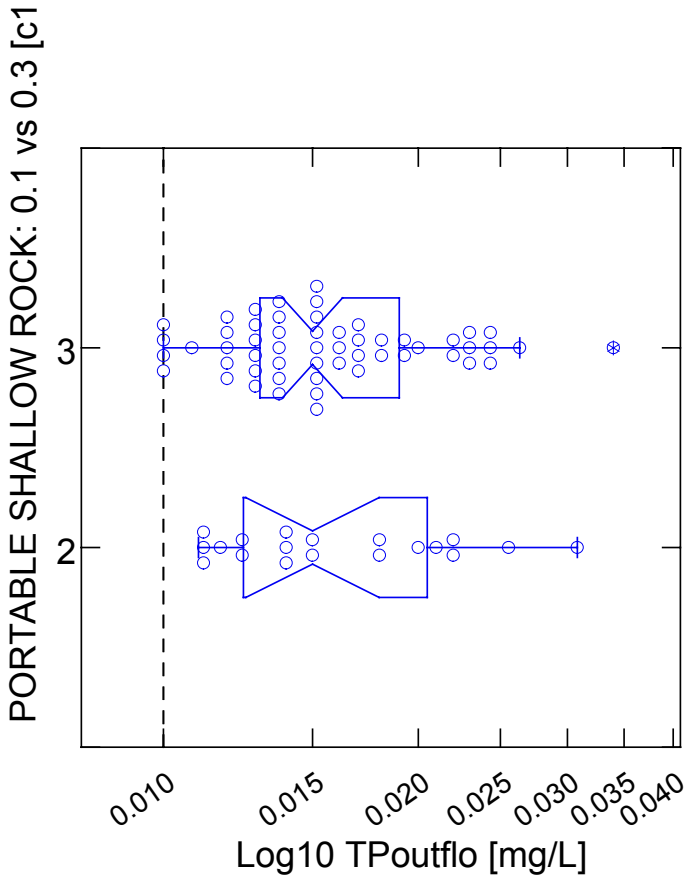


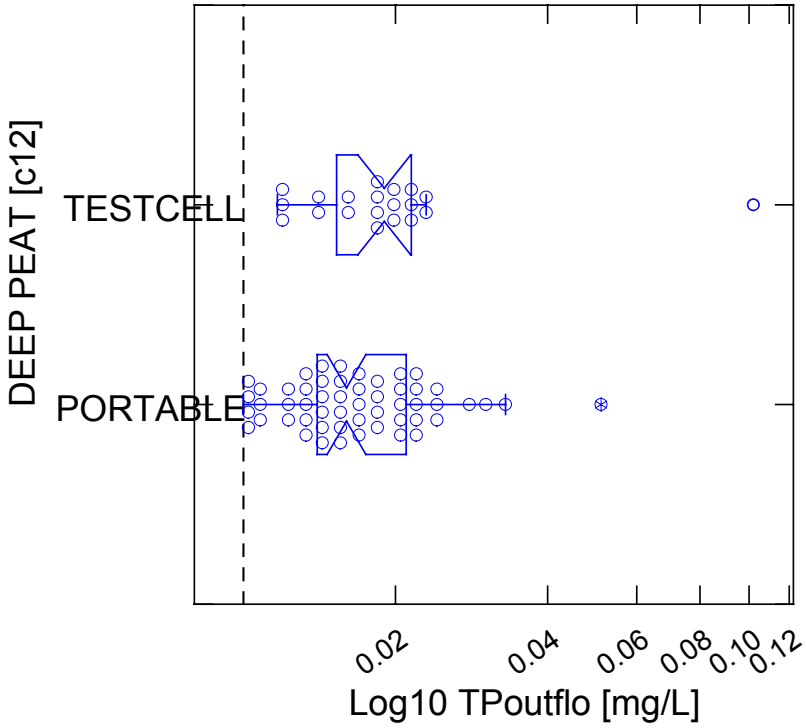

PORTABLE: DEEP ROCK @ DWRatio4 [c07
12
06
0.01
0.02
0.03
0.04
0.05
Log10 TPoutflo [mg/L]

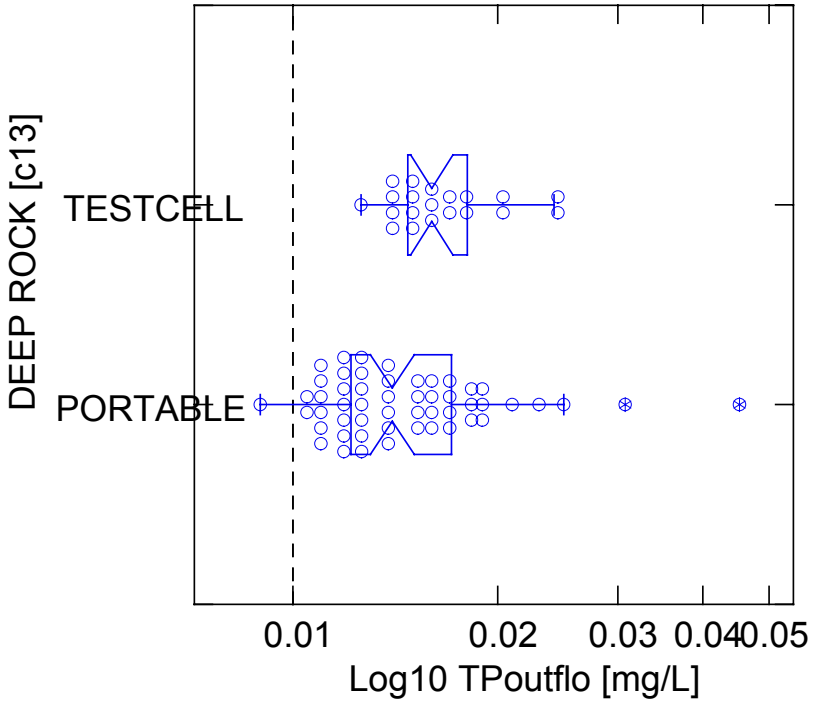

PORTABLE DEEP PEAT @ DWRatio4: MACROPHYT
Y
N
0.01
0.02
0.03
0.04
0.05
0.06
Log10 TPoutflo [mg/L]

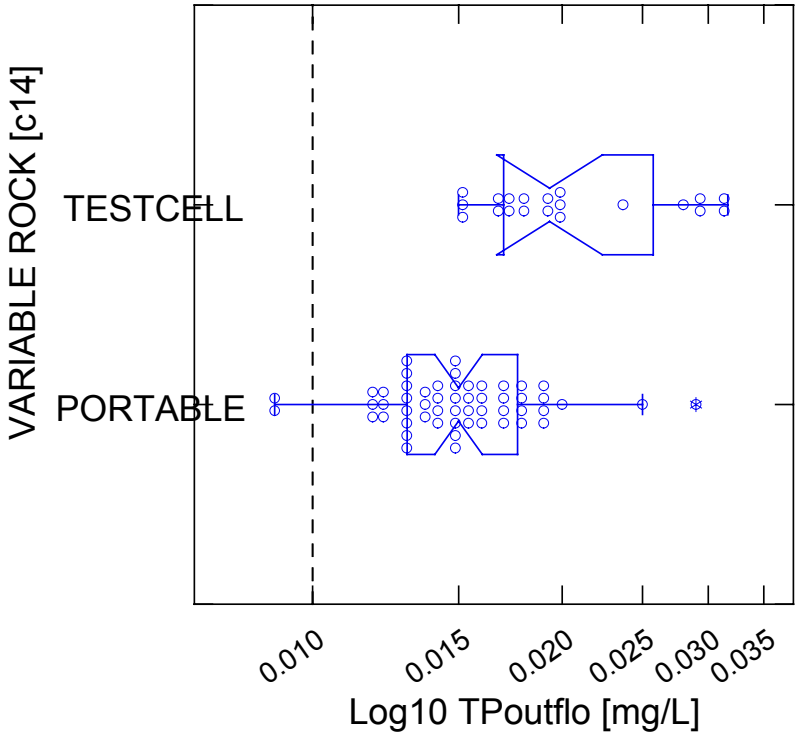

PORTABLE DEEP ROCK @ DWRatio4: MACROPHYT
Y
N
0.01
0.02
0.03
0.04
0.05
0.06
Log10 TPoutflo [mg/L]


PORTABLE SHALLOW PEAT: 0.1 vs 0.3 [c10
3
2
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Log10 TPoutflo [mg/L]


PORTABLE SHALLOW ROCK: 0.1 vs 0.3 [c1
3
2
0.010
0.015
0.020
0.025
0.030
0.035
0.040
Log10 TPoutflo [mg/L]


DEEP PEAT [c12]
TESTCELL
PORTABLE
0.02
0.04
0.06
0.08
0.10
0.12
Log10 TPoutflo [mg/L]


DEEP ROCK [c13]
TESTCELL
PORTABLE
0.01
0.02
0.03
0.04
0.05
Log10 TPoutflo [mg/L]


VARIABLE ROCK [c14]
TESTCELL
PORTABLE
0.010
0.015
0.020
0.025
0.030
0.035
Log10 TPoutflo [mg/L]

ATTACHMENT M.

PSTA FACTOR COMPARISONS: TOTAL PHOSPHOROUS [mg/L]
RESULTS.FACTORS.xls//11DEC.rtf

	F	df	P	KW	P	
SUBSTRATE						
PEAT * SHELLROCK	1.527	1,38	0.224	252	0.159	c01: CpDx10 * CrdX10
PEAT * SHELLROCK	0.099	1,105	0.754	1396.5	0.83	c02: PpDx41/2/3 * PrDx41/2/3
PEAT * SHELLROCK	1.932	1,36	0.173	242.5	0.07	c04: PpSx20 * PrSx20
PEAT * SHELLROCK * SAND	1.952	2,138	0.146	6.45	0.04	c03: PpDx41/2/3 * PrDx41/2/3 * PsdX41/2
						ROCK 59.9 < SAND 74.2 < PEAT 79.7
DEPTH						
DEEP * VARIABLE	8.415	1,38	0.006	98.5	0.006	c05: CrDx10 * CrVx10
						DEEP 15.4 < VARIABLE 25.6
SHALLOW * VARIABLE	1.52	1,106	0.22	1560	0.53	c06: PrSx31/2/3 * PrVx31/2/3
LOADING						
6 cm/d * 12 cm/d	1.279	1,100	0.261	1169	0.38	c07: PrDlo41/2/3 * PrDhi41/2/3
SHADE						
MACRO * NoMACRO	2.416	1,69	0.125	340.5	0.07	c08: PpDx41/2/3 * PpDx40
MACRO * NoMACRO	0.607	1,69	0.439	510.5	0.83	c09: PrDx41/2/3 * PrDx40
DEPTH|WIDTH RATIO						
0.3 * 0.1	3.69	1,70	0.059	749	0.002	c10: PpSx31/2/3 * PpSx20
						D_W 0.3 31.8 < D_W 0.1 49.4
0.3 * 0.1	0.09	1,71	0.765	510.5	0.975	c11: PrSx31/2/3 * PrSx20
SCALE:RATIO						
TESTCELL_0.02* PSTA_0.6	2.026	1,71	0.159	434	0.235	c12: CpDx10 * PpDX41/2/3
TESTCELL_0.02* PSTA_0.6	0.929	1,70	0.338	334	0.019	c13: CrDx10 * PrDx41/2/3
						PSTA 32.9 < TestCell 45.8
TESTCELL_0.02* PSTA_0.3	27.3	1,72	<0.001	175	<0.001	c14: CrVx10 * PrVx31/2/3
						PSTA 30.7 < TestCell 55.75

ATTACHMENT N.

PSTA EXPERIMENTAL UNITS: 95% CONFIDENCE INTERVAL ESTIMATES

RESULTS.INTRVL.xls // 12DEC.rtf

CODE	TP:IN	TP:OUT	TP:IN-OUT	TP:IN/OUT
CpDx10	0.015 - 0.038	0.013 - 0.031	-0.001 - 0.019	1.014 - 2.015
CrDx10	0.017 - 0.035	0.015 - 0.018	0.001 - 0.018	1.112 - 2.101
CrVx10	0.018 - 0.033	0.018 - 0.024	-0.006 - 0.014	0.744 - 1.825
PpDx41	0.014 - 0.024	0.012 - 0.016	0.000 - 0.011	1.02 - 1.077
PpDx42	0.015 - 0.025	0.016 - 0.025	-0.007 - 0.007	0.706 - 1.580
PpDx43	0.015 - 0.024	0.017 - 0.022	-0.006 - 0.006	0.722 - 1.422
PrDx41	0.016 - 0.031	0.014 - 0.017	-0.000 - 0.016	1.029 - 2.100
PrDx42	0.015 - 0.024	0.012 - 0.017	-0.000 - 0.011	1.052 - 1.935
PrDx43	0.015 - 0.024	0.013 - 0.021	-0.003 - 0.009	0.973 - 1.662
PpSx31	0.015 - 0.024	0.014 - 0.021	-0.004 - 0.008	0.807 - 1.668
PpSx32	0.015 - 0.024	0.012 - 0.014	0.002 - 0.012	1.055 - 2.168
PpSx33	0.015 - 0.024	0.016 - 0.024	-0.007 - 0.006	0.643 - 1.599
PrSx31	0.015 - 0.024	0.013 - 0.017	-0.000 - 0.010	1.012 - 1.724
PrSx32	0.015 - 0.024	0.012 - 0.017	0.001 - 0.010	1..154 - 1.696
PrSx33	0.015 - 0.024	0.017 - 0.022	-0.005 - 0.006	0.756 - 1.438
PrDX41	0.015 - 0.024	0.014 - 0.021	-0.005 - 0.010	0.772 - 1.867
PrDX42	0.015 - 0.025	0.014 - 0.026	-0.009 - 0.009	0.781 - 1.781
PrDX43	0.015 - 0.024	0.013 - 0.015	0.001 - 0.010	1.087 - 1.775
PrVx31	0.015 - 0.024	0.014 - 0.018	-0.001 - 0.009	0.934 - 1.656
PrVx32	0.016 - 0.025	0.014 - 0.017	-0.000 - 0.009	0.949 - 1.689
PrVx33	0.015 - 0.024	0.012 - 0.016	0.000 - 0.011	1.054 - 1.911
PsDx41	0.016 - 0.026	0.013 - 0.019	0.001 - 0.010	1.080 - 1.685
PsDx42	0.015 - 0.024	0.016 - 0.021	-0.003 - 0.005	0.893 - 1.265
PpDx40	0.015 - 0.024	0.013 - 0.017	-0.001 - 0.009	0.878 - 1.875
PrDx40	0.015 - 0.024	0.012 - 0.021	-0.004 - 0.009	1.009 - 1.638
PrSx20	0.015 - 0.024	0.006 - 0.014	-0.003 - 0.008	0.870 - 1.659
PpSx20	0.015 - 0.024	0.015 - 0.027	-0.009 - 0.005	0.742 - 1.309

Test Cell Treatment 1: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	122	122	Height	m	0.63	0.63
q(in)	m/d	0.05	0.05	P	m/d	0.00	0.00
u(in)	m/d	6.92	6.92	ET	m/d	0.00	0.00
C	µgP/L	23	23	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	24	24				
TSSi	mg/L	1	1	qCin		1.253	1.253
xTSS(in	mgP/g	1	1	qC		0.845	0.845
R	gm/m2	1160.0	1229.1	pCr		0.00	0.00
RxR	mgP/m	381.6	404.4	IC		0.00	0.00
N	gm/m2	0.0	28.1	J		0.41	0.41
(aN)	m2/m2	1	1	sum in		1.253	1.253
xN	mgP/g	1.15	1.15	sum out		1.253	1.253
NxN	mgP/m	0.00	32.23				
Ci	µg/L	0	0	qCpin		0.054	0.054
G	gm/m2-	0.36	0.80	qCp		0.312	0.312
D	gm/m2-	0.00	0.56	TP sum in		1.307	1.307
T	gm/m2-	5.2000	5.2000	TP sum out		1.157	1.157
S	gm/m2-	0.21	0.21	TxT		5.2000	5.2000
R	gm/m2-	0.21	0.21	RxR		0.0692	0.0692
J	mgP/m2-	0.41	0.41	SxN		0.240	0.240
PCrain	mgP/m2-	0.00	0.00	GxN		0.408	0.924
IC	mgP/m2-	0.00	0.00	xND		0.000	0.645
?N/?t	gm/m2-	0.15	0.03	bxND		0.000	0.516
(?RxR)/	mgP/m2-	-0.02	0.11	(1-b)xND		0.000	0.129
kgross	m/yr	2.4	2.4				
knet	m/yr	-0.3	1.8	NxN		0.00	32.23
Qo	m/d	122.00	122.00	Sum		0.168	0.039
(q)(out)	m/d	0.05	0.05	RxR		381.6	404.4
u(out)	m/d	6.92	6.92	Sum		-0.017	0.112
C(out)	µgP/L	15.511	15.511				
Cp(out)	µgP/L	5.73	5.73				
TP(out)	µgP/L	21.2	21.2				
TSS(ou	mg/L	7.75	7.75				
xTSS(ou	mgP/g	0.74	0.74				

Note: All model results are preliminary and subject to revision.

Test Cell Treatment 2: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	122	122	Height	m	0.6	0.6
q(in)	m/d	0.05	0.05	P	m/d	0.00	0.00
u(in)	m/d	7.26	7.26	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.579	1.579
xTSS(in	mgP/g	1	1	qC		0.600	0.600
R	gm/m2	1930.0	2064.4	pCr		0.00	0.00
RxR	mgP/m	1553.7	1661.8	IC		0.00	0.00
N	gm/m2	0.0	178.0	J		0.98	0.98
(aN)	m2/m2	1	1	sum in		1.579	1.579
xN	mgP/g	0.92	0.92	sum out		1.579	1.579
NxN	mgP/m	0.00	164.64				
Ci	µg/L	0	0	qCpin		0.054	0.054
G	gm/m2-	1.06	3.91	qCp		0.287	0.287
D	gm/m2-	0.00	3.56	TP sum in		1.634	1.634
T	gm/m2-	6.4000	6.4000	TP sum out		0.886	0.886
S	gm/m2-	0.13	0.13	TxT		6.4000	6.4000
R	gm/m2-	0.22	0.22	RxR		0.1735	0.1735
J	mgP/m2-	0.98	0.98	SxN		0.123	0.123
PCrain	mgP/m2-	0.00	0.00	GxN		0.980	3.614
IC	mgP/m2-	0.00	0.00	xND		0.000	3.293
?N/?t	gm/m2-	0.93	0.21	bxND		0.000	2.634
(?RxR)/	mgP/m2-	-0.11	0.55	(1-b)xND		0.000	0.659
kgross	m/yr	11.8	11.8				
knet	m/yr	-1.7	8.7	NxN		0.00	164.64
Qo	m/d	122.00	122.00	Sum		0.857	0.198
(q)(out)	m/d	0.05	0.05	RxR		1553.7	1661.8
u(out)	m/d	7.26	7.26	Sum		-0.110	0.549
C(out)	µgP/L	11.015	11.015				
Cp(out)	µgP/L	5.26	5.26				
TP(out)	µgP/L	16.3	16.3				
TSS(ou	mg/L	6.22	6.22				
xTSS(ou	mgP/g	0.85	0.85				

Note: All model results are preliminary and subject to revision.

Test Cell Treatment 3: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	147	147	Height	m	0.7	0.7
q(in)	m/d	0.07	0.07	P	m/d	0.00	0.00
u(in)	m/d	7.50	7.50	ET	m/d	0.00	0.00
C	µgP/L	28	28	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	29	29				
TSSi	mg/L	1	1	qCin		1.837	1.837
xTSS(in	mgP/g	1	1	qC		1.075	1.075
R	gm/m2	1890.0	1967.3	pCr		0.00	0.00
RxR	mgP/m	1561.1	1625.0	IC		0.00	0.00
N	gm/m2	0.0	97.0	J		0.76	0.76
(aN)	m2/m2	1	1	sum in		1.837	1.837
xN	mgP/g	1.20	1.20	sum out		1.837	1.837
NxN	mgP/m	0.00	116.00				
Ci	µg/L	0	0	qCpin		0.066	0.066
G	gm/m2-	0.64	2.19	qCp		0.335	0.335
D	gm/m2-	0.00	1.94	TP sum in		1.903	1.903
T	gm/m2-	7.0000	7.0000	TP sum out		1.410	1.410
S	gm/m2-	0.13	0.13	TxT		7.0000	7.0000
R	gm/m2-	0.22	0.22	RxR		0.1809	0.1809
J	mgP/m2-	0.76	0.76	SxN		0.159	0.159
PCrain	mgP/m2-	0.00	0.00	GxN		0.763	2.619
IC	mgP/m2-	0.00	0.00	xND		0.000	2.320
?N/?t	gm/m2-	0.50	0.12	bxND		0.000	1.856
(?RxR)/	mgP/m2-	-0.11	0.35	(1-b)xND		0.000	0.464
kgross	m/yr	7.1	7.1				
knet	m/yr	-1.6	5.1	NxN		0.00	116.00
Qo	m/d	147.00	147.00	Sum		0.604	0.140
(q)(out)	m/d	0.07	0.07	RxR		1561.1	1625.0
u(out)	m/d	7.50	7.50	Sum		-0.111	0.353
C(out)	µgP/L	16.380	16.380				
Cp(out)	µgP/L	5.11	5.11				
TP(out)	µgP/L	21.5	21.5				
TSS(ou	mg/L	5.29	5.29				
xTSS(ou	mgP/g	0.97	0.97				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline Case: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2051.5	pCr		0.00	0.00
RxR	mgP/m	1558.6	1674.0	IC		0.00	0.00
N	gm/m2	0.0	180.2	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	174.69				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	3.93	qCp		0.282	0.282
D	gm/m2-	0.00	3.60	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		1.000	1.000
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.02	1.02	SxN		0.108	0.108
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	3.812
IC	mgP/m2-	0.00	0.00	xND		0.000	3.494
?N/?t	gm/m2-	0.94	0.22	bxND		0.000	2.795
(?RxR)/	mgP/m2-	-0.11	0.58	(1-b)xND		0.000	0.699
kgross	m/yr	12.4	12.4				
knet	m/yr	-1.8	9.1	NxN		0.00	174.69
Qo	m/d	134.00	134.00	Sum		0.909	0.211
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1674.0
u(out)	m/d	7.98	7.98	Sum		-0.114	0.584
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	4.71	4.71				
TP(out)	µgP/L	16.7	16.7				
TSS(ou	mg/L	5.46	5.46				
xTSS(ou	mgP/g	0.86	0.86				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 10X kso: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	1846.4	pCr		0.00	0.00
RxR	mgP/m	1558.6	1506.7	IC		0.00	0.00
N	gm/m2	0.0	-11.7	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	-11.30				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	0.86	qCp		1.250	1.250
D	gm/m2-	0.00	-0.23	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		1.968	1.968
S	gm/m2-	1.11	1.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.02	1.02	SxN		1.076	1.076
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	0.836
IC	mgP/m2-	0.00	0.00	xND		0.000	-0.226
?N/?t	gm/m2-	-0.06	-0.01	bxND		0.000	-0.181
(?RxR)/	mgP/m2-	-0.11	-0.16	(1-b)xND		0.000	-0.045
kgross	m/yr	-2.0	-2.0				
knet	m/yr	-1.3	-1.9	NxN		0.00	-11.30
Qo	m/d	134.00	134.00	Sum		-0.059	-0.014
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1506.7
u(out)	m/d	7.98	7.98	Sum		-0.114	-0.160
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	20.89	20.89				
TP(out)	µgP/L	32.9	32.9				
TSS(ou	mg/L	22.15	22.15				
xTSS(ou	mgP/g	0.94	0.94				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 0.1x kso: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2072.0	pCr		0.00	0.00
RxR	mgP/m	1558.6	1690.8	IC		0.00	0.00
N	gm/m2	0.0	199.3	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	193.28				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	4.24	qCp		0.185	0.185
D	gm/m2-	0.00	3.99	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.903	0.903
S	gm/m2-	0.01	0.01	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.02	1.02	SxN		0.011	0.011
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	4.109
IC	mgP/m2-	0.00	0.00	xND		0.000	3.866
?N/?t	gm/m2-	1.04	0.24	bxND		0.000	3.093
(?RxR)/	mgP/m2-	-0.11	0.66	(1-b)xND		0.000	0.773
kgross	m/yr	14.4	14.4				
knet	m/yr	-1.9	10.7	NxN		0.00	193.28
Qo	m/d	134.00	134.00	Sum		1.006	0.233
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1690.8
u(out)	m/d	7.98	7.98	Sum		-0.114	0.659
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	3.09	3.09				
TP(out)	µgP/L	15.1	15.1				
TSS(ou	mg/L	3.79	3.79				
xTSS(ou	mgP/g	0.82	0.82				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 10x kT: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2333.3	pCr		0.00	0.00
RxR	mgP/m	1558.6	1904.0	IC		0.00	0.00
N	gm/m2	0.0	180.2	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	174.69				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	3.93	qCp		-0.348	-0.348
D	gm/m2-	0.00	3.60	TP sum in		1.795	1.795
T	gm/m2-	0.6999	0.6999	TP sum out		0.370	0.370
S	gm/m2-	0.11	0.11	TxT		0.6999	0.6999
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.02	1.02	SxN		0.108	0.108
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	3.812
IC	mgP/m2-	0.00	0.00	xND		0.000	3.494
?N/?t	gm/m2-	0.94	0.22	bxND		0.000	2.795
(?RxR)/	mgP/m2-	0.52	1.21	(1-b)xND		0.000	0.699
kgross	m/yr	28.8	28.8				
knet	m/yr	10.4	24.5	NxN		0.00	174.69
Qo	m/d	134.00	134.00	Sum		0.909	0.211
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1904.0
u(out)	m/d	7.98	7.98	Sum		0.516	1.214
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	-5.82	-5.82				
TP(out)	µgP/L	6.2	6.2				
TSS(ou	mg/L	-5.07	-5.07				
xTSS(ou	mgP/g	1.15	1.15				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 0.1x kT: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2023.3	pCr		0.00	0.00
RxR	mgP/m	1558.6	1651.0	IC		0.00	0.00
N	gm/m2	0.0	180.2	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	174.69				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	3.93	qCp		0.345	0.345
D	gm/m2-	0.00	3.60	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		1.063	1.063
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.02	1.02	SxN		0.108	0.108
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	3.812
IC	mgP/m2-	0.00	0.00	xND		0.000	3.494
?N/?t	gm/m2-	0.94	0.22	bxND		0.000	2.795
(?RxR)/	mgP/m2-	-0.18	0.52	(1-b)xND		0.000	0.699
kgross	m/yr	11.2	11.2				
knet	m/yr	-2.7	8.0	NxN		0.00	174.69
Qo	m/d	134.00	134.00	Sum		0.909	0.211
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1651.0
u(out)	m/d	7.98	7.98	Sum		-0.177	0.521
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	5.76	5.76				
TP(out)	µgP/L	17.8	17.8				
TSS(ou	mg/L	6.51	6.51				
xTSS(ou	mgP/g	0.88	0.88				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 10x kwo: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.114	0.114
R	gm/m2	1910.0	2188.1	pCr		0.00	0.00
RxR	mgP/m	1558.6	1785.5	IC		0.00	0.00
N	gm/m2	0.0	499.8	J		1.62	1.62
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.60	0.60	sum out		1.735	1.735
NxN	mgP/m	0.00	298.57				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	2.71	10.71	qCp		0.240	0.240
D	gm/m2-	0.00	10.00	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.355	0.355
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	1.62	1.62	SxN		0.066	0.066
PCrain	mgP/m2-	0.00	0.00	GxN		1.620	6.397
IC	mgP/m2-	0.00	0.00	xND		0.000	5.971
?N/?t	gm/m2-	2.60	0.60	bxND		0.000	4.777
(?RxR)/	mgP/m2-	-0.11	1.08	(1-b)xND		0.000	1.194
kgross	m/yr	29.3	29.3				
knet	m/yr	-2.3	21.9	NxN		0.00	298.57
Qo	m/d	134.00	134.00	Sum		1.554	0.360
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1785.5
u(out)	m/d	7.98	7.98	Sum		-0.114	1.080
C(out)	µgP/L	1.913	1.913				
Cp(out)	µgP/L	4.02	4.02				
TP(out)	µgP/L	5.9	5.9				
TSS(ou	mg/L	5.46	5.46				
xTSS(ou	mgP/g	0.74	0.74				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 0.1x kwo: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		1.520	1.520
R	gm/m2	1910.0	1861.1	pCr		0.00	0.00
RxR	mgP/m	1558.6	1518.6	IC		0.00	0.00
N	gm/m2	0.0	1.1	J		0.22	0.22
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	1.84	1.84	sum out		1.735	1.735
NxN	mgP/m	0.00	2.03				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	0.12	0.13	qCp		0.379	0.379
D	gm/m2-	0.00	0.02	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		1.898	1.898
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		0.1843	0.1843
J	mgP/m2-	0.22	0.22	SxN		0.205	0.205
PCrain	mgP/m2-	0.00	0.00	GxN		0.215	0.248
IC	mgP/m2-	0.00	0.00	xND		0.000	0.041
?N/?t	gm/m2-	0.01	0.00	bxND		0.000	0.032
(?RxR)/	mgP/m2-	-0.11	-0.11	(1-b)xND		0.000	0.008
kgross	m/yr	-1.2	-1.2				
knet	m/yr	-1.4	-1.3	NxN		0.00	2.03
Qo	m/d	134.00	134.00	Sum		0.011	0.002
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1518.6
u(out)	m/d	7.98	7.98	Sum		-0.114	-0.106
C(out)	µgP/L	25.402	25.402				
Cp(out)	µgP/L	6.33	6.33				
TP(out)	µgP/L	31.7	31.7				
TSS(ou	mg/L	5.46	5.46				
xTSS(ou	mgP/g	1.16	1.16				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 10x Flow: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	1340	1340	Height	m	0.6	0.6
q(in)	m/d	0.60	0.60	P	m/d	0.00	0.00
u(in)	m/d	79.76	79.76	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		17.348	17.348
xTSS(in	mgP/g	1	1	qC		11.982	11.982
R	gm/m2	1910.0	2779.9	pCr		0.00	0.00
RxR	mgP/m	1558.6	2268.4	IC		0.00	0.00
N	gm/m2	0.0	699.4	J		5.37	5.37
(aN)	m2/m2	1	1	sum in		17.348	17.348
xN	mgP/g	1.43	1.43	sum out		17.348	17.348
NxN	mgP/m	0.00	996.86				
Ci	µg/L	0	0	qCpin		0.598	0.598
G	gm/m2-	3.76	14.95	qCp		1.289	1.289
D	gm/m2-	0.00	13.99	TP sum in		17.946	17.946
T	gm/m2-	7.0000	7.0000	TP sum out		13.270	13.270
S	gm/m2-	0.12	0.12	TxT		7.0000	7.0000
R	gm/m2-	0.71	0.71	RxR		0.5830	0.5830
J	mgP/m2-	5.37	5.37	SxN		0.177	0.177
PCrain	mgP/m2-	0.00	0.00	GxN		5.366	21.316
IC	mgP/m2-	0.00	0.00	xND		0.000	19.937
?N/?t	gm/m2-	3.64	0.84	bxND		0.000	15.950
(?RxR)/	mgP/m2-	-0.51	3.47	(1-b)xND		0.000	3.987
kgross	m/yr	65.4	65.4				
knet	m/yr	-7.2	48.6	NxN		0.00	996.86
Qo	m/d	1340.0	1340.0	Sum		5.189	1.202
(q)(out)	m/d	0.60	0.60	RxR		1558.6	2268.4
u(out)	m/d	79.76	79.76	Sum		-0.513	3.474
C(out)	µgP/L	20.029	20.029				
Cp(out)	µgP/L	2.15	2.15				
TP(out)	µgP/L	22.2	22.2				
TSS(ou	mg/L	2.29	2.29				
xTSS(ou	mgP/g	0.94	0.94				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + 0.1x Flow: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	13.4	13.4	Height	m	0.6	0.6
q(in)	m/d	0.01	0.01	P	m/d	0.00	0.00
u(in)	m/d	0.80	0.80	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		0.173	0.173
xTSS(in	mgP/g	1	1	qC		0.032	0.032
R	gm/m2	1910.0	1930.6	pCr		0.00	0.00
RxR	mgP/m	1558.6	1575.3	IC		0.00	0.00
N	gm/m2	0.0	19.8	J		0.14	0.14
(aN)	m2/m2	1	1	sum in		0.173	0.173
xN	mgP/g	0.70	0.70	sum out		0.173	0.173
NxN	mgP/m	0.00	13.90				
Ci	µg/L	0	0	qCpin		0.006	0.006
G	gm/m2-	0.20	0.52	qCp		0.064	0.064
D	gm/m2-	0.00	0.40	TP sum in		0.179	0.179
T	gm/m2-	7.0000	7.0000	TP sum out		0.095	0.095
S	gm/m2-	0.10	0.10	TxT		7.0000	7.0000
R	gm/m2-	0.07	0.07	RxR		5.8301	5.8301
J	mgP/m2-	0.14	0.14	SxN		0.069	0.069
PCrain	mgP/m2-	0.00	0.00	GxN		0.142	0.364
IC	mgP/m2-	0.00	0.00	xND		0.000	0.278
?N/?t	gm/m2-	0.10	0.02	bxND		0.000	0.222
(?RxR)/	mgP/m2-	0.01	0.07	(1-b)xND		0.000	0.056
kgross	m/yr	1.3	1.3				
knet	m/yr	0.2	1.1	NxN		0.00	13.90
Qo	m/d	13.40	13.40	Sum		0.072	0.017
(q)(out)	m/d	0.01	0.01	RxR		1558.6	1575.3
u(out)	m/d	0.80	0.80	Sum		0.012	0.067
C(out)	µgP/L	5.293	5.293				
Cp(out)	µgP/L	10.66	10.66				
TP(out)	µgP/L	16.0	16.0				
TSS(ou	mg/L	17.77	17.77				
xTSS(ou	mgP/g	0.60	0.60				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + Residual TP 200 mg/kg: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2284.4	pCr		0.00	0.00
RxR	mgP/m	764.0	913.8	IC		0.00	0.00
N	gm/m2	0.0	180.2	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	174.69				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	3.93	qCp		0.188	0.188
D	gm/m2-	0.00	3.60	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.906	0.906
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		9.0374	9.0374
J	mgP/m2-	1.02	1.02	SxN		0.108	0.108
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	3.812
IC	mgP/m2-	0.00	0.00	xND		0.000	3.494
?N/?t	gm/m2-	0.94	0.22	bxND		0.000	2.795
(?RxR)/	mgP/m2-	-0.02	0.68	(1-b)xND		0.000	0.699
kgross	m/yr	14.4	14.4				
knet	m/yr	-0.3	11.0	NxN		0.00	174.69
Qo	m/d	134.00	134.00	Sum		0.909	0.211
(q)(out)	m/d	0.06	0.06	RxR		764.0	913.8
u(out)	m/d	7.98	7.98	Sum		-0.020	0.678
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	3.14	3.14				
TP(out)	µgP/L	15.1	15.1				
TSS(ou	mg/L	5.46	5.46				
xTSS(ou	mgP/g	0.57	0.57				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + Residual TP 400 mg/kg: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.6	0.6
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	7.98	7.98	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.718	0.718
R	gm/m2	1910.0	2284.4	pCr		0.00	0.00
RxR	mgP/m	764.0	913.8	IC		0.00	0.00
N	gm/m2	0.0	180.2	J		1.02	1.02
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.97	0.97	sum out		1.735	1.735
NxN	mgP/m	0.00	174.69				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.05	3.93	qCp		0.188	0.188
D	gm/m2-	0.00	3.60	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.906	0.906
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.23	0.23	RxR		9.0374	9.0374
J	mgP/m2-	1.02	1.02	SxN		0.108	0.108
PCrain	mgP/m2-	0.00	0.00	GxN		1.017	3.812
IC	mgP/m2-	0.00	0.00	xND		0.000	3.494
?N/?t	gm/m2-	0.94	0.22	bxND		0.000	2.795
(?RxR)/	mgP/m2-	-0.02	0.68	(1-b)xND		0.000	0.699
kgross	m/yr	14.4	14.4				
knet	m/yr	-0.3	11.0	NxN		0.00	174.69
Qo	m/d	134.00	134.00	Sum		0.909	0.211
(q)(out)	m/d	0.06	0.06	RxR		764.0	913.8
u(out)	m/d	7.98	7.98	Sum		-0.020	0.678
C(out)	µgP/L	12.002	12.002				
Cp(out)	µgP/L	3.14	3.14				
TP(out)	µgP/L	15.1	15.1				
TSS(ou	mg/L	5.46	5.46				
xTSS(ou	mgP/g	0.57	0.57				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + Depth 30cm: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.3	0.3
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	15.95	15.95	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.578	0.578
R	gm/m2	1910.0	2048.8	pCr		0.00	0.00
RxR	mgP/m	1558.6	1671.8	IC		0.00	0.00
N	gm/m2	0.0	234.5	J		1.16	1.16
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.87	0.87	sum out		1.735	1.735
NxN	mgP/m	0.00	203.18				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.34	5.09	qCp		0.350	0.350
D	gm/m2-	0.00	4.69	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.928	0.928
S	gm/m2-	0.11	0.11	TxT		7.0000	7.0000
R	gm/m2-	0.32	0.32	RxR		0.2607	0.2607
J	mgP/m2-	1.16	1.16	SxN		0.100	0.100
PCrain	mgP/m2-	0.00	0.00	GxN		1.157	4.408
IC	mgP/m2-	0.00	0.00	xND		0.000	4.064
?N/?t	gm/m2-	1.22	0.28	bxND		0.000	3.251
(?RxR)/	mgP/m2-	-0.19	0.62	(1-b)xND		0.000	0.813
kgross	m/yr	13.9	13.9				
knet	m/yr	-3.1	10.0	NxN		0.00	203.18
Qo	m/d	134.00	134.00	Sum		1.058	0.245
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1671.8
u(out)	m/d	15.95	15.95	Sum		-0.191	0.622
C(out)	µgP/L	9.657	9.657				
Cp(out)	µgP/L	5.85	5.85				
TP(out)	µgP/L	15.5	15.5				
TSS(ou	mg/L	7.09	7.09				
xTSS(ou	mgP/g	0.83	0.83				

Note: All model results are preliminary and subject to revision.

Test Cell Baseline + Depth 10 cm: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	134	134	Height	m	0.1	0.1
q(in)	m/d	0.06	0.06	P	m/d	0.00	0.00
u(in)	m/d	47.86	47.86	ET	m/d	0.00	0.00
C	µgP/L	29	29	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	30	30				
TSSi	mg/L	1	1	qCin		1.735	1.735
xTSS(in	mgP/g	1	1	qC		0.388	0.388
R	gm/m2	1910.0	2005.5	pCr		0.00	0.00
RxR	mgP/m	1558.6	1636.5	IC		0.00	0.00
N	gm/m2	0.0	324.3	J		1.35	1.35
(aN)	m2/m2	1	1	sum in		1.735	1.735
xN	mgP/g	0.74	0.74	sum out		1.735	1.735
NxN	mgP/m	0.00	241.36				
Ci	µg/L	0	0	qCpin		0.060	0.060
G	gm/m2-	1.81	7.00	qCp		0.532	0.532
D	gm/m2-	0.00	6.49	TP sum in		1.795	1.795
T	gm/m2-	7.0000	7.0000	TP sum out		0.920	0.920
S	gm/m2-	0.12	0.12	TxT		7.0000	7.0000
R	gm/m2-	0.55	0.55	RxR		0.4515	0.4515
J	mgP/m2-	1.35	1.35	SxN		0.090	0.090
PCrain	mgP/m2-	0.00	0.00	GxN		1.347	5.208
IC	mgP/m2-	0.00	0.00	xND		0.000	4.827
?N/?t	gm/m2-	1.69	0.39	bxND		0.000	3.862
(?RxR)/	mgP/m2-	-0.38	0.58	(1-b)xND		0.000	0.965
kgross	m/yr	14.1	14.1				
knet	m/yr	-6.1	9.4	NxN		0.00	241.36
Qo	m/d	134.00	134.00	Sum		1.256	0.291
(q)(out)	m/d	0.06	0.06	RxR		1558.6	1636.5
u(out)	m/d	47.86	47.86	Sum		-0.382	0.584
C(out)	µgP/L	6.489	6.489				
Cp(out)	µgP/L	8.89	8.89				
TP(out)	µgP/L	15.4	15.4				
TSS(ou	mg/L	11.11	11.11				
xTSS(ou	mgP/g	0.80	0.80				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 1: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.46	0.46	Height	m	0.65	0.65
q(in)	m/d	0.08	0.08	P	m/d	0.00	0.00
u(in)	m/d	0.71	0.71	ET	m/d	0.00	0.00
C	µgP/L	19	19	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	20	20				
TSSi	mg/L	1	1	qCin		1.457	1.457
xTSS(in	mgP/g	1	1	qC		1.313	1.313
R	gm/m2	1120.0	1197.8	pCr		0.00	0.00
RxR	mgP/m	246.4	263.5	IC		0.00	0.00
N	gm/m2	0.0	0.2	J		0.14	0.14
(aN)	m2/m2	1	1	sum in		1.457	1.457
xN	mgP/g	1.24	1.24	sum out		1.457	1.457
NxN	mgP/m	0.00	0.28				
Ci	µg/L	0	0	qCpin		0.077	0.077
G	gm/m2-	0.12	0.12	qCp		0.173	0.173
D	gm/m2-	0.00	0.00	TP sum in		1.533	1.533
T	gm/m2-	6.1000	6.1000	TP sum out		1.486	1.486
S	gm/m2-	0.11	0.11	TxT		6.1000	6.1000
R	gm/m2-	0.07	0.07	RxR		1.4805	1.4805
J	mgP/m2-	0.14	0.14	SxN		0.143	0.143
PCrain	mgP/m2-	0.00	0.00	GxN		0.144	0.149
IC	mgP/m2-	0.00	0.00	xND		0.000	0.006
?N/?t	gm/m2-	0.00	0.00	bxND		0.000	0.005
(?RxR)/	mgP/m2-	0.05	0.05	(1-b)xND		0.000	0.001
kgross	m/yr	0.9	0.9				
knet	m/yr	0.9	0.9	NxN		0.00	0.28
Qo	m/d	0.46	0.46	Sum		0.001	0.000
(q)(out)	m/d	0.08	0.08	RxR		246.4	263.5
u(out)	m/d	0.71	0.71	Sum		0.046	0.047
C(out)	µgP/L	17.121	17.121				
Cp(out)	µgP/L	2.26	2.26				
TP(out)	µgP/L	19.4	19.4				
TSS(ou	mg/L	2.58	2.58				
xTSS(ou	mgP/g	0.87	0.87				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 2: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.46	0.46	Height	m	0.65	0.65
q(in)	m/d	0.08	0.08	P	m/d	0.00	0.00
u(in)	m/d	0.71	0.71	ET	m/d	0.00	0.00
C	µgP/L	19	19	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	20	20				
TSSi	mg/L	1	1	qCin		1.457	1.457
xTSS(in	mgP/g	1	1	qC		0.997	0.997
R	gm/m2	1820.0	1881.9	pCr		0.00	0.00
RxR	mgP/m	1863.7	1927.1	IC		0.00	0.00
N	gm/m2	0.0	65.6	J		0.46	0.46
(aN)	m2/m2	1	1	sum in		1.457	1.457
xN	mgP/g	1.02	1.02	sum out		1.457	1.457
NxN	mgP/m	0.00	66.76				
Ci	µg/L	0	0	qCpin		0.077	0.077
G	gm/m2-	0.45	1.50	qCp		0.180	0.180
D	gm/m2-	0.00	1.31	TP sum in		1.533	1.533
T	gm/m2-	7.8000	7.8000	TP sum out		1.177	1.177
S	gm/m2-	0.11	0.11	TxT		7.8000	7.8000
R	gm/m2-	0.07	0.07	RxR		6.8914	6.8914
J	mgP/m2-	0.46	0.46	SxN		0.112	0.112
PCrain	mgP/m2-	0.00	0.00	GxN		0.460	1.528
IC	mgP/m2-	0.00	0.00	xND		0.000	1.335
?N/?t	gm/m2-	0.34	0.08	bxND		0.000	1.068
(?RxR)/	mgP/m2-	0.01	0.28	(1-b)xND		0.000	0.267
kgross	m/yr	7.4	7.4				
knet	m/yr	0.2	5.7	NxN		0.00	66.76
Qo	m/d	0.46	0.46	Sum		0.348	0.080
(q)(out)	m/d	0.08	0.08	RxR		1863.7	1927.1
u(out)	m/d	0.71	0.71	Sum		0.009	0.276
C(out)	µgP/L	13.006	13.006				
Cp(out)	µgP/L	2.34	2.34				
TP(out)	µgP/L	15.3	15.3				
TSS(ou	mg/L	2.30	2.30				
xTSS(ou	mgP/g	1.02	1.02				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 3: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.41	0.41	Height	m	0.3	0.3
q(in)	m/d	0.07	0.07	P	m/d	0.00	0.00
u(in)	m/d	1.37	1.37	ET	m/d	0.00	0.00
C	µgP/L	18	18	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	19	19				
TSSi	mg/L	1	1	qCin		1.230	1.230
xTSS(in	mgP/g	1	1	qC		1.050	1.050
R	gm/m2	1100.0	1148.6	pCr		0.00	0.00
RxR	mgP/m	234.3	244.7	IC		0.00	0.00
N	gm/m2	0.0	10.8	J		0.18	0.18
(aN)	m2/m2	1	1	sum in		1.230	1.230
xN	mgP/g	1.14	1.14	sum out		1.230	1.230
NxN	mgP/m	0.00	12.28				
Ci	µg/L	0	0	qCpin		0.068	0.068
G	gm/m2-	0.16	0.33	qCp		0.186	0.186
D	gm/m2-	0.00	0.22	TP sum in		1.298	1.298
T	gm/m2-	1.7999	1.7999	TP sum out		1.236	1.236
S	gm/m2-	0.10	0.10	TxT		1.7999	1.7999
R	gm/m2-	0.09	0.09	RxR		1.9920	1.9920
J	mgP/m2-	0.18	0.18	SxN		0.116	0.116
PCrain	mgP/m2-	0.00	0.00	GxN		0.180	0.376
IC	mgP/m2-	0.00	0.00	xND		0.000	0.246
?N/?t	gm/m2-	0.06	0.01	bxND		0.000	0.196
(?RxR)/	mgP/m2-	0.00	0.05	(1-b)xND		0.000	0.049
kgross	m/yr	1.2	1.2				
knet	m/yr	0.0	0.9	NxN		0.00	12.28
Qo	m/d	0.41	0.41	Sum		0.064	0.015
(q)(out)	m/d	0.07	0.07	RxR		234.3	244.7
u(out)	m/d	1.37	1.37	Sum		-0.002	0.047
C(out)	µgP/L	15.370	15.370				
Cp(out)	µgP/L	2.72	2.72				
TP(out)	µgP/L	18.1	18.1				
TSS(ou	mg/L	3.59	3.59				
xTSS(ou	mgP/g	0.76	0.76				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 4: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.41	0.41	Height	m	0.37	0.37
q(in)	m/d	0.07	0.07	P	m/d	0.00	0.00
u(in)	m/d	1.11	1.11	ET	m/d	0.00	0.00
C	µgP/L	18	18	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	19	19				
TSSi	mg/L	1	1	qCin		1.230	1.230
xTSS(in	mgP/g	1	1	qC		0.908	0.908
R	gm/m2	1820.0	1849.2	pCr		0.00	0.00
RxR	mgP/m	1872.8	1902.8	IC		0.00	0.00
N	gm/m2	0.0	37.7	J		0.32	0.32
(aN)	m2/m2	1	1	sum in		1.230	1.230
xN	mgP/g	1.03	1.03	sum out		1.230	1.230
NxN	mgP/m	0.00	38.91				
Ci	µg/L	0	0	qCpin		0.068	0.068
G	gm/m2-	0.31	0.92	qCp		0.201	0.201
D	gm/m2-	0.00	0.75	TP sum in		1.298	1.298
T	gm/m2-	7.2999	7.2999	TP sum out		1.109	1.109
S	gm/m2-	0.12	0.12	TxT		7.2999	7.2999
R	gm/m2-	0.08	0.08	RxR		0.0866	0.0866
J	mgP/m2-	0.32	0.32	SxN		0.119	0.119
PCrain	mgP/m2-	0.00	0.00	GxN		0.322	0.944
IC	mgP/m2-	0.00	0.00	xND		0.000	0.778
?N/?t	gm/m2-	0.20	0.05	bxND		0.000	0.623
(?RxR)/	mgP/m2-	-0.01	0.14	(1-b)xND		0.000	0.156
kgross	m/yr	3.9	3.9				
knet	m/yr	-0.3	2.9	NxN		0.00	38.91
Qo	m/d	0.41	0.41	Sum		0.203	0.047
(q)(out)	m/d	0.07	0.07	RxR		1872.8	1902.8
u(out)	m/d	1.11	1.11	Sum		-0.014	0.142
C(out)	µgP/L	13.291	13.291				
Cp(out)	µgP/L	2.94	2.94				
TP(out)	µgP/L	16.2	16.2				
TSS(ou	mg/L	2.86	2.86				
xTSS(ou	mgP/g	1.03	1.03				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 5: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.77	0.77	Height	m	0.64	0.64
q(in)	m/d	0.13	0.13	P	m/d	0.00	0.00
u(in)	m/d	1.20	1.20	ET	m/d	0.00	0.00
C	µgP/L	19	19	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	20	20				
TSSi	mg/L	1	1	qCin		2.438	2.438
xTSS(in	mgP/g	1	1	qC		2.009	2.009
R	gm/m2	1850.0	1881.0	pCr		0.00	0.00
RxR	mgP/m	1925.8	1958.1	IC		0.00	0.00
N	gm/m2	0.0	49.1	J		0.43	0.43
(aN)	m2/m2	1	1	sum in		2.438	2.438
xN	mgP/g	1.16	1.16	sum out		2.438	2.438
NxN	mgP/m	0.00	56.71				
Ci	µg/L	0	0	qCpin		0.128	0.128
G	gm/m2-	0.37	1.16	qCp		0.314	0.314
D	gm/m2-	0.00	0.98	TP sum in		2.567	2.567
T	gm/m2-	3.9999	3.9999	TP sum out		2.323	2.323
S	gm/m2-	0.12	0.12	TxT		3.9999	3.9999
R	gm/m2-	0.09	0.09	RxR		9.1347	9.1347
J	mgP/m2-	0.43	0.43	SxN		0.134	0.134
PCrain	mgP/m2-	0.00	0.00	GxN		0.429	1.337
IC	mgP/m2-	0.00	0.00	xND		0.000	1.134
?N/?t	gm/m2-	0.26	0.06	bxND		0.000	0.907
(?RxR)/	mgP/m2-	-0.05	0.18	(1-b)xND		0.000	0.227
kgross	m/yr	4.7	4.7				
knet	m/yr	-1.0	3.4	NxN		0.00	56.71
Qo	m/d	0.77	0.77	Sum		0.295	0.068
(q)(out)	m/d	0.13	0.13	RxR		1925.8	1958.1
u(out)	m/d	1.20	1.20	Sum		-0.051	0.175
C(out)	µgP/L	15.655	15.655				
Cp(out)	µgP/L	2.45	2.45				
TP(out)	µgP/L	18.1	18.1				
TSS(ou	mg/L	2.28	2.28				
xTSS(ou	mgP/g	1.07	1.07				

Note: All model results are preliminary and subject to revision.

PortaPSTA Treatment 6: Summary Results

Time	day	0	365	Time	day	0	365
Qi	m3/d	0.46	0.46	Height	m	0.64	0.64
q(in)	m/d	0.08	0.08	P	m/d	0.00	0.00
u(in)	m/d	0.72	0.72	ET	m/d	0.00	0.00
C	µgP/L	19	19	Crain	µg/L	20	20
Cp	µgP/L	1	1	Temp	C	20	20
TP(in)	µgP/L	20	20				
TSSi	mg/L	1	1	qCin		1.457	1.457
xTSS(in	mgP/g	1	1	qC		1.059	1.059
R	gm/m2	1860.0	1910.4	pCr		0.00	0.00
RxR	mgP/m	1822.8	1872.2	IC		0.00	0.00
N	gm/m2	0.0	51.3	J		0.40	0.40
(aN)	m2/m2	1	1	sum in		1.457	1.457
xN	mgP/g	1.06	1.06	sum out		1.457	1.457
NxN	mgP/m	0.00	54.29				
Ci	µg/L	0	0	qCpin		0.077	0.077
G	gm/m2-	0.38	1.20	qCp		0.191	0.191
D	gm/m2-	0.00	1.03	TP sum in		1.533	1.533
T	gm/m2-	0.0680	0.0680	TP sum out		1.249	1.249
S	gm/m2-	0.11	0.11	TxT		0.0680	0.0680
R	gm/m2-	0.07	0.07	RxR		0.0664	0.0664
J	mgP/m2-	0.40	0.40	SxN		0.115	0.115
PCrain	mgP/m2-	0.00	0.00	GxN		0.398	1.267
IC	mgP/m2-	0.00	0.00	xND		0.000	1.086
?N/?t	gm/m2-	0.27	0.06	bxND		0.000	0.869
(?RxR)/	mgP/m2-	0.00	0.22	(1-b)xND		0.000	0.217
kgross	m/yr	5.7	5.7				
knet	m/yr	0.0	4.4	NxN		0.00	54.29
Qo	m/d	0.46	0.46	Sum		0.283	0.065
(q)(out)	m/d	0.08	0.08	RxR		1822.8	1872.2
u(out)	m/d	0.72	0.72	Sum		0.002	0.219
C(out)	µgP/L	13.808	13.808				
Cp(out)	µgP/L	2.49	2.49				
TP(out)	µgP/L	16.3	16.3				
TSS(ou	mg/L	2.42	2.42				
xTSS(ou	mgP/g	1.03	1.03				

Note: All model results are preliminary and subject to revision.