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Turkey Point Plant

Semi-Annual Monitoring Report

Units 3 & 4 Uprate Project

February 15, 2011

Prepared for:

FPL

Prepared by:

ecology and environment, inc.

Celebrating 40 Years of Green Solutions

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%	percent
%D	percent difference
%R	percent recovery
‰	parts per thousand
°C	degrees Celsius
°F	degrees Fahrenheit
µmol m^{-2} s^{-1}	micromoles of quanta per second per square meter
µohms/cm	micro ohms per centimeter
µS/cm	micro Siemens per centimeter
AAS	atomic absorption spectroscopy
ADCP	Acoustic Doppler Current Profiler
AdaPT	Automated Data Processing Tool
API	American Petroleum Institute
ADVM	Acoustic Doppler Veolocity Meters
ANOVA	Analysis of Variance
ASTM	American Society of Testing Materials
AT#	Aqua TROLL® instrument
ATN	Attenuation
BBCA	Braun-Blanquet Cover Assessment
BBSW	Biscayne Bay Surface Water
BT	bottom track
CaCO3	bicarbonate
CCS	Cooling Canal System
cfs	cubic feet per second
CL	carapace length

cm	centimeter
COV	covariance
COC	chain of custody
COD	chemical oxygen demand
Cr(III)	chromium oxide
Cr(VI)	hexavalent chromium
CRP	continuous resistivity profiling
CVAAS	cold vapor / atomic absorption spectometry
CW	carapace length
D	deep
DBH	diameter breast height
DERM	Miami-Dade County Department of Environmental Resources Management
D_f	fresh water density (=1.000 g/cm3)
DFA	Discriminate Function Analysis
DIC	dissolved inorganic carbon
DMG	distance made good
DO	dissolved oxygen
DQO	data quality objective
DTM	digital terrain model
DTS	distributed temperature sensing
DVR	data validation report
D_w	groundwater density (g/cm3)
EAI	Ecological Associates, Inc.
EDD	electronic data deliverable
EEL	Environmentally Endangered Lands
ENS	ensembles
EPA	Environmental Protection Agency
EST	Eastern Standard Time
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FIAN	Fish and Invertebrate Assessment Network

FLAAS	flame atomic absorption
FPL	Florida Power & Light Company
FSQM	Field Sampling Quality Manual
f/s	feet per second
FTT	Faunal Throw Trap
g	grams
g/cm^3	grams per cubic centimeter
GFAAS	graphite furnace / atomic absorption spectroscopy
GIS	Geographic Information System
GISP	Greenland Ice Sheet Precipitation
GMWL	Global Meteoric Water Line
GPS	global positioning system
GW	groundwater
HCL	hydrocholoric acid
HDPE	high-density polyethylene
H_f	fresh water equivalent groundwater elevation (ft NAVD88)
HNO_3	nitric acid
HRMS	horizontal root mean squared
H_w	groundwater elevation (ft NAVD88)
IAEA	International Atomic Energy Agency
IC	initial calibration
ICP	Inductively coupled plasma
ICP-AES	ICP-atomic emission spectroscopy
ICP-MS	ICP-mass spectrometry
ICS	interference check sample
ICV	initial calibration verification
ID	Interceptor Ditch
IDL	instrument detection limit
IRMS	isotope ration mass spectrometry
IS	internal standard
IT	information technology

K	potassium
km	kilometer
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDO	luminescent dissolved oxygen
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LSC	liquid scintillation counting
LT	Level TROLL®
M	intermediate
m	meter
m^2	square meter
Mag	magnitude
MB	megabyte
MCL	maximum contaminant levels
MDC	minimum detectable concentration
MDL	method detection limit
mg/g	milligrams per gram
mg/L	milligrams per liter, ppm
$mile^2$	square mile
mL	milliliter
mm	millimeter
mmHg	millimeters of mercury
Monitoring Plan	2009 Groundwater, Surface Water, and Ecological Monitoring Plan for the Florida Power & Light Company (FPL) Turkey Point Nuclear Power Plant
M_P	measured pressure (psi)
mph	miles per hour
MQL	method quantitation limit
MS	mass spectrometry
MSA	method of standard additions
mS/cm	specific conductivity

MSD	matrix spike duplicate
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolts
NAD	North American Datum
NAVD	North American Vertical Datum of 1988
NC	not calculated
ND	no data
NELAC	National Environmental Laboratory Accreditation Conference
NGVD	National Geodetic Vertical Datum of 1929
NH3	ammonia
NH4+	ammonium
NIST	National Institute of Standards and Technology
nm	nanometers
NO_x	nitrogen oxide
NTU	nephelometric turbidity unit
OBI	optical borehole imaging
ORP	oxidation reduction potential
PAFW	statistical software
PAR	photosynthetically active radiation
pCi/L	pico Curies per liter
PDS	post digestion spike
PE	performance evaluation
PM	project manager
PP	polypropylene
ppb	parts per billion
PPF	Photosynthetic Photon Flux
ppm	parts per million
ppt	parts per thousand, ‰
PQL	practical quantitation limit
PSS78	Practical Salinity Scale of 1978

PSU	practical salinity units
PTFE	polytetra fluroethylene
PVC	polyvinyl chloride
Q	flow
QA	quality assurance
QAPP	Quality Assurance Project Plan
QASR	Quality Assurance Systems Requirements
QC	quality control
RECOVER	Restoration Coordination and Verification
RER	replicate error ratio
RF	radio frequency
R_L	reference water level (ft NAVD 88)
RM	reference material
R_P	reference pressure (psi)
RPD	relative percent difference
RSD	relative standard deviation
RTK	Real Time Kinematic
s	second
S	Shallow
SA	Semiannual event.
SAV	submerged aquatic vegetation
SBAS	Satellite Based Augmentation System
SDG	sample delivery group
SD	serial dilution
SFWMD	South Florida Water Management District
SG	Specific gravity (unitless)
SL	sea level
SL#	Side Looker instrument
SLAP	Standard Light Arctic Precipitation
SO_4^{2-}	sulfate
SOP	standard operating procedure

SPT	standard penetration test
sq ft	square foot
SRP	soluble reactive phosphorus
Std./|Avg.|	Standard deviation/average of magnitude
SW	surface water
S_w	well screen midpoint elevation (ft NAVD88)
TCP-IP	Transmission Control Protocol/Internet Protocol
TDS	total dissolved solids
TIMS	Thermal ionization mass spectrometer
TKN	total Kjeldahl nitrogen
TL	total length
TN	total nitrogen
TOC	Total Organic Carbon
TP	total phosphorus
TPGW	Turkey Point Groundwater
TPM-1	Turkey Point Meteorological Station
TPSWC	Turkey Point Surface Water Canal
TPSWCCS	Turkey Point Surface Water Cooling Canal System
TPSWID	Turkey Point Surface Water Interceptor Ditch
TRIC	Tritium Inter-Laboratory Comparison
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
Vel.	velocity
VPDB	Vienna Pee Dee Belemnite
VRS	virtual reference station
VSMOW	Vienna Standard Mean Ocean Water
WACS	Water Assurance Compliance System
W_L	water level (ft NAVD 88)
WUE	water-use efficiency

1. INTRODUCTION

This Florida Power & Light Company (FPL) Turkey Point Semi-Annual Monitoring Report for the Units 3 and 4 Uprate Project (Semi-Annual Monitoring Report) has been prepared in accordance with the FPL Turkey Point Power Plant Groundwater, Surface Water and Ecological Monitoring Plan, referred to herein as (the Monitoring Plan (South Florida Water Management District [SFWMD] et al. 2009]). The Monitoring Plan specifies monitoring requirements pursuant to the Conditions of Certification IX and X of the Power Plant Site Certification (PA03-45A2) for FPL's Turkey Point Nuclear Units 3 and 4 Uprate Project. The Monitoring Plan requires the collection of groundwater, surface water, meteorological, flow and ecological data in and around the plant to establish baseline conditions and determine the horizontal and vertical effects and extent if any of the cooling canal system (CCS) water. Data must be collected prior to (pre-uprate) and after (post-uprate) the Uprate project is implemented. This Semi-Annual Monitoring Report covers the first part of the pre-Uprate monitoring period and includes data collected from June 1 to December 20, 2010, and available by the end of 2010. Data were collected in accordance with the FPL Quality Assurance Project Plan (QAPP [FPL August 2010]) and modifications as provided to the SFWMD in November 2010 (Appendix A). Any notable deviations are discussed herein.

The primary purpose of this Semi-Annual Monitoring Report is to summarize the monitoring efforts to-date and to present and summarize the data. While preliminary observations will be made, more detailed interpretations will be conducted at a later date.

1.1 Brief Overview of Automated Monitoring Network

A monitoring network has been set up to collect groundwater, surface, meteorological, and hydrologic data at 15-minute intervals over a broad area surrounding Turkey Point. A brief overview of each is provided below and further discussion regarding the instrumentation, data collection, and results for the automated network is included in Section 2 of this report. Pictures of the automated stations are provided in Appendix B.

1.1.1 Groundwater

From February through June 2010, FPL and their contractors installed 42 wells in 14 well clusters (TPGW-1 to TPGW-14) at and around Turkey Point (see Figure 1-1). The locations were determined based on site conditions and extensive coordination among FPL and the SFWMD, the Florida Department of Environmental Protection (FDEP), and Miami-Dade County Department of Environmental Resources Management (DERM) (the Agencies). The placement of station locations in Biscayne Bay also was coordinated with Biscayne National Park.
At each location, three separate wells were installed: a shallow well (S), an intermediate depth well (M) and a deep well (D). The borehole for the deep well was drilled first and down-hole

geophysical methods were conducted to help determine high flow zones and other subsurface characteristics. Based on a collaborative effort among FPL, JLA Geoscience, and the SFWMD, screen depths were established with screen lengths varying from 2 to 6 feet based on site conditions. Further details are provided in the Geology and Hydrology Report (JLA Geosciences, Inc. 2010).

Following well completion, the top of each well casing was surveyed (Appendix C) and the infrastructure (probes, telemetry, solar panels, and other elements) was installed to facilitate the collection of automated groundwater quality and stage data at 15-minute intervals. The measured water quality parameters include specific conductance and temperature. Salinity, density, and total dissolved solids (TDS) are calculated by the instrumentation based on the measured parameters. Groundwater data are remotely transmitted via telemetry each day and uploaded to an FPL database.

1.1.2 Surface Water

Per the Monitoring Plan and as shown on Figure 1-1, automated surface water stations were installed at the following locations:

- seven stations in the CCS;
- five stations in adjacent canals;
- three stations in the Interceptor Ditch; and
- five stations in Biscayne Bay.

The locations of the monitoring stations were determined jointly with the Agencies and provide broad coverage of the key water bodies in the project area. Two additional stations (TPBBSW-10 and -14) were added to record stages in Biscayne Bay and are co-located with TPGW-10 and -14.

Surface water automated stations record water quality data using the same parameters as the groundwater stations. Stage data are recorded at all locations except four stations in Biscayne Bay (BBSW-1, -2, -4, and -5) that do not have the infrastructure to support stage recorders or a telemetry system. The data at these locations are retrieved manually at approximately six week intervals and downloaded into the database. Data from the other stations are transmitted via telemetry daily onto a secure server system and automatically uploaded into the FPL database.

1.1.3 Meteorological and Rainfall

One meteorological station that includes instrumentation to measure solar radiation, wind speed, wind direction, air temperature, relative humidity, and rainfall was installed near the center of the CCS (TPM-1). Five additional rainfall gauging stations were installed around the CCS (Figure 1-2). Data are collected at 15-minute intervals. Data from the meteorological station are uploaded nightly into the database while the rainfall gauges are manually downloaded during routine site visits. Information collected from these stations will be used to help calculate a water budget for the CCS. Additionally, seven rainfall collectors were installed around the CCS to assess atmospheric deposition of tritium. Figure 1-2 shows the locations of the above-mentioned stations.

1.1.4 Hydrological

Acoustic Doppler Velocity Meters (ADVM), otherwise known as index-velocity meters or index-meters, have been set up to determine flow at three strategic locations in the CCS: near the power plant discharge into the CCS, power plant intake in the CCS, and the southern end of the CCS before the water enters the return canal of the CCS (Figure 1-3).This information will be used as part of the water budget to help estimate water losses and gains in the CCS. Data collected from these instruments are sent remotely via telemetry and automatically uploaded to the database.

An index velocity factor was established for each of these meters in late November 2010. One of the stations is still not consistently transmitting data, so at present flow data are limited. Further details regarding the instrumentation, data collection, and indexing methods and results will be provided at the agency water budget meetings and in the Annual Monitoring Report.

In addition to the flow meters installed in the CCS, four flow meters were installed in the interceptor pump bays to measure pumped flow from the Interceptor Ditch into the CCS. The associated flow data, which will be used in the water budget, will also be presented in the Annual Monitoring Report.

1.1.5 Water Budget

A water budget will be developed for the CCS based in part on the meteorological and hydrological data. As discussed with the Agencies, the approach and results will be developed in parallel with the monitoring effort and preliminary information will be provided to the Agencies as it is developed. The results will be presented in the Annual Monitoring Report and not the Semi-Annual Monitoring Report.

1.2 Quarterly Sampling for Laboratory Analysis

The aforementioned monitoring network for groundwater and surface water supports the collection of water samples for laboratory analysis. The Monitoring Plan specifies samples must be collected from the 42 groundwater wells and the 20 surface water stations previously discussed. Also, samples must be collected from one additional location on the Card Sound Road canal on a quarterly basis and at an anomalous location identified by the SFWMD in the CCS for the first quarterly event. The samples must be analyzed for a variety of parameters including CCS tracer suite constituents, ions, trace elements, nutrients, TDS, and/or gross alpha, along with field parameters depending on the media and whether the effort was a quarterly or semi-annual event. Further discussion of the analytical parameters, sample collection methods, and results is provided in Section 3 of this Semi-Annual Monitoring Report. The analytical data included in this report are based on a sampling event during June and early July 2010 and a second event in September 2010. Another sampling event occurred in December 2010; however, the results are not available at this writing.

1.3 Ecological Monitoring

The Monitoring Plan and QAPP outline an ecological monitoring program that is designed to help identify the existing baseline conditions and future impacts of the CCS waters as described in the Conditions of Certification IX and X. Biotic components of interest include marsh vegetation in adjacent wetlands, mangroves, submersed aquatic vegetation, and benthic fauna in and adjacent to Biscayne Bay. Ecological monitoring efforts (setting up transects [Figure 1-4] and conducting ecological surveys) were initiated in October 2010 and completed in December 2010. Information on the transect plot setups, sampling methods and materials, and general findings are included in Section 4 of this Semi-Annual Monitoring Report.

1.4 Initial Porewater Survey

In accordance with the Monitoring Plan and through coordination with the Agencies, a broad-scale survey of porewater temperature and specific conductance was conducted during March 2010 (the dry season) at over 200 locations in adjacent wetlands and Biscayne Bay. A second porewater temperature and specific conductance survey was conducted in August 2010, the wet season, at 100 locations in Biscayne Bay. Based on the initial temperature and specific conductance measurements, locations where wet season porewater samples would be collected for laboratory analysis were established. That effort took place in October 2010, but is still pending for the dry season. Based on discussions with the Agencies, a decision was made to delay preparing the Initial Ecological Condition Characterization Report until the associated porewater work was complete. The Agencies requested one single report that contained the wet and dry season results.

FIGURES

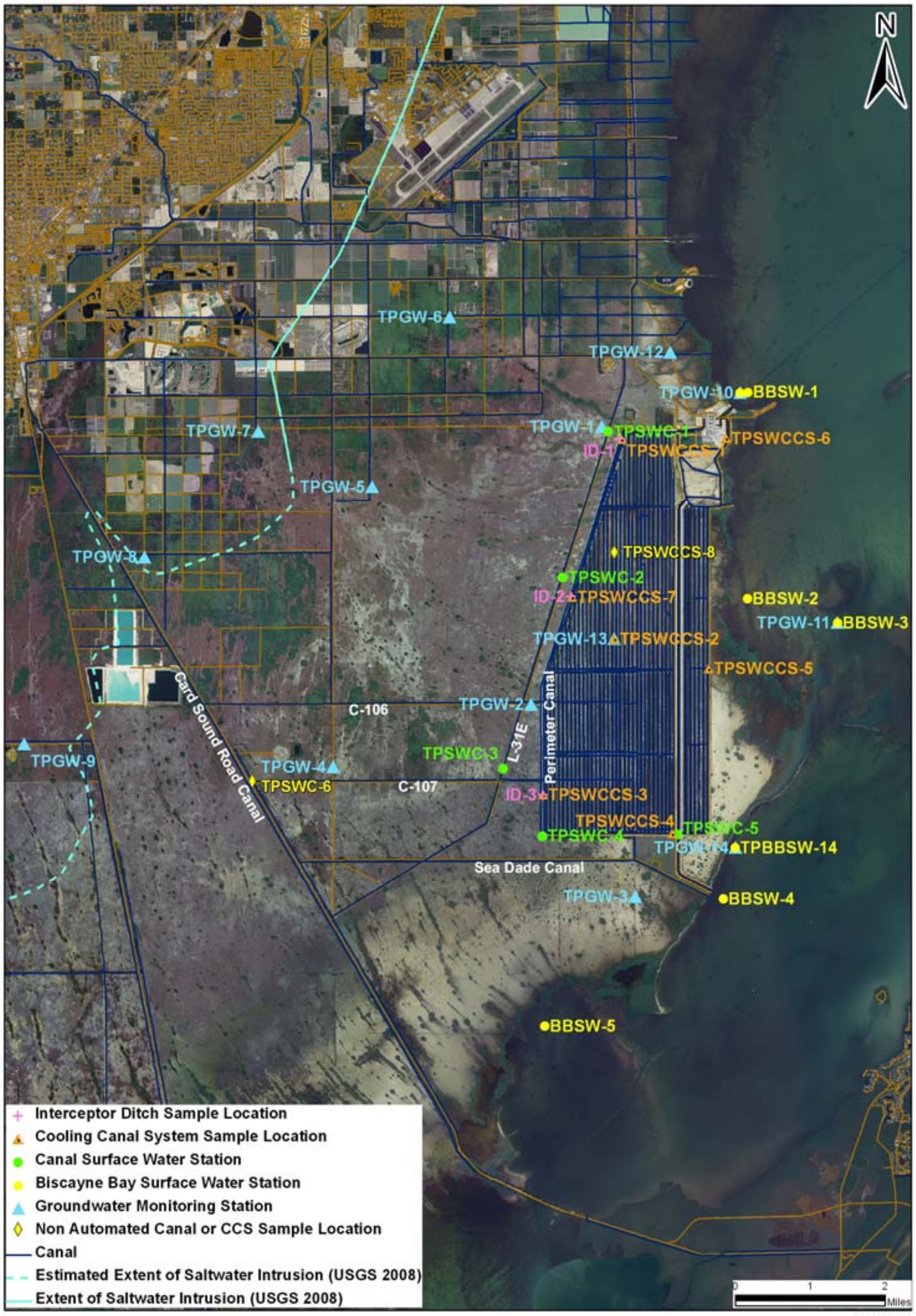


Figure 1-1. Locations of Groundwater and Surface Water Monitoring Stations.

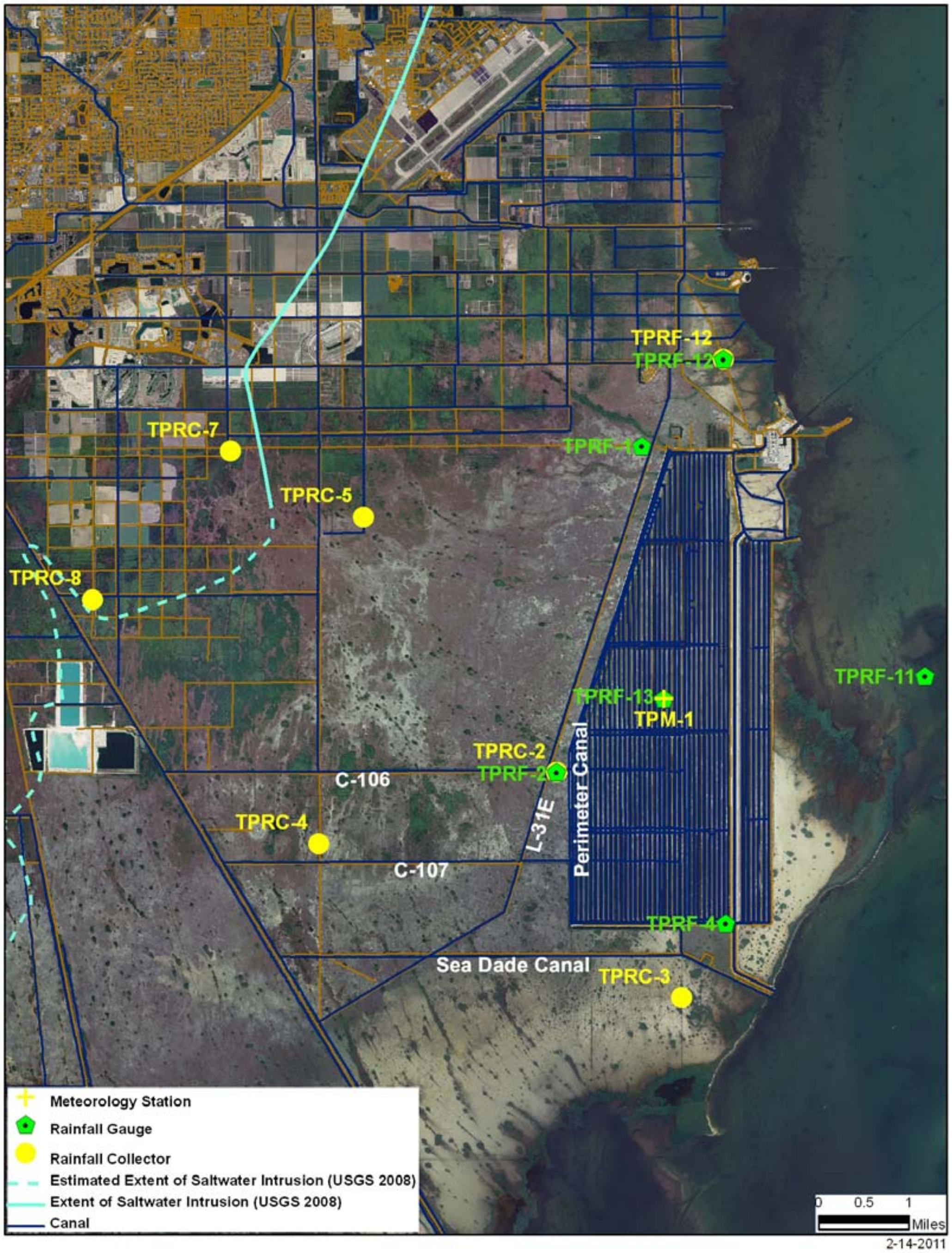
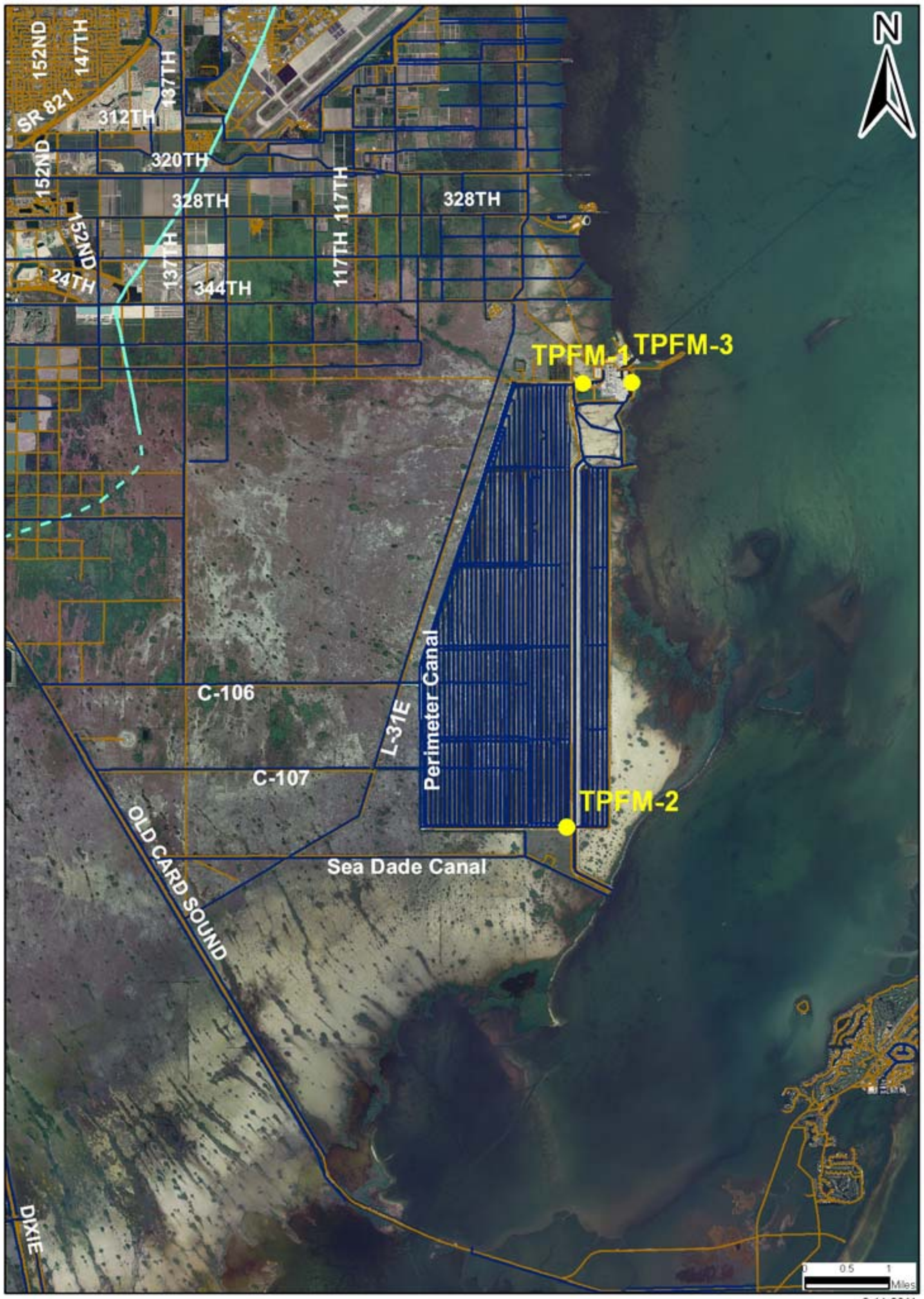


Figure 1-2. Locations of Meteorological Station, Rainfall Gauging Stations and Rainfall Collectors.



Flow Meter Locations

Figure 1-3. Flow Meter Locations in the CCS.

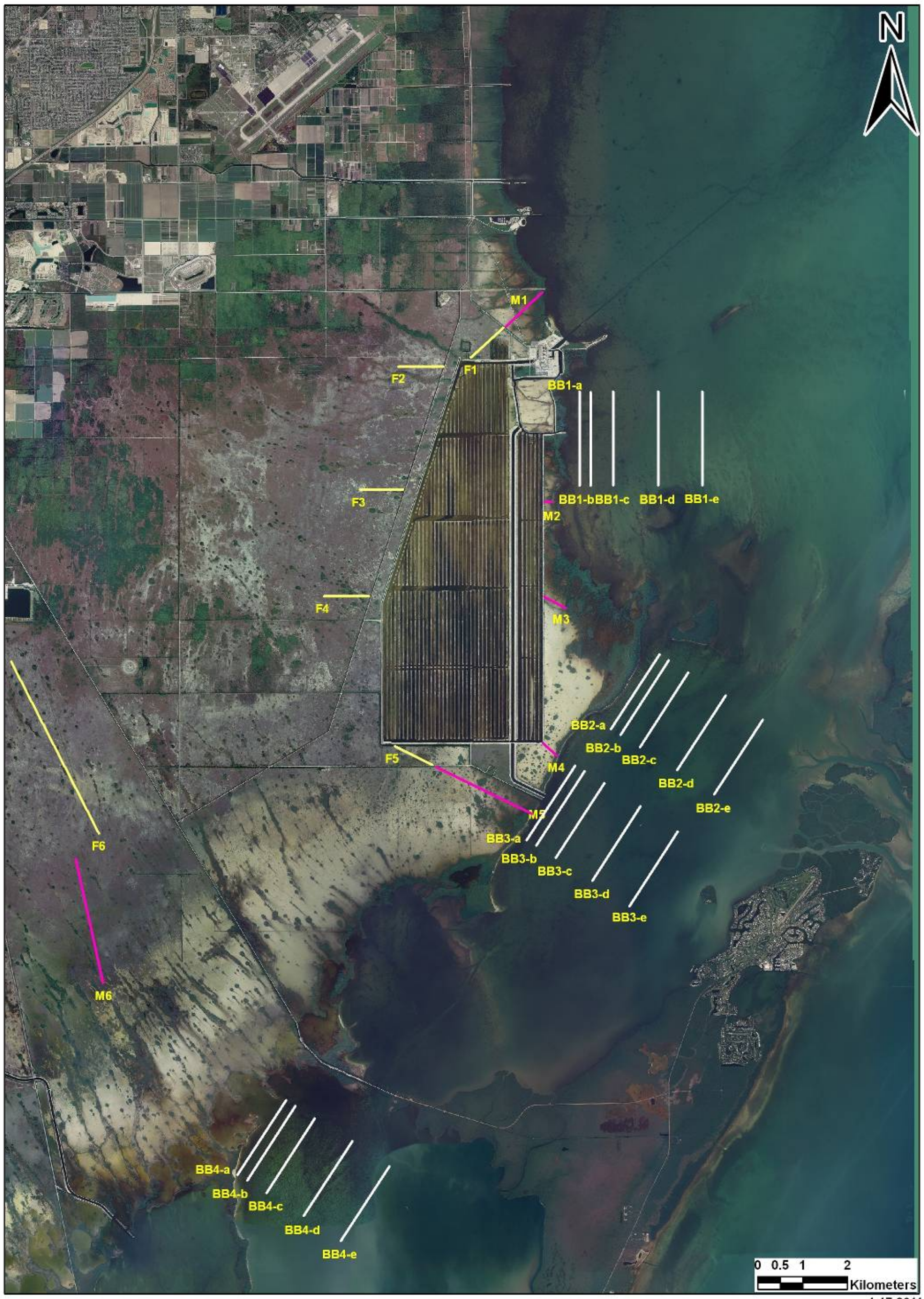


Figure 1-4. Ecological Transect Locations.

2. AUTOMATED DATA COLLECTION

2.1 GROUNDWATER QUALITY

2.1.1 Instrumentation and Data Collection Methods

As mentioned in Section 1, automated groundwater stations were installed at 14 well clusters. As infrastructure became available and wells were surveyed to known datum (North American Vertical Datum of 1988 [NAVD 88] and National Geodetic Vertical Datum of 1929 [NGVD 29]), automated data collection systems manufactured by In-Situ, Inc. were installed at each of these sites by the In-Situ technical staff. These systems involve deployment of two types of probes on RuggedCable® systems for communication and power, which in turn are connected to a telemetry unit that regulates uploading of the data into a central database developed by FPL. Figure 2-1 illustrates a groundwater station with telemetry.

Two probes are installed at each well: an Aqua TROLL® 100 (AT100) and a Level TROLL® 500 (LT500). The AT100 has a titanium body with a completely sealed, internal lithium battery, real-time clock, and temperature and conductivity sensors. The AT100 probes are deployed using a non-vented cable attached to a well dock and twist-lock hanger that suspends the cable and probe at a fixed height from the top of the 2-inch well casing. These probes are deployed into the middle of the screened well interval where they record water quality parameters. The groundwater AT100s collect a suite of water quality parameters, including actual conductivity, specific conductivity, salinity, TDS, resistivity and water density. The AT100s calculate salinity based on actual conductivity and temperature, and is reflected in practical salinity units (PSU). The AT100s calculate TDS based on specific conductivity with a default conversion factor of 0.65 and results are reflected in parts per thousand (ppt). Water density is calculated using salinity and temperature, and is reflected in grams per cubic centimeter (g/cm^3).

The LT500 is a titanium probe with a completely sealed, internal lithium battery, real-time clock, and pressure sensor. The LT500 is designed to capture stage data and is deployed in the top 5 feet of the water table for accurate readings. It is hung from the same well dock with its own twist-lock hanger, providing a stable height for the probe, and thus stable readings of stage. Water level technical details and calculations involved are discussed in depth below. However, it should be noted that because of different water densities throughout the landscape, water density data from the AT100 is combined with LT500 data for a more accurate depiction of stage data at a given well site.

Both probe types are programmed to capture data at 15-minute intervals. Both the AT100 and LT500 should be time-accurate to within one second per day; however, the internal clock slips slightly while deployed and is therefore checked when revisited for cleaning and calibrating events. Per the QAPP, the ideal cleaning and calibrating schedule for the automated probes generally takes place approximately every eight weeks, with the Biscayne Bay probes on a rotation of approximately every six -weeks. The actual schedule depends on field conditions and logistics. The cleaning and calibrating efforts include a general cleaning of the probe, done with water and a non-abrasive cloth or sponge. Actual sensors are cleaned using a cotton swab or soft pipe cleaner.

Once the probes have been cleaned, the AT100 is then calibrated. For this process an initial reading is taken using a calibration solution within the range of normal measurement for the site in which the probe is deployed. This reading is used to check data drift. The probe is then calibrated using this same strength of calibration solution. The cell constant based on the reading of the probe versus the strength of the calibration solution is ideal if within 0.98 to 1.02 of each other. Per the manufacturer's recommendations, if the cell constant is less than 0.90 or greater than 1.10 after checking with a new calibration solution, then the probe should be returned to In-Situ for factory recalibration.

After calibration of the probe, a verification reading is taken from the same solution. Finally, a higher bracket solution is used for an additional verification reading, including verification of the temperature using a National Institute of Standards and Technology (NIST) certified thermometer. The temperature reading of the probe is considered acceptable within a 0.5 degree Celsius (°C) range from the NIST thermometer reading. The calibration logs for these automated station probes are included in Appendix D.

Several issues have arisen involving probe programming over the initial period of deployment. Infrastructure and surveying were not complete at the time of In-Situ staff's first visit in late June, therefore they returned in late summer to finish deployment of the probes in September 2010. Towards the end of this visit, In-Situ released a new firmware update for the probes. This necessitated resetting virtually all probes, a process that involves stopping the active data log, uploading the new firmware onto the probe, then reprogramming the probe and new data log for continued data collection. All probes are now updated with the most current firmware and have additionally been programmed to acceptable reference levels and pressures (further discussed in Section 2.3.1). During the period when a log is stopped, data cannot be collected and new logs are started on an approximately one-hour lag. Data are not collected during the time period – sometimes several hours – when a probe is pulled for cleaning and calibration.

Operational parameters involving general system functionality are addressed during cleaning and calibration. The External battery voltage that powers the telemetry system, which is active from 12:00 pm to 2:00 pm each day, is checked. These are 12-volt batteries charged using a connected solar panel. General system issues such as fuses, changing of desiccants in the system, and overall cleanliness and wired connections also are checked. In addition, internal voltage and memory availability of all probes are checked.

2.1.2 Results

The data validation and qualification effort is a multi-step process. As there are a large number of data points from the approximately six months of continuous 15-minute data generation (greater than 10,000 points from a probe on average), and the information technology (IT) database is still in various stages of testing and setup, all data were exported to Microsoft® Excel for quality assurance (QA) for this Semi-Annual Monitoring Report.

For long-term data management, the initial automated screening will be done computationally where data exceeding a defined bracket will be flagged. This bracketing will be defined by the initial data gathered from the first six months of instrument function and will be seasonally compensated. This will minimize time and effort in the initial review of the information as data reviewers will then be sent daily notifications of instances where data have exceeded the normal range. However, as this feature has yet to be implemented, all procedures were manually implemented during the QA effort for this report.

For the current water quality data sets from the AT100s, each data point was compared to its previous 15-minute value. Salinity differences ≥1 PSU and temperature changes ≥1°C were flagged, and both data rows were highlighted. Data were then manually reviewed for validity. Specifically, the data were compared against meteorological data if it was a real or spurious observation of data outside normal parameters, or was an instance when the probe exhibited extreme 15-minute oscillations (e.g., up to 40 PSU fluctuations) for a time period before resuming function within normal ranges. Other examples of unusual data included occurrences when the salinity values dropped drastically and instantaneously and remained at low levels for days to weeks, or oscillated for one or two time intervals before returning to original levels. An In-Situ representative stated that these large fluctuations can be caused by air bubbles on the sensor or blocked sensor heads. In instances where large oscillations were noted over a period of time and did not correlate with temperature changes and/or was not explainable by a climatic event, all data rows were flagged. Data related to salinity, (i.e., specific conductance, density, TDS) for this period were qualified as these parameters are inter-related.

The qualifiers used in the data qualification effort are "!" indicating suspect or questionable data and "C" indicating a calibration event. Once the data were reviewed and either qualified as not needing qualifiers, the data were typically passed to a second reviewer for validation. This two-tiered qualification process enhances data consistency.

Figures 2-2 through 2-15 show time series graphs of specific conductance, temperature, and salinity at each well. These graphs depict validated data and exclude data that have been qualified as questionable or part of a calibration event. Appendix E shows time series graphs of these three parameters but with all reported data.

Overall, the qualified groundwater specific conductance data indicated fairly consistent conditions once the outliers were removed. Temperature values were also somewhat robust although trends of increasing temperature were observed in several probes (e.g., TPGW-4S, -13S); these observations have been previously observed with In-Situ Aqua TROLL® probes in other locations (S. Krupa, pers. comm.).

Specific conductance was lowest in the wells to the west (TPGW-7, -8, -9) and remained consistently low with the onset of the dry season (November onwards). All three wells at

TPGW-7 and -9 (where data was available) had specific conductance values less than 1000 micro Siemens per centimeter (µS/cm and temperatures around 25°C.

At TPGW-8, although the intermediate (TPGW-8M) and deep (TPGW-8D) wells had specific conductance less than 1000 µS/cm, the shallow well (TPGW-8S) had higher values (approximately 3000 µS/cm) throughout this reporting period.

In TPGW-6 located north of the Turkey Point Plant in the proximity to the drainage canals, a pattern opposite to TPGW-8 was observed where the specific conductance in the shallow well was below the intermediate and deep wells. Similarly, TPGW-4 and -5 to the west of the CCS exhibited the same pattern of specific conductance with depth as TPGW-6. North of the CCS, TPGW-12 showed the same vertical trend of increasing specific conductance with depth except that the values observed at this location were higher than TPGW-4, -5 or -6.

Wells to the west (TPGW-1, -2) and south (TPGW-3) of the CCS had specific conductance values greater than 50,000 µS/cm, regardless of depth. Although the deeper wells had slightly higher specific conductance than the shallow and intermediate wells, the increase with depth was limited.

Tidal wells (TPGW-10, -11, -14) exhibited the same vertical trends (i.e., deeper wells more saline than shallow wells) and a landscape-scale pattern of increasing specific conductance southward. TPGW-14 had the highest specific conductance values.

At TPGW-13, which is located within the CCS, the intermediate depth well (TPGW-13M) readings did not stabilize despite cleaning and calibration. The complete dataset was qualified and the probe will be replaced. Specific conductance and temperature were highest at this well.

2.2 SURFACE WATER QUALITY

2.2.1 Instrumentation and Data Collection Methods

As detailed in Section 1, automated surface water stations were located throughout the Turkey Point landscape as determined jointly with the Agencies. These stations typically record water quality data, as well as stage data, at 15-minute intervals. While most sites recording surface water data have two probes associated with them, some have only one, depending on surface water depth and other logistical considerations. Stations that are in less than 3 to 5 feet of water have only one probe, an Aqua TROLL® 200 (AT200), associated with them. All other surface water stations have two probes associated with them, an AT100 at approximately 1 foot above the bottom, and an AT200 within 3 feet of minimum water levels at the surface. Just as in groundwater sites, probe cables are attached to a telemetry system that uploads once a day for most sites. Table 2-1 summarizes the probes used at each surface water station and parameters measured.

The AT200 has a titanium body with a completely sealed internal lithium battery, real-time clock, pressure, temperature, and conductivity sensors, and is deployed using a vented cable. The vented cable contains a tube that applies atmospheric pressure to the back of the pressure gauge. The instrument is programmed to automatically subtract this value from the measured pressure, reflected in the formula:

$$P\ gauge = P\ absolute - P\ atmosphere.$$

Thus, the AT200 excludes the atmospheric pressure component. The vented cable is attached to a well dock and twist-lock hanger that suspends the cable and probe at a fixed height from the 2-inch well casing. Since the AT200 has a pressure sensor, it is able to record stage data. It also has the ability to auto-correct water levels for water density based on readings recorded by the probe. This feature is explained in greater detail in Section 2.3.1. The AT200 records the following parameters: actual conductivity, specific conductivity, salinity, TDS, resistivity, water density, and depth. The AT100 is situated approximately 1 foot above the bottom at surface water sites and records the following parameters: actual conductivity, specific conductivity, salinity, TDS, resistivity, and water density. Both the AT100 and AT200 calculate salinity, TDS and water density, as described above.

Surface water sites tend to experience greater growth and fouling of probes than other sites, so the sensors on several of the probes at these sites are protected by the TROLL Shield®, a copper guard that surrounds the sensors while still allowing water flow and inhibits biological growth and fouling of the sensors (see Figure 2-16). These probes are cleaned and calibrated using the same methodology as described for groundwater sites. Refer to Appendix D for field calibration logs.

Surface water probes not associated with groundwater sites in Biscayne Bay (TPBBSW-1, -2, -4, and -5) are deployed by attaching the probe to a cement paver/pad with two eye rings drilled in it. The probe is placed between these eye rings and attached using a titanium twist-lock hanger to one of the eye rings. A TROLL® Shield is placed over the sensors, and both ends of the probe are attached to the eye rings using multiple zip ties. Then plastic, secured with electrical tape for prevention of excessive fouling, is wrapped around all portions of the probe except for where the TROLL® Shield is located; this allows water flow over the sensors.

These pads are placed at pre-determined locations on the bay bottom and the probes record surface water quality parameters for Biscayne Bay. These probes are AT100s, have no telemetry capability, and do not record stage data, which is recorded at sites associated with groundwater platforms in Biscayne Bay. Probes deployed on the bay bottom are swapped out on an approximate six-week rotation, taken back to a land-based facility where they are cleaned, and the data are manually uploaded onto the online database.

2.2.2 Results

The automated surface water data are qualified and validated in the same manner as the automated groundwater data. Figures 2-17 through 2-36 show time series graphs of specific conductance, temperature, and salinity at each surface water station. These graphs depict validated data and exclude data that have been qualified as questionable or part of a calibration event. Appendix E shows time series graphs of these three parameters but with all reported data.

Initial observations of the automated surface water stations reveal the following:

- In Biscayne Bay, specific conductance typically ranged from 30,000 to 50,000 µS/cm and salinity typically ranged from 15 to 35 PSU with the highest variability in concentrations at BBSW-1, -2, and -3. The northern stations are more directly influenced by stormwater discharges from the regional area drainage canals;
- The response in specific conductivity and salinity in Biscayne Bay to a rainfall event is not as readily evident as in groundwater since regional drainage canal releases may not always occur simultaneously with the rainfall;
- The specific conductance and salinity levels in the CCS were higher than those in Biscayne Bay (see Figure 2-37). The highest salinity value was 63.9 PSU but for the majority of the reporting period the levels were less than 50 PSU;
- While specific conductance and salinities at TPSWC-4 (downstream of S-20 discharge structure) were quite variable, the values were fairly steady at TPSWC-5 which is directly connected to Biscayne Bay. At depth, specific conductivity and salinity at TPSWC-5 were around 60,000 µS/cm and 40 PSU, respectively;
- Specific conductance values in the L-31 Canal were all less than 1,274 µS/cm except at TPSWC-3B in December during a drier period;
- Temperature in Biscayne Bay typically ranged from 15°C to a little over 30°C; however, in December the temperature dropped below 15°C on several occasions;
- Temperatures in Biscayne Bay were less than those measured in the CCS (see Figure 2-38);
- Temperatures in the CCS typically ranged between 20 to 40°C; however, for a short period in November and December, temperatures dropped near or less than 15°C at some locations;
- Temperatures at the discharge side of the plant into the CCS are typically more than 5°C higher than at the plant intake side in the CCS (see Figure 2-39) and the water at the south end of the CCS is approximately the same temperature as the intake temperature; and
- Temperatures in the L-31 Canal followed a similar trend as those in Biscayne Bay.

2.3 WATER LEVELS

2.3.1 Instrumentation and Data Collection Methods

Water pressures are measured and water levels calculated at 15-minute intervals in all groundwater and surface water stations. The only exception to this is four water quality stations in Biscayne Bay that do not have stage recorders. Per the Monitoring Plan, automated CCS and canal surface water stations are to have stage recorders and automated surface water quality monitoring stations co-located with a groundwater monitoring well clusters in Biscayne Bay are to have surface water stage recorders. During the siting of the wells and surface water station in the Biscayne Bay, only one surface water quality station in the bay (BBSW-3) was co-located with a well cluster (TPGW-11); thus one stage recorder was initially installed in Biscayne Bay. FPL later opted to install two additional stage recorders in Biscayne Bay (one each at the platforms associated with TPGW-10 and TPGW-14) to better assess groundwater and surface water interactions and tidal lag given that the data are being recorded at such short intervals.

Water levels are calculated in the instruments based on the following formula:

$$W_L = R_L + (2.31 * (R_P - M_P)/SG) \text{ where:}$$

W_L - water level (feet [ft] NAVD 88)
R_L - reference water level (ft NAVD 88)
R_P – reference pressure (pounds per square inch [psi])
M_P – measured pressure (psi)
SG – specific gravity (unitless)

The reference level (R_L) was established by manually measuring from the top of the well casing or top of stilling well at each location to the top of the water surface using a water level indicator. Because each well had been surveyed to a known datum (both NAVD 88 and NVGD 29),the actual surface water elevation at that moment in time could be easily calculated by subtracting the water level from the NAVD 88 surveyed elevation. This value was then entered into the probe as the reference level. The probe then automatically calculates the related pressure value, referred to as the reference pressure (R_P). Subsequent pressure measurements recorded by the probe are relative to the reference pressure and its associated elevation.

Two probe models are used to record water pressure/levels: the LT500 and AT200. The LT500 measures water pressure and temperature. This probe model is used in all automated groundwater well sites and is co-located with AT100 units. The AT200 measures water pressure and water quality parameters (as discussed above). The AT200s are located in surface water monitoring sites. Both types of probes have been installed as vented setups and measure water pressure above the probe. An explanation of the specifications of vented setups is provided above.

Aside from being able to measure water quality parameters, the biggest difference between the AT200 and the LT500 is how specific gravity (SG) is handled. In the AT200, an option exists to auto-correct water levels based on actual measured density. This option, called dynamic density, is input based on the latitude and elevation of the surveyed well, which calculates a local gravitational acceleration factor. Based on advice from In-Situ technical staff, all AT200 probes were programmed based on a latitude of 25.471190 and a fixed elevation of 5 feet. This measurement was calculated based on an average reading for Florida City. The gravitational acceleration factor is multiplied by the SG to get a location-corrected SG which, for this latitude, only affects the SG by 0.001 foot. Like the LT500s, probes can equally be programmed with a fixed density value (fresh water, brackish water, or saltwater). Since the units of density are being measured in grams per cubic centimeter (g/cm^3), and the density of fresh water is 1.0 g/cm^3, the measured density is the SG value being used in the formula above. Since the LT500 does not have the auto-correct option for density, a set density or SG has to be programmed into the instrument.

The determination of which probe model to use at a particular location was based on the parameters that needed to be measured per the Monitoring Plan, depth of installation, and accuracy of the measurements per the QAPP. Depth of installation is important since shallower depth placement allows the use of an instrument with a finer pressure scale and more accurate water level readings. Since groundwater gradients are expected to be small, the level of accuracy in the QAPP is relatively high (0.03 feet) which necessitates shallower depth placements. Based on the technical specifications, accuracy of water level readings for pressure sensors in both the LT500 and AT200 are both temperature and depth dependent. With a range of 0 to 5 pounds per square inch gauge (psig; water depth to 11.5 feet) they provide accurate readings within 0.01 feet. These same instruments, built for a range of 0 to100 psig and at deeper placement (up to 230.67 feet below the water) yield accuracy of 0.23 feet, which is not acceptable.

At all 42 groundwater wells installed for this monitoring effort, both water quality parameters and stage need to be recorded. However, since the water quality measurements have to be made at the well screen, which ranges from 20 to 110 feet below the water surface, the collection of pressure measurements at those depths with an AT200 result in readings that may have too much error. Thus, a totally different probe model was selected to measure the water quality parameters at depth (AT100) and the LT500 was placed in each well within 5 feet of the groundwater surface to measure pressure. As discussed above, the LT500 does not allow for an auto correction for density. In-Situ programmed all the LT500s to a brackish water density setting of 1.012 g/cm^3 and the water levels in the raw data files are calculated on that density. However, since density levels vary between well locations and possibly over time, the raw data is post corrected using density values from the water quality sensor located in the same well. The average daily density is used and a density corrected water level at 15-minute intervals is provided in the database.

At surface water stations where stage and water quality parameters are reported, the AT200 is used since water quality data are recorded at the top of the water column or in water that is less than 3 to 5 feet. The advantage of the AT200 is that it records density in the same probe at every 15 minutes, and when the density auto-correct feature is implemented, no post correction is needed.

When In-Situ originally installed the water level probes over the course of five months, they did not set many of the AT200s to auto-correct for density and, in a number of cases, did not have a reference level and reference pressure based on a surveyed datum. Thus, caution is advised when looking at the raw stage data. Subsequent to the installation, Ecology and Environment, Inc., (E & E) established reference levels and reference pressures for all probes (except TPBBSW-10) and reset the AT200s to auto-correct for density by December 2010. Table 2-2 provides a summary of water level setups and current reference levels and pressures. E &E has post corrected the previous data (except for TPBBSW-10B and TPBBSW-14B) by using the above equation reference levels and pressures based on NAVD 88 and included the density measurements in the calculations. The corrected water levels are in the queryable database. From this point forward, the surface water level data should not need further correction based on density (see exception below), but the groundwater levels will still need to be corrected on a daily basis for density since the levels are reported with the LT500.

Stations TPBBSW-10B and TPBBSW-14B, which were subsequently added, currently have LT500s and while the data can be post corrected, it is a more cumbersome process. Also, the density values need to come from a totally separate Biscayne Bay station in the general area and those data are not remotely transmitted. To simplify matters, the LT500s will be replaced with AT200s in the near future and set to auto-correct water levels for density. An added benefit is that water quality parameters will be collected and uploaded daily via telemetry.

2.3.2 Results

Groundwater

Figures 2-40 through 2-53 show time series graphs at all automated groundwater stations. These graphs are based on validated data and exclude data that are questionable or recorded during a calibration event when the log was still running. Stage data were typically not qualified if the density values were suspect since the differences in the instrument calculated density had little effect on the pressure reading/stage results given the shallow depth of probe placement. The density is of greater significance when discussing freshwater equivalent later in this section.

Some observations of the groundwater time series plots include:

- Water levels at TPGW-1, TPGW-2, TPGW-4 through TPGW-9, and TPGW-13 appear to respond to rainfall events (see Table 2-11 in Section 2.4.1). Water levels recorded in wells at these stations exhibited increases that coincide with observed rainfall events. For example, water level increases of up to 1 foot within a 24-hour period were observed in the TPGW-7 wells after the September 29, 2010 rainfall event. Water level responses for the November 3, 2010, rainfall event when conditions were drier were less marked than responses for the September 29, 2010, rainfall event during the peak of the rainy season.
- At most locations, wells at all three depths exhibited similar changes in water levels over time. At most onshore locations, water levels were generally highest in the shallow monitoring wells and progressively lower in the intermediate zone and deep wells.
- At stations TPGW-3, TPGW-10, TPGW-11 TPGW-12, and TPGW-14, water levels in wells at all three depths exhibited tidal influence. During the reporting period, diurnal water level fluctuations were observed in all wells at these locations. In addition, there are preliminary indications of a lunar cycle overlying the daily patterns.
- Stage levels in wells in the CCS and just west of the CCS exhibited little response to tidal changes.

Surface Water

Figures 2-54 through 2-69 show time series graphs at all surface water stations where data from automated stage recorders are available. These graphs are based on validated data and exclude data that are questionable or recorded during a calibration event when the log was running. Some observations from these time series plots include the following:

- Water levels at all onshore surface water stations appear to respond to rainfall events. Water level increases up to 1 foot were observed at the land-based station following significant rainfall events that occurred on September 29 and November 3, 2010.
- Diurnal water level variations were observed at surface water stations TPSWC-4 and TPSWC-5, however, the effects of rainfall were more pronounced at TPSWC-4 since this station is downstream of S-20 discharges.
- Water level elevations and water level variations during the reporting period were similar at stations TPSWID-1, TPSWID-2, and TPSWID-3. Each station exhibited similar water level rises following the September 29 and November 3, 2010, rainfall events.
- Water levels on the plant intake side of the CCS are lower than on the plant discharge side in the CCS with the intake station (TPSWCCS-6) being 1 to 2 feet lower than the CCS discharge station (TPSWCCS-1) (see Figure 2-70).
- Water levels in the CCS appear to exhibit little response to tidal influences in Biscayne Bay water. Figure 2-71 provides a representative time series plot for a spring tide on December 5, 2010.

Water Levels during Differing Conditions

To further assess water levels, surface water and groundwater stage data were extracted from the database that are representative of a spring tide, neap tide, and after a significant rainfall event and a dry period (see Table 2-3). Groundwater level elevations during the spring tide, neap tide; and post-rainfall event and dry period are presented in Tables 2-4, 2-5, and 2-6, respectively, and are illustrated on Figures 2-72, 2-73, and 2-74, respectively. Freshwater equivalent groundwater elevations during the spring tide and post-rainfall event and dry period are presented in Tables 2-7 and 2-8, respectively, and are illustrated on Figures 2-75 and 2-76, respectively. Freshwater equivalents were not calculated for those stations where density was suspect since the conversion to freshwater equivalents involves the height of water above the well screen and density values can impact the results particularly in the deeper wells. Surface water elevations during the spring tide, neap tide, and post-rainfall event and dry period are illustrated on Figures 2-77, 2-78, and 2-79, respectively.

Groundwater

During the December 5, 2010, spring tide, wells at all three depths at stations TPGW-2, -4, through -9, located west of the CCS and station TPGW-13 located in the CCS exhibited water level declines up to 0.03 feet from high tide to low tide. At stations TPGW-1 and -12, located north of the CCS, and at station TPGW-3 located south of the CCS, water levels in wells at all three depths declined from high tide to low tide. The TPGW-6 wells exhibited water level declines of approximately 0.06 foot. The TPGW-3 and -12 wells exhibited water level declines at all three depths of approximately 0.29 foot and 0.90 foot, respectively. The greatest water level declines from high tide to low tide were recorded in Biscayne Bay stations TPGW-10, -11, and -14. These stations exhibited high tide to low tide water level declines of approximately 1.52 feet, 1.80 feet, and 0.73 foot, respectively.

During the December 14, 2010, neap tide, groundwater high tide and low tide responses were similar to those observed during the spring tide event. Wells at all three depths at groundwater stations TPGW1, -2, -4 through -9, and TPGW-13 exhibited minimal (0.01 to 0.03 foot) declines from high tide to low tide. Water levels at all three depths at stations TPGW-3 and -12 exhibited high tide to low tide declines of approximately 0.15 foot and 0.37 foot, respectively. In addition, Biscayne Bay stations TPGW-10, -11, and -14 exhibited high tide to low tide water level declines of approximately 0.63 foot, 0.82 foot, and 0.34 foot, respectively.

Groundwater levels recorded at the groundwater stations on November 4, 2010, following a significant rainfall event on the 3rd ranged from 0.34 foot to 1.24 feet higher than groundwater levels measured at the stations on December 18, 2010, following a greater than 20-day-long dry period.

At stations TPGW-4, -5, -8 through -10, and TPGW-13, groundwater levels on both measurement dates were generally highest in the shallow monitoring wells and progressively lower in the intermediate zone and deep wells. In contrast, at stations TPGW-2 and -12, water levels on both measurement dates were lowest in the shallow wells and progressively higher in the intermediate zone and deep wells. During both measurement events, intermediate zone groundwater levels were lower than groundwater levels recorded in the shallow and deep monitoring wells at stations TPGW-1, -6, and -14. In addition, at station TPGW-7, groundwater levels recorded at all three depth intervals were similar on both measurement dates (i.e., recorded groundwater levels in the shallow, intermediate zone and deep wells were within 0.02 foot of each other).

Water levels at two stations stood out as anomalous when compared to other wells. One station was at TPGW-2 where levels were typically higher than surrounding stations in the deep and intermediate depth wells. Also the water levels in all three wells at TPGW-8 were much lower than surrounding wells. The cause for these different levels is not clear. Field teams double-checked the reference levels and sensor settings and no equipment issues were observed.

Freshwater Equivalent Groundwater Elevations

Freshwater equivalent groundwater elevations for the spring tide; and post rainfall event and dry period were calculated using the following formula:

$$H_f = (H_W - S_w) * \left(\frac{D_w}{D_f} - \frac{D_f}{D_f} \right) + H_w$$

where:
H_f = fresh water equivalent groundwater elevation (ft NAVD88)
H_w = groundwater elevation (ft NAVD88)
S_w = well screen midpoint elevation (ft NAVD88)
D_w = groundwater density (g/cm^3)
D_f = fresh water density (=1.000 g/cm^3).

Note:
For wells with reported groundwater densities of less than 1.000 g/cm^3, freshwater density of (1.000 g/cm^3) was used to calculate the freshwater equivalent groundwater elevation.

The freshwater equivalent groundwater level elevations calculated for the December 5, 2010 spring high tide, low tide, post rainfall event, and post dry period exhibited trends of progressively larger ranges of elevation for the shallow, intermediate zone, and deep wells. This trend of increasing freshwater equivalent elevation ranges with depth appears to be related in part to the depth ranges of the shallow, intermediate zone, and deep wells, which are progressively greater with depth. Based on well screen midpoint elevations, the shallow, intermediate zone, and deep wells have depth ranges of approximately 20 feet, 52 feet and 74 feet, respectively.

Surface Water

During the December 5, 2010 spring tide, onshore surface water stations with the exception of stations TPSWC-4 and -5, exhibited decreases in water levels between high and low tide of 0.03 foot or less. Stations TPSWC-4 and -5 exhibited water level decreases of 0.69 foot and 1.03 foot, respectively, from high to low tide on this date. During both high and low tides, water levels at stations located west of the CCS were higher than water levels at stations in the CCS.

Similar surface water level relationships were observed during the December 14, 2010 neap tide. During the neap tide event, the onshore stations exhibited water level decreases of 0.06 foot or less from high tide to low tide. From high tide and low tide, the water level at station TPSWC-5 decreased by 0.46 foot. During both high and low tides, water levels in stations located west of the CCS were higher than water levels at stations in the CCS.

Water levels measured at the onshore surface water stations on November 4, 2010 following a significant rainfall event range from 0.36 foot to 1.27 foot higher than water levels measured at the stations on December 18, 2010 following a greater than 20 day long dry period. During both measurement events, water levels at stations west of the CCS were generally higher than water levels at stations within the CCS.

2.4 METEOROLOGICAL DATA

A meteorological station (TPM-1) was set up in the middle of the CCS (Figure 1-2 in Section 1), near TPGW-13 and TPSWCCS-2. Additionally, five rainfall gauges have been set up in the vicinity of the Plant to determine the spatial and temporal variability in rain amounts on and offshore Turkey Point.

2.4.1 Instrumentation and Data Collection Methods

The station is a Vaisala WXT520 Weather Transmitter and a Li-Cor 190SA Quantum Sensor attached to a Campbell datalogger and telemetry system (Figure 2-80). The station collects data from a range of parameters (Table 2-9) at 15-minute intervals and uploads to the FPL IT database on a daily basis. Technical specifications on the instrumentation are provided in Appendix I of the QAPP.

2.4.2 Results

One of the key parameter of interest is the amount of precipitation in the CCS and surrounding areas. The rainfall timing, duration, and amount of rainfall are important in providing insight to the hydrology of this area. Barometric pressure, wind speed, and light levels can also help provide information on the meteorology around the CCS area. Wind speed is a key parameter for evaporation calculations. Figure 2-81 includes time series plots of rainfall, barometric pressure, wind speed, and photosynthetically active radiation (PAR). The rainfall in the figure reflects rain over 15-minute intervals and must be summed each day to get a daily rainfall total. There were several days where rainfall amounts were in excess of 0.25 inches (Table 2-10), and in some instances, exceeded four inches (e.g., September 29, 2010 and November 3, 2010) in a calendar day.

For example, during the rain event in early August (8^{th} – 10^{th}), there were over five inches within a 3-day period, most likely as a consequence of offshore climatic instability from Tropical Storm Colin. The precipitation during this storm event was at times quite intense as there were several instances of precipitation in excess of 0.25 inches recorded during a 15-minute interval.

The rain events observed on September 29 and November 3, 2010 were correlated with a cold frontal passage through the South Florida region. This is evident as the rainfall is accompanied by significant drops in barometric pressure during these events. Subsequent to the passage of the cold front, wind speeds are noticeably higher a few days following the rain event (Figure 2-81). Unlike precipitation trends generated by a tropical storm, the rainfall from frontal events is usually < 24 hours long.

Light levels during this monthly period did not appear to be significantly affected by either tropical storm or cold front events. However, there is a noticeable trend of declining light levels with approach towards the winter time period.

TABLES

Table 2-1. Probes Types/Automated Measurements at Surface Water Stations

Surface Water Site	Probe	Parameters Measured
TPSWC-1T	AT200	Water Quality, Stage
TPSWC-1B	AT100	Water Quality
TPSWC-2T	AT200	Water Quality, Stage
TPSWC-2B	AT100	Water Quality
TPSWC-3T	AT200	Water Quality, Stage
TPSWC-3B	AT100	Water Quality
TPSWC-4T	AT200	Water Quality, Stage
TPSWC-4B	AT100	Water Quality
TPSWC-5T	AT200	Water Quality, Stage
TPSWC-5B	AT100	Water Quality
TPSWID-1T	AT200	Water Quality, Stage
TPSWID-1B	AT100	Water Quality
TPSWID-2T	AT200	Water Quality, Stage
TPSWID-3T	AT100	Water Quality
TPSWID-3B	AT200	Water Quality, Stage
TPSWCCS-1T	AT200	Water Quality, Stage
TPSWCCS-2T	AT200	Water Quality, Stage
TPSWCCS-3T	AT200	Water Quality, Stage
TPSWCCS-4T	AT200	Water Quality, Stage
TPSWCCS-4B	AT100	Water Quality
TPSWCCS-5T	AT200	Water Quality, Stage
TPSWCCS-5B	AT100	Water Quality
TPSWCCS-6T	AT200	Water Quality, Stage
TPSWCCS-6B	AT100	Water Quality
TPBBSW-1B	AT100	Water Quality
TPBBSW-2B	AT100	Water Quality
TPBBSW-3B	AT200	Water Quality, Stage
TPBBSW-4B	AT100	Water Quality
TPBBSW-5B	AT100	Water Quality
TPBBSW-10B	LT500[1]	Stage
TPBBSW-14B	LT500[1]	Stage

Notes:
[1] Probe will be replaced with AT200 which will measure stage and water quality parameters.

Key:
AT - Aqua TROLL®. B – Bottom. LT – Level TROLL®. T – Top.

Table 2-2. Probe Sites, Installation Notes, Date of Reprogramming and Associated Reference Values

In-Situ Notes	Data Collection Initiation Date	In-Situ Installation Notes	Date of E & E Reset	Reference Level	Reference Pressure
TPGW 1S-AT	9/12/2010	Reference levels need to be reset on all Level TROLLs®. Firmware up to date.	11/9/2010		
TPGW 1S-LT	9/12/2010		11/9/2010	-0.23	2.83435
TPGW 1M-AT	9/12/2010		11/9/2010		
TPGW 1M-LT	9/12/2010		11/9/2010	-0.87	2.19963
TPGW 1D-AT	9/12/2010		11/9/2010		
TPGW 1D-LT	9/12/2010		11/9/2010	-0.83	2.18702
TPGW 2S-AT	6/22/2010	Reference level set correctly. Need to update firmware on all sensors.	10/28/2010		
TPGW 2S-LT	6/22/2010		10/28/2010	-0.3	1.27736
TPGW 2M-AT	6/22/2010		10/28/2010		
TPGW 2M-LT	6/22/2010		10/28/2010	0.31	2.49062
TPGW 2D-AT	6/22/2010		10/28/2010		
TPGW 2D-LT	6/22/2010		10/28/2010	0.38	1.94907
TPGW 3S-AT	6/22/2010	Reference level set correctly. Firmware up to date	11/8/2010		
TPGW 3S-LT	6/22/2010		11/8/2010	0.24	3.21875
TPGW 3M-AT	6/22/2010		11/8/2010		
TPGW 3M-LT	6/22/2010		11/8/2010	0.22	2.68423
TPGW 3D-AT	6/22/2010		11/8/2010		
TPGW 3D-LT	6/22/2010		11/8/2010	0.22	2.9946
TPGW 4S-AT	8/31/2010	Reference level set correctly. Firmware up to date.	11/9/2010		
TPGW 4S-LT	8/31/2010		11/9/2010	0.82	1.60854
TPGW 4M-AT	8/31/2010		11/9/2010		
TPGW 4M-LT	8/31/2010		11/9/2010	0.32	1.5836
TPGW 4D-AT	8/31/2010		11/9/2010		
TPGW 4D-LT	8/31/2010		11/9/2010	0.09	1.5468
TPGW 5S-AT	9/14/2010	Reference level set correctly. Firmware up to date.	11/10/2010		
TPGW 5S-LT	9/14/2010		11/10/2010	0.82	2.2543
TPGW 5M-AT	9/14/2010		11/10/2010		
TPGW 5M-LT	9/14/2010		11/10/2010	0.35	2.12817
TPGW 5D-AT	9/14/2010		11/10/2010		
TPGW 5D-LT	9/14/2010		11/10/2010	0.22	2.16742
TPGW 6S-AT	6/23/2010	Reference Firmware update needed on all probes. Reference set correctly.	10/26/2010		
TPGW 6S-LT	6/23/2010		10/26/2010	0.31	1.46943
TPGW 6M-AT	6/23/2010		10/26/2010		
TPGW 6M-LT	6/23/2010		10/26/2010	-0.08	1.62408
TPGW 6D-AT	6/23/2010		10/26/2010		
TPGW 6D-LT	6/23/2010		10/26/2010	0.39	1.6466
TPGW 7S-AT	9/13/2010	Reference levels need to be reset on all	10/26/2010		
TPGW 7S-LT	9/13/2010		10/26/2010	0.71	2.27218

Table 2-2. Probe Sites, Installation Notes, Date of Reprogramming and Associated Reference Values

In-Situ Notes	Data Collection Initiation Date	In-Situ Installation Notes	Date of E & E Reset	Reference Level	Reference Pressure
TPGW 7M-AT	9/13/2010	Level TROLLs®. Firmware up to date.	10/26/2010		
TPGW 7M-LT	9/13/2010		10/26/2010	0.7	2.09172
TPGW 7D-AT	9/13/2010		10/26/2010		
TPGW 7D-LT	9/13/2010		10/26/2010	0.69	2.08501
TPGW 8S-AT	9/15/2010	Reference level set correctly. Firmware up to date.	9/15/2010		
TPGW 8S-LT	9/15/2010		9/15/2010	-0.14	2.18246
TPGW 8M-AT	9/15/2010		9/15/2010		
TPGW 8M-LT	9/15/2010		9/15/2010	-0.21	2.17523
TPGW 8D-AT	9/15/2010		9/15/2010		
TPGW 8D-LT	9/15/2010		9/15/2010	-0.22	1.76936
TPGW 9S-AT	6/24/2010	Reference level need to be updated on all sensors. Update firmware on all sensors.	10/25/2010		
TPGW 9S-LT	6/24/2010		10/25/2010	1.03	0.625084
TPGW 9M-AT	6/24/2010		10/25/2010		
TPGW 9M-LT	6/24/2010		10/25/2010	1.03	2.31608
TPGW 9D-AT	6/24/2010		10/25/2010		
TPGW 9D-LT	6/24/2010		10/25/2010	0.97	0.894112
TPGW 10S-AT	9/17/2010	Firmware up to date on all sensors. Reference set correctly on all Level TROLLs®.	11/17/2010		
TPGW 10S-LT	9/17/2010		11/17/2010	0	1.69011
TPGW 10M-AT	9/17/2010		11/17/2010		
TPGW 10M-LT	9/17/2010		11/17/2010	0	1.95621
TPGW 10D-AT	9/17/2010		11/17/2010		
TPGW 10D-LT	9/17/2010		11/17/2010	-0.03	1.69006
TPGW 11S-AT	9/17/2010	Firmware up to date on all sensors. Reference set correctly on all Level TROLLs®.	11/17/2010		
TPGW 11S-LT	9/17/2010		11/17/2010	-1.05	2.24035
TPGW 11M-AT	9/17/2010		11/17/2010		
TPGW 11M-LT	9/17/2010		11/17/2010	-0.859	2.24409
TPGW 11D-AT	9/17/2010		11/17/2010		
TPGW 11D-LT	9/17/2010		11/17/2010	-0.92	2.18697
TPGW 12S-AT	6/23/2010	Need to reset reference levels on level TROLLs®. Need to update firm-ware on Level TROLLs®.	11/5/2010		
TPGW 12S-LT	6/23/2010		11/5/2010	0.07	1.62936
TPGW 12M-AT	6/23/2010		11/5/2010		
TPGW 12M-LT	6/23/2010		11/5/2010	0.05	2.69837
TPGW 12D-AT	6/23/2010		11/5/2010		
TPGW 12D-LT	6/23/2010		11/5/2010	0.02	1.31059
TPGW 13S-AT	6/23/2010	Need to update reference level on Level s TROLLs®. Need to update	11/10/2010		
TPGW 13S-LT	6/23/2010		11/10/2010	0.24	1.68158
TPGW 13M-AT	6/23/2010		11/10/2010		
TPGW 13M-LT	6/23/2010		11/10/2010	0.24	2.55875

Table 2-2. Probe Sites, Installation Notes, Date of Reprogramming and Associated Reference Values

In-Situ Notes	Data Collection Initiation Date	In-Situ Installation Notes	Date of E & E Reset	Reference Level	Reference Pressure
TPGW 13D-AT	6/23/2010	firmware on Level TROLLs®.	11/10/2010		
TPGW 13D-LT	6/23/2010		11/10/2010	-0.15	3.49419
TPGW 14S-AT	9/18/2010	Need to set reference levels on Level TROLLs®. Firmware up to date on all probes.	11/17/2010		
TPGW 14S-LT	9/18/2010		11/17/2010	-0.41	2.33289
TPGW 14M-AT	9/18/2010		11/17/2010		
TPGW 14M-LT	9/18/2010		11/17/2010	-0.52	2.19967
TPGW 14D-AT	9/18/2010		11/17/2010		
TPGW 14D-LT	9/18/2010		11/17/2010	-0.41	2.14292
TPSWC-1T	9/6/2010	Reference level needs to be reprogrammed.	11/9/2010	0.66	1.34285
TPSWC-1B	9/6/2010		11/9/2010		
TPSWC-2T	8/30/2010	Reference level needs to be reprogrammed.	11/9/2010	0.64	1.39067
TPSWC-2B	8/30/2010		11/9/2010		
TPSWC-3T	8/30/2010	Reference level needs to be reprogrammed.	11/9/2010	0.65	1.39143
TPSWC-3B	8/30/2010		11/9/2010		
TPSWC-4T	8/26/2010	Reference level needs to be reprogrammed.	10/28/2010	-0.66	1.05765
TPSWC-4B	8/26/2010		10/28/2010		
TPSWC-5T	9/1/2010	Reference level needs to be reprogrammed.	11/8/2010	-0.28	1.21204
TPSWC-5B	9/1/2010		11/8/2010		
TPSWCCS-1B	8/27/2010	Reference level needs to be reprogrammed.	11/5/2010	0.11	0.721152
TPSWCCS-2B		Reference set correctly.			
TPSWCCS-3B	8/25/2010	Reference level needs to be reprogrammed. Need to update firmware.	11/29/2010	-0.32	0.72025
TPSWCCS-4T	9/1/2010	Need to reprogram reference level.	11/8/2010	-0.09	1.60082
TPSWCCS-4B	9/1/2010		11/8/2010		
TPSWCCS-5T	9/1/2010	Reference level needs to be reprogrammed.	11/8/2010	-0.19	1.49394
TPSWCCS-5B	9/1/2010		11/8/2010		
TPSWCCS-6T	9/15/2010	Reference set correctly.	11/5/2010	-1.26	1.40488
TPSWCCS-6B	9/15/2010				
TPSWCCS-7B	8/25/2010	Reference level needs to be reprogrammed.	11/10/2010	0.06	0.699189
TPSWID-1T	8/27/2010	Reference level needs to be reprogrammed.	11/29/2010	0.18	1.7032
TPSWID-1B	8/27/2010		11/29/2010		
TPSWID-2T	8/25/2010	Reference level needs	11/10/2010	0.6	2.03141

Table 2-2. Probe Sites, Installation Notes, Date of Reprogramming and Associated Reference Values

In-Situ Notes	Data Collection Initiation Date	In-Situ Installation Notes	Date of E & E Reset	Reference Level	Reference Pressure
TPSWID-2B	8/25/2010	to be reprogrammed.	11/10/2010		
TPSWID-3T	8/25/2010	Reference level needs to be reprogrammed. Need to update firmware. Need to switch out telemetry unit.	10/28/2010	0.4	1.8177
TPSWID-3B	8/25/2010				
TPBBSW-1 [1]	9/2/2010	Firmware up to date.		N/A	N/A
TPBBSW-2 [1]	9/2/2010	Firmware up to date.		N/A	N/A
TPBBSW-3	9/17/2010	Reference level set correctly.	12/15/2010	-1.353	1.98953
TPBBSW-4 [1]	9/2/2010	Firmware up to date.		N/A	N/A
TPBBSW-5 [1]	9/2/2010	Firmware up to date.		N/A	N/A
TPBBSW-10 [2]		Reference set correctly, but no corresponding density. Need to adjust stilling well. Need to swap sensor for AT200.			
TPBBSW-14 [3]	9/30/2010	Reference set correctly but no corresponding density. Need to swap sensor for AT200.	12/15/2010	-0.497	0.883588

Notes

In-Situ installation notes refer to outstanding issues for specific probes after first deployment. The Date of Reset column refers to the date when E & E staff revisited these locations to update firmware, reprogram reference level settings and reset data collection logs. The associated reference levels and pressures were then used to perform global corrections for all water level data, which will be available in the queryable database developed by FPL. For surface water stations, where the probes contain the auto-correction for density option, this is a one time correction. For groundwater stations where density values must be inserted from readings at the deeper probe, these corrections will be ongoing to provide accurate water level measurements. Reference levels will be periodically updated, and these values then entered into the algorithm for water level corrections after this specific date and time.

[1] These probes monitor surface water quality parameters and are deployed without telemetry on the bay bottom, they do not measure stage and therefore do not have reference levels or pressures.

[2] This probe has not been properly set due to problems with the location of the stilling well, which at the time of this report is in the process of being re-set. Additionally, although originally a LT500 was set in this site, this will soon be switched out for an AT200 able to provide the auto correction for density option.

[3] This probe is currently a LT500, but will soon be switched to an AT200, which will allow the auto correction for density option.

Table 2-3. Representative Conditions to Assess Variability in Water Levels

CONDITION	DATE (Military Time)
Spring Tide - Low	12/05/10 (04:30)
Spring Tide - High	12/05/10 (10:45)
Neap Tide – High	12/14/10 (04:45)
Neap Tide - Low	12/14/10 (12:00)
No Rain over 0.01 inches in more than 20 days	12/18/10 (00:00)
After significant rain event	11/04/10 (00:00)

Table 2-4. Spring Tide Groundwater Elevations, FPL Turkey Point Plant, December 5, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Spring High Tide 12/5/10 10:15 hours	Spring Low Tide 12/5/10 04:30 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW1-S	3.82	-28.18	-30.18	-0.69	-0.75
TPGW1-M	3.93	-48.17	-50.17	-1.32	-1.38
TPGW1-D	4.22	-81.08	-85.08	-1.28	-1.34
TPGW2-S	1.35	-23.35	-27.35	-0.53	-0.54
TPGW2-M	1.16	-49.34	-51.34	0.09	0.08
TPGW2-D	1.13	-84.37	-86.37	0.39	0.38
TPGW3-S	1.44	-25.66	-29.66	-0.14	-0.43
TPGW3-M	1.22	-53.48	-57.48	-0.15	-0.43
TPGW3-D	1.1	-85.50	-87.50	-0.14	-0.42
TPGW4-S	2.24	-20.96	-22.96	0.36	0.36
TPGW4-M	1.82	-36.28	-41.28	-0.16	-0.16
TPGW4-D	1.92	-59.68	-63.68	-0.39	-0.38
TPGW5-S	5.35	-23.25	-27.25	0.24	0.25
TPGW5-M	5.07	-44.23	-49.23	-0.21	-0.20
TPGW5-D	5.22	-61.78	-66.78	-0.35	-0.34
TPGW6-S	1.56	-20.74	-22.74	-0.06	-0.08
TPGW6-M	1.52	-47.18	-51.18	-0.45	-0.47

Table 2-4. Spring Tide Groundwater Elevations, FPL Turkey Point Plant, December 5, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Spring High Tide 12/5/10 10:15 hours	Spring Low Tide 12/5/10 04:30 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW6-D	1.59	-80.31	-84.31	0.03	0.00
TPGW7-S	1.36	-20.44	-24.44	0.21	0.22
TPGW7-M	1.25	-46.45	-50.45	0.22	0.24
TPGW7-D	1.19	-78.51	-82.51	0.22	0.23
TPGW8-S	0.42	-16.38	-20.38	ND	ND
TPGW8-M	0.55	-34.35	-36.35	-1.06	-1.06
TPGW8-D	0.45	-48.75	-52.75	-1.17	-1.16
TPGW9-S	3.63	-11.27	-15.27	0.61	0.61
TPGW9-M	3.53	-30.77	-32.77	0.59	0.59
TPGW9-D	3.52	-44.38	-46.38	0.53	0.54
TPGW10-S	8.47	-27.93	-29.93	0.06	-1.46
TPGW10-M	8.47	-51.93	-55.93	-0.05	-1.57
TPGW10-D	8.57	-117.93	-121.93	-0.19	-1.71
TPGW11-S	8.47	-30.93	-34.93	-0.08	-1.90
TPGW11-M	8.47	-81.93	-85.93	-0.13	-1.92
TPGW11-D	8.47	-113.93	-117.93	0.01	-1.78
TPGW12-S	0.52	-21.08	-23.08	-0.24	-1.14

Table 2-4. Spring Tide Groundwater Elevations, FPL Turkey Point Plant, December 5, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Spring High Tide 12/5/10 10:15 hours	Spring Low Tide 12/5/10 04:30 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW12-M	0.73	-55.07	-59.07	-0.04	-0.97
TPGW12-D	0.76	-89.04	-93.04	0.00	-0.88
TPGW13-S	2.19	-27.61	-31.61	-0.15	-0.16
TPGW13-M	2.13	-54.57	-58.57	-0.14	-0.16
TPGW13-D	2.18	-82.72	-86.72	-0.52	-0.53
TPGW14-S	8.87	-23.63	-27.63	-0.42	-1.15
TPGW14-M	8.87	-47.43	-51.43	-0.51	-1.24
TPGW14-D	8.67	-93.53	-97.53	-0.31	-1.03

Key:

ft NAVD88 = Feet relative to the North American Vertical Datum of 1988.

Table 2-5. Neap Tide Groundwater Elevations, FPL Turkey Point Plant, December 14, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Neap High Tide 12/14/2010 04:45 hours	Neap Low Tide 12/14/10 12:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW1-S	3.82	-28.18	-30.18	-0.75	-0.78
TPGW1-M	3.93	-48.17	-50.17	-1.44	-1.47
TPGW1-D	4.22	-81.08	-85.08	-1.39	-1.42
TPGW2-S	1.35	-23.35	-27.35	-0.56	-0.58
TPGW2-M	1.16	-49.34	-51.34	0.01	-0.02
TPGW2-D	1.13	-84.37	-86.37	0.28	0.25
TPGW3-S	1.44	-25.66	-29.66	-0.22	-0.37
TPGW3-M	1.22	-53.48	-57.48	-0.31	-0.46
TPGW3-D	1.1	-85.50	-87.50	-0.30	-0.46
TPGW4-S	2.24	-20.96	-22.96	0.23	0.22
TPGW4-M	1.82	-36.28	-41.28	-0.25	-0.26
TPGW4-D	1.92	-59.68	-63.68	-0.51	-0.52
TPGW5-S	5.35	-23.25	-27.25	0.07	0.05
TPGW5-M	5.07	-44.23	-49.23	-0.38	-0.39
TPGW5-D	5.22	-61.78	-66.78	-0.52	-0.54
TPGW6-S	1.56	-20.74	-22.74	-0.17	-0.19

Table 2-5. Neap Tide Groundwater Elevations, FPL Turkey Point Plant, December 14, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Neap High Tide 12/14/2010 04:45 hours	Neap Low Tide 12/14/10 12:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW6-M	1.52	-47.18	-51.18	-0.47	-0.49
TPGW6-D	1.59	-80.31	-84.31	0.01	-0.01
TPGW7-S	1.36	-20.44	-24.44	0.05	0.03
TPGW7-M	1.25	-46.45	-50.45	0.07	0.05
TPGW7-D	1.19	-78.51	-82.51	0.05	0.04
TPGW8-S	0.42	-16.38	-20.38	-1.15	-1.17
TPGW8-M	0.55	-34.35	-36.35	-1.23	-1.25
TPGW8-D	0.45	-48.75	-52.75	-1.39	-1.41
TPGW9-S	3.63	-11.27	-15.27	0.47	0.46
TPGW9-M	3.53	-30.77	-32.77	0.44	0.43
TPGW9-D	3.52	-44.38	-46.38	0.38	0.37
TPGW10-S	8.47	-27.93	-29.93	-0.43	-1.06
TPGW10-M	8.47	-51.93	-55.93	-0.53	-1.16
TPGW10-D	8.57	-117.93	-121.93	-0.68	-1.30
TPGW11-S	8.47	-30.93	-34.93	-0.62	-1.47
TPGW11-M	8.47	-81.93	-85.93	-0.67	-1.45
TPGW11-D	8.47	-113.93	-117.93	-0.52	-1.36

Table 2-5. Neap Tide Groundwater Elevations, FPL Turkey Point Plant, December 14, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Neap High Tide 12/14/2010 04:45 hours	Neap Low Tide 12/14/10 12:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW12-S	0.52	-21.08	-23.08	-0.59	-0.97
TPGW12-M	0.73	-55.07	-59.07	-0.41	-0.80
TPGW12-D	0.76	-89.04	-93.04	-0.37	-0.73
TPGW13-S	2.19	-27.61	-31.61	-0.25	-0.27
TPGW13-M	2.13	-54.57	-58.57	-0.26	-0.29
TPGW13-D	2.18	-82.72	-86.72	-0.61	-0.64
TPGW14-S	8.87	-23.63	-27.63	-0.70	-1.05
TPGW14-M	8.87	-47.43	-51.43	-0.80	-1.15
TPGW14-D	8.67	-93.53	-97.53	-0.58	-0.90

Key:

ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.

Table 2-6. Post-Rainfall Event and Dry Period Groundwater Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours	Dry Period 12/18/10 00:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW1-S	3.82	-28.18	-30.18	-0.14	-0.84
TPGW1-M	3.93	-48.17	-50.17	-0.82	-1.53
TPGW1-D	4.22	-81.08	-85.08	-0.71	-1.48
TPGW2-S	1.35	-23.35	-27.35	0.10	-0.63
TPGW2-M	1.16	-49.34	-51.34	0.69	-0.07
TPGW2-D	1.13	-84.37	-86.37	0.99	0.20
TPGW3-S	1.44	-25.66	-29.66	-0.01	-0.43
TPGW3-M	1.22	-53.48	-57.48	0.09	-0.52
TPGW3-D	1.1	-85.50	-87.50	0.05	-0.51
TPGW4-S	2.24	-20.96	-22.96	0.91	0.16
TPGW4-M	1.82	-36.28	-41.28	0.45	-0.31
TPGW4-D	1.92	-59.68	-63.68	0.24	-0.57
TPGW5-S	5.35	-23.25	-27.25	0.94	0.01
TPGW5-M	5.07	-44.23	-49.23	0.48	-0.43
TPGW5-D	5.22	-61.78	-66.78	0.23	-0.58

Table 2-6. Post-Rainfall Event and Dry Period Groundwater Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours	Dry Period 12/18/10 00:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW6-S	1.56	-20.74	-22.74	0.80	-0.18
TPGW6-M	1.52	-47.18	-51.18	0.38	-0.48
TPGW6-D	1.59	-80.31	-84.31	0.87	0.00
TPGW7-S	1.36	-20.44	-24.44	1.19	0.01
TPGW7-M	1.25	-46.45	-50.45	1.20	0.03
TPGW7-D	1.19	-78.51	-82.51	1.19	0.01
TPGW8-S	0.42	-16.38	-20.38	-0.03	-1.21
TPGW8-M	0.55	-34.35	-36.35	-0.10	-1.29
TPGW8-D	0.45	-48.75	-52.75	-0.21	-1.45
TPGW9-S	3.63	-11.27	-15.27	1.16	0.40
TPGW9-M	3.53	-30.77	-32.77	1.14	0.37
TPGW9-D	3.52	-44.38	-46.38	1.08	0.31
TPGW10-S	8.47	-27.93	-29.93	-0.43	-1.21
TPGW10-M	8.47	-51.93	-55.93	-0.56	-1.26
TPGW10-D	8.57	-117.93	-121.93	-0.65	-1.46
TPGW11-S	8.47	-30.93	-34.93	-1.03	-1.71
TPGW11-M	8.47	-81.93	-85.93	-1.04	-1.73

Table 2-6. Post-Rainfall Event and Dry Period Groundwater Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours	Dry Period 12/18/10 00:00 hours
				Water Level Elevation (ft NAVD 88)	Water Level Elevation (ft NAVD 88)
TPGW11-D	8.47	-113.93	-117.93	-1.05	-1.58
TPGW12-S	0.52	-21.08	-23.08	-0.40	-1.03
TPGW12-M	0.73	-55.07	-59.07	-0.17	-0.87
TPGW12-D	0.76	-89.04	-93.04	-0.11	-0.80
TPGW13-S	2.19	-27.61	-31.61	0.61	-0.29
TPGW13-M	2.13	-54.57	-58.57	0.36	-0.31
TPGW13-D	2.18	-82.72	-86.72	-0.04	-0.66
TPGW14-S	8.87	-23.63	-27.63	-0.63	-1.17
TPGW14-M	8.87	-47.43	-51.43	-0.88	-1.27
TPGW14-D	8.67	-93.53	-97.53	-0.68	-1.02

Key:

ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.

Table 2-7. Spring Tide Fresh Water Equivalent Head Elevations, FPL Turkey Point Plant, December 5, 2010

Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Spring High Tide 12/5/10 10:15 hours			Spring Low Tide 12/5/10 04:30 hours		
		Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW1-S	-29.18	-0.69	1.025	0.02	-0.75	1.025	-0.04
TPGW1-M	-49.17	-1.32	1.034	0.30	-1.38	1.035	0.30
TPGW1-D	-83.08	-1.28	1.034	1.50	-1.34	1.034	1.44
TPGW2-S	-25.35	-0.53	1.034	0.32	-0.54	1.034	0.30
TPGW2-M	-50.34	0.09	1.037*	NC	0.08	1.037*	NC
TPGW2-D	-85.37	0.39	1.036	3.48	0.38	1.036	3.46
TPGW3-S	-27.66	-0.14	1.029	0.66	-0.43	1.029	0.36
TPGW3-M	-55.48	-0.15	1.033	1.68	-0.43	1.033	1.39
TPGW3-D	-86.5	-0.14	1.033	2.71	-0.42	1.033	2.42
TPGW4-S	-21.96	0.36	0.998	0.36	0.36	0.998	0.36
TPGW4-M	-38.78	-0.16	1.015	0.42	-0.16	1.015	0.42
TPGW4-D	-61.68	-0.39	1.005	-0.08	-0.38	1.017	0.66
TPGW5-S	-25.25	0.24	0.998	0.24	0.25	0.998	0.25
TPGW5-M	-46.73	-0.21	1.012	0.35	-0.20	1.012	0.36
TPGW5-D	-64.28	-0.35	1.013	0.48	-0.34	1.013	0.49
TPGW6-S	-21.74	-0.06	0.998	-0.06	-0.08	0.998	-0.08

Table 2-7. Spring Tide Fresh Water Equivalent Head Elevations, FPL Turkey Point Plant, December 5, 2010

		Spring High Tide 12/5/10 10:15 hours			Spring Low Tide 12/5/10 04:30 hours		
Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW6-M	-49.18	-0.45	1.008	-0.06	-0.47	1.008	-0.08
TPGW6-D	-82.31	0.03	1.008	0.69	0.00	1.008	0.66
TPGW7-S	-22.44	0.21	0.997	0.21	0.22	0.997	0.22
TPGW7-M	-48.45	0.22	0.998	0.22	0.24	0.998	0.24
TPGW7-D	-80.51	0.22	0.998	0.22	0.23	0.998	0.23
TPGW8-S	-18.38	ND	ND	ND	ND	ND	ND
TPGW8-M	-35.35	-1.06	0.998	-1.06	-1.06	0.998	-1.06
TPGW8-D	-50.75	-1.17	0.998	-1.17	-1.16	0.998	-1.16
TPGW9-S	-13.27	0.61	0.997	0.61	0.61	0.997	0.61
TPGW9-M	-31.77	0.59	0.998	0.59	0.59	0.998	0.59
TPGW9-D	-45.38	0.53	0.998	0.53	0.54	0.998	0.54
TPGW10-S	-28.93	0.06	1.022	0.70	-1.46	1.022	-0.85
TPGW10-M	-53.93	-0.05	1.025	1.30	-1.57	1.025	-0.26
TPGW10-D	-119.93	-0.19	1.025	2.81	-1.71	1.025	1.25
TPGW11-S	-32.93	-0.08	1.025	0.74	-1.90	1.025	-1.12
TPGW11-M	-83.93	-0.13	1.026	2.05	-1.92	1.026	0.21
TPGW11-D	-115.93	0.01	1.027	3.14	-1.78	1.027	1.31

Table 2-7. Spring Tide Fresh Water Equivalent Head Elevations, FPL Turkey Point Plant, December 5, 2010

Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Spring High Tide 12/5/10 10:15 hours			Spring Low Tide 12/5/10 04:30 hours		
		Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW12-S	-22.08	-0.24	1.017	0.13	-1.14	1.017	-0.78
TPGW12-M	-57.07	-0.04	1.030	1.67	-0.97	1.030	0.71
TPGW12-D	-91.04	0.00	1.030	2.73	-0.88	1.030	1.82
TPGW13-S	-29.61	-0.15	1.042	1.09	-0.16	1.042	1.08
TPGW13-M	-56.57	-0.14	1.027*	NC	-0.16	1.010*	NC
TPGW13-D	-84.72	-0.52	1.041	2.93	-0.53	1.041	2.92
TPGW14-S	-25.63	-0.42	1.027	0.26	-1.15	1.027	-0.49
TPGW14-M	-49.43	-0.51	1.029	0.91	-1.24	1.030	0.20
TPGW14-D	-95.53	-0.31	1.036	3.12	-1.03	1.036	2.37

Key:

* - Density value suspect.
ft NAVD88 - Feet relative to the North American Vertical Datum of 1988.
g/cm^3 - Grams per cubic centimeter.
NC – Not calculated.
ND = No data.

Table 2-8. Post-Rainfall Event and Dry Period Freshwater Equivalent Head Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours			Dry Period 12/18/10 00:00 hours		
		Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW1-S	-29.18	-0.14	1.027	0.65	-0.84	1.024	-0.16
TPGW1-M	-49.17	-0.82	1.035	0.87	-1.53	1.037	0.24
TPGW1-D	-83.08	-0.71	1.035	2.17	-1.48	1.034	1.30
TPGW2-S	-25.35	0.10	1.014*	NC	-0.63	1.034	0.21
TPGW2-M	-50.34	0.69	1.036*	NC	-0.07	1.037	1.79
TPGW2-D	-85.37	0.99	1.036	4.10	0.20	1.036	3.28
TPGW3-S	-27.66	-0.01	1.030	0.82	-0.43	1.029	0.36
TPGW3-M	-55.48	0.09	1.033	1.93	-0.52	1.033	1.29
TPGW3-D	-86.5	0.05	1.032	2.82	-0.51	1.033	2.33
TPGW4-S	-21.96	0.91	0.998	0.91	0.16	0.998	0.16
TPGW4-M	-38.78	0.45	1.015	1.04	-0.31	1.015	0.27
TPGW4-D	-61.68	0.24	1.009	0.80	-0.57	1.023	0.84
TPGW5-S	-25.25	0.94	0.998	0.94	0.01	0.998	0.01
TPGW5-M	-46.73	0.48	1.012	1.05	-0.43	1.012	0.13
TPGW5-D	-64.28	0.23	1.013	1.07	-0.58	1.013	0.25

Table 2-8. Post-Rainfall Event and Dry Period Freshwater Equivalent Head Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours			Dry Period 12/18/10 00:00 hours		
		Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW6-S	-21.74	0.80	0.998	0.80	-0.18	0.998	-0.18
TPGW6-M	-49.18	0.38	1.008	0.78	-0.48	1.008	-0.09
TPGW6-D	-82.31	0.87	1.008	1.54	0.00	1.008	0.66
TPGW7-S	-22.44	1.19	0.998	1.19	0.01	0.997	0.01
TPGW7-M	-48.45	1.20	0.998	1.20	0.03	0.998	0.03
TPGW7-D	-80.51	1.19	0.998	1.19	0.01	0.998	0.01
TPGW8-S	-18.38	-0.03	0.999	-0.03	-1.21	0.999	-1.21
TPGW8-M	-35.35	-0.10	0.998	-0.10	-1.29	0.998	-1.29
TPGW8-D	-50.75	-0.21	0.998	-0.21	-1.45	0.998	-1.45
TPGW9-S	-13.27	1.16	0.997	1.16	0.40	0.997	0.40
TPGW9-M	-31.77	1.14	0.998	1.14	0.37	0.998	0.37
TPGW9-D	-45.38	1.08	0.998	1.08	0.31	0.998	0.31
TPGW10-S	-28.93	-0.43	1.023	0.23	-1.21	1.022	-0.60
TPGW10-M	-53.93	-0.56	1.025	0.78	-1.26	1.025	0.06
TPGW10-D	-119.93	-0.65	1.025	2.33	-1.46	1.025	1.50
TPGW11-S	-32.93	-1.03	1.025	-0.23	-1.71	1.025	-0.93

Table 2-8. Post-Rainfall Event and Dry Period Freshwater Equivalent Head Elevations, FPL Turkey Point Plant, November 4, 2010 and December 18, 2010

Monitoring Well	Elevation Screen Midpoint (ft NAVD 88)	Post-Rainfall Event 11/4/10 00:00 hours			Dry Period 12/18/10 00:00 hours		
		Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)	Measured Water Level Elevation (NAVD 88)	Water Density (g/cm^3)	Freshwater Head Equivalent Elevation (ft NAVD 88)
TPGW11-M	-83.93	-1.04	1.026	1.12	-1.73	1.026	0.41
TPGW11-D	-115.93	-1.05	1.027	2.05	-1.58	1.027	1.51
TPGW12-S	-22.08	-0.40	1.016	-0.05	-1.03	1.017	-0.67
TPGW12-M	-57.07	-0.17	1.030	1.54	-0.87	1.030	0.81
TPGW12-D	-91.04	-0.11	1.029	2.53	-0.80	1.030	1.91
TPGW13-S	-29.61	0.61	1.042	1.88	-0.29	1.042	0.94
TPGW13-M	-56.57	0.36	1.001*	NC	-0.31	1.008*	NC
TPGW13-D	-84.72	-0.04	1.041*	NC	-0.66	1.041	2.79

Key:
* - Density value suspect.
ft NAVD88 - Feet relative to the North American Vertical Datum of 1988.
g/cm^3 - Grams per cubic centimeter.
NC – Not calculated.
ND = No data.

Table 2-9. Parameters Collected at 15-Minute Intervals Reported by the Meteorological Station

Parameter	Units	Accuracy	Resolution
Rainfall –amount	Inches	Better than 5%, weather dependent	0.001
Relative humidity	%	± 3	0.1
Temperature	°Celcius	± 0.3	± 0.1
Barometric pressure	mmHg	0.5	0.5
Wind speed- average	mph	1 ft/sec	0.3 ft/sec
Wind speed- gusts and lull	mph	1 ft/sec	0.3 ft/sec
Wind direction	degrees	± 3	1
Light level	µmol m^{-2} s^{-1}	5-10 µA/100 µmol m^{-2} s^{-1}	NA
Hail	Hits	1	1

Key:
ft/sec – Feet per second.
mmHg - Millimeters of mercury.
mph – Miles per hour.
NA – Not applicable.
µmol m^{-2} s^{-1} - Micromoles of quanta per second per square meter.
µmol - Micromoles per liter.

Table 2-10. Rainfall Events Where More Than 0.25 Inches Was Recorded at the Meteorological Station

Rain Dates	Amount of Rainfall (in)
8/8/2010	0.98
8/9/2010	3.07
8/10/2010	1.22
8/23/2010	0.37
8/27/2010	0.27
8/28/2010	0.29
8/30/2010	1.46
9/29/2010	4.82
10/12/2010	0.57
10/23/2010	0.30
10/29/2010	0.90
11/3/2010	4.35
11/4/2010	0.87

Note:
No data between 9/20/2010 and 9/29/2010.

FIGURES

Figure 2-1. Automated Groundwater Station.

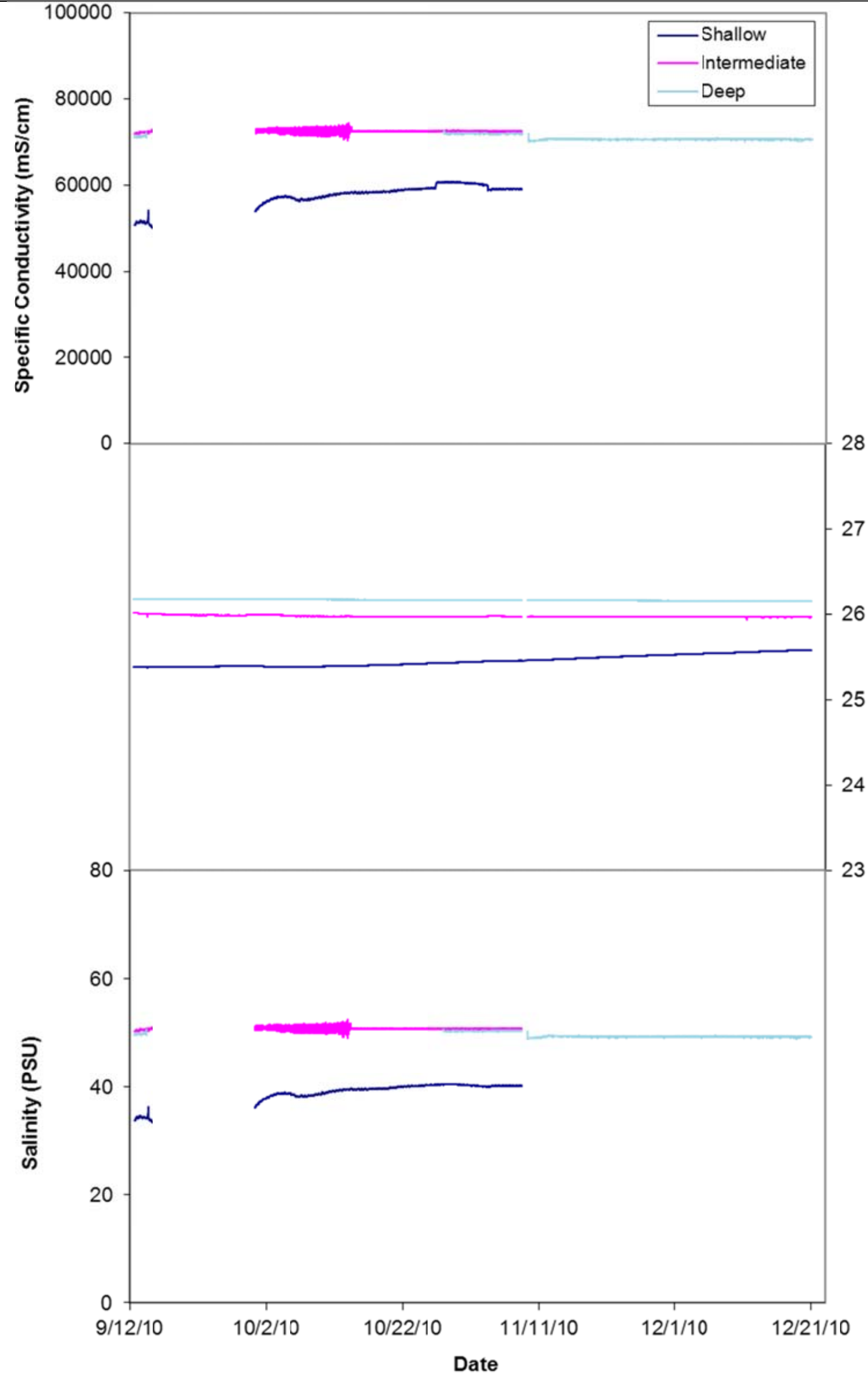


Figure 2-2. TPGW-1 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

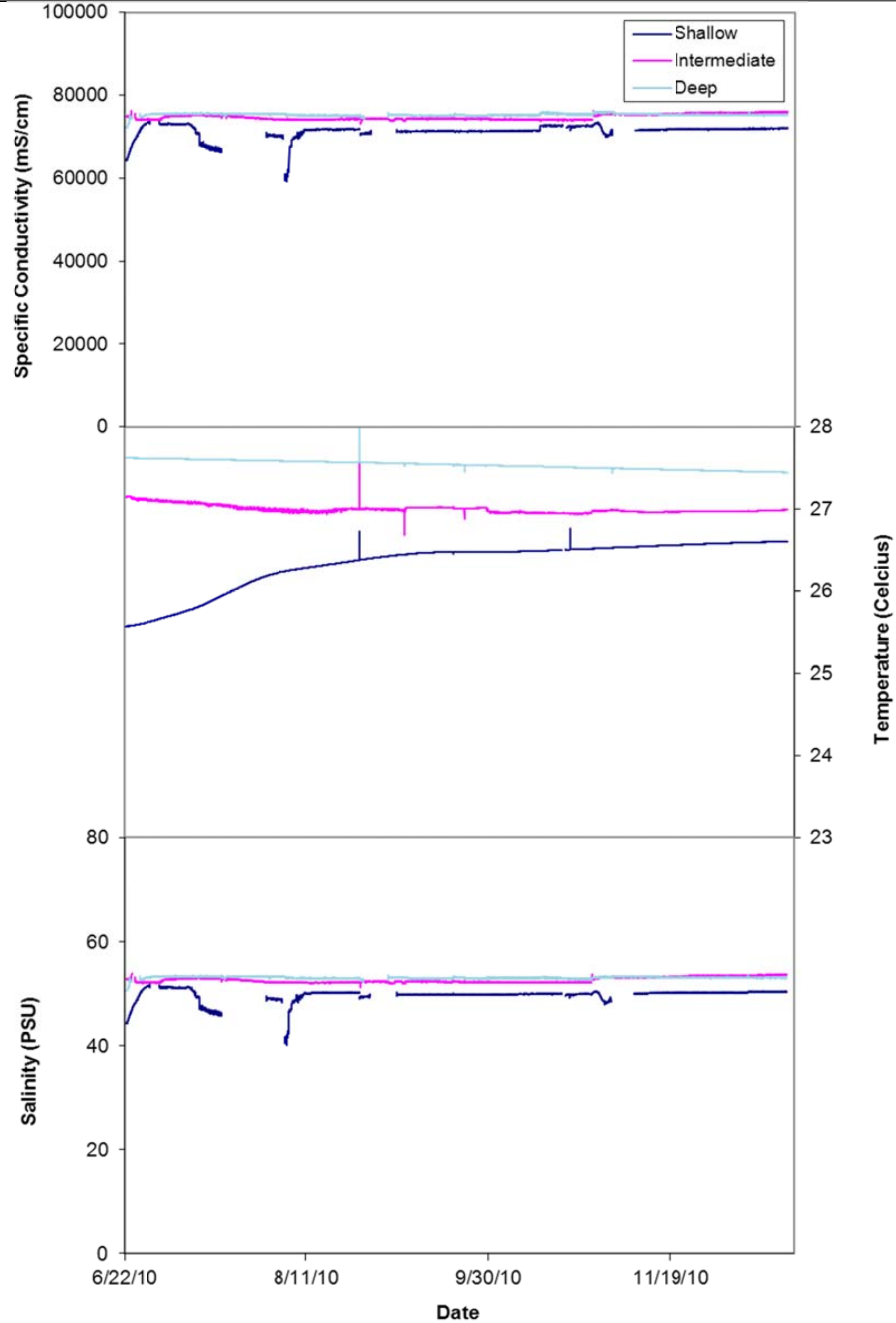


Figure 2-3. TPGW-2 Specific Conductance, Temperature and Salinity(Excludes Qualified Data).

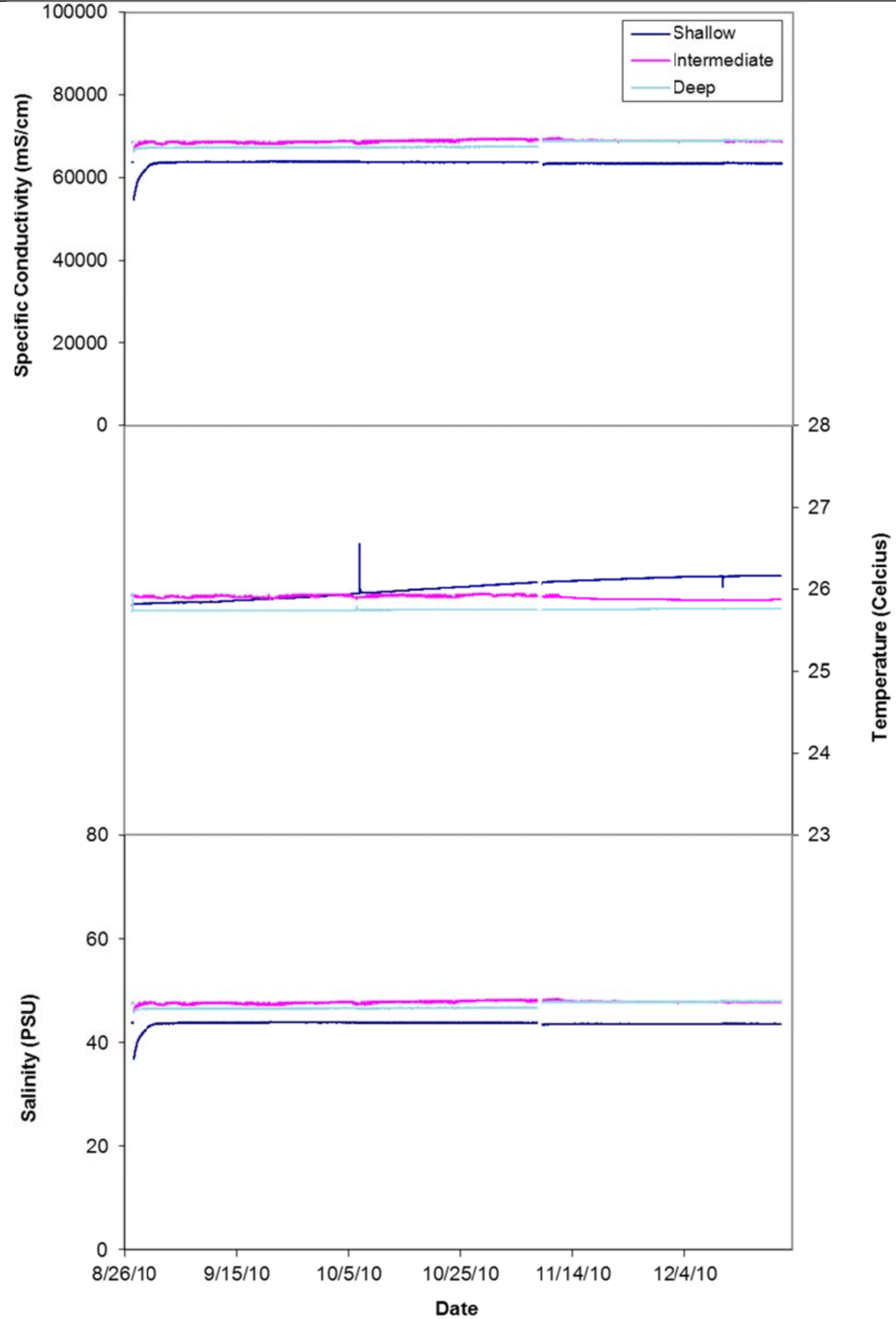


Figure 2-4. TPGW-3 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

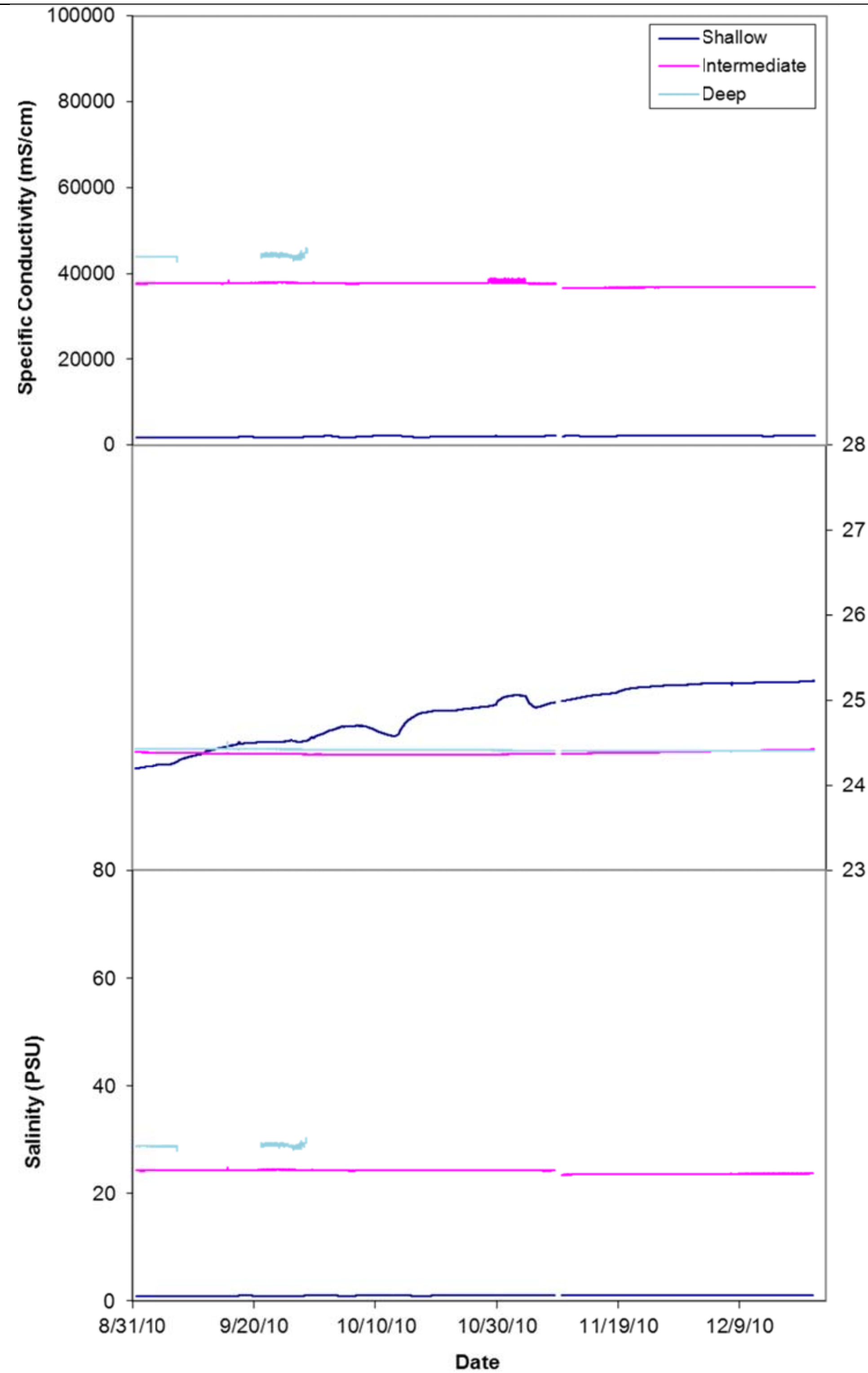


Figure 2-5. TPGW-4 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

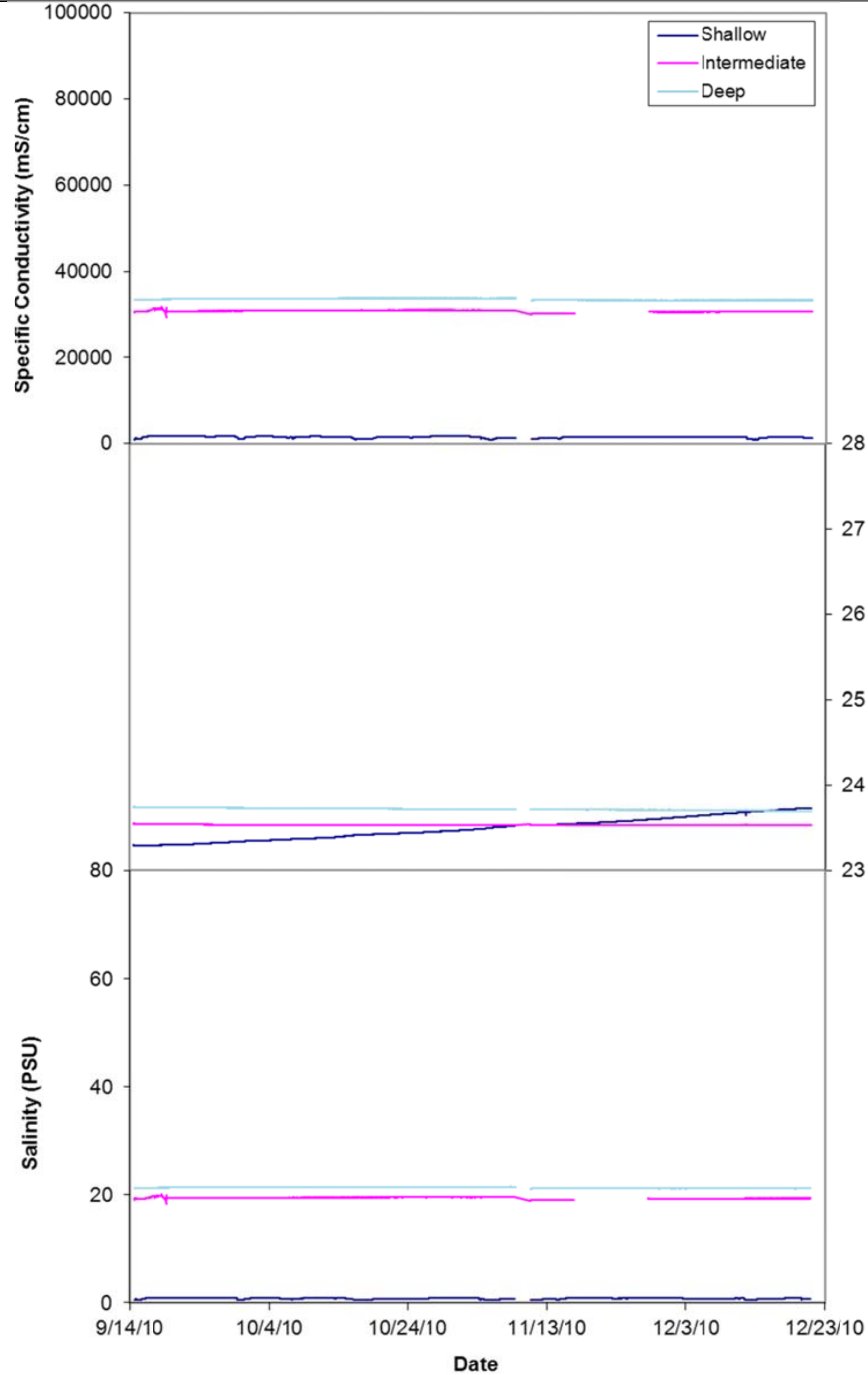


Figure 2-6. TPGW-5 Conductance, Temperature and Salinity (Excludes Qualified Data).

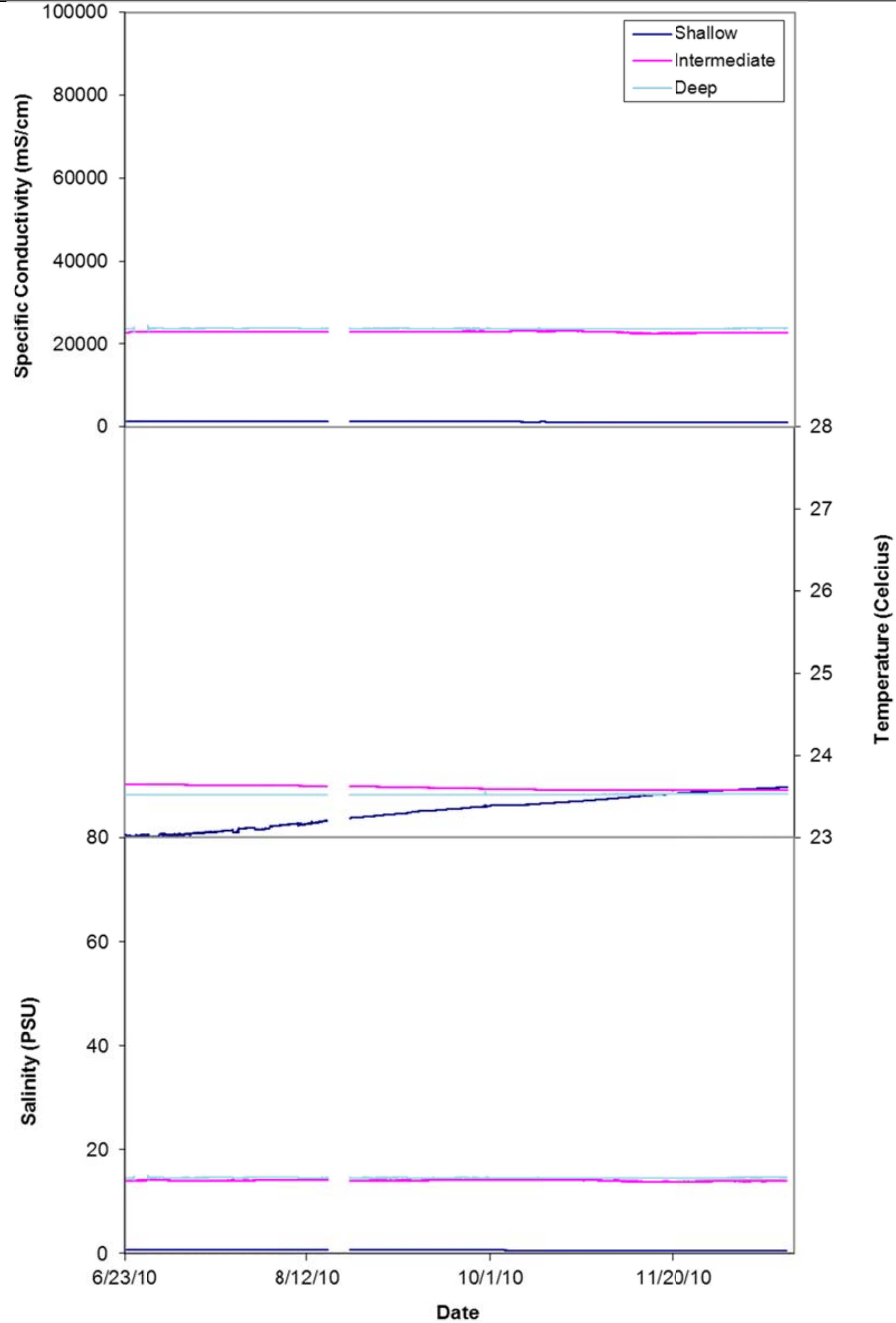


Figure 2-7. TPGW-6 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

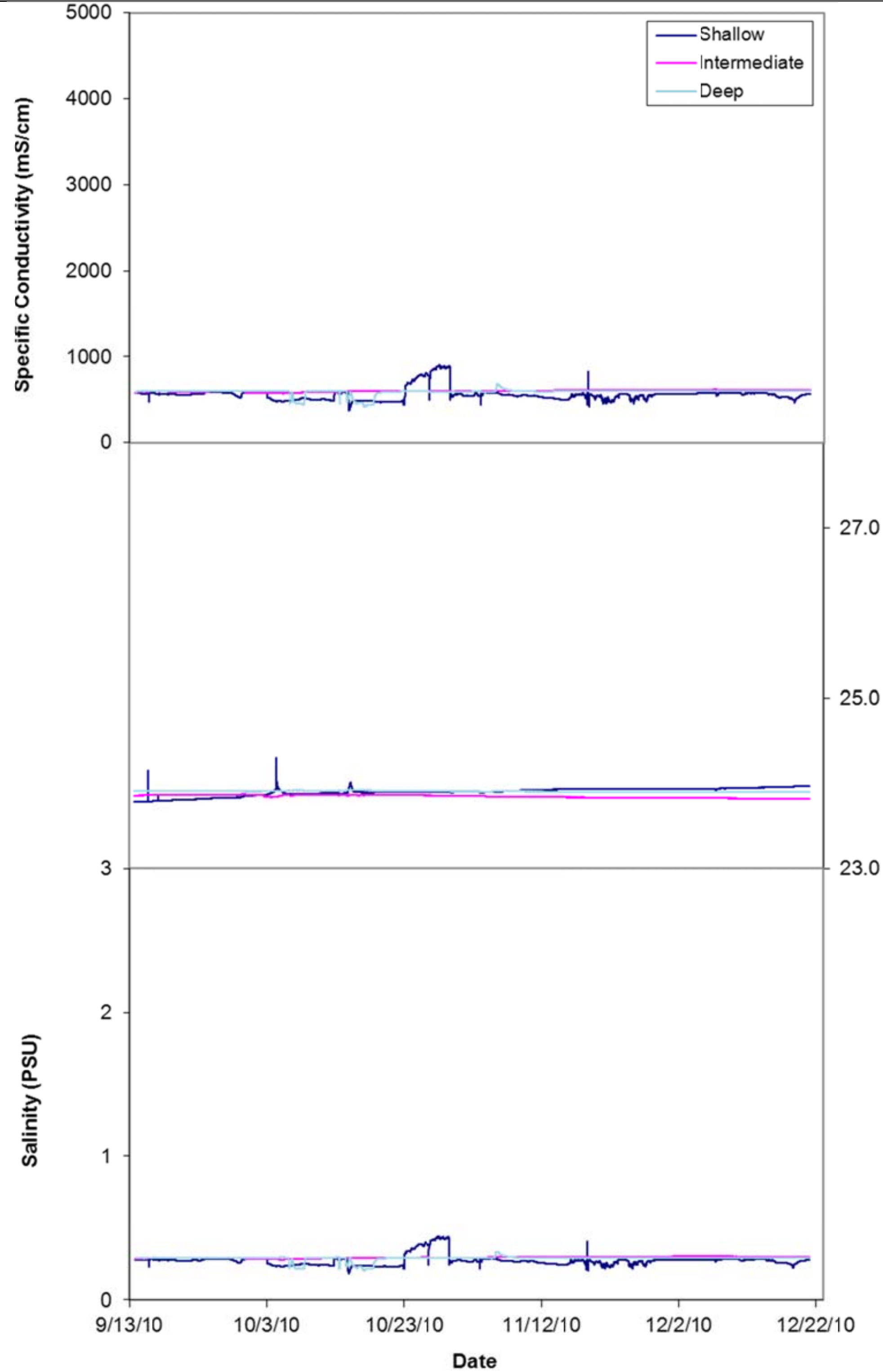


Figure 2-8. TPGW-7 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

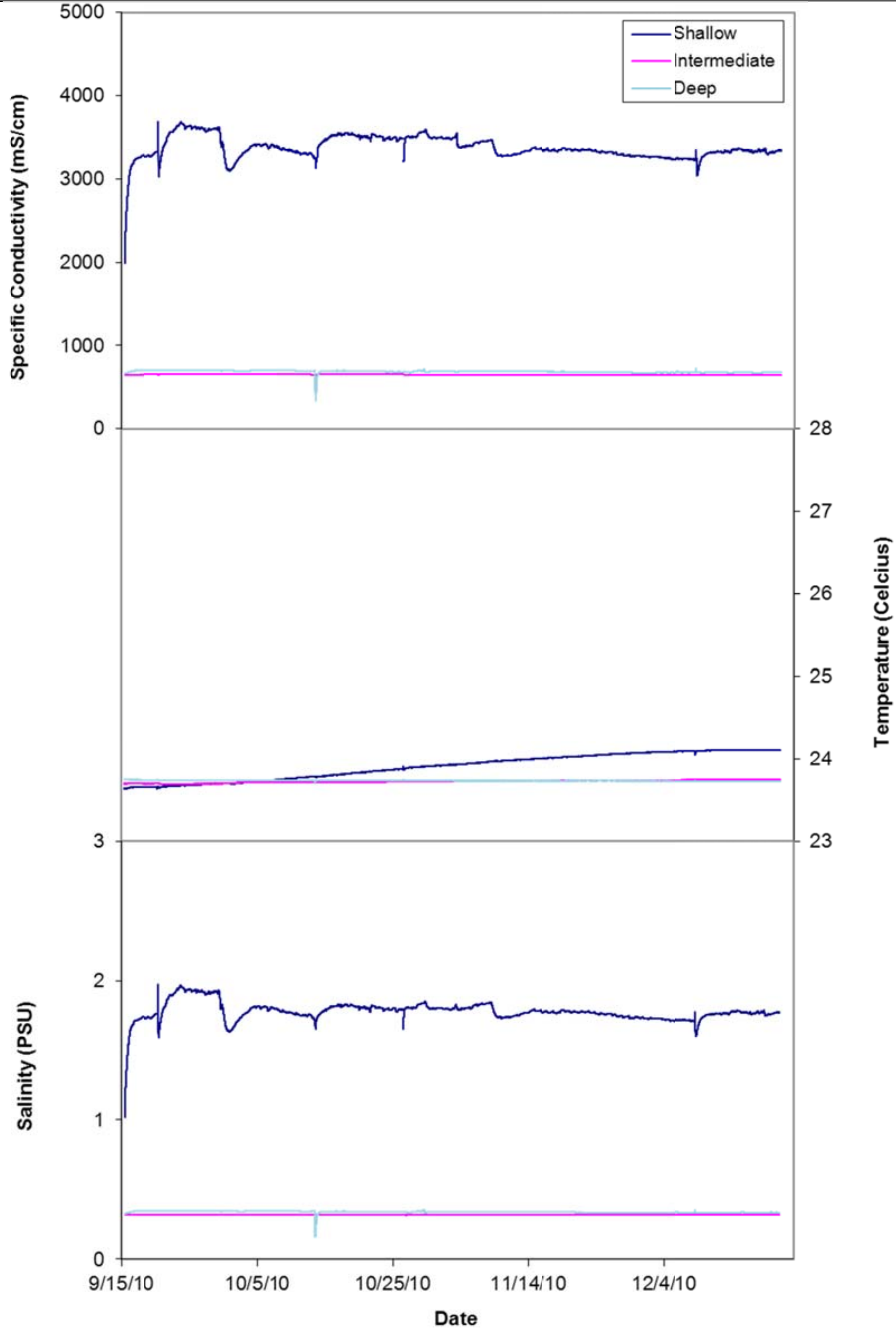


Figure 2-9. TPGW-8 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

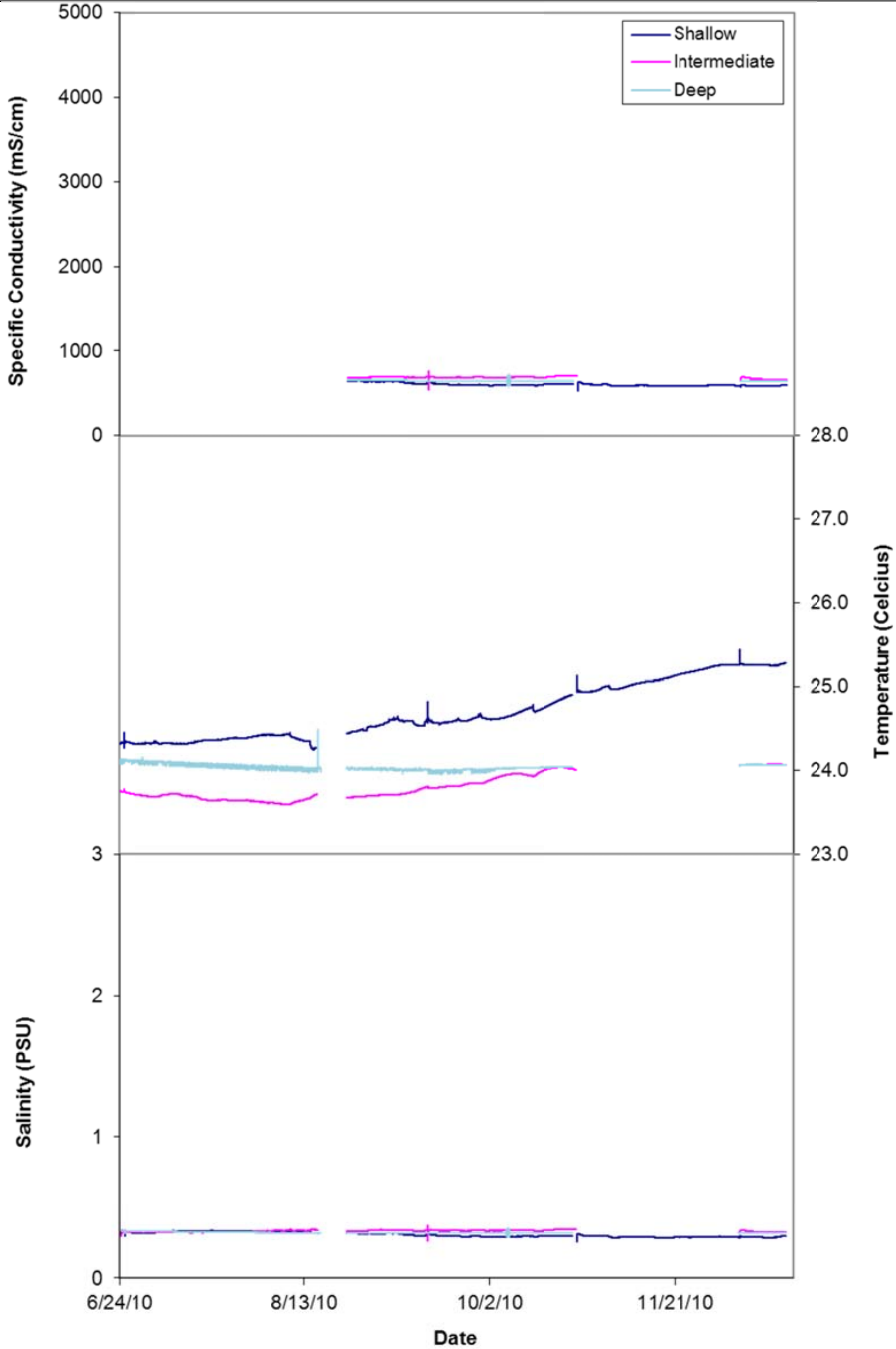


Figure 2-10. TPGW-9 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

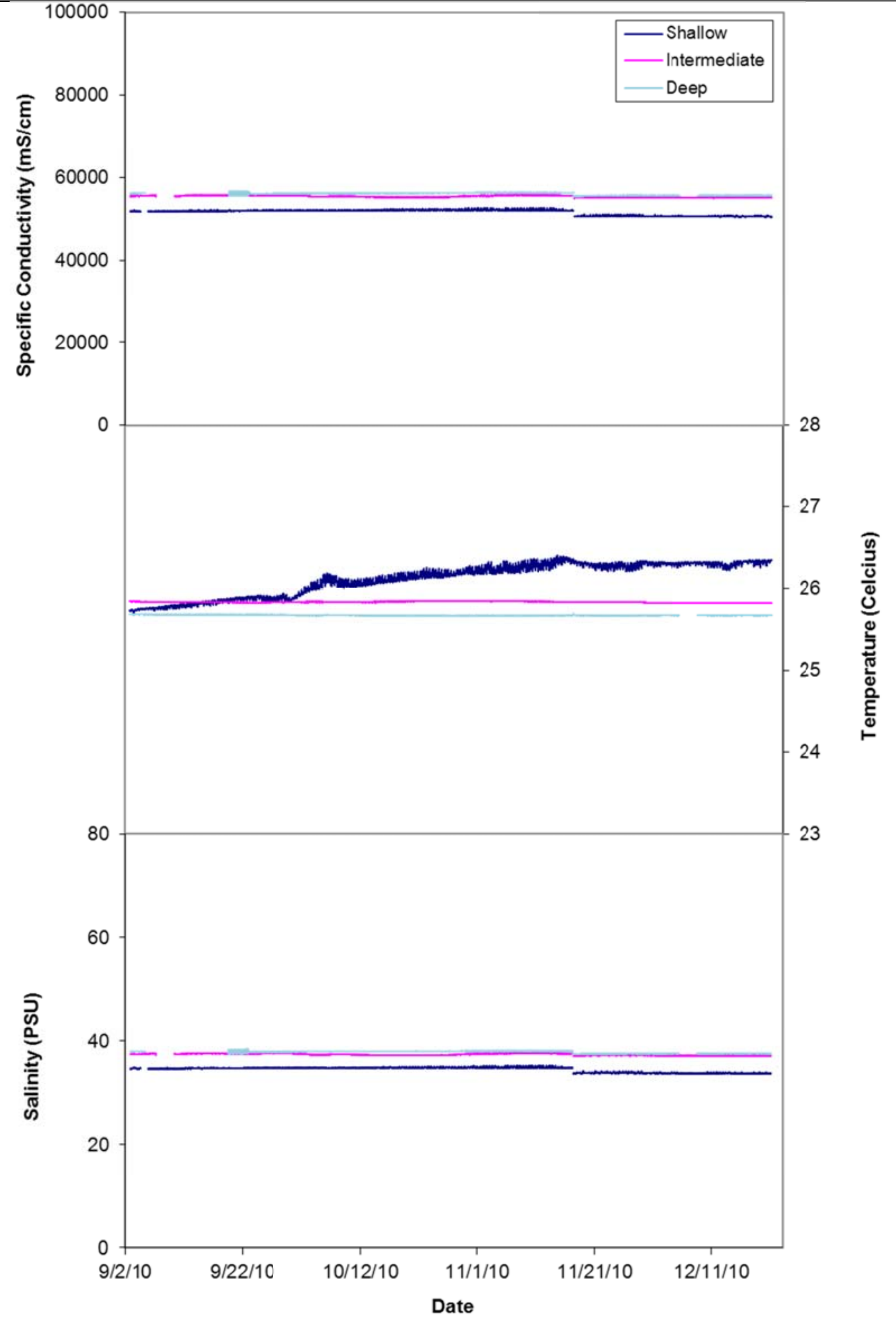


Figure 2-11. TPGW-10 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

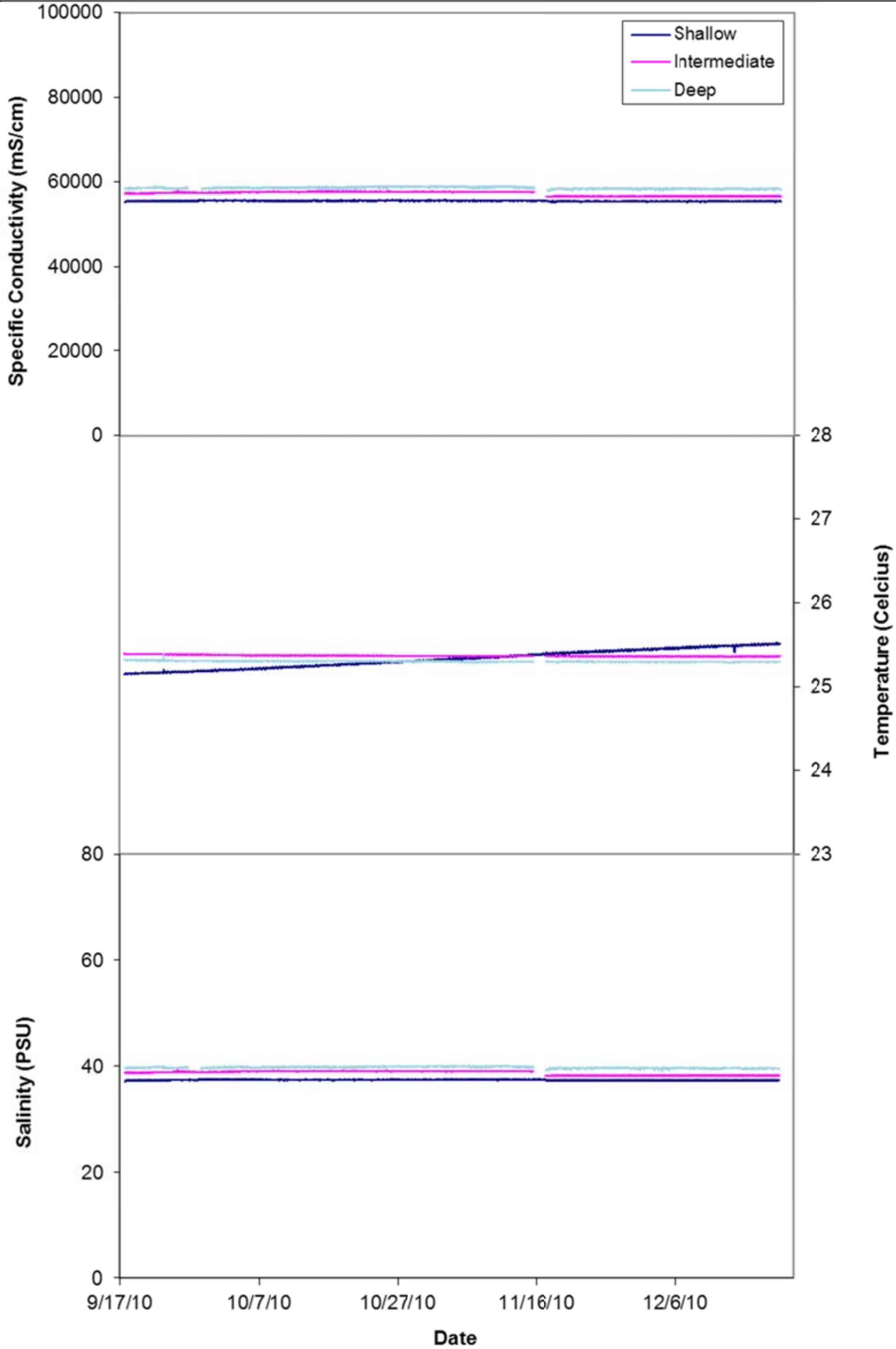


Figure 2-12. TPGW-11 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

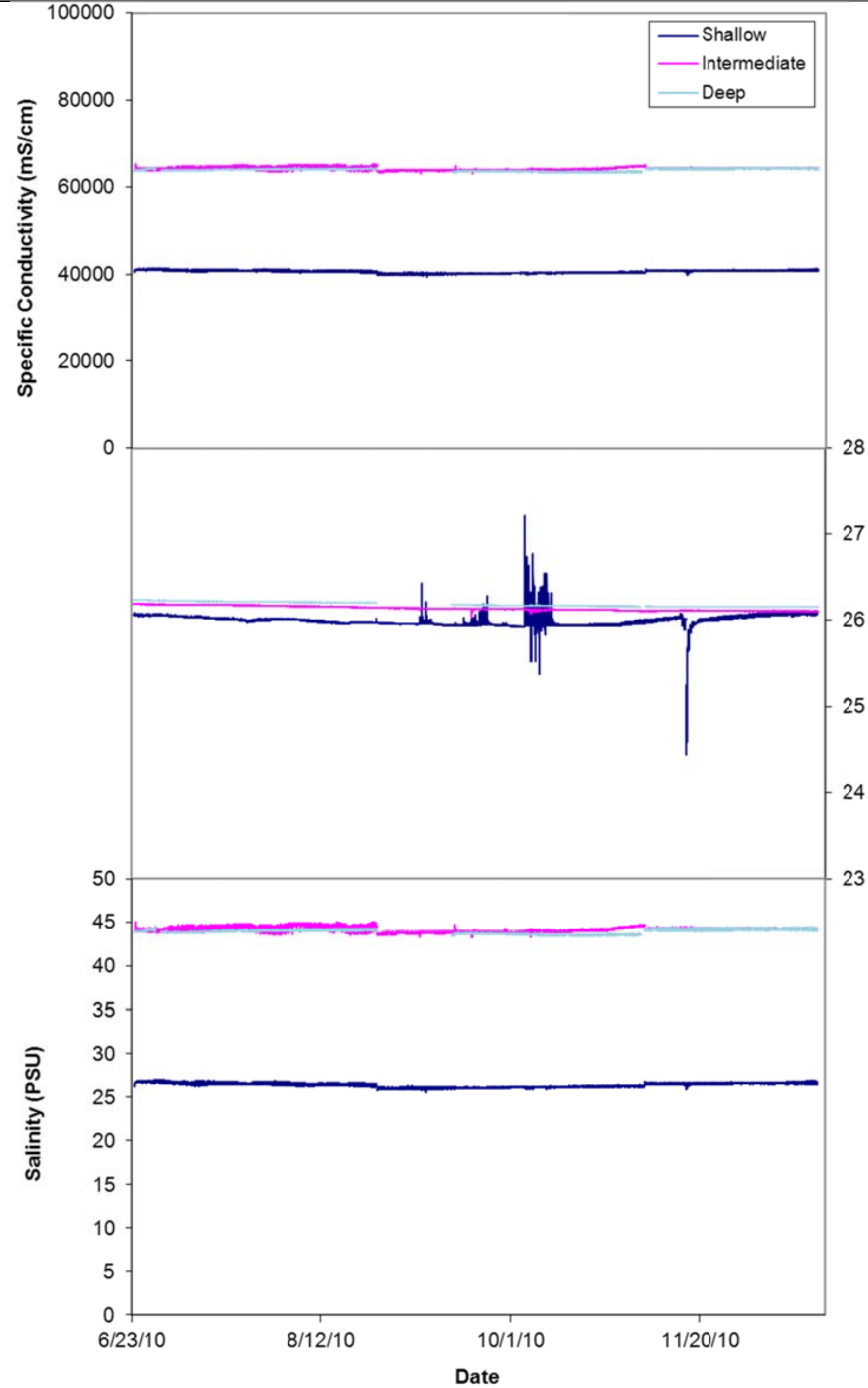


Figure 2-13. TPGW-12 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

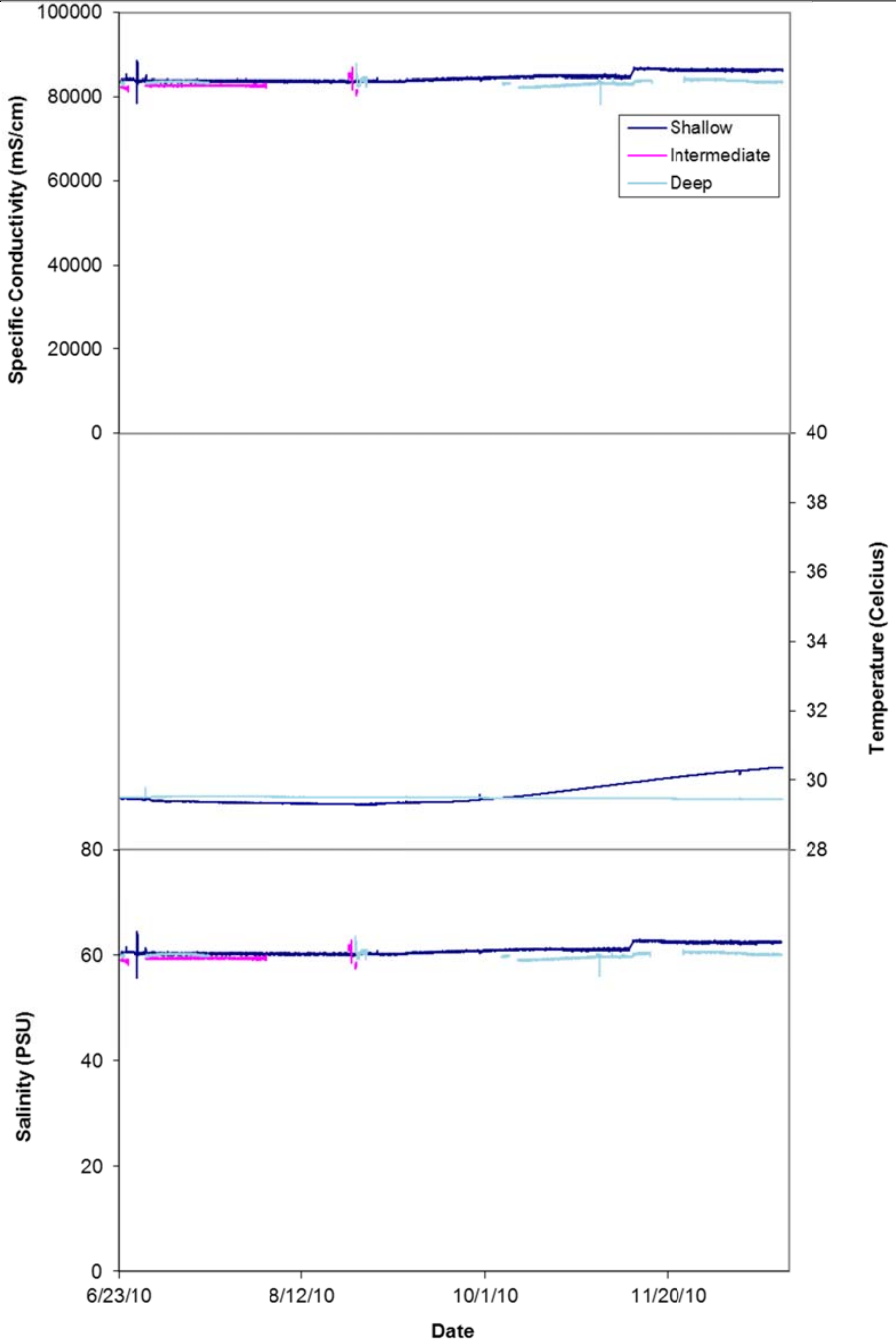


Figure 2-14. TPGW-13 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

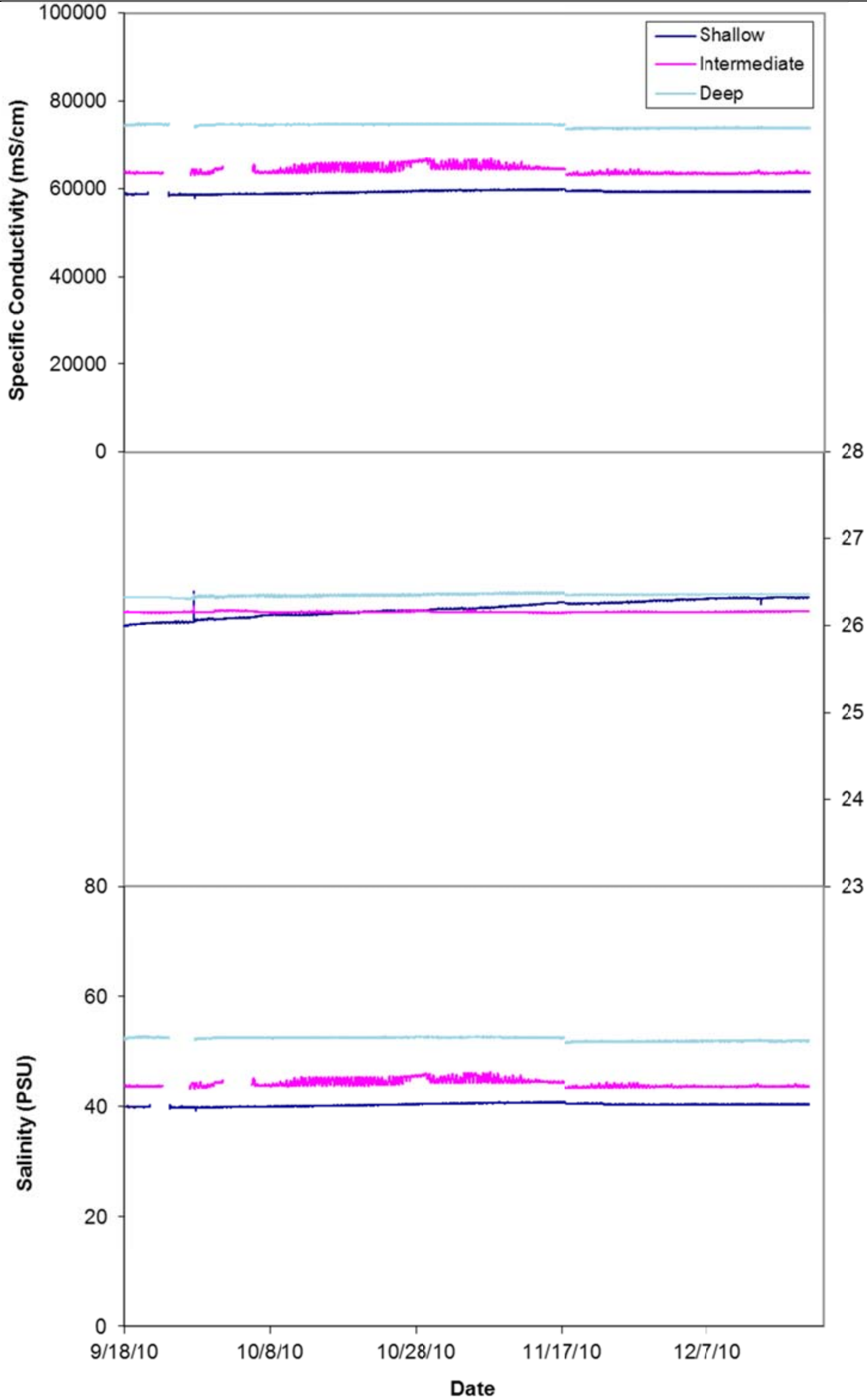


Figure 2-15. TPGW-14 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

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Figure 2-16. Preparing AquaTROLL® 100 for deployment in Biscayne Bay. The sensors within the probe are protected by a Copper Gard (shield of wound copper fitting over probe end).

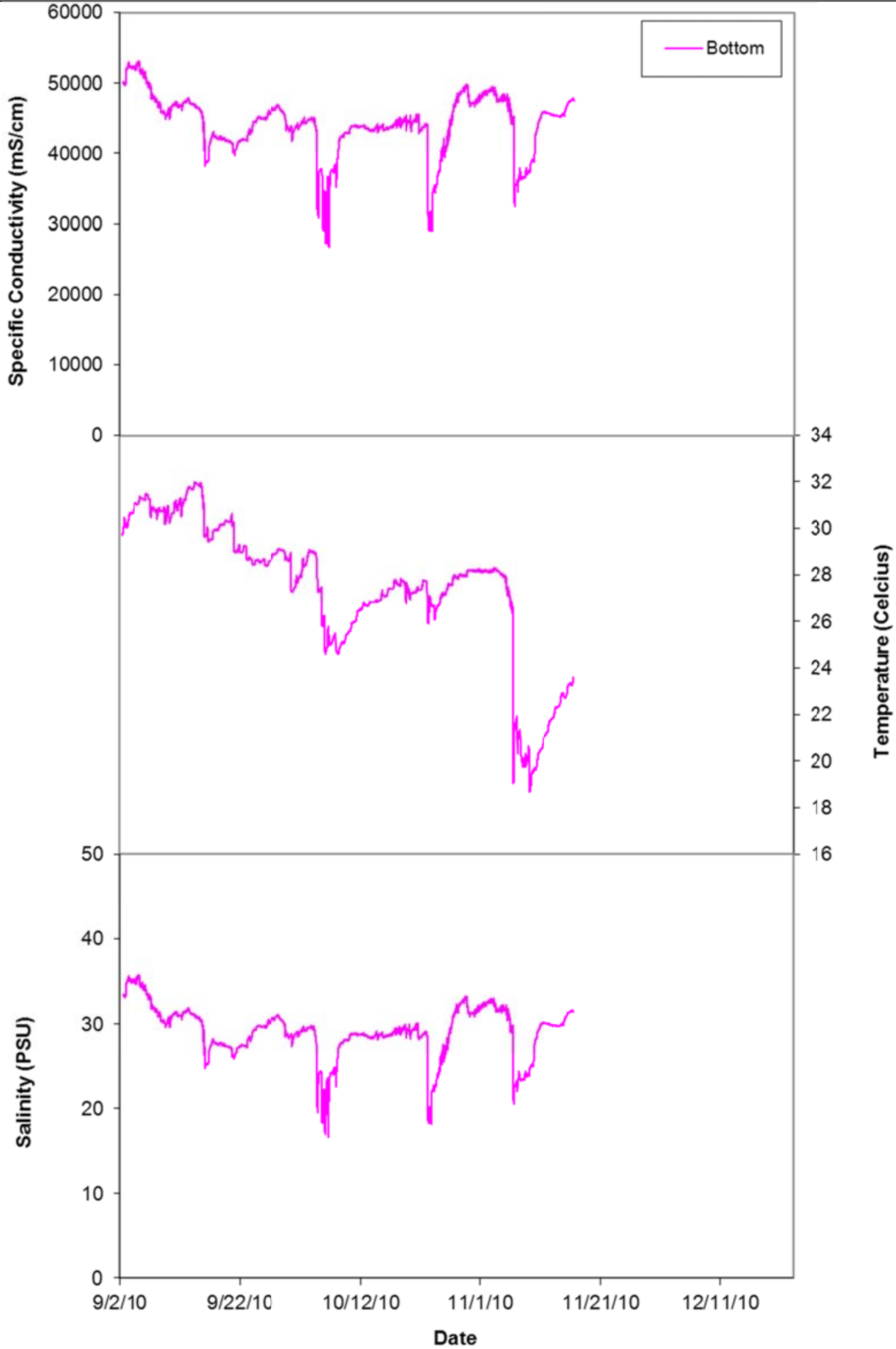


Figure 2-17. TPBBSW-1 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

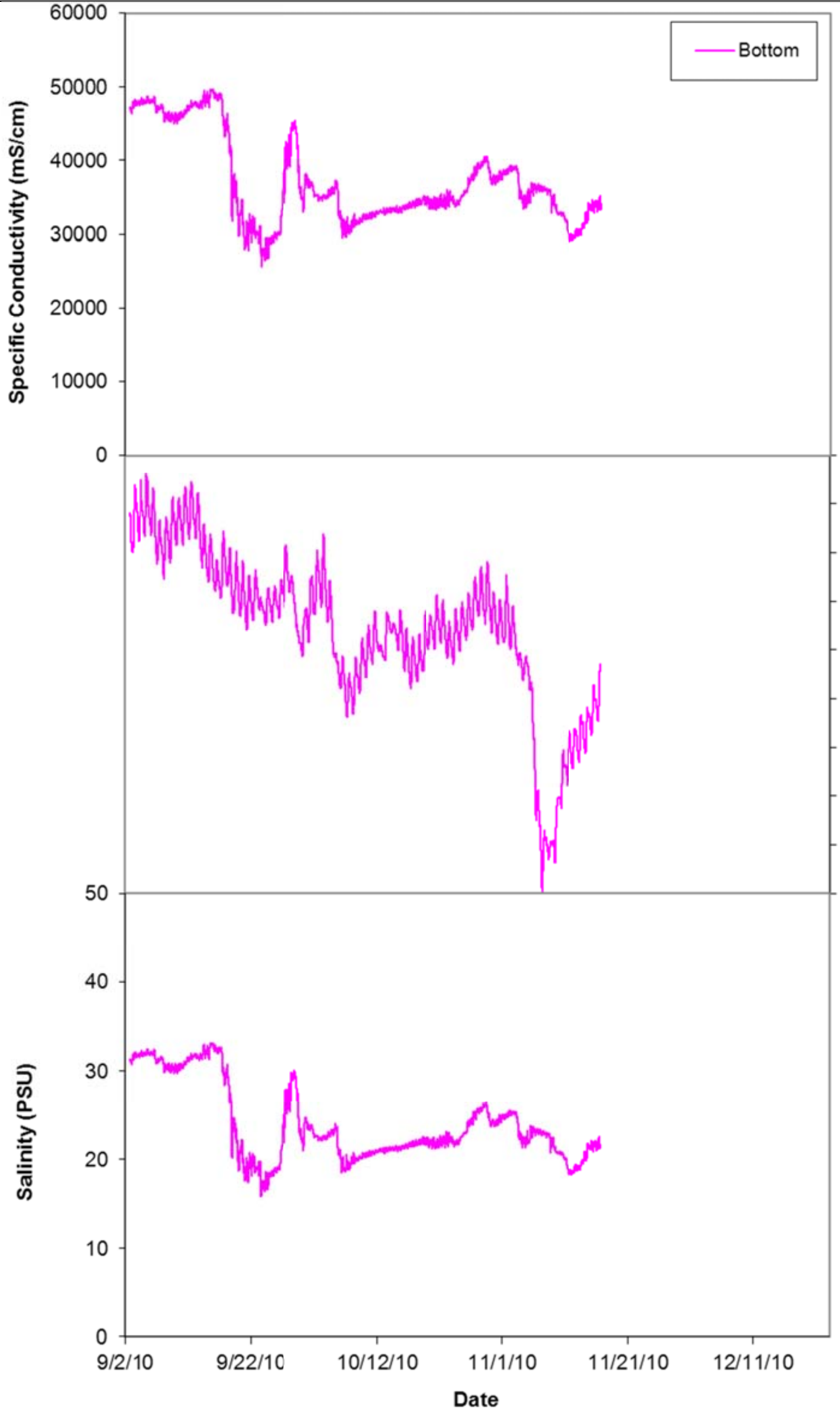


Figure 2-18. TPBBSW-2 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

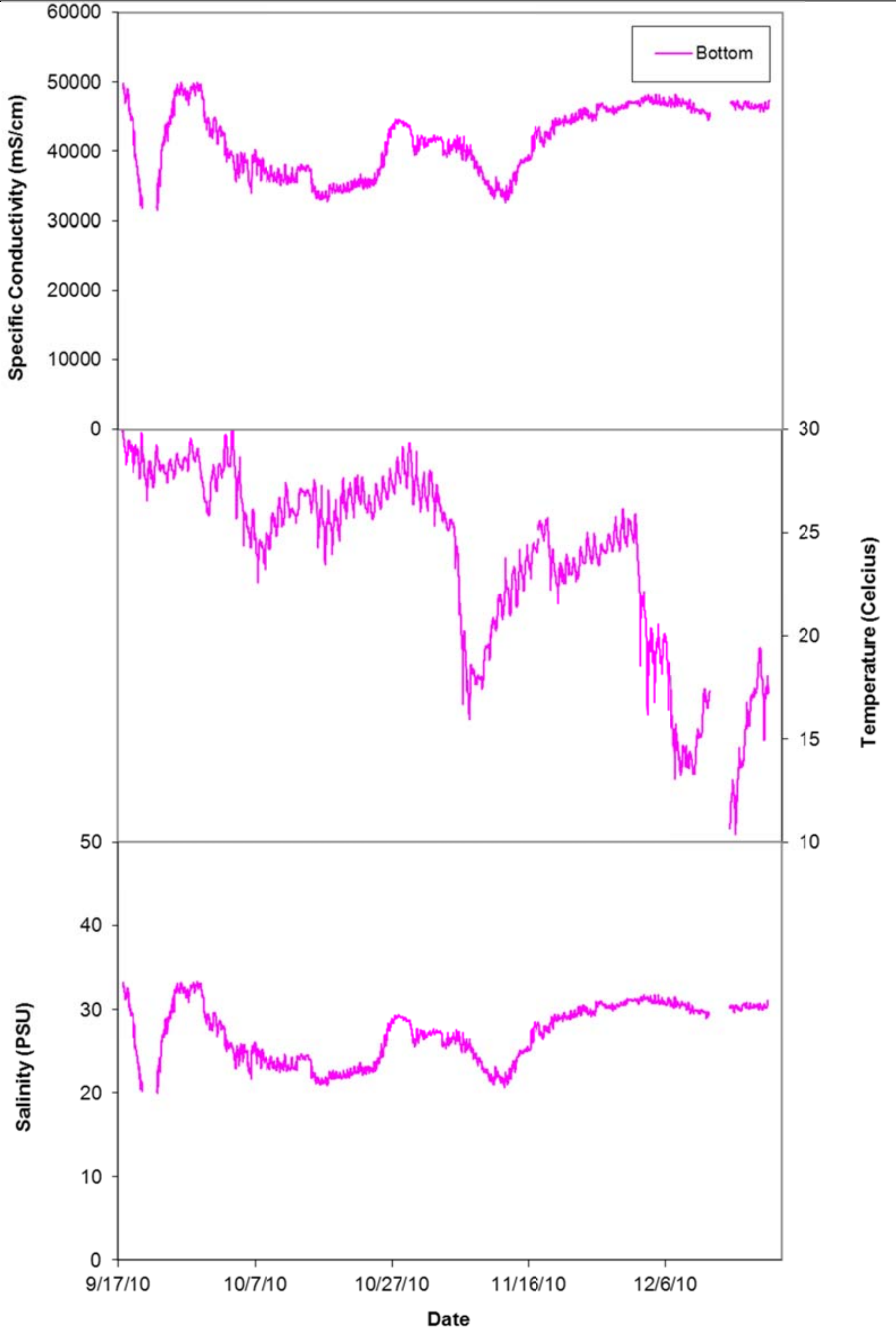


Figure 2-19. TPBBSW-3 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

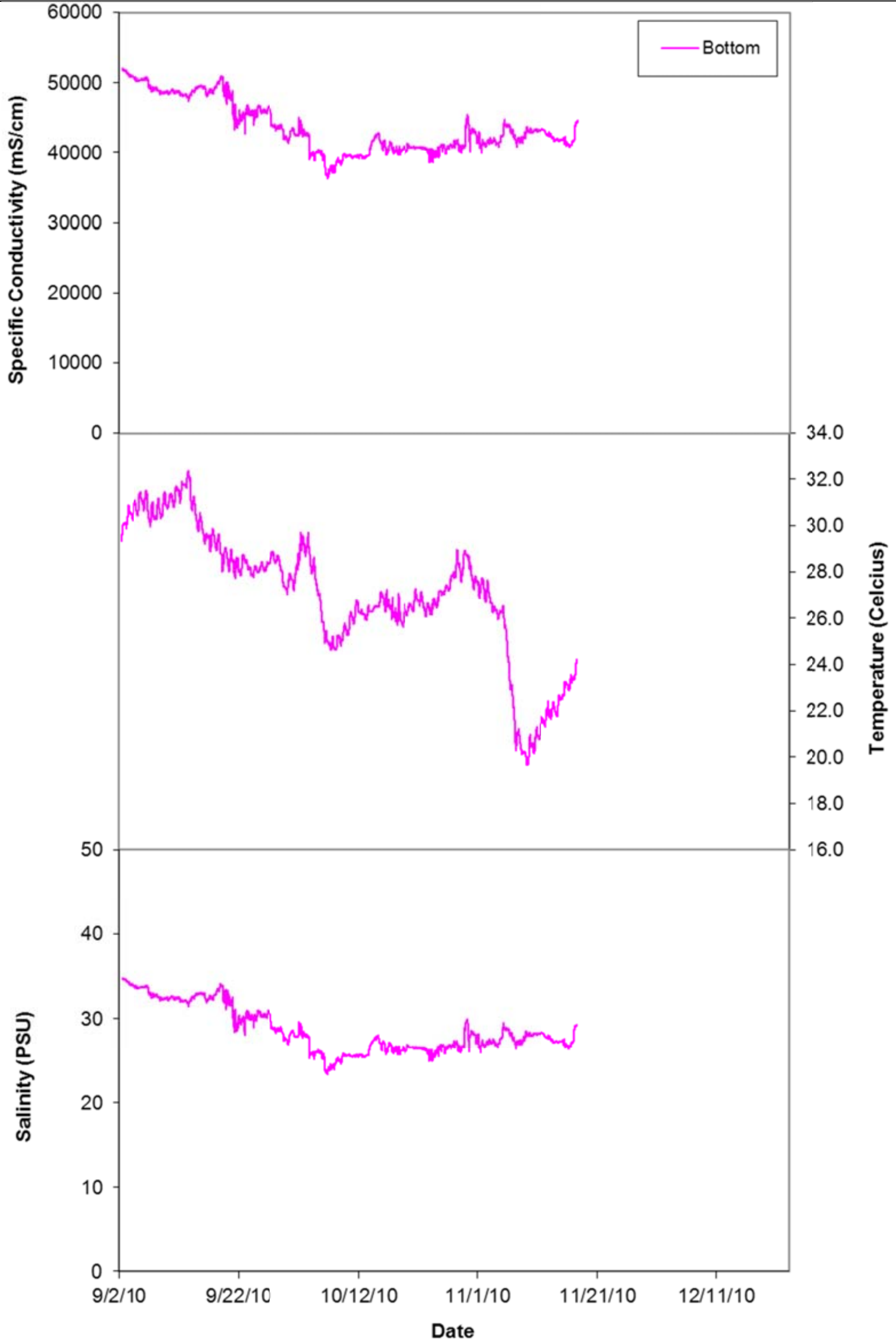


Figure 2-20. TPBBSW-4 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

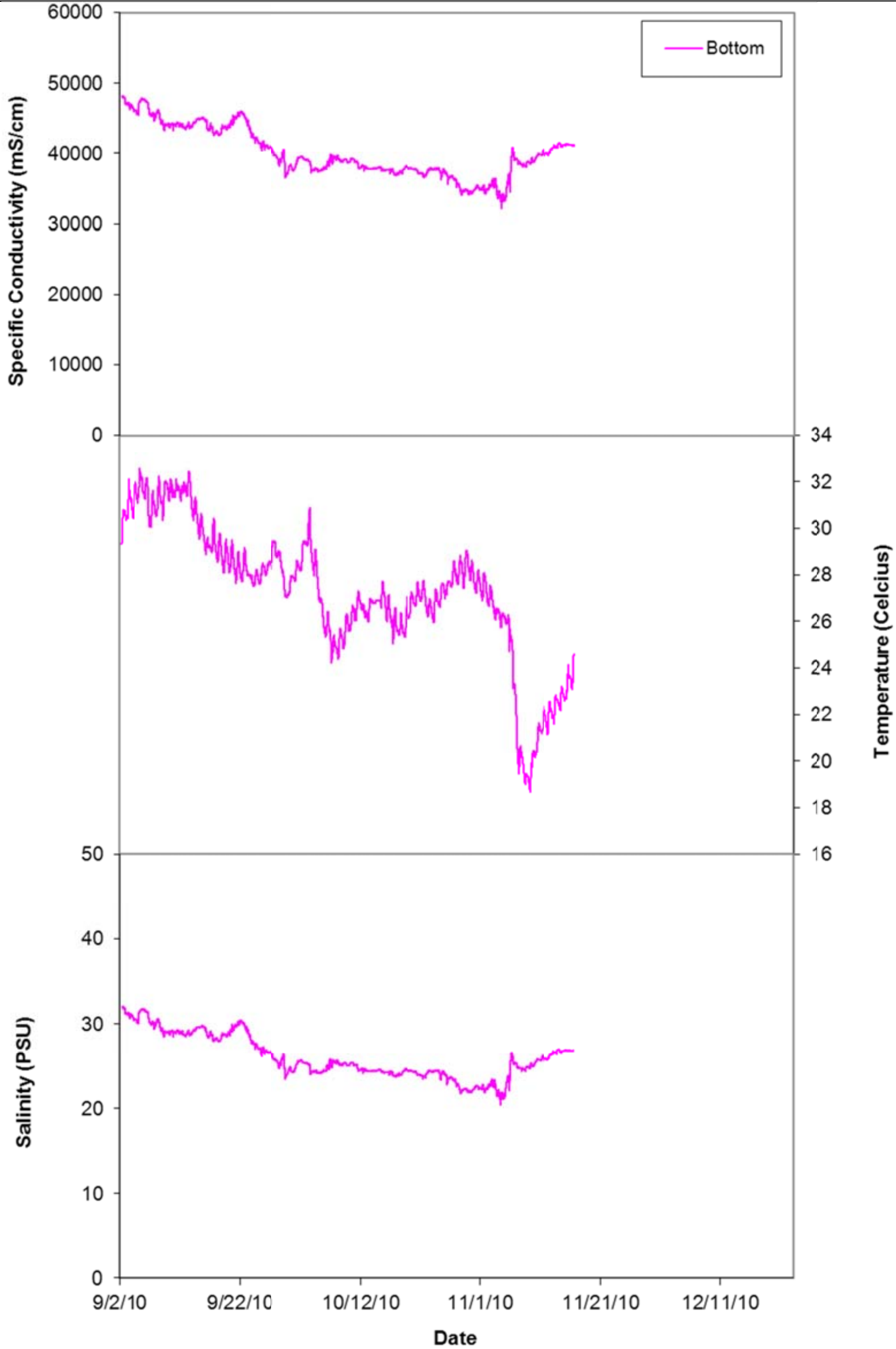


Figure 2-21. TPBBSW-5 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

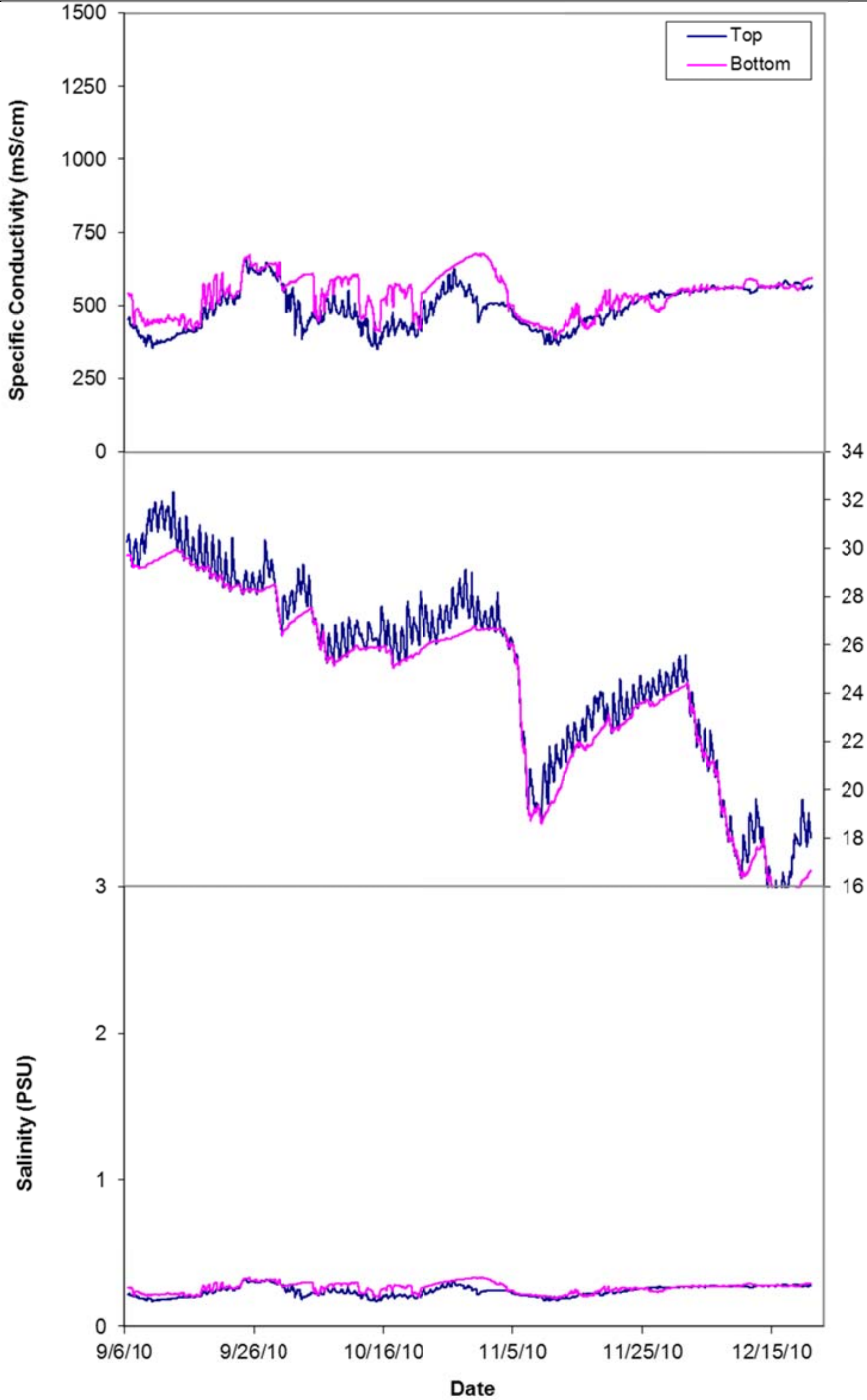


Figure 2-22. TPSWC-1 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

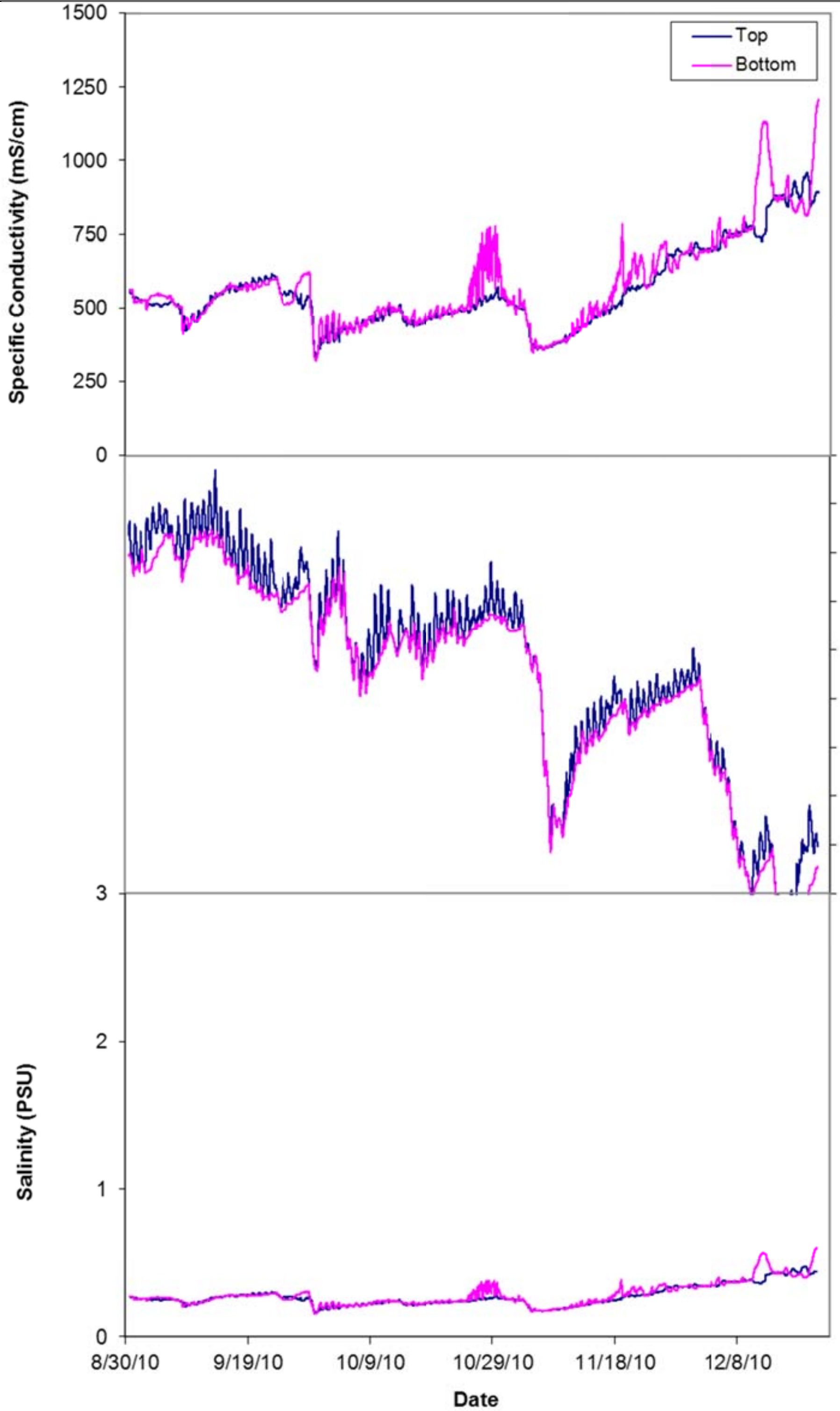


Figure 2-23. TPSWC-2 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

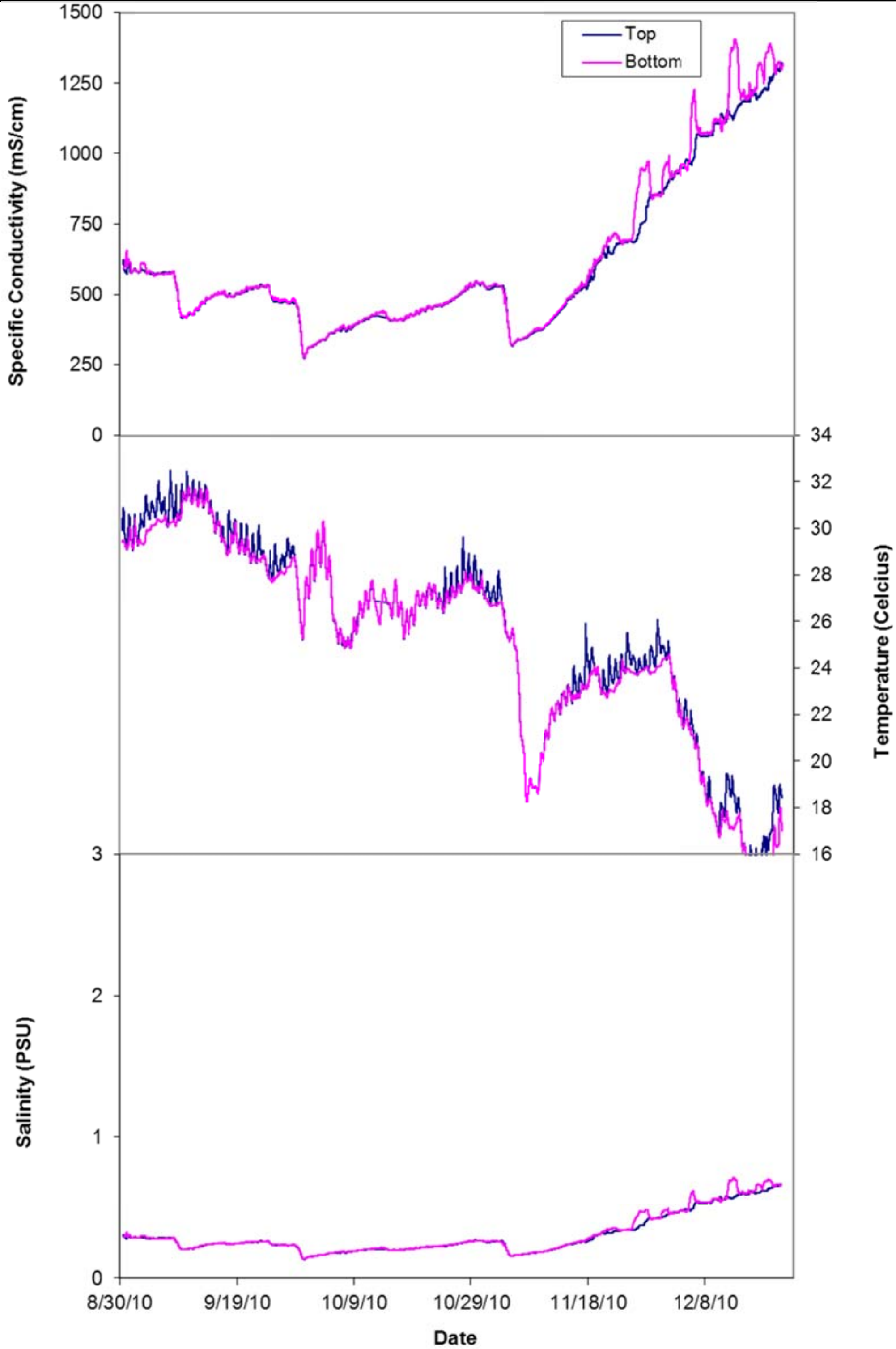


Figure 2-24. TPSWC-3 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

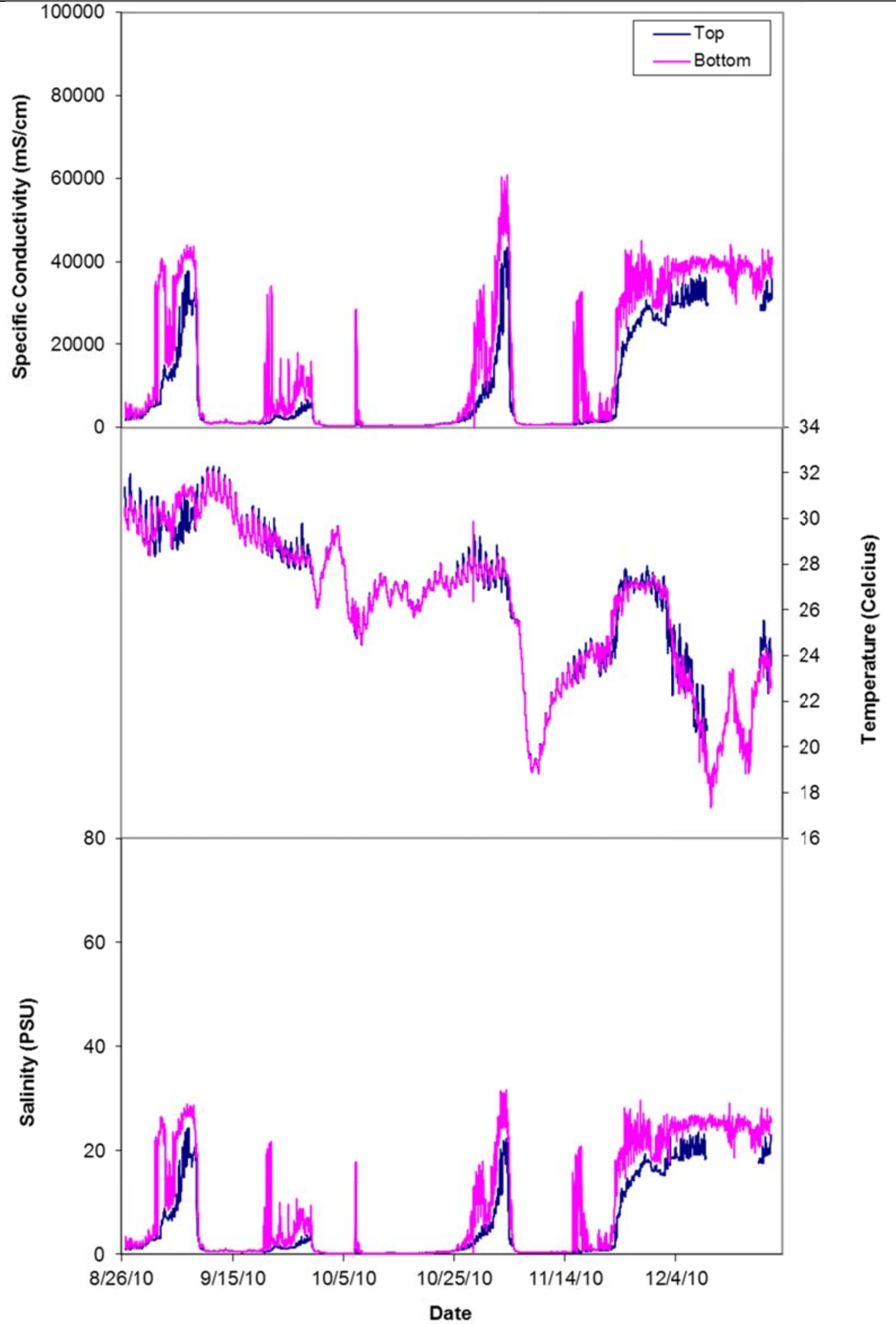


Figure 2-25. TPSWC-4 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

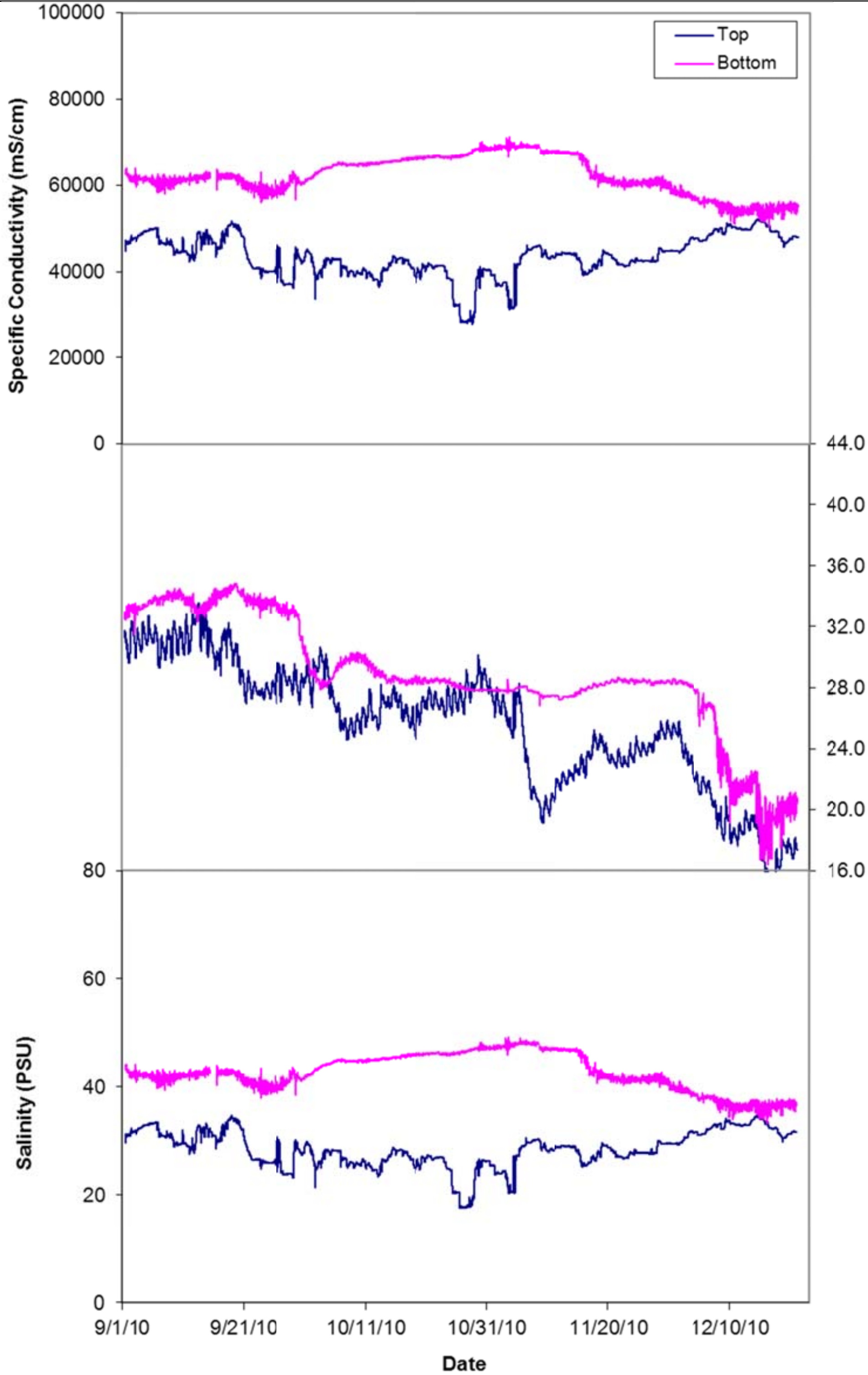


Figure 2-26. TPSWC-5 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

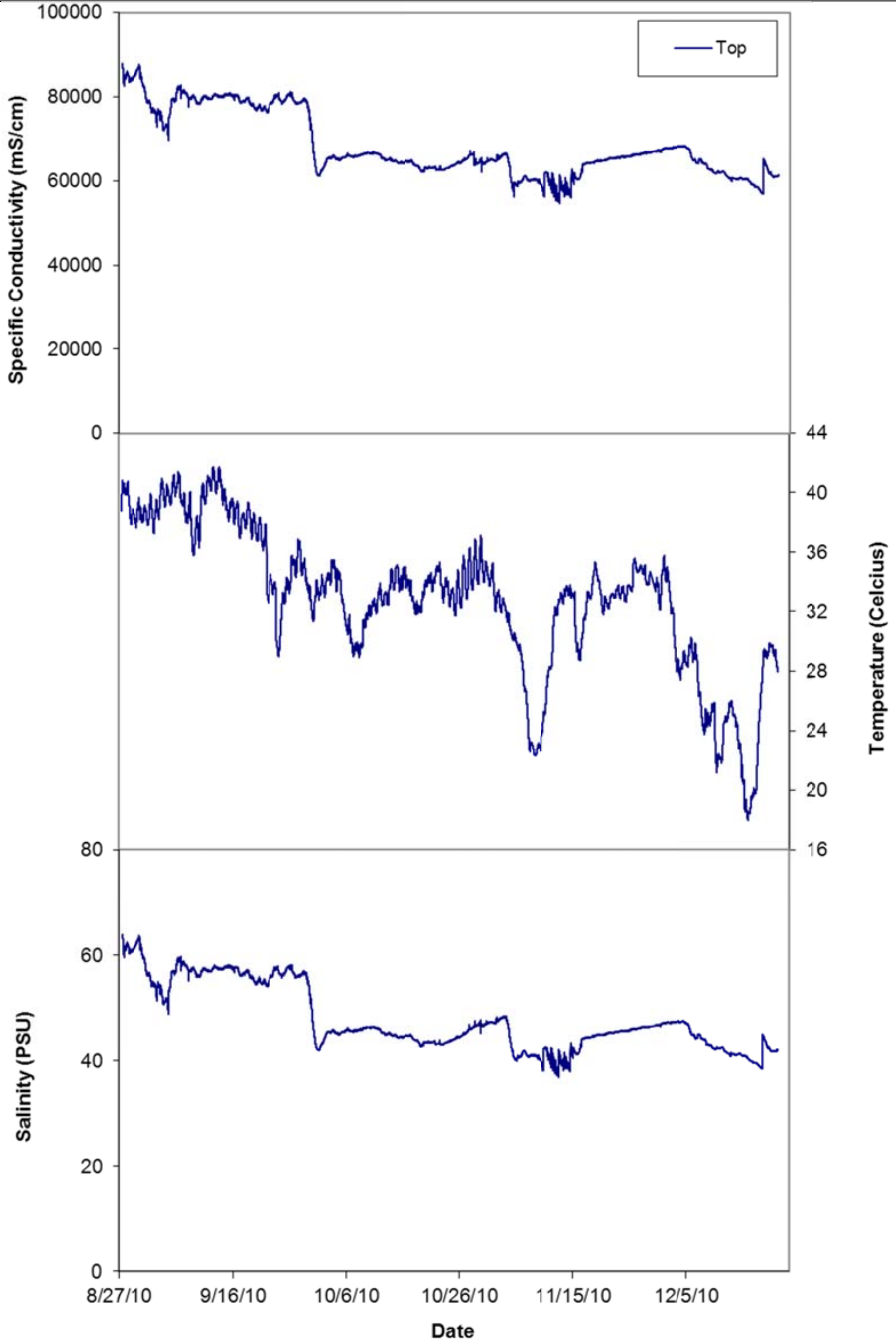


Figure 2-27. TPSWCCS-1 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

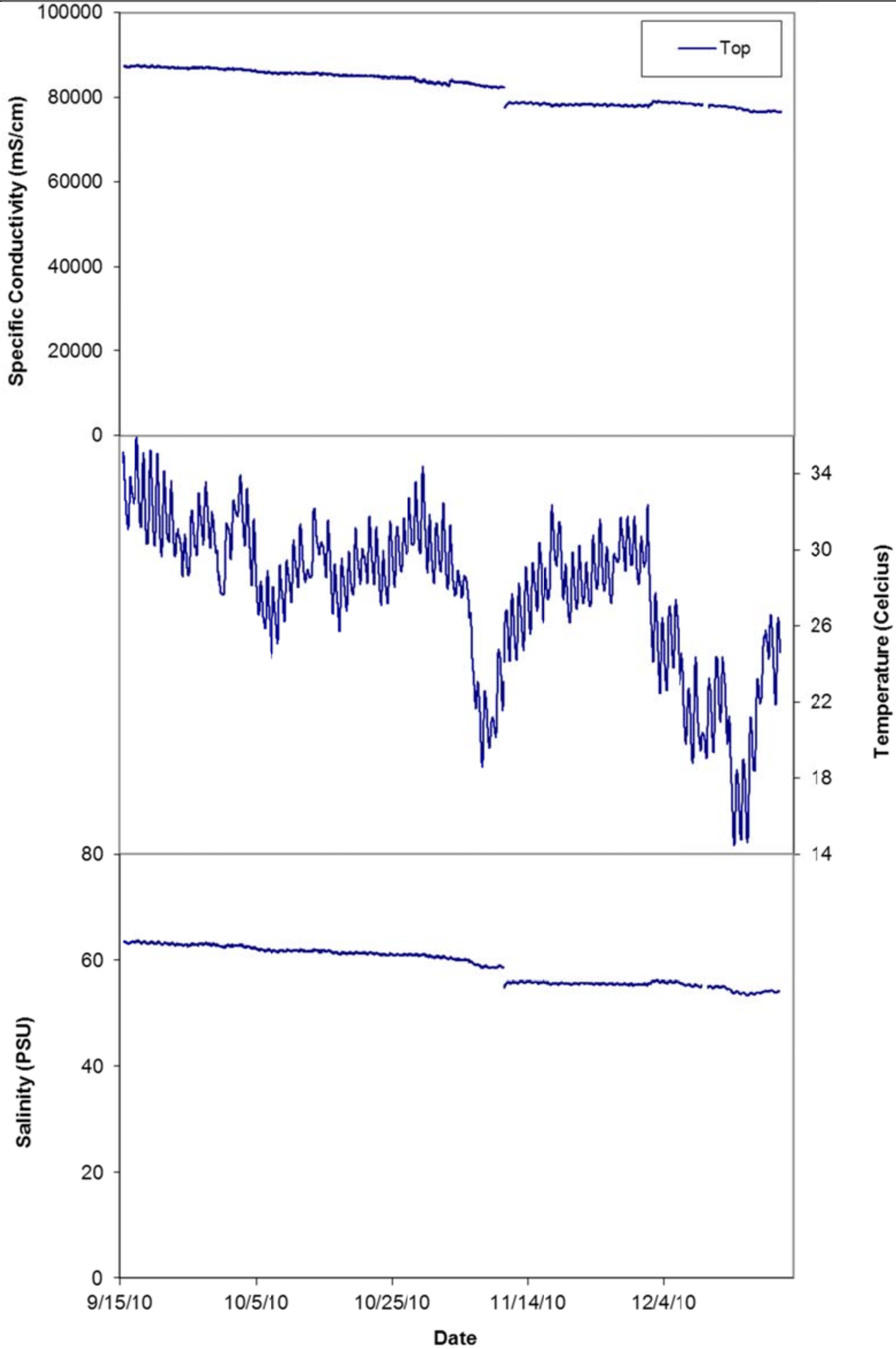


Figure 2-28. TPSWCCS-2 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

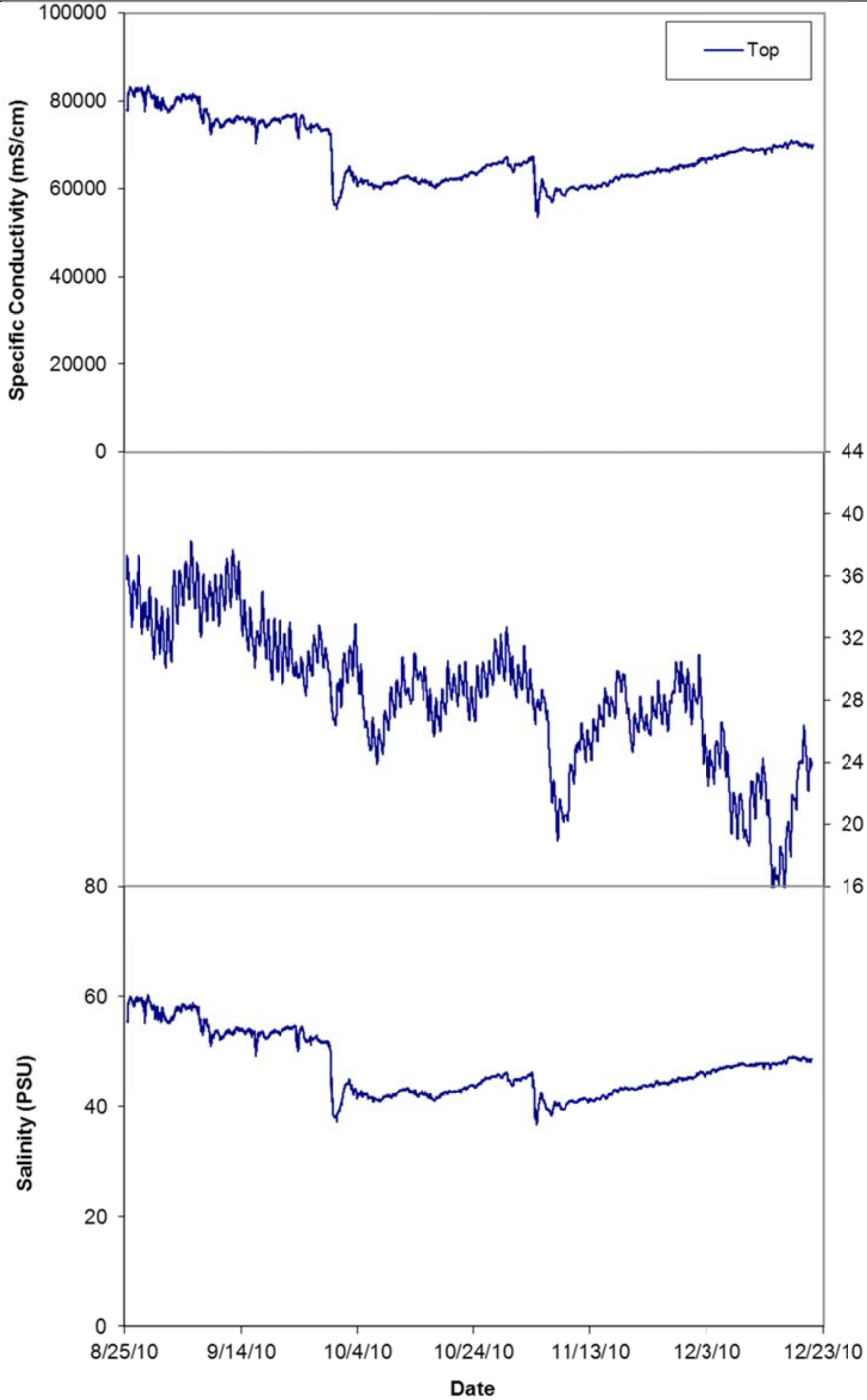


Figure 2-29. TPSWCCS-3 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

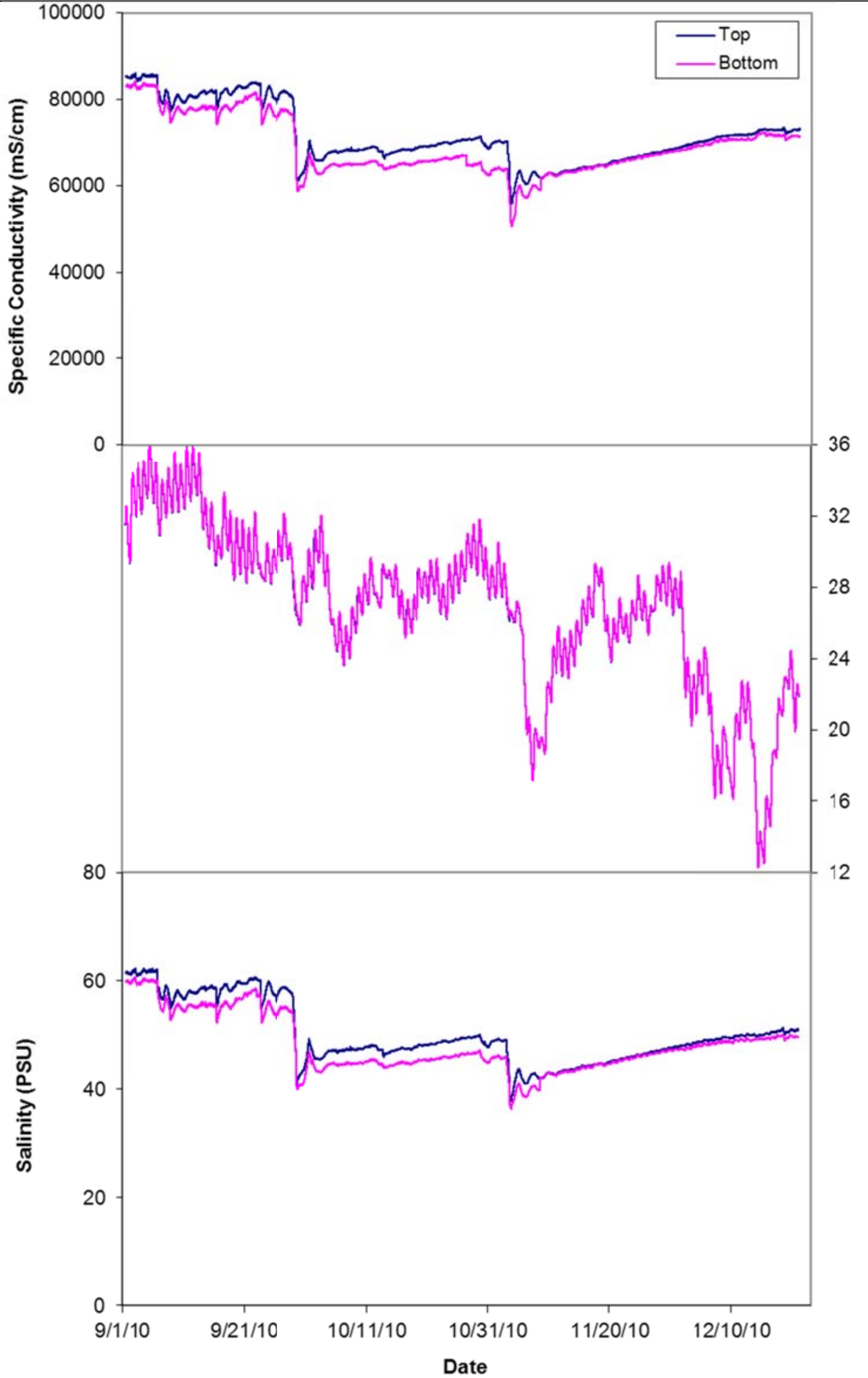


Figure 2-30. TPSWCCS-4 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

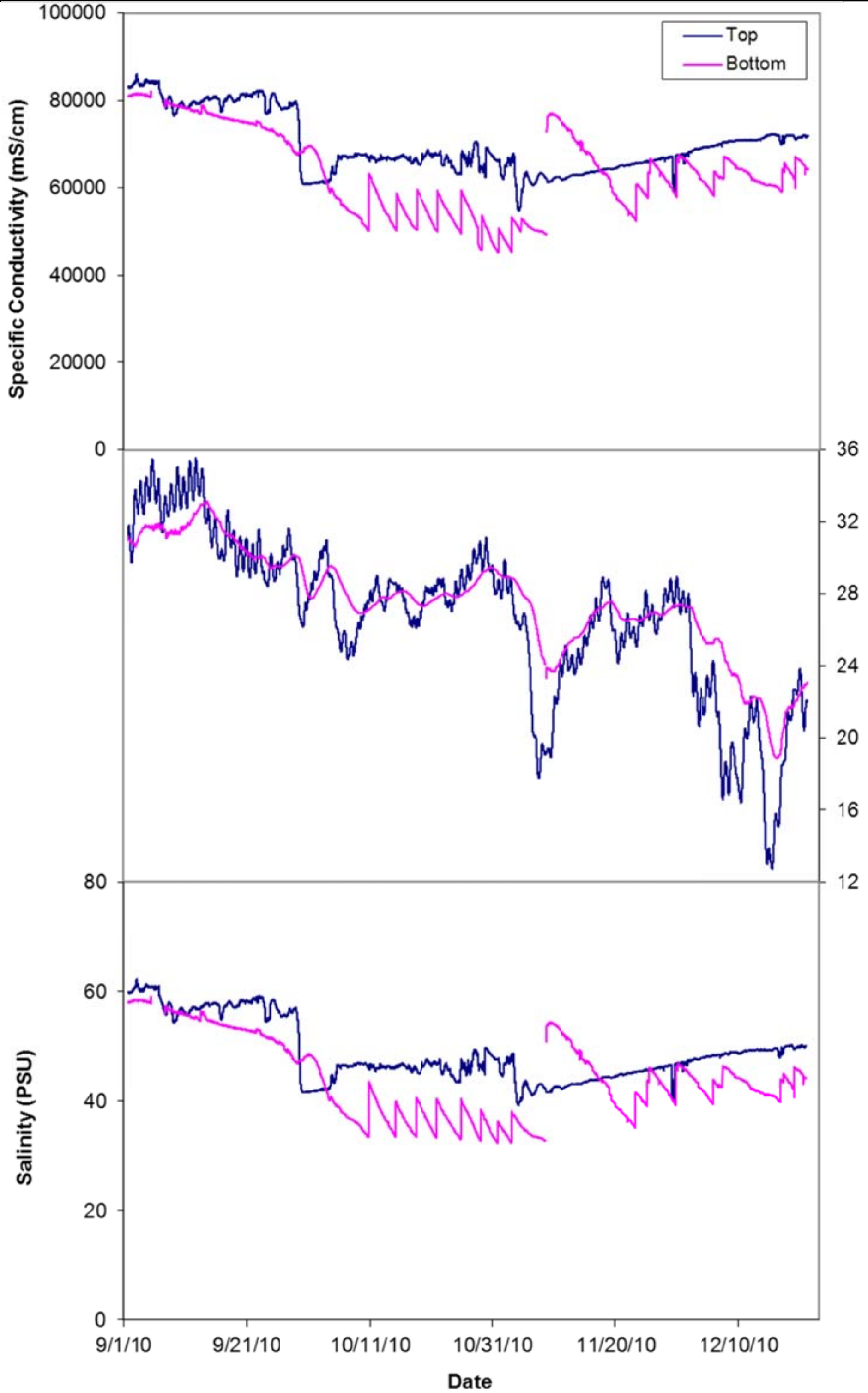


Figure 2-31. TPSWCCS-5 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

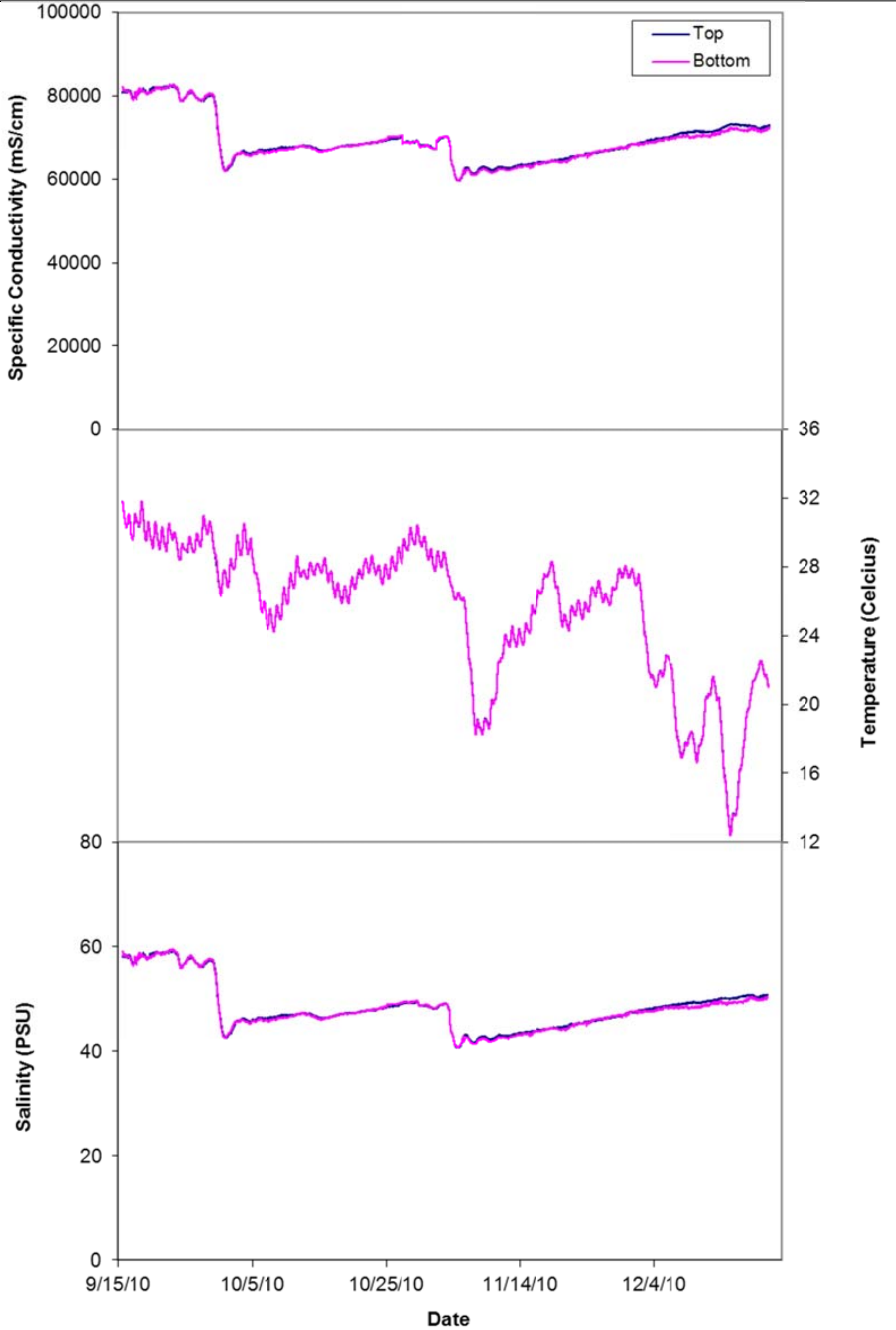


Figure 2-32. TPSWCCS-6 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

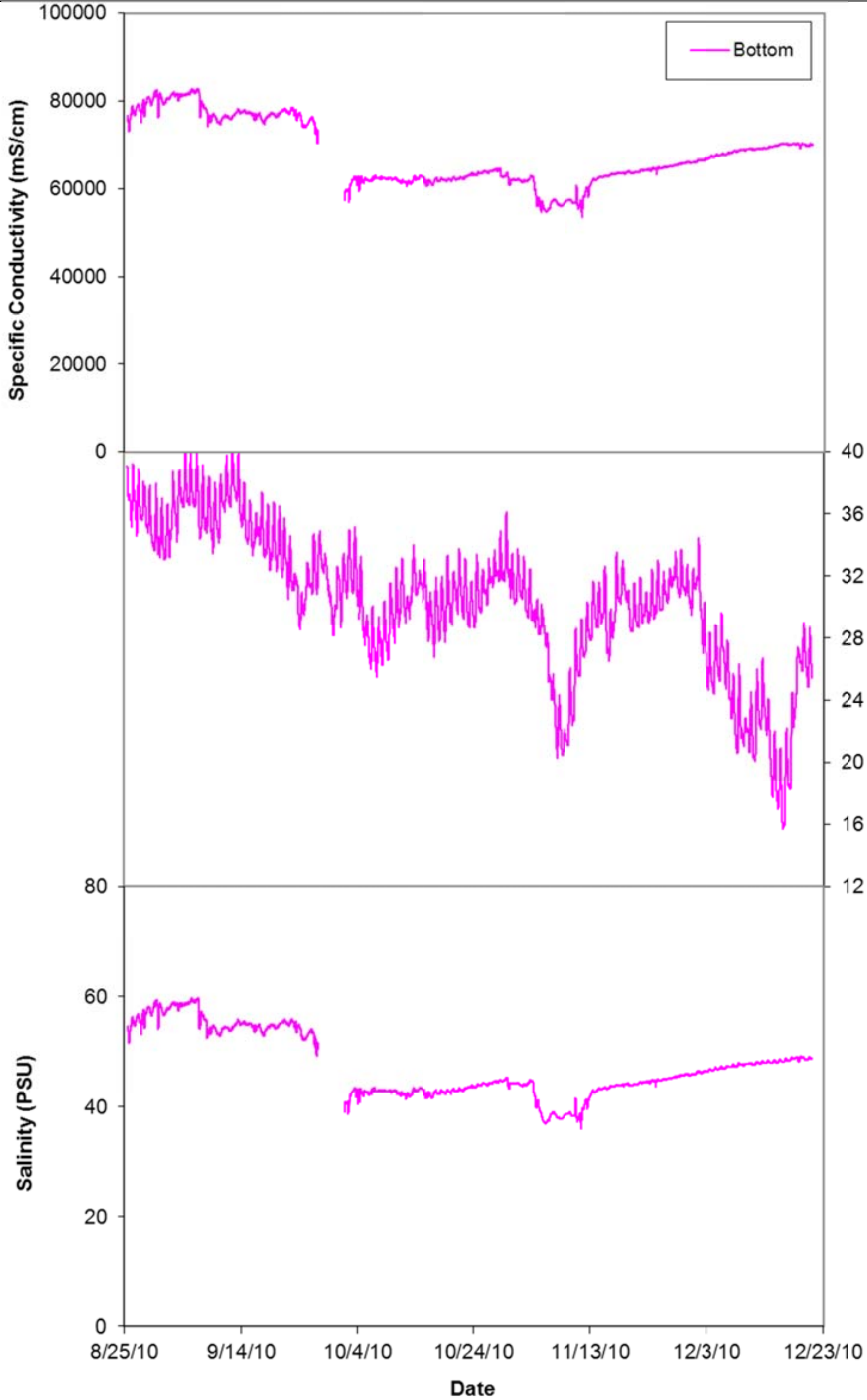


Figure 2-33. TPSWCCS-7 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

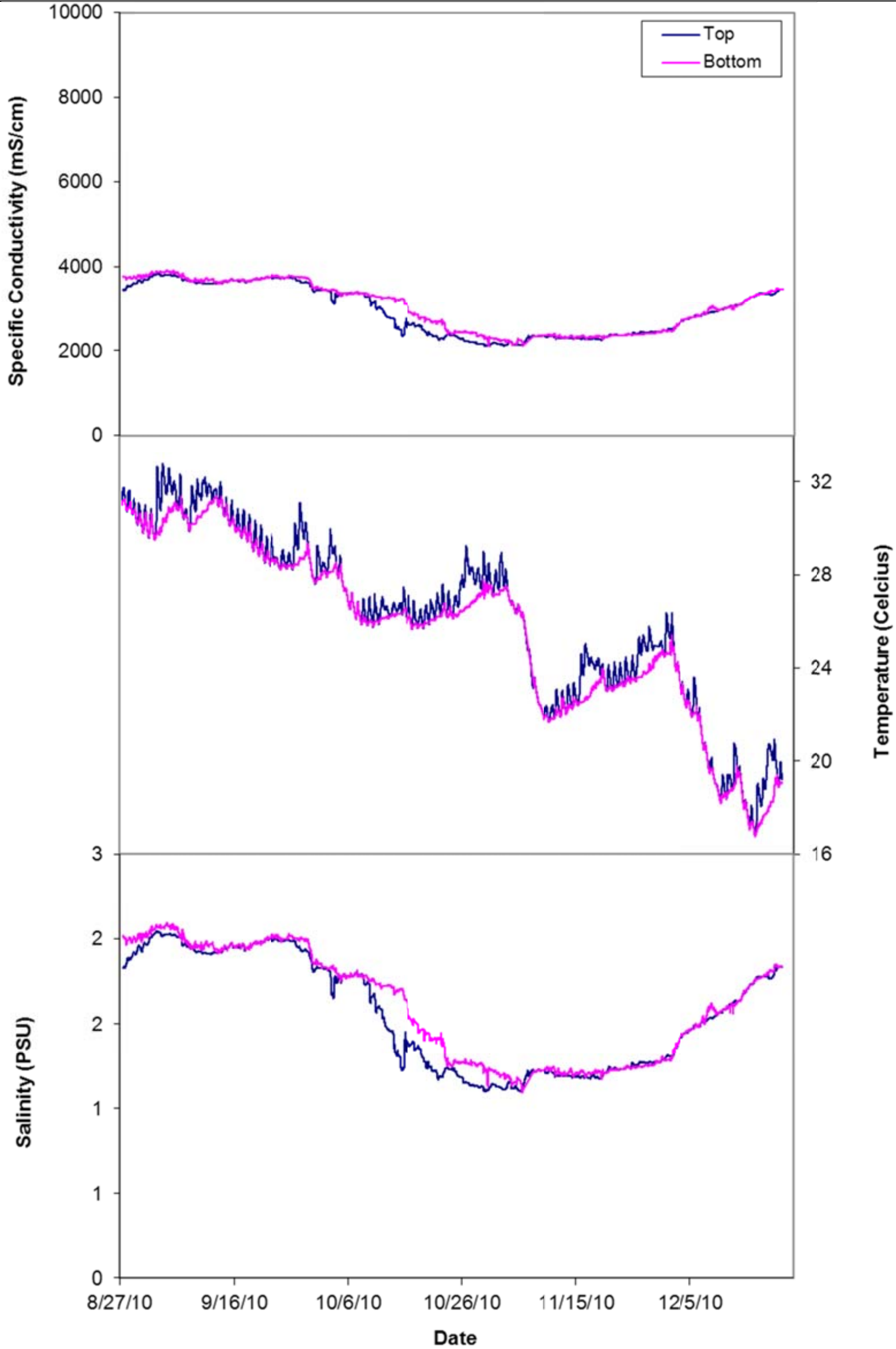


Figure 2-34. TPSWID-1 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

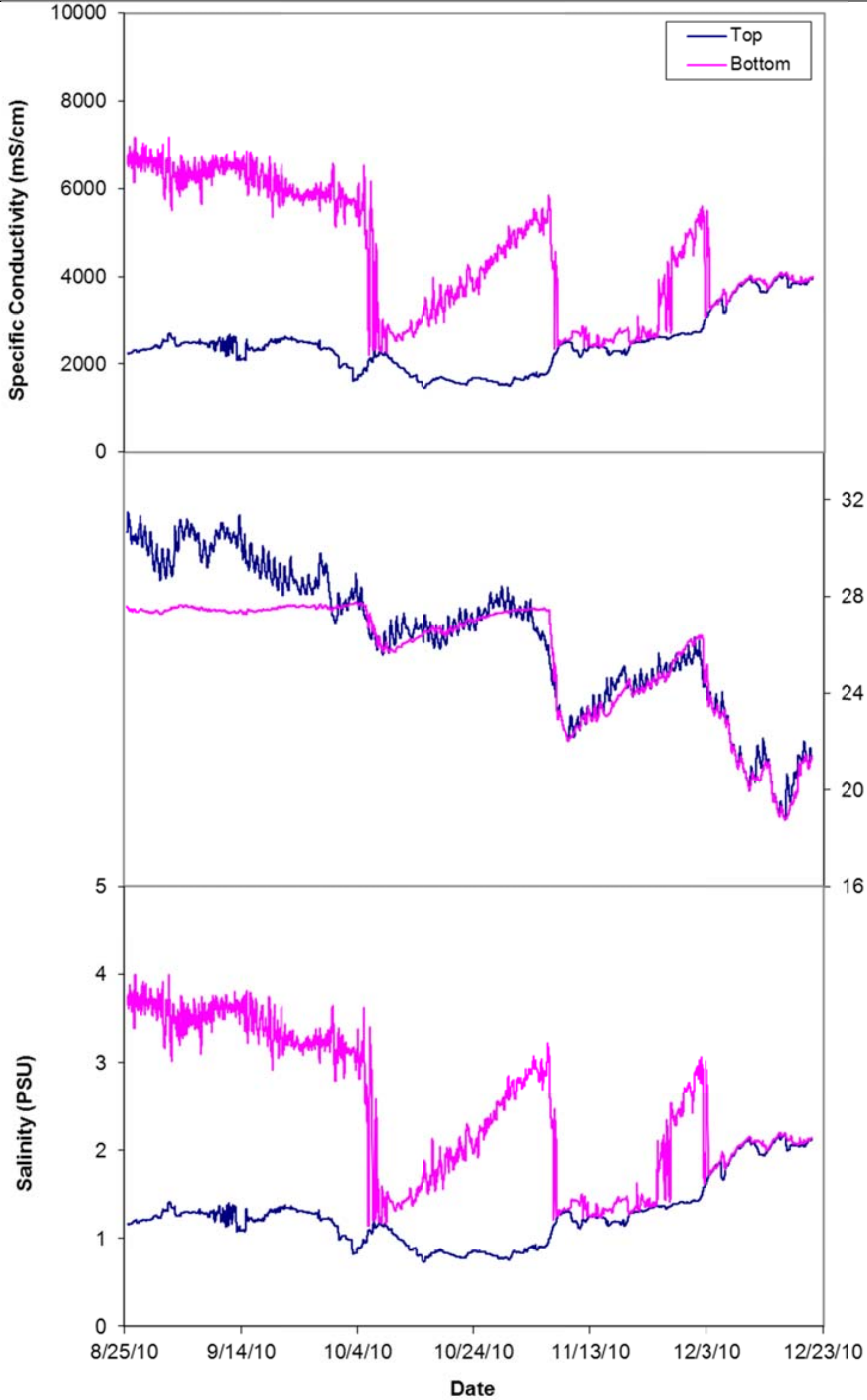


Figure 2-35. TPSWID-2 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

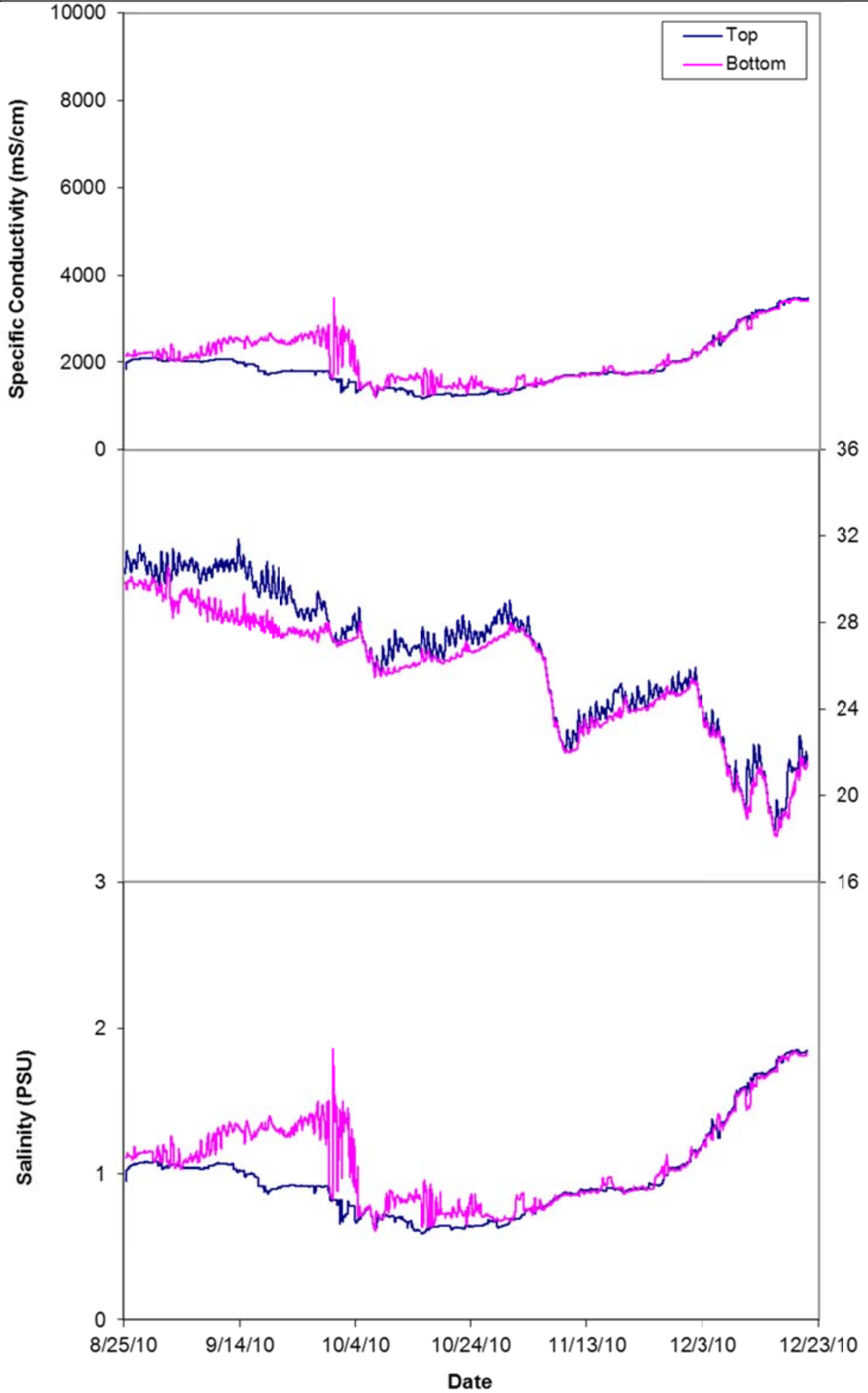


Figure 2-36. TPSWID-3 Specific Conductance, Temperature and Salinity (Excludes Qualified Data).

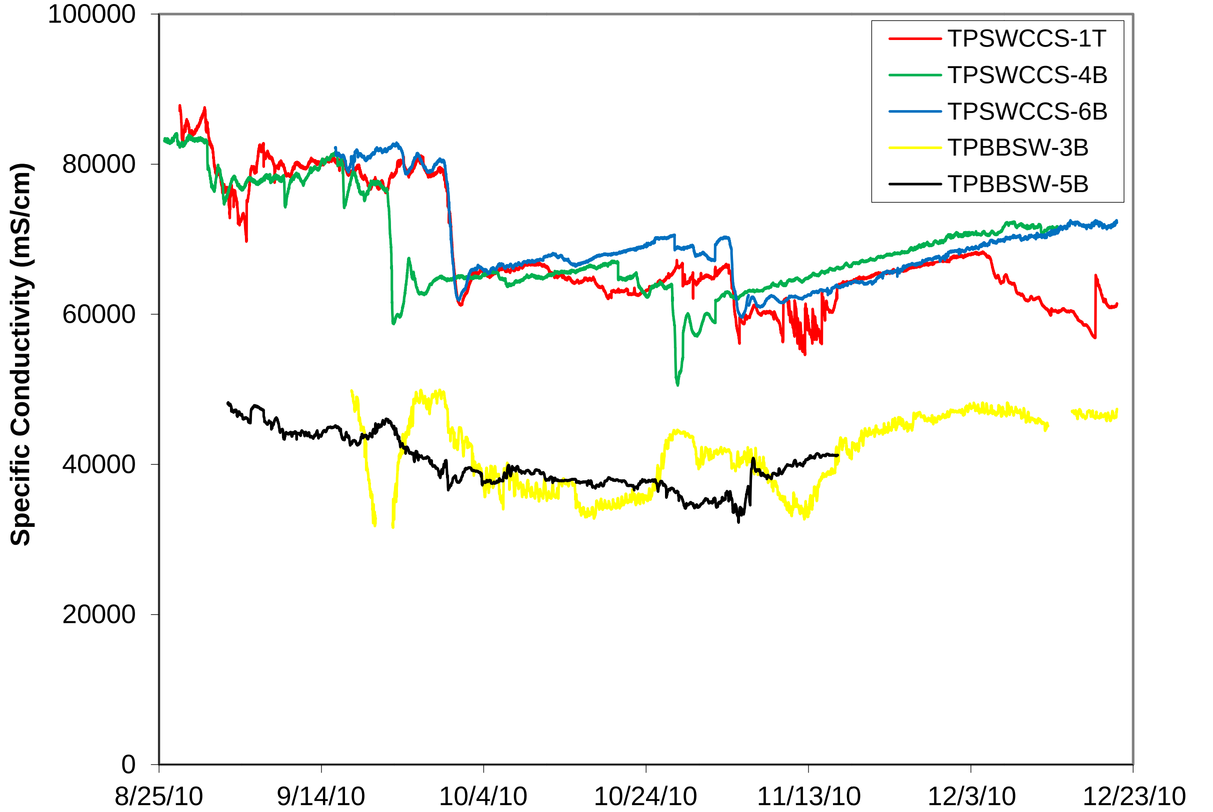


Figure 2-37. Specific Conductance Levels in the CCS and Biscayne Bay.

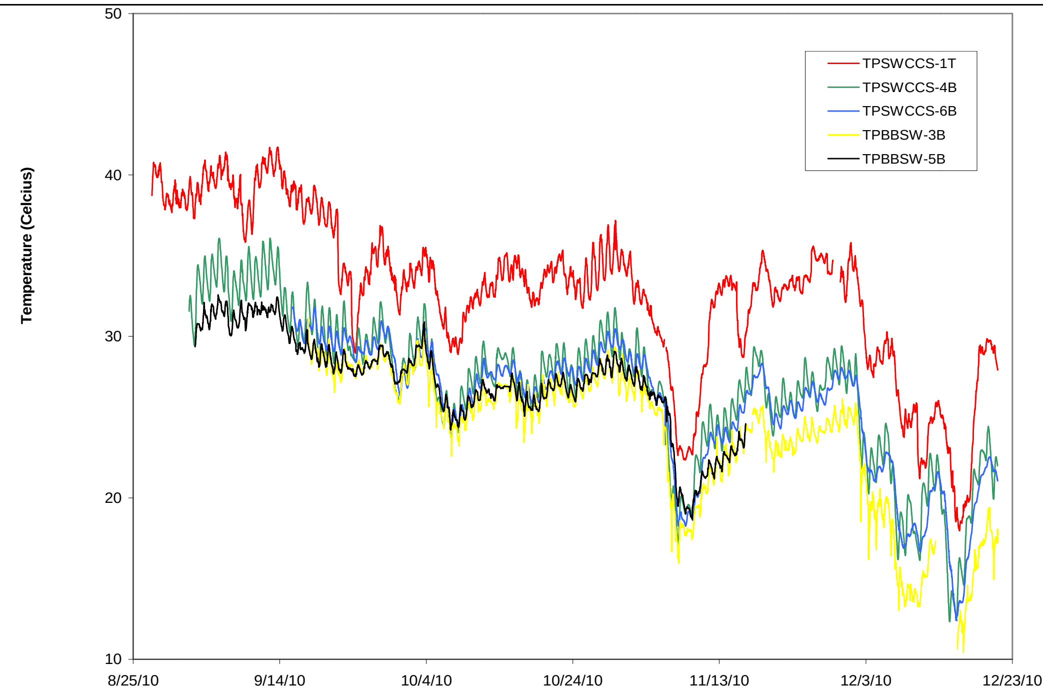


Figure 2-38. Temperatures in the CCS and Biscayne Bay.

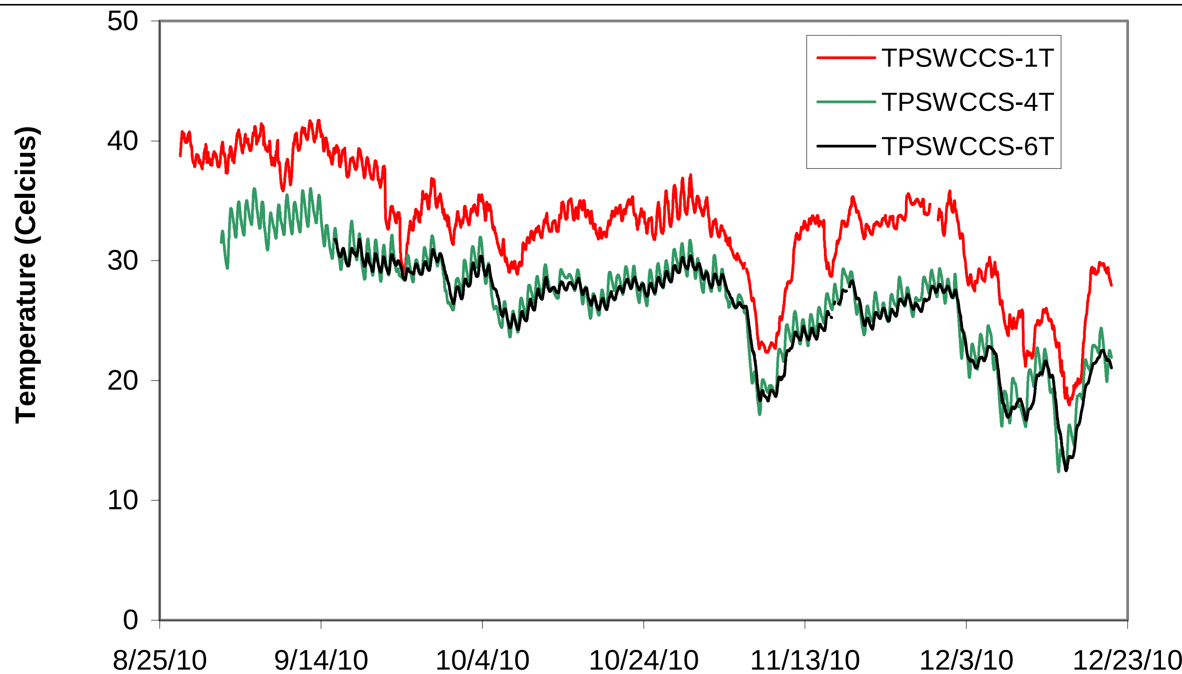


Figure 2-39. Temperatures at the Discharge Side of the CCS are Typically More than 5°C Higher than at the Intake Side of the CCS.

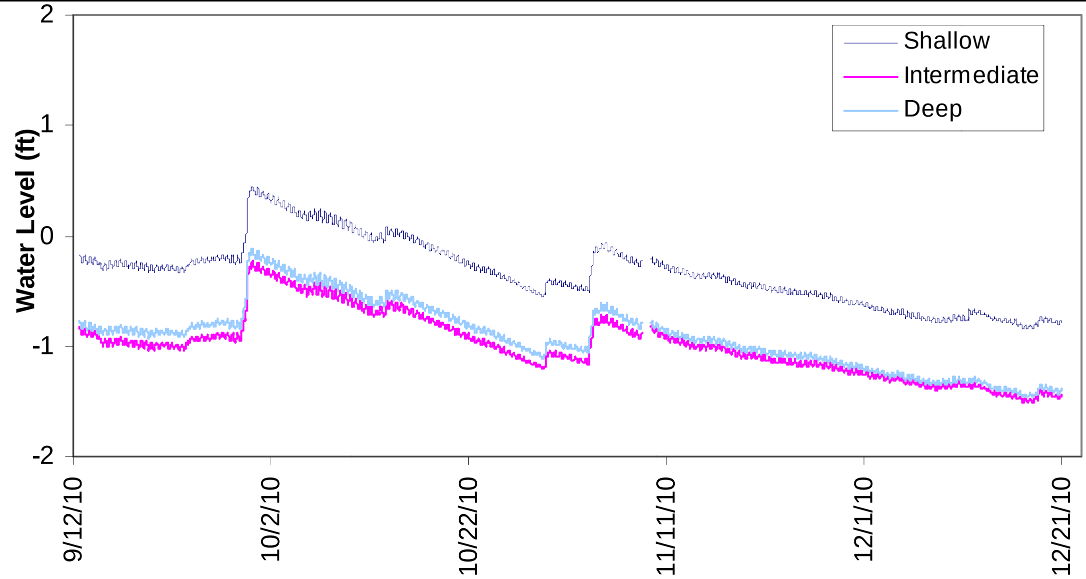


Figure 2-40. TPGW-1 Water Levels (Excludes Qualified Data).

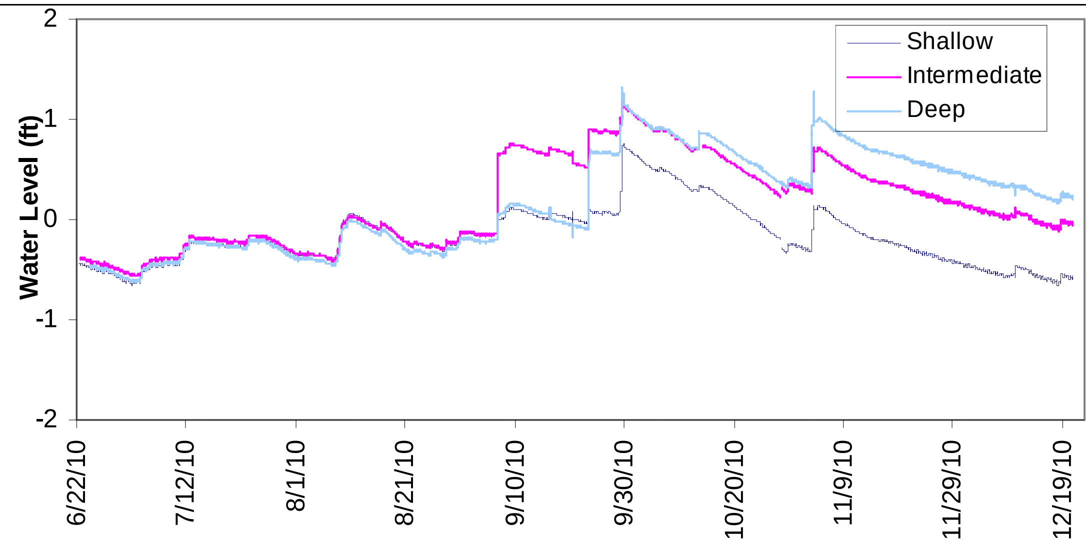


Figure 2-41. TPGW-2 Water Levels (Excludes Qualified Data).

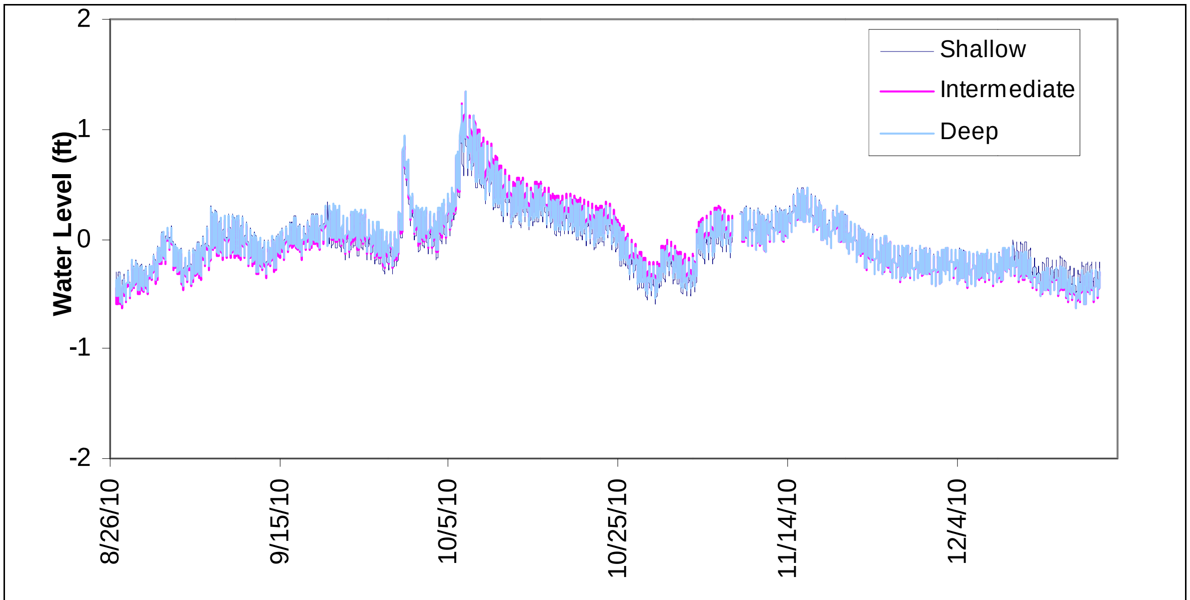


Figure 2-42. TPGW-3 Water Levels (Excludes Qualified Data).

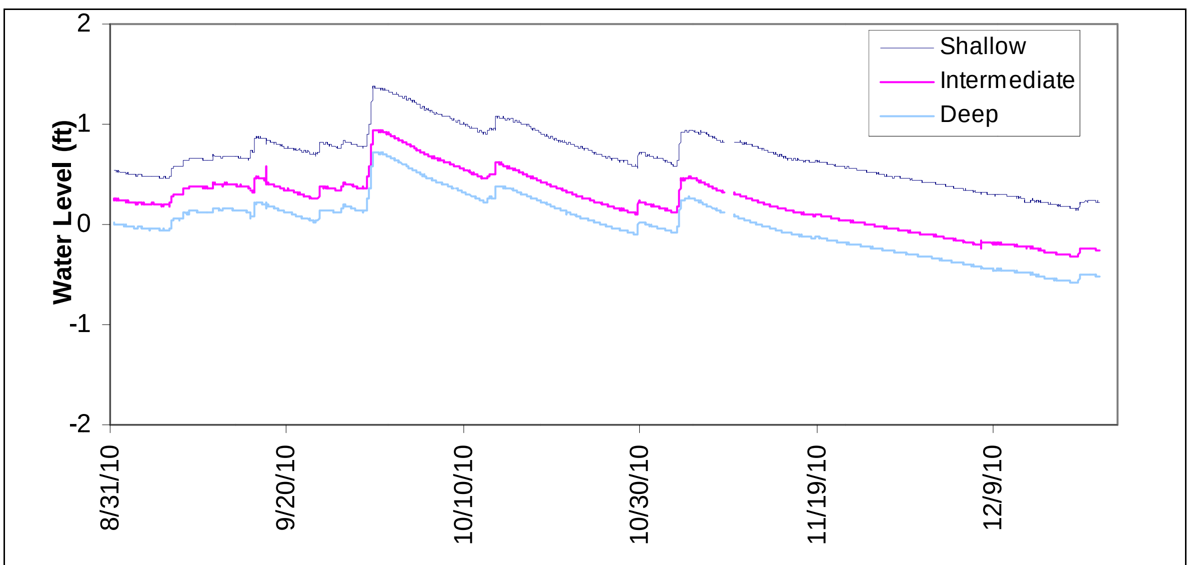


Figure 2-43. TPGW-4 Water Levels (Excludes Qualified Data).

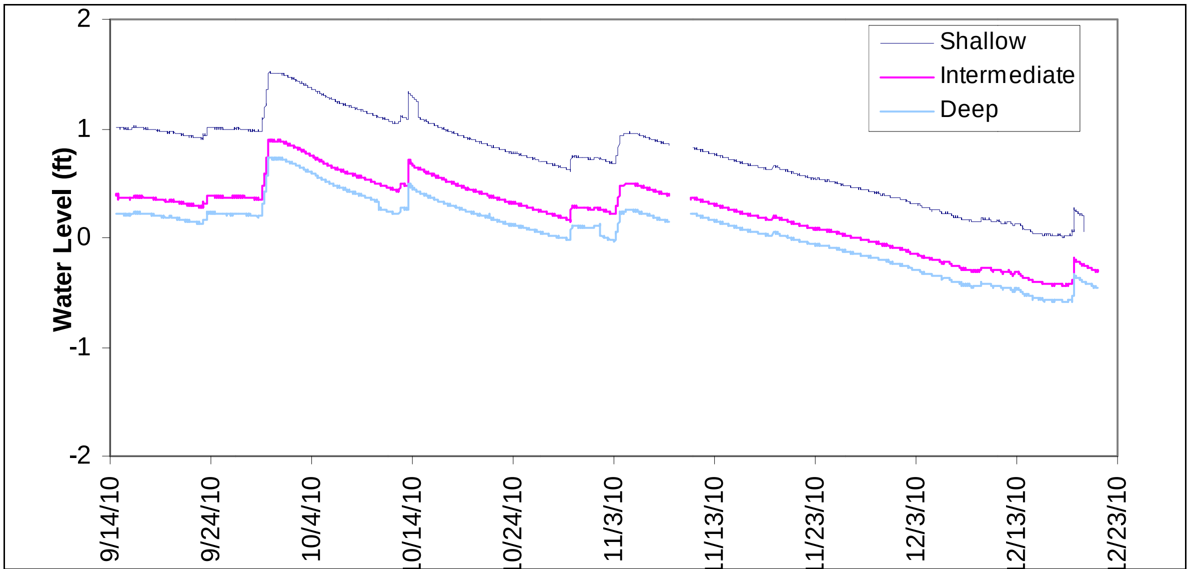


Figure 2-44. TPGW-5 Water Levels (Excludes Qualified Data).

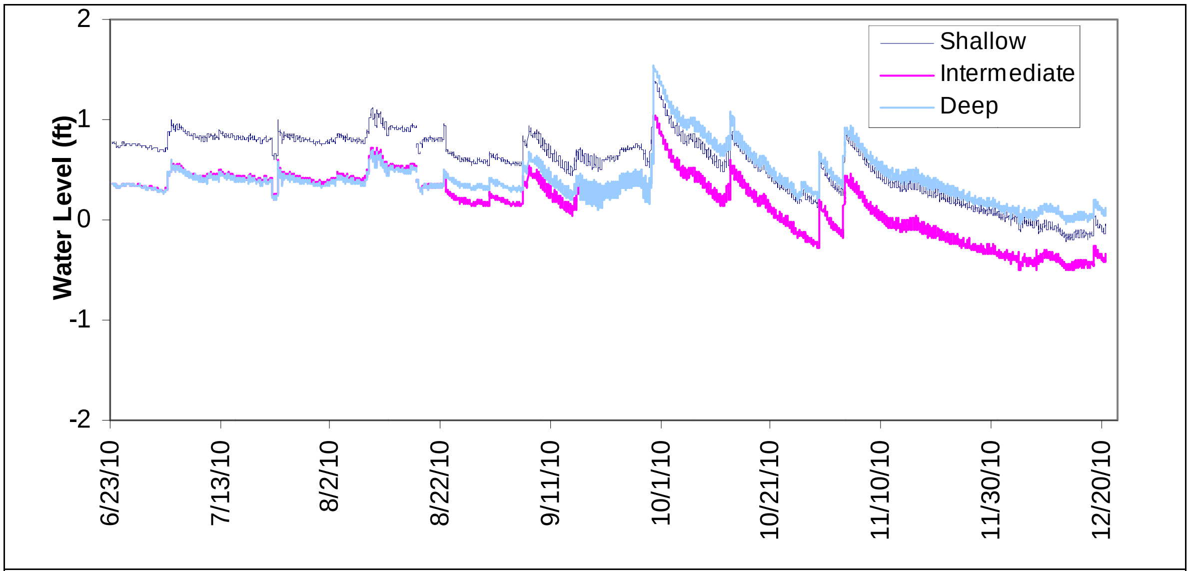


Figure 2-45. TPGW-6 Water Levels (Excludes Qualified Data).

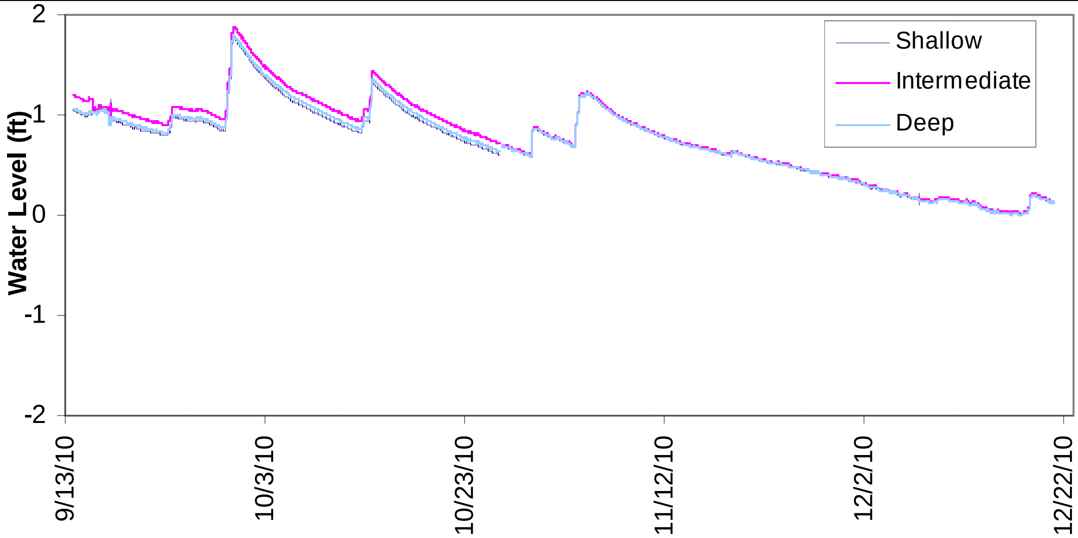


Figure 2-46. TPGW-7 Water Levels (Excludes Qualified Data).

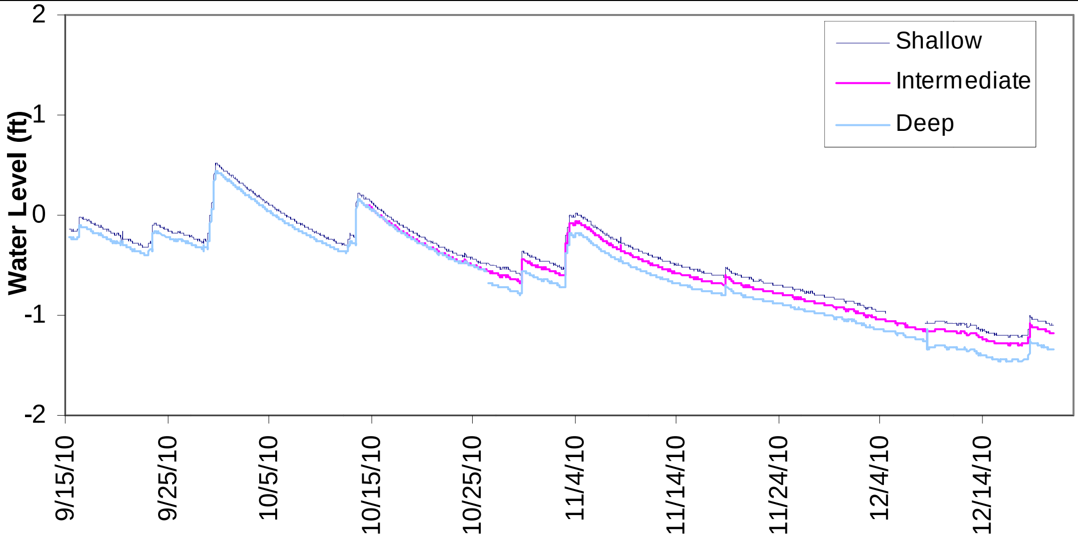


Figure 2-47. TPGW-8 Water Levels (Excludes Qualified Data).

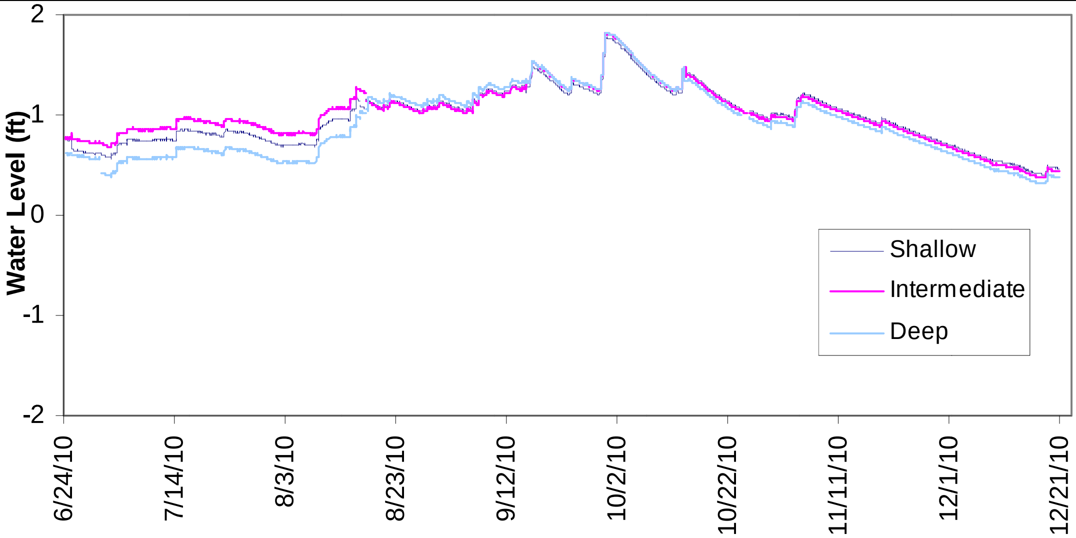


Figure 2-48. TPGW-9 Water Levels (Excludes Qualified Data).

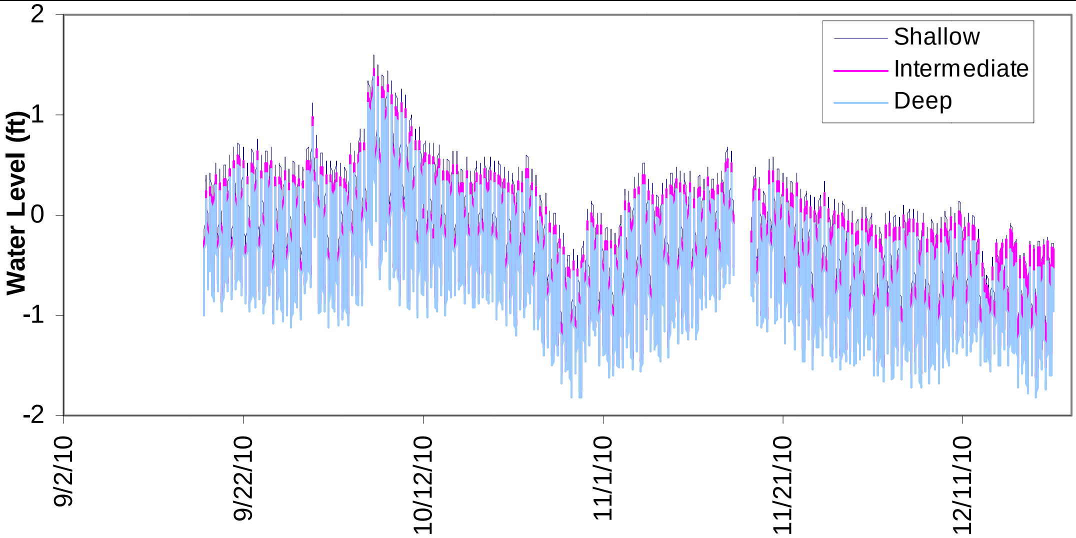


Figure 2-49. TPGW-10 Water Levels (Excludes Qualified Data).

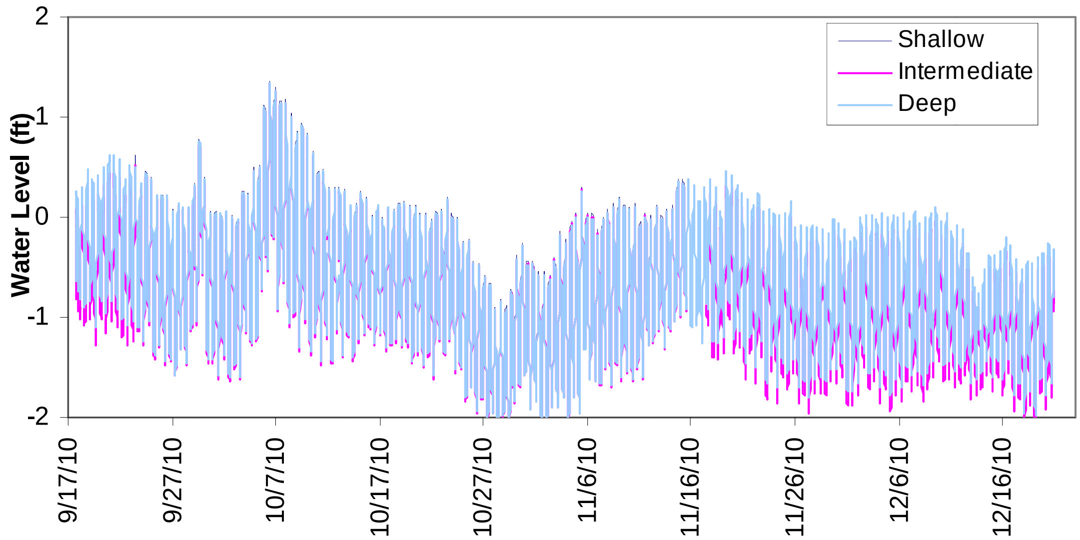


Figure 2-50. TPGW-11 Water Levels (Excludes Qualified Data).

Figure 2-51. TPGW-12 Water Levels (Excludes Qualified Data).

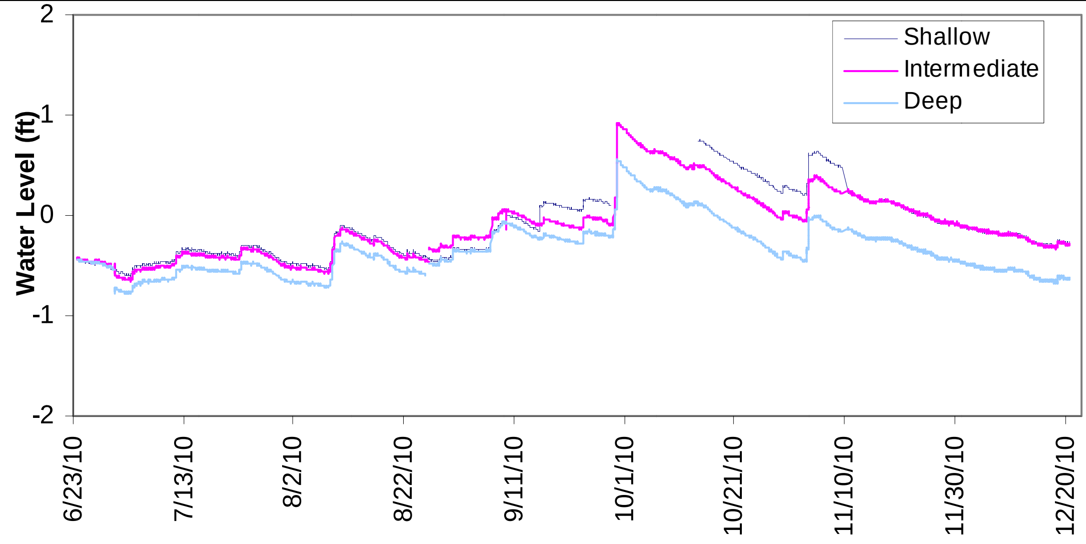


Figure 2-52. TPGW-13 Water Levels (Excludes Qualified Data).

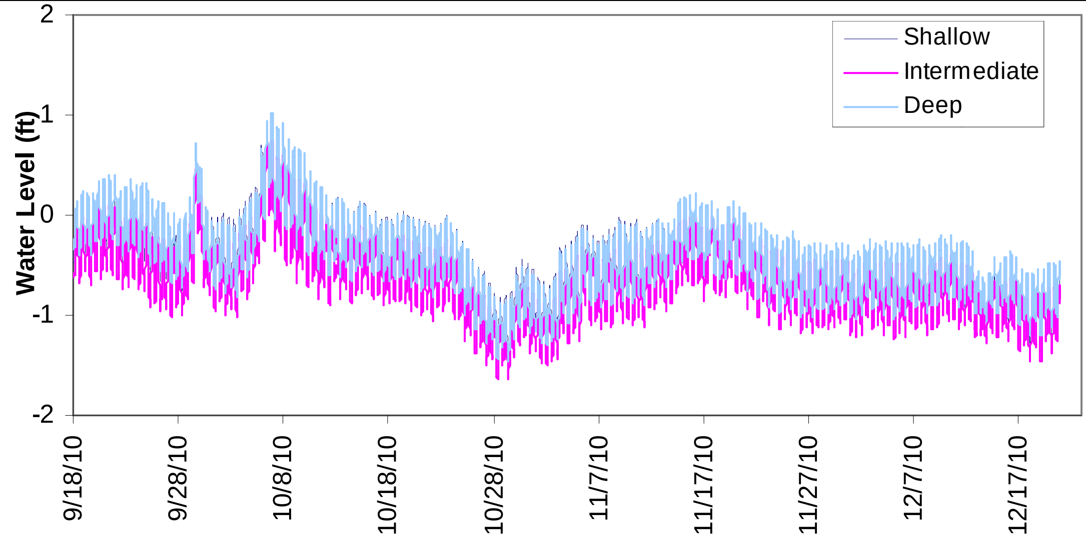


Figure 2-53. TPGW-14 Water Levels (Excludes Qualified Data).

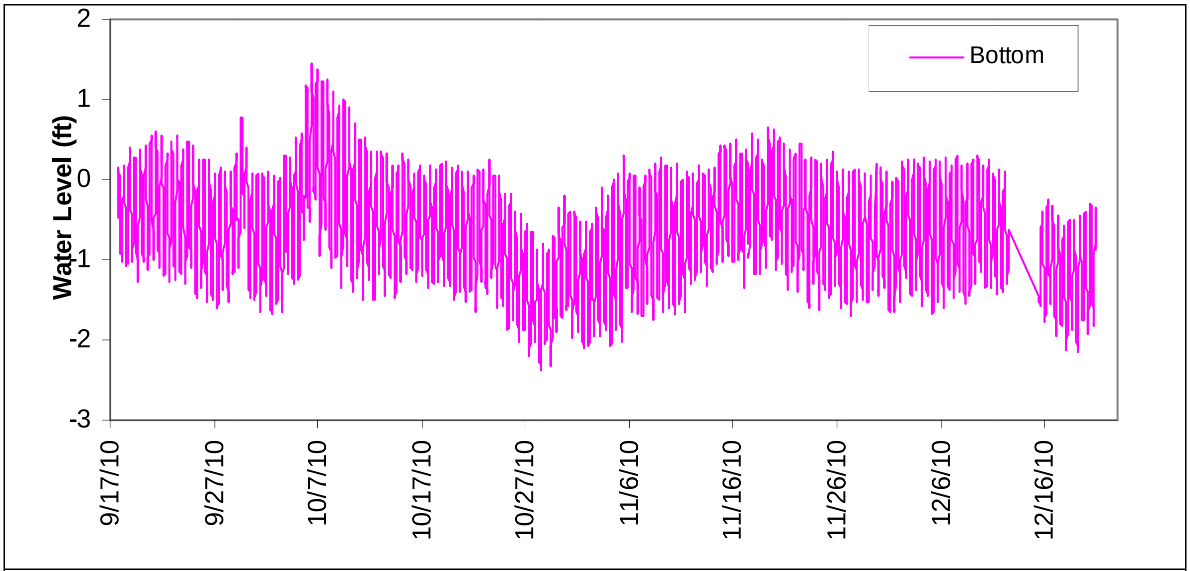


Figure 2-54. TPBBSW-3 Water Levels (Excludes Qualified Data).

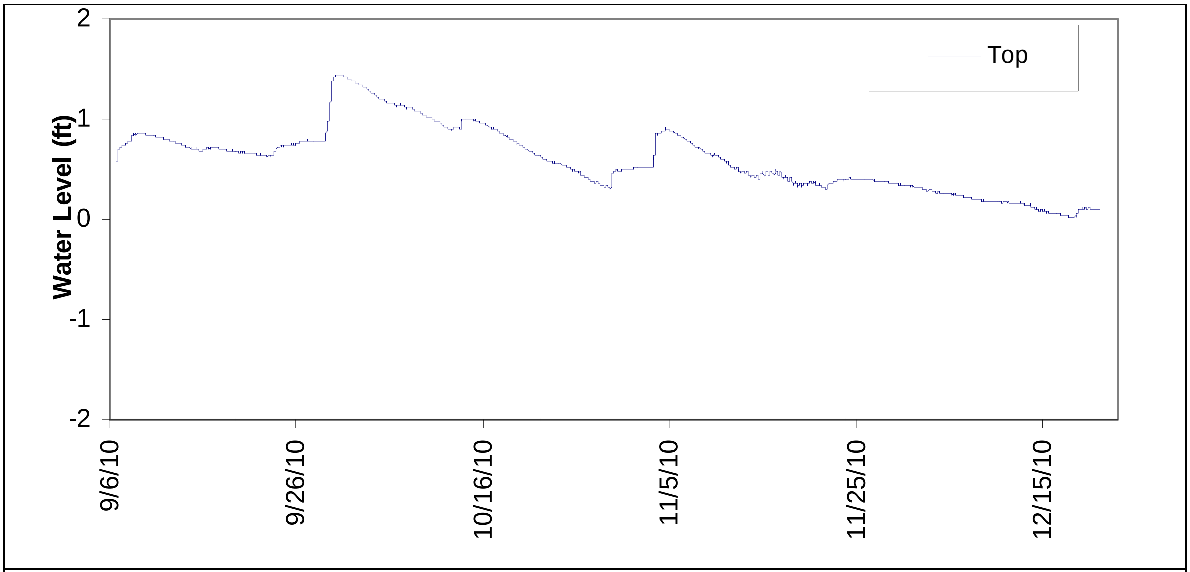


Figure 2-55. TPSWC-1 Water Levels (Excludes Qualified Data).

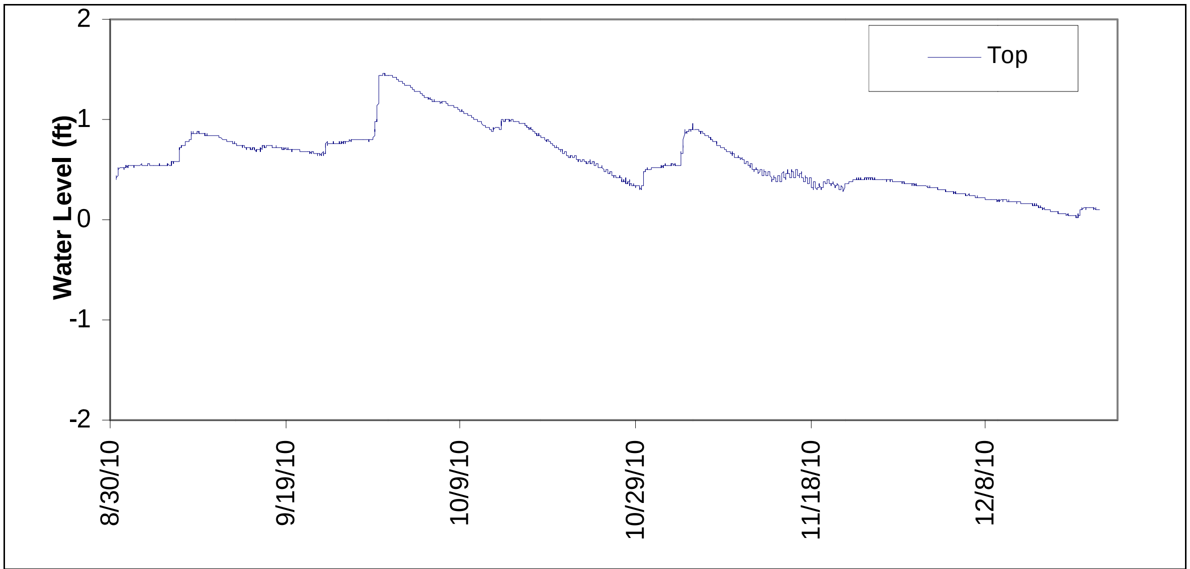


Figure 2-56. TPSWC-2 Water Levels (Excludes Qualified Data).

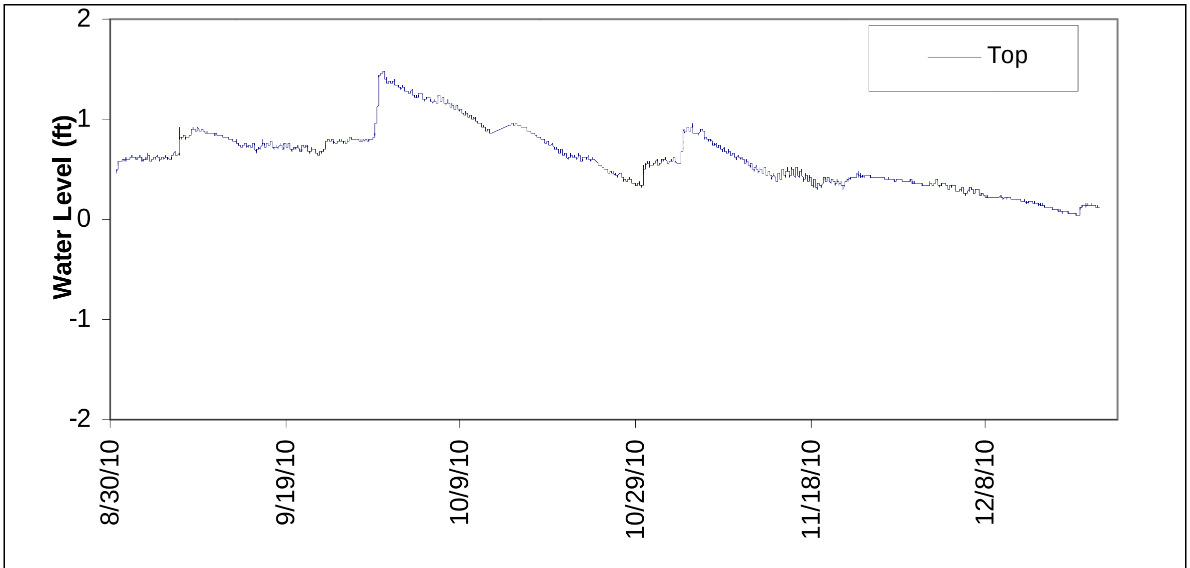


Figure 2-57. TPSWC-3 Water Levels (Excludes Qualified Data).

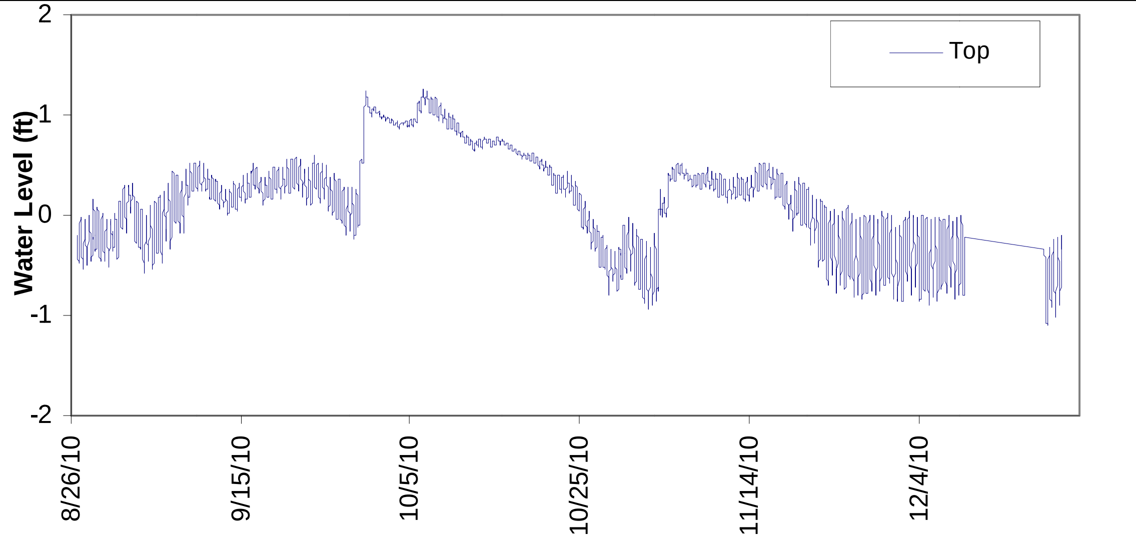


Figure 2-58. TPSWC-4 Water Levels (Excludes Qualified Data).

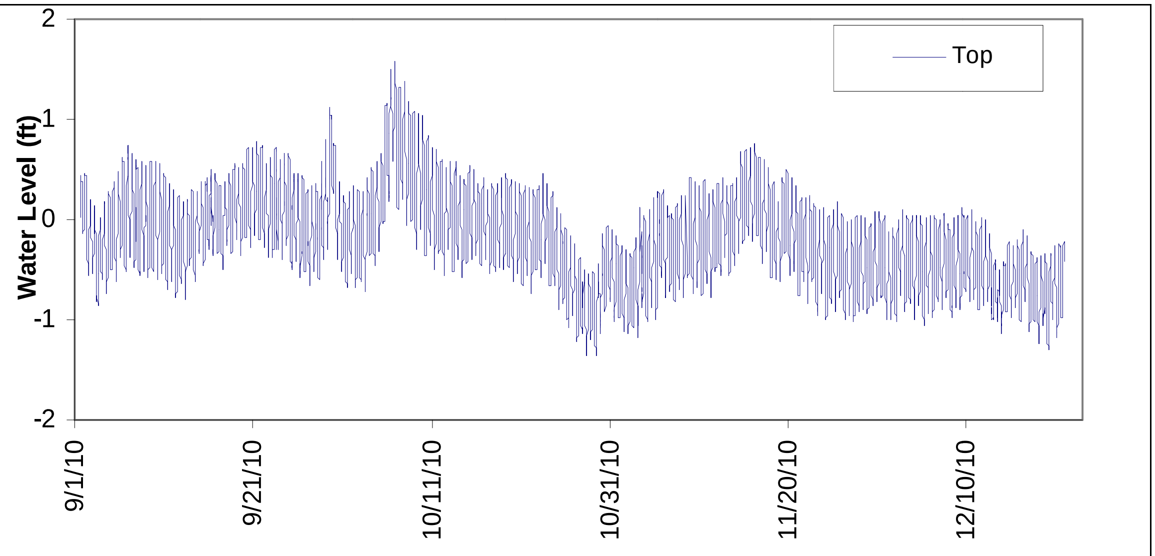


Figure 2-59. TPSWC-5 Water Levels (Excludes Qualified Data).

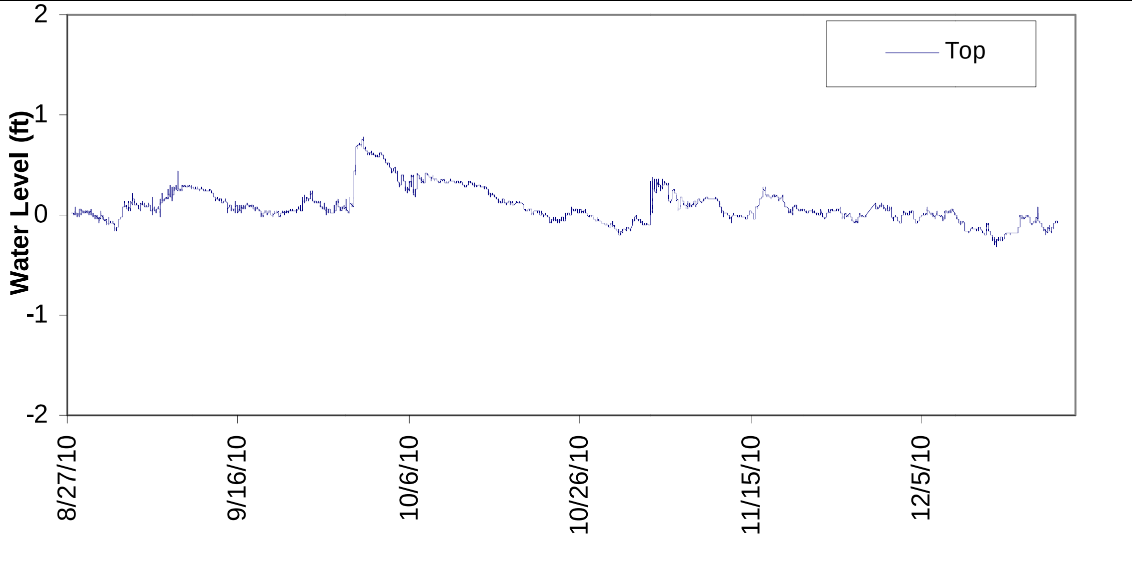


Figure 2-60. TPSWCCS-1 Water Levels (Excludes Qualified Data).

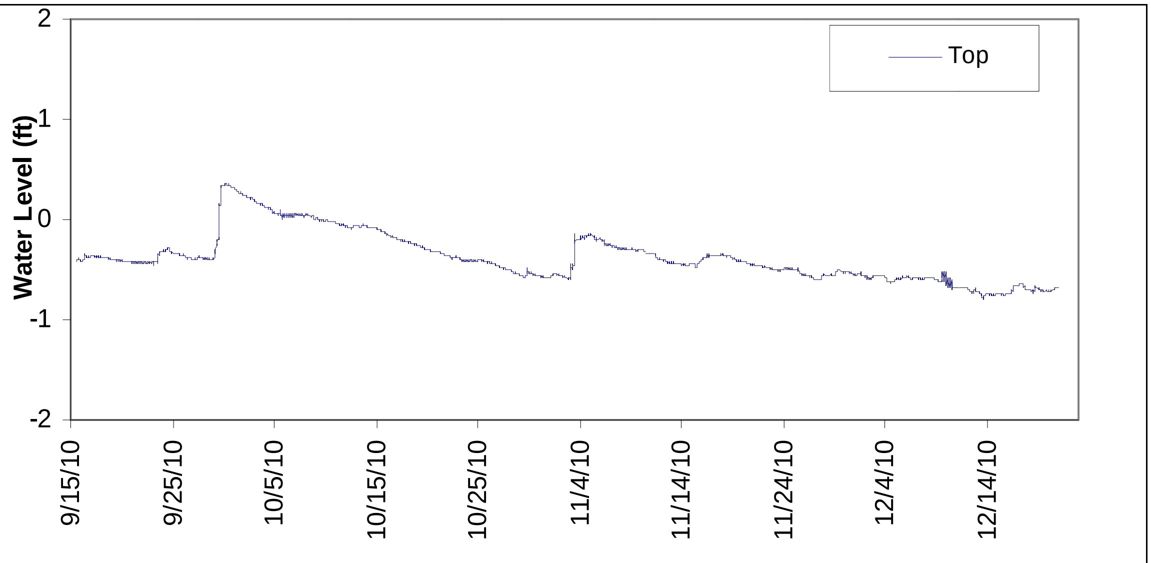


Figure 2-61. TPSWCCS-2 Water Levels (Excludes Qualified Data).

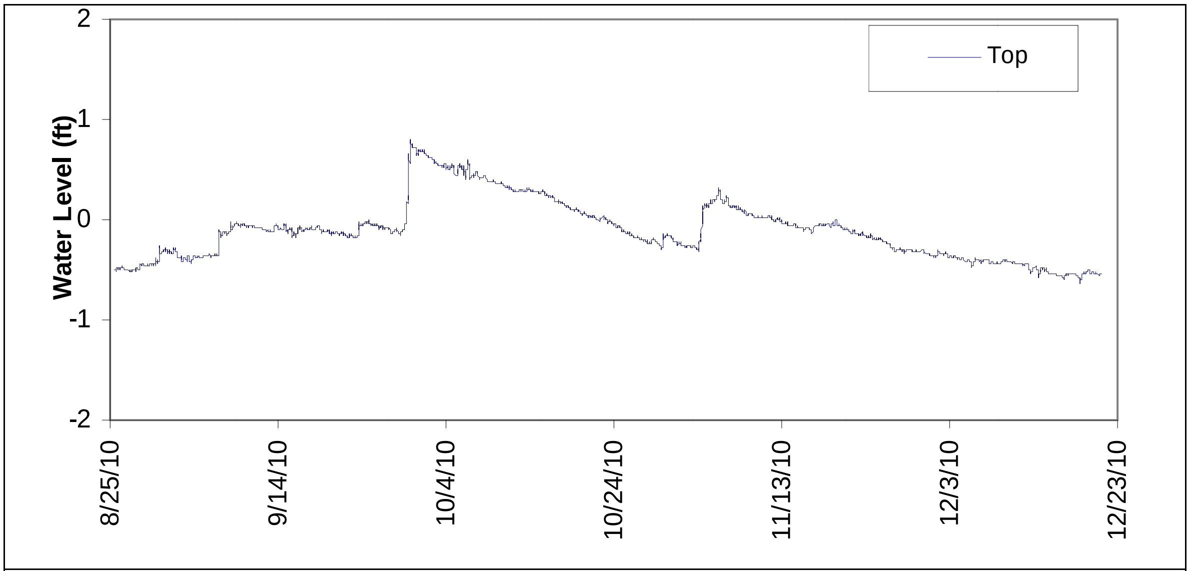


Figure 2-62. TPSWCCS-3 Water Levels (Excludes Qualified Data).

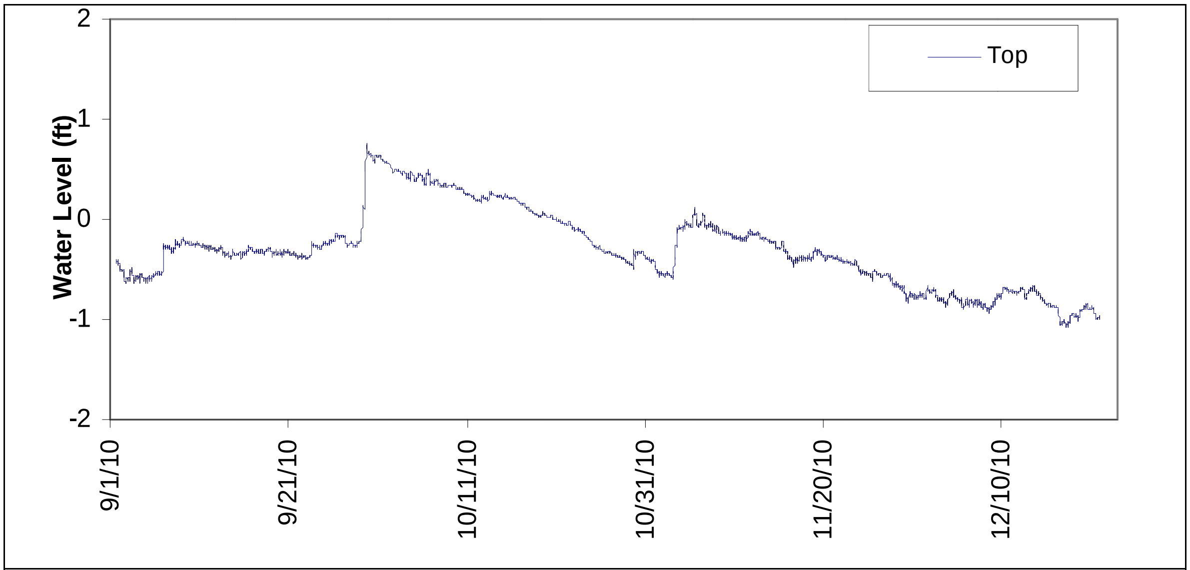


Figure 2-63. TPSWCCS-4 Water Levels (Excludes Qualified Data).

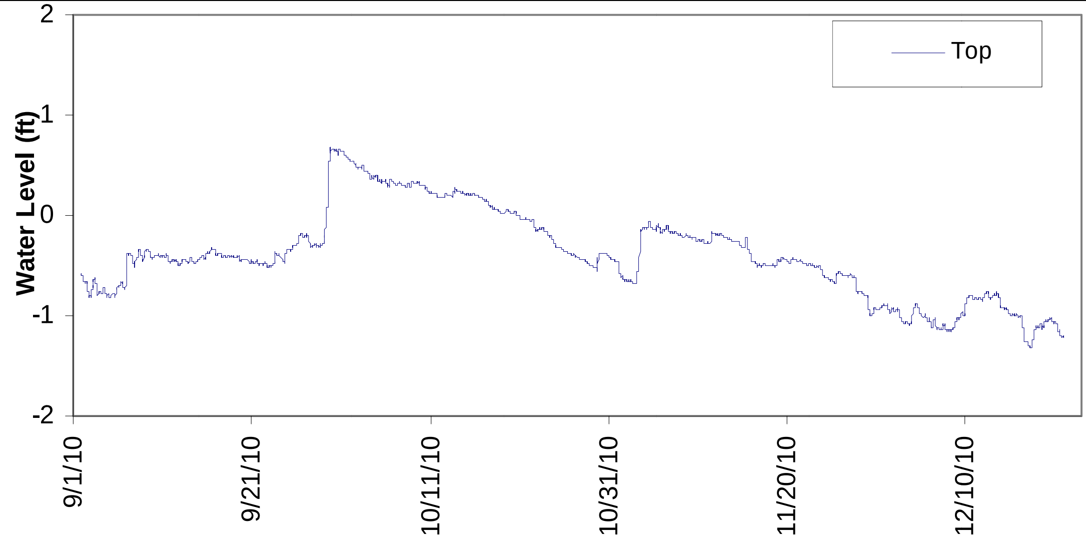


Figure 2-64. TPSWCCS-5 Water Levels (Excludes Qualified Data).

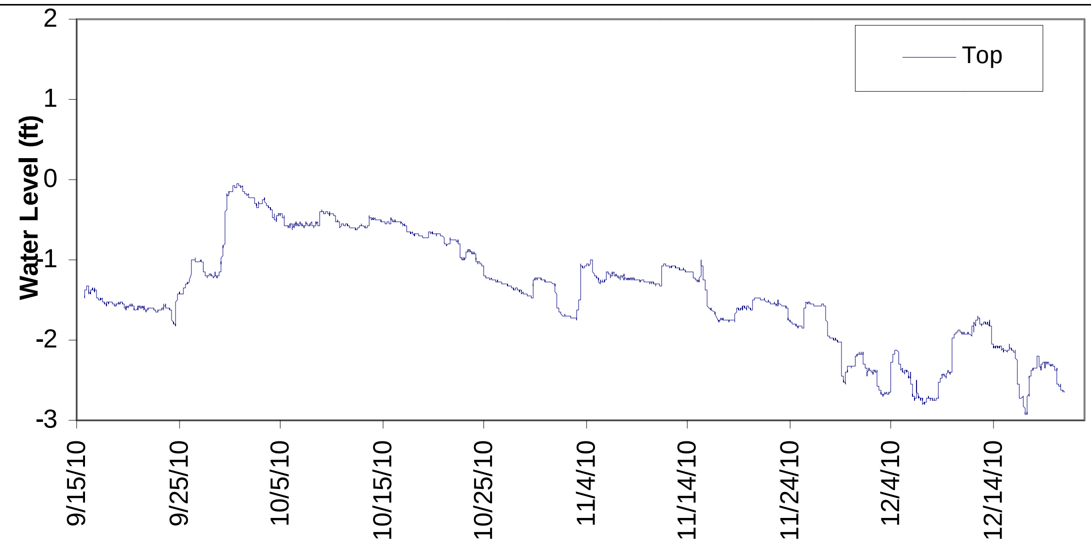


Figure 2-65. TPSWCCS-6 Water Levels (Excludes Qualified Data).

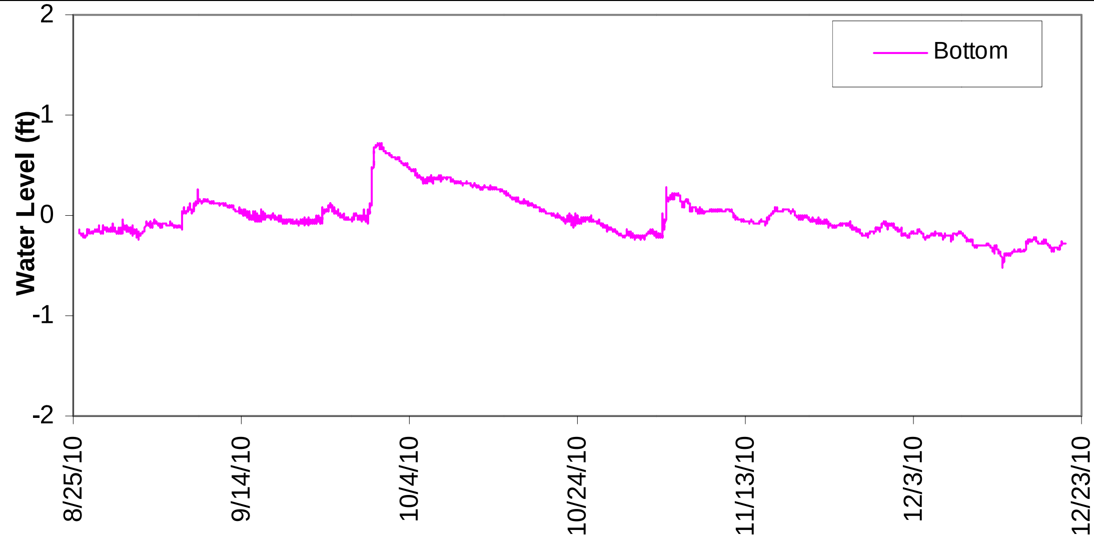


Figure 2-66. TPSWCCS-7 Water Levels (Excludes Qualified Data).

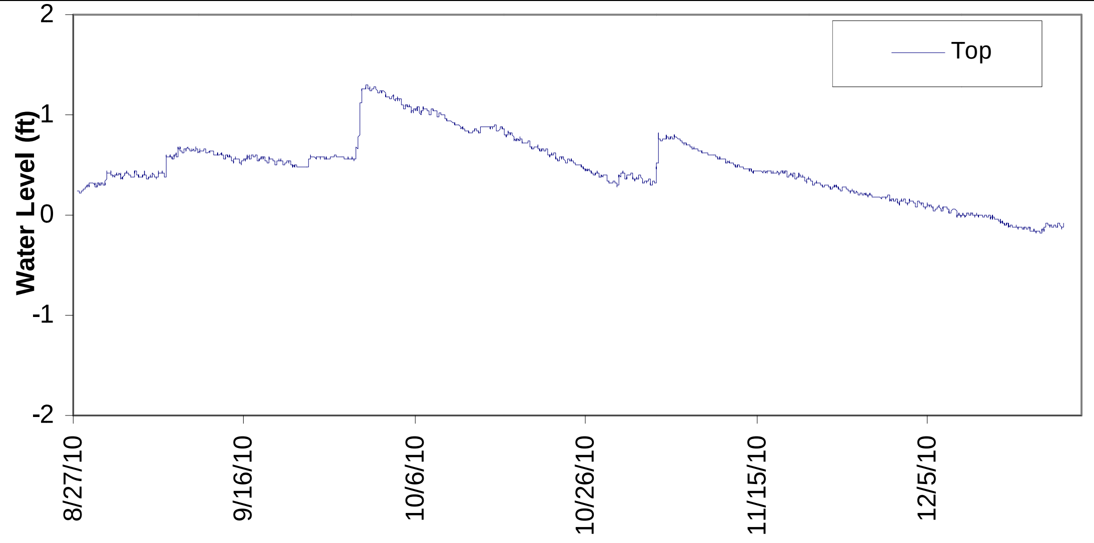


Figure 2-67. TPSWID-1 Water Levels (Excludes Qualified Data).

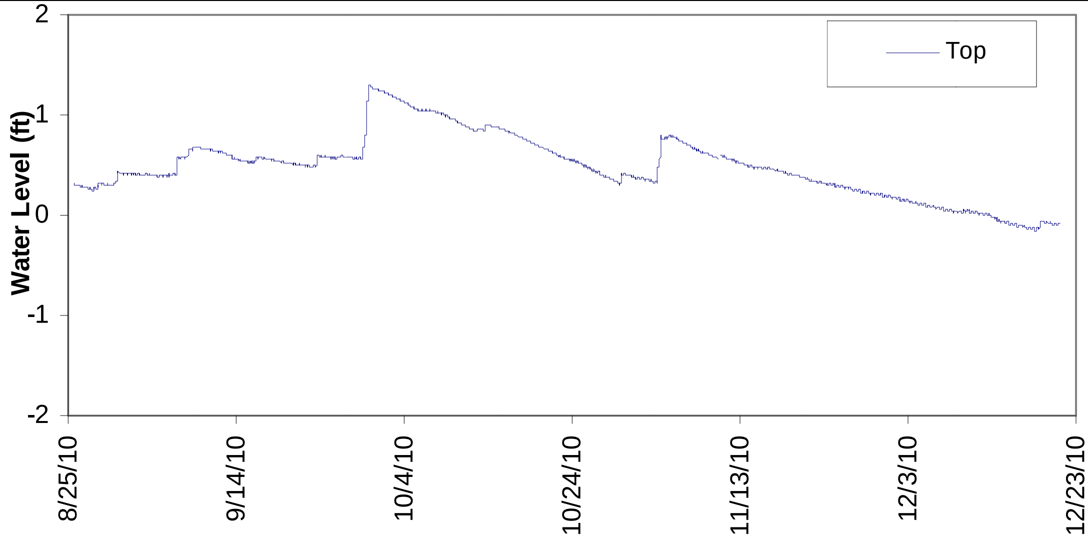


Figure 2-68. TPSWID-2 Water Levels (Excludes Qualified Data).

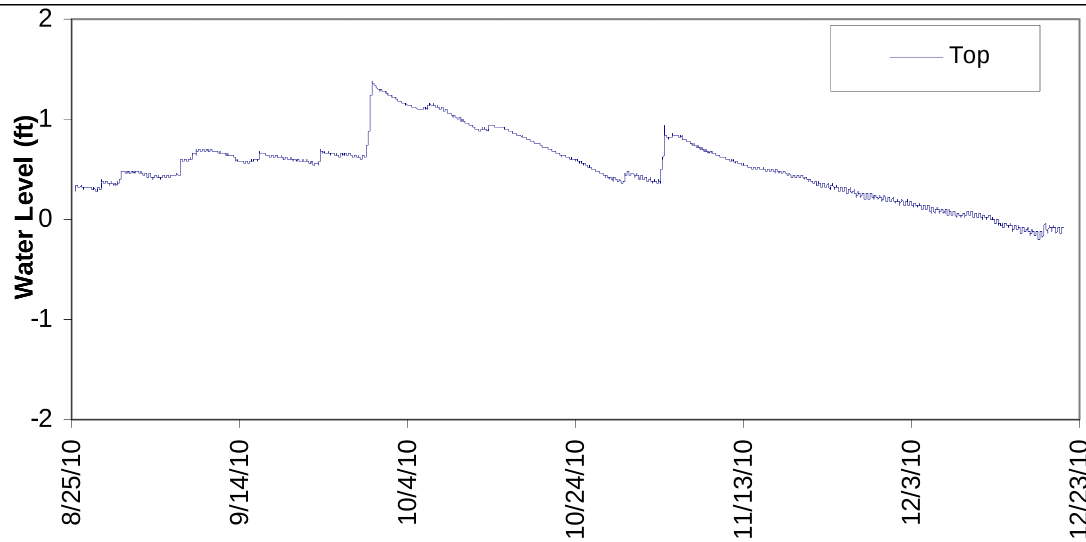


Figure 2-69. TPSWID-3 Water Levels (Excludes Qualified Data).

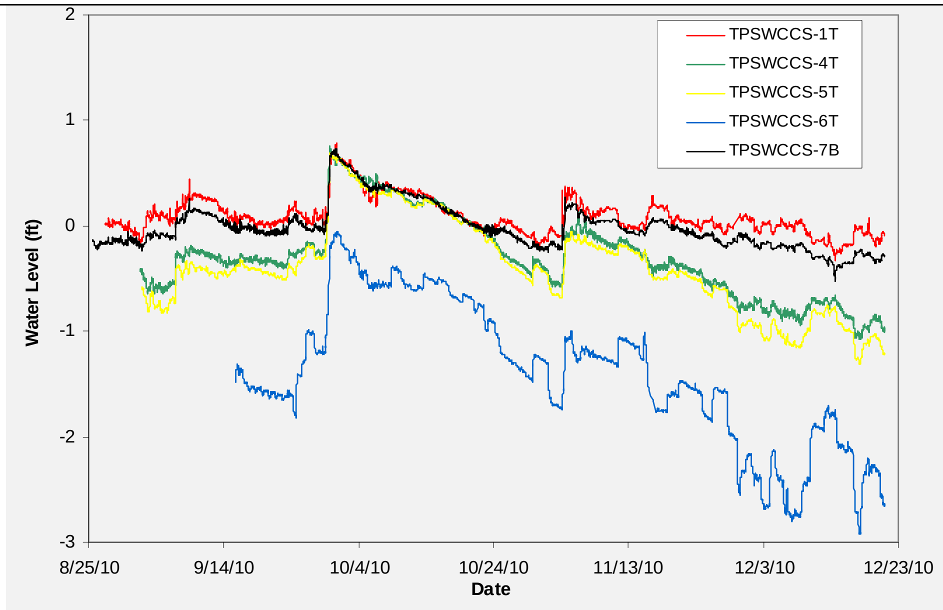


Figure 2-70. Water Levels in the CCS from September 2010 through December 2010.

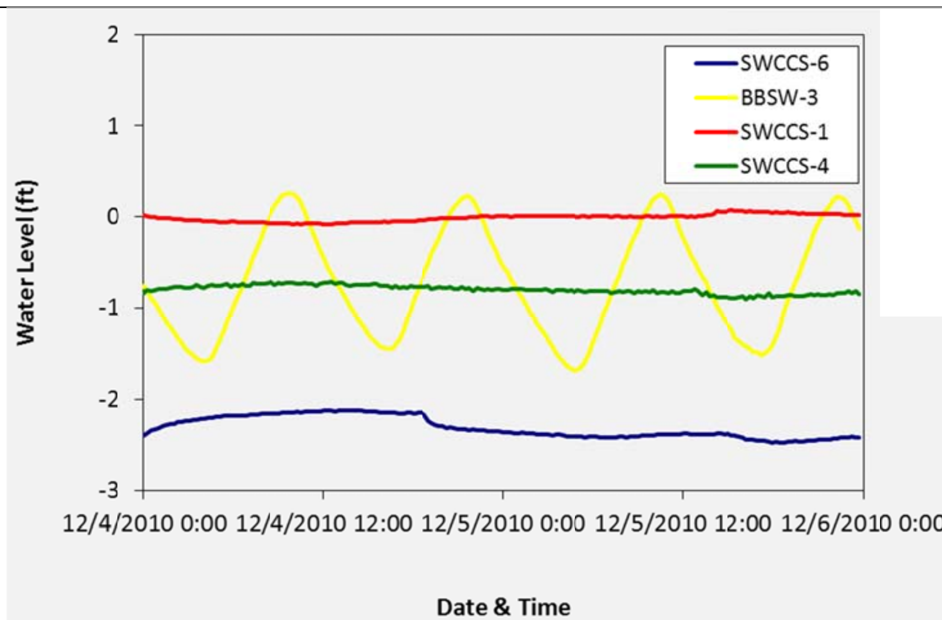
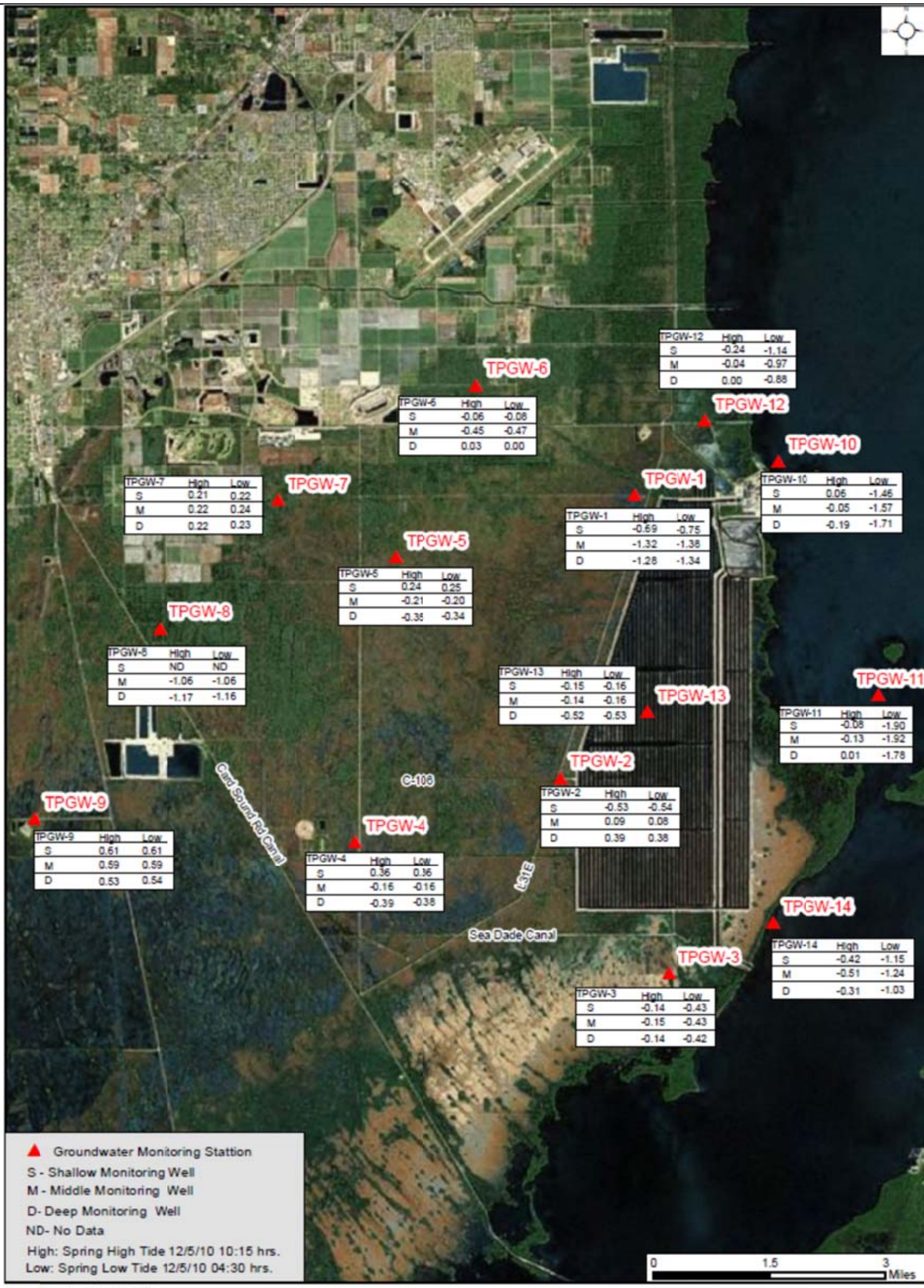
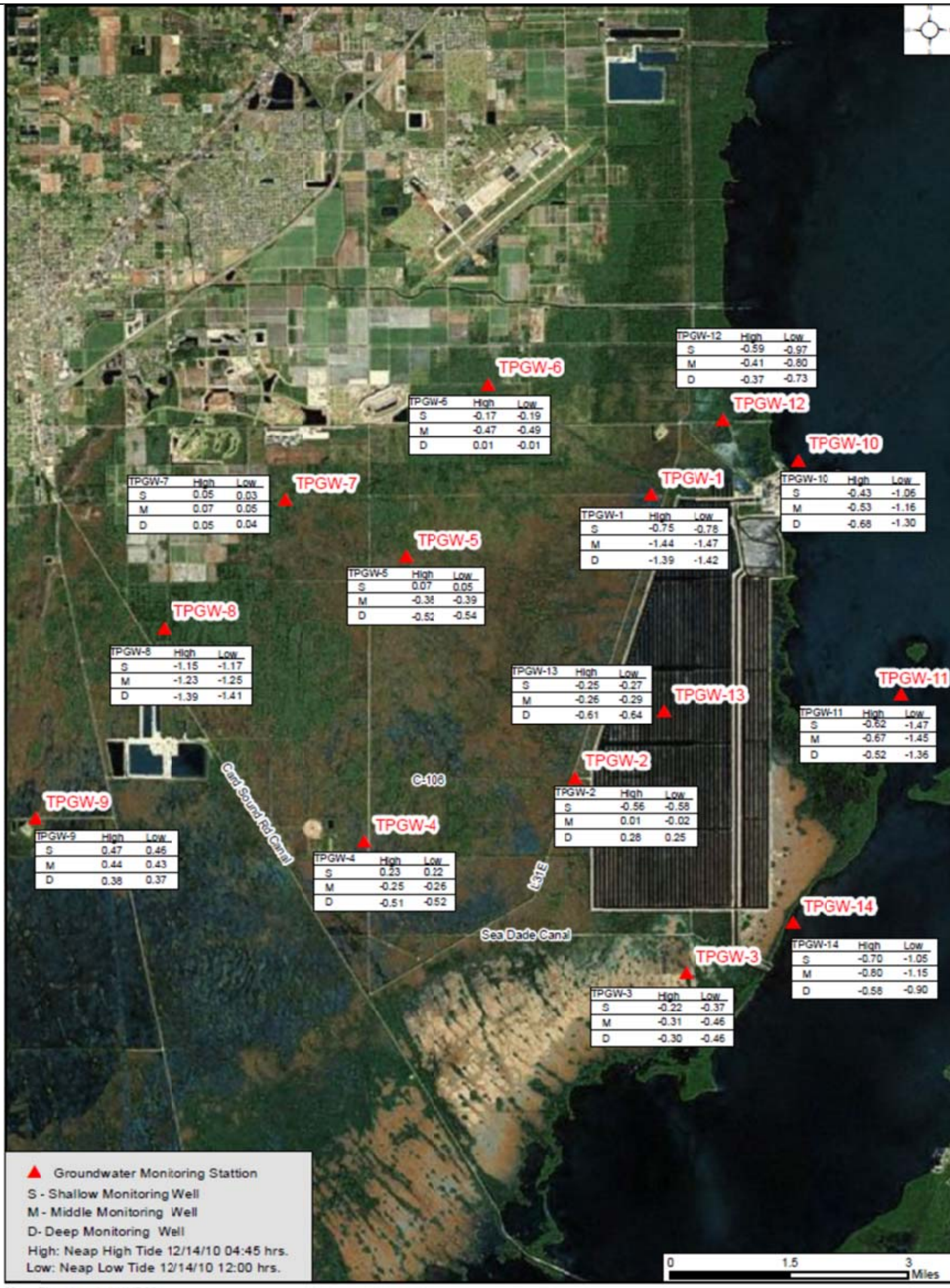


Figure 2-71. Comparison of Water Levels in the CCS and Biscayne Bay during Spring Tide in December 2010.



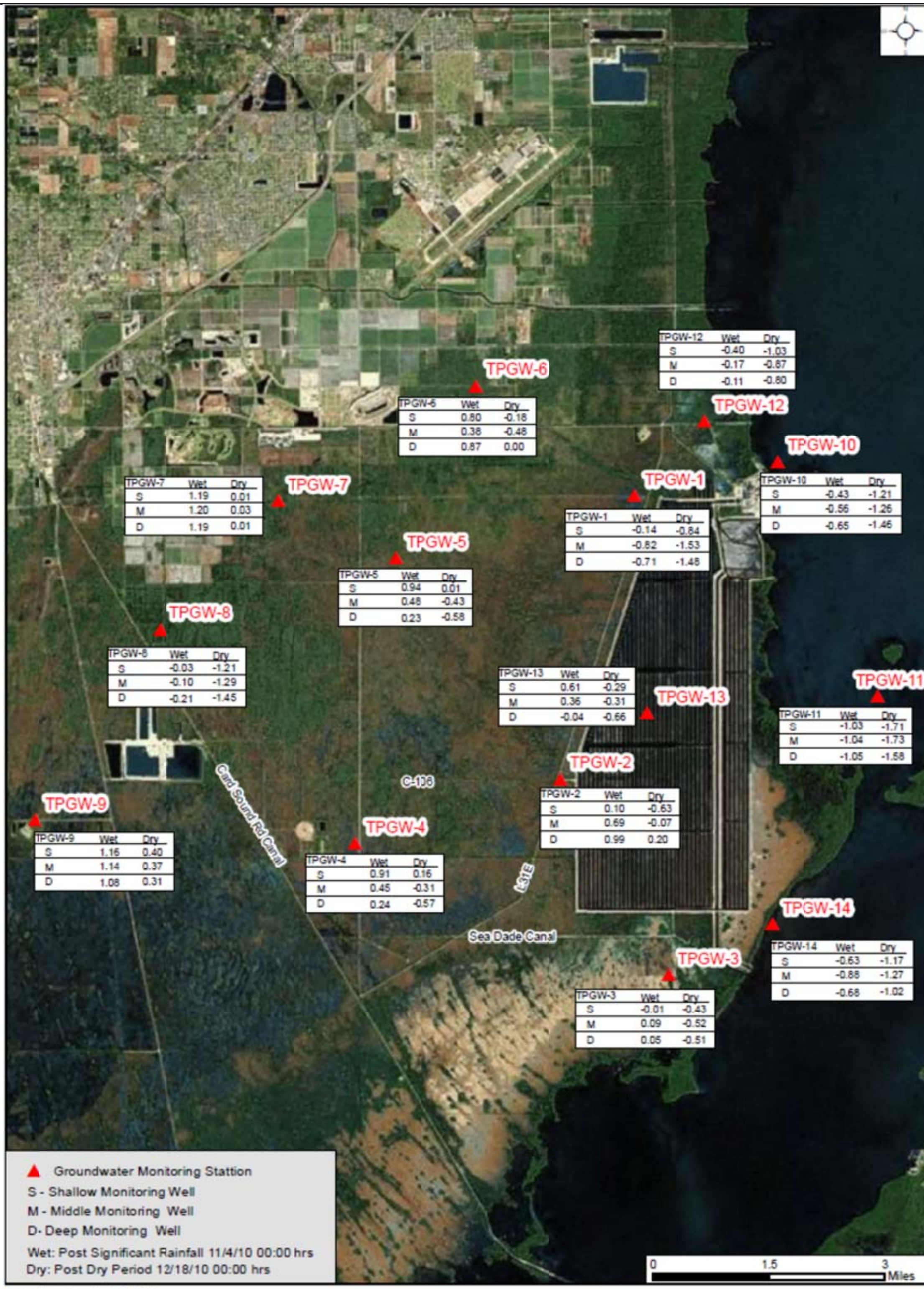
Note: Elevations in NAVD88

Figure 2-72. Spring Tide Groundwater Level Elevations, December 5, 2010.



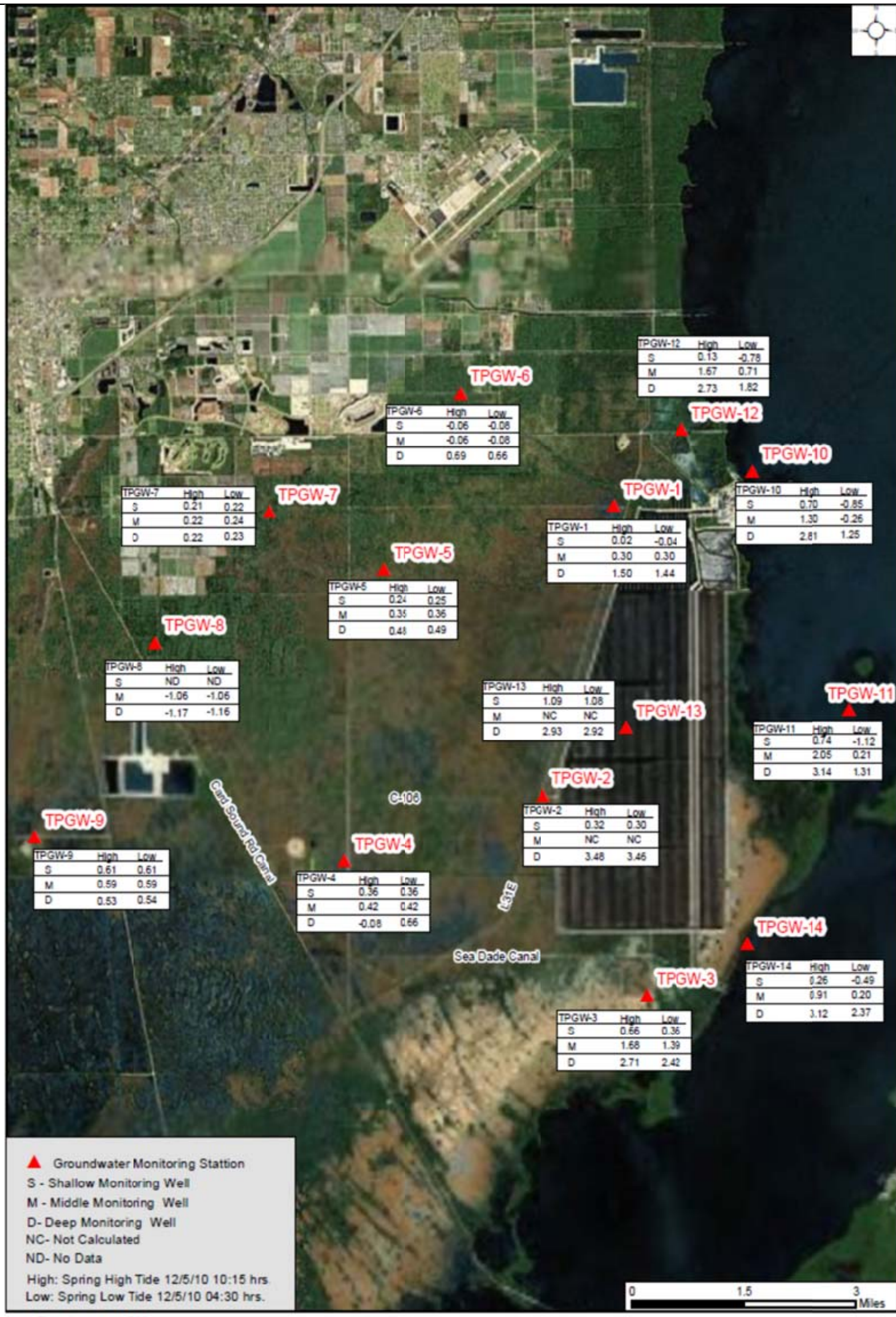
Note: Elevations in NAVD88

Figure 2-73. Neap Tide Groundwater Elevations, December 14, 2010.



Note: Elevations in NAVD88

Figure 2-74. Post Rainfall Event and Dry Period Groundwater Level Elevations, November 4 and December 18, 2010.



Note: Elevations in NAVD88

Figure 2-75. Spring Tide Groundwater Fresh Water Equivalent Elevations, December 5, 2010.

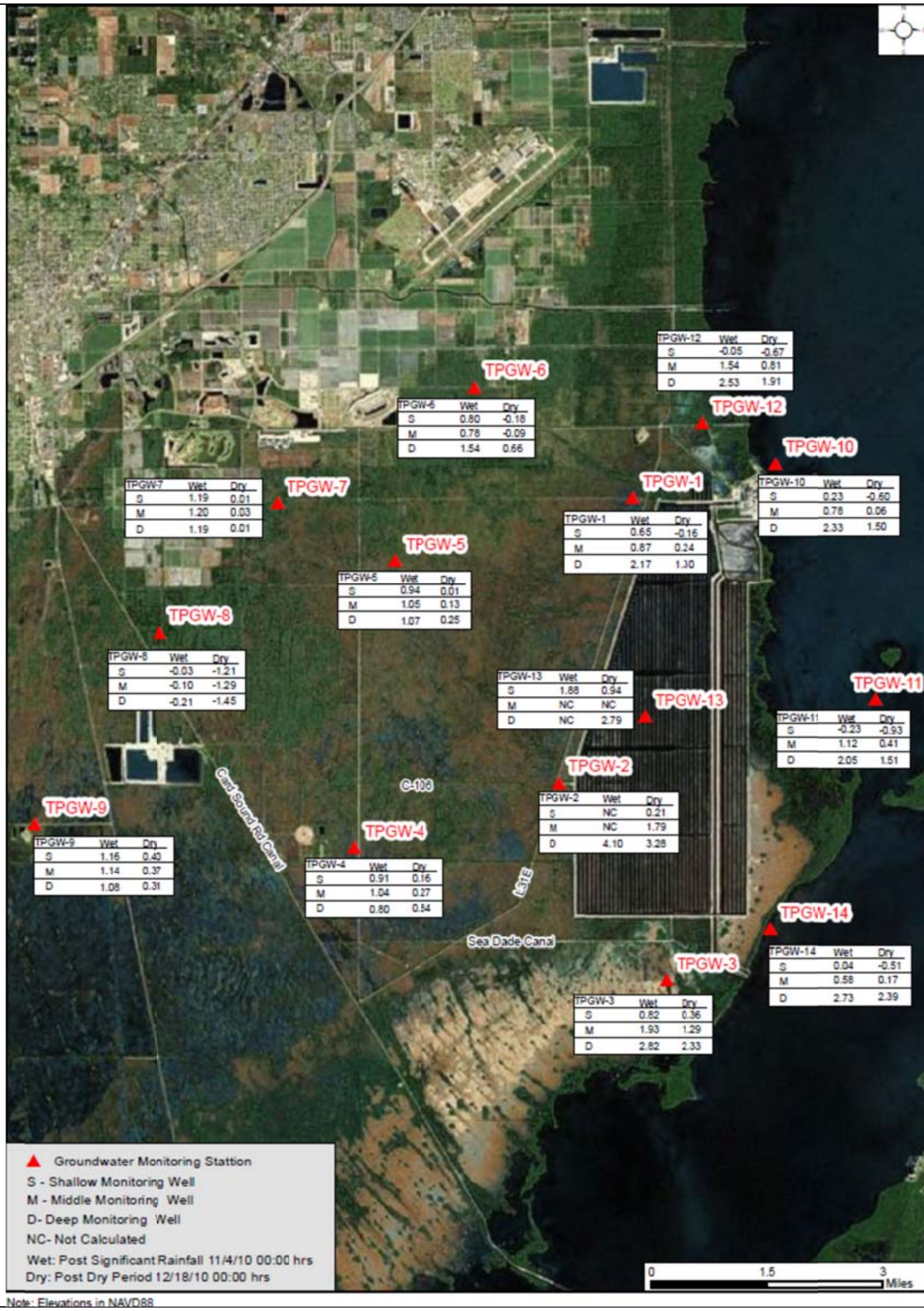
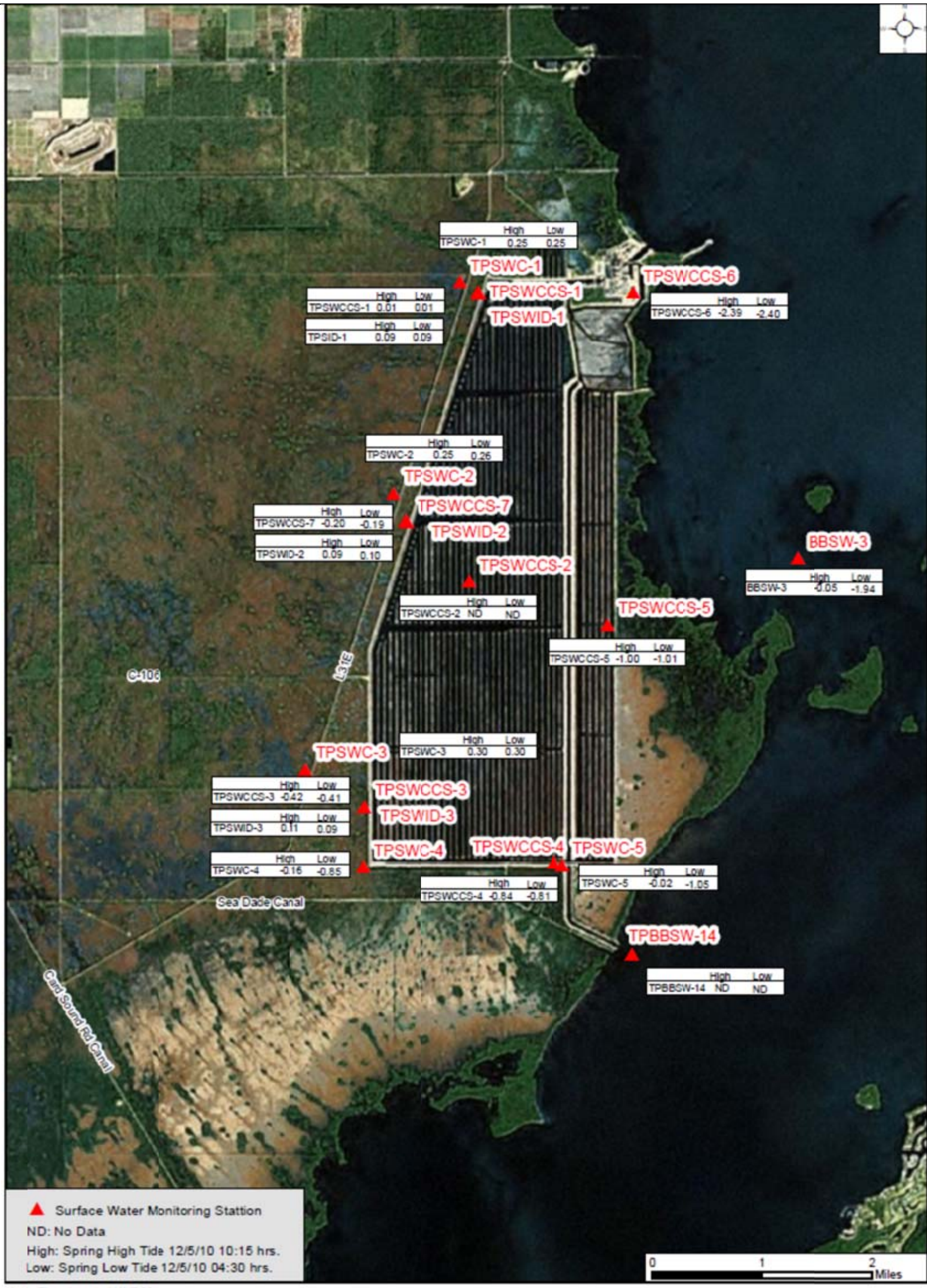


Figure 2-76. Post Rainfall Event and Dry Period Groundwater Fresh Water Equivalent Elevations, November 4 and December 18, 2010.



Note: Elevations in NAVD88

Figure 2-77. Spring Tide Surface Water Level Elevations, December 5, 2010.

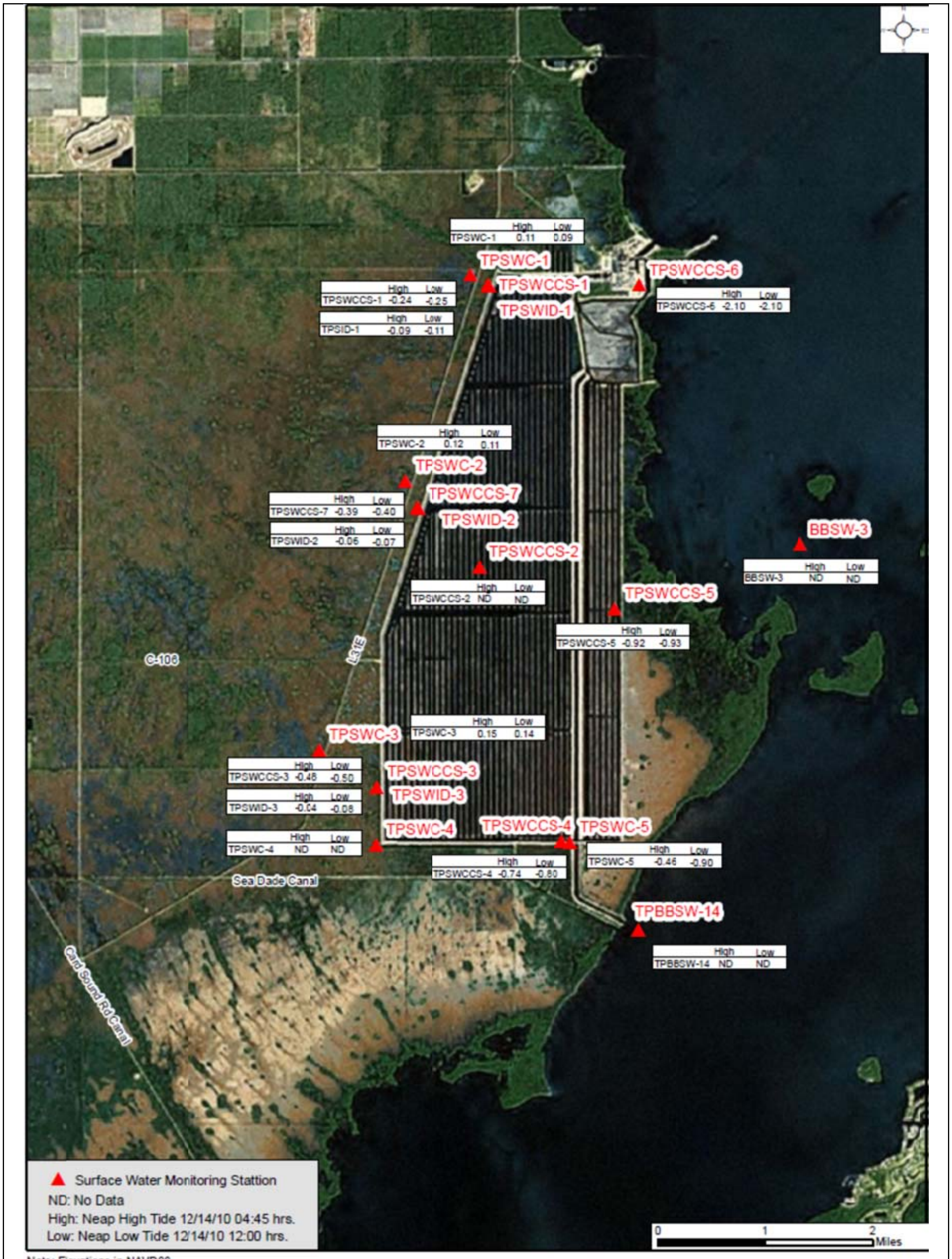


Figure 2-78. Neap Tide Surface Water Level Elevations, December 14, 2010.

Note: Elevations in NAVD88

Figure 2-79. Post Rainfall Event and Dry Period Surface Water Level Elevations, November 4 and December 18, 2010.

Figure 2-80. Meteorological Station Showing Vaisala WST520 Weather Transmitter, a Static Electricity Dissipater (Bristle Brush at Highest Point of Structure) and the LI-190SA Quantum Sensor. The solar panel is located between the instrumentation and the Campbell datalogger (housed within the stainless steel box). Data are recorded in the CR-1000 logger at 15-minute intervals and uploaded daily via telemetry.

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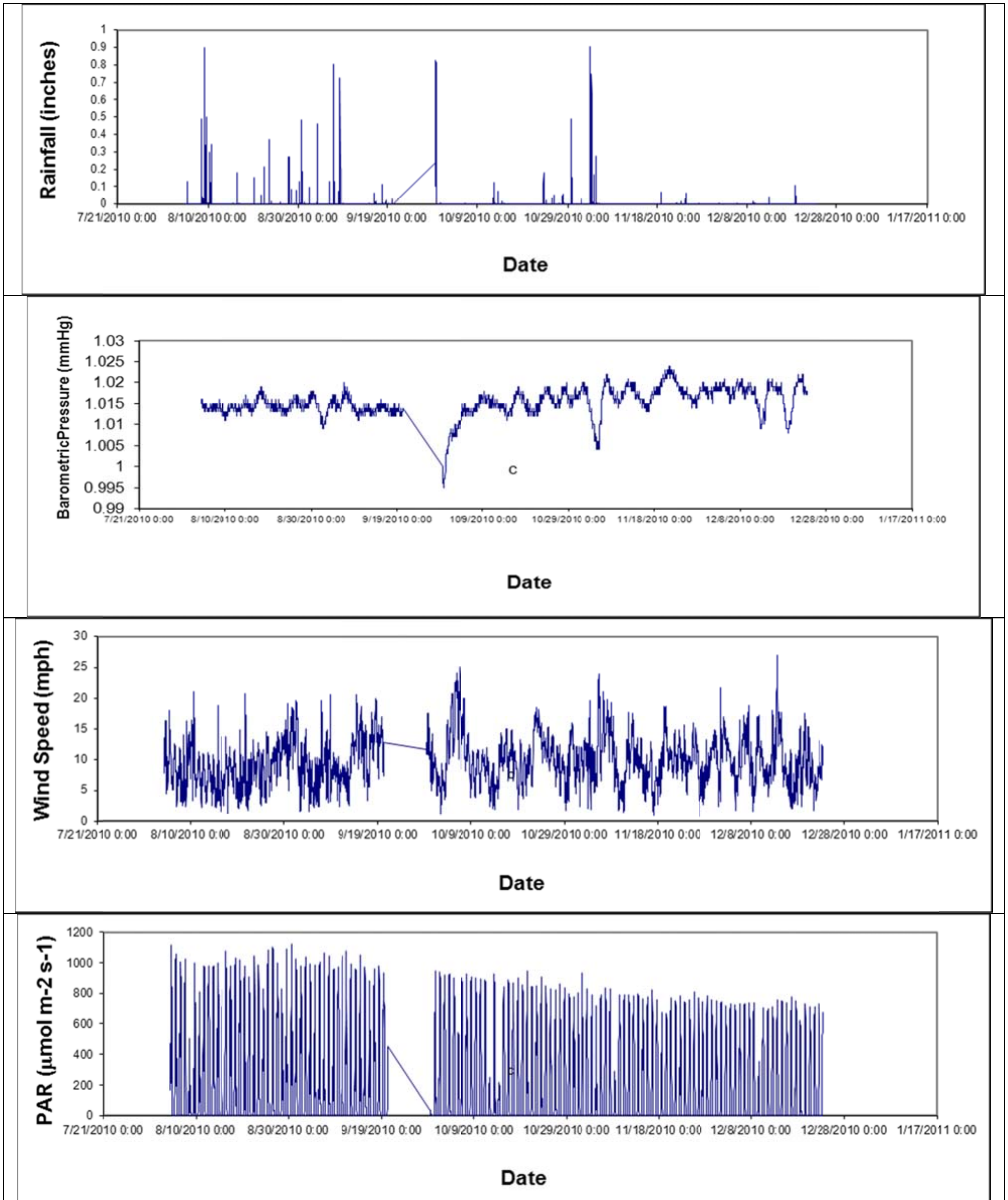

Key: PAR = Photosythentically active radiation.

Figure 2-81. Meteorological Parameters from the Gauge Located within the CCS (TPM-1).

3.0 QUARTERLY GROUNDWATER AND SURFACE WATER SAMPLING RESULTS

The Monitoring Plan and QAPP for this project outline the locations and analytes for the groundwater and surface water sampling and analysis for quarterly and semi-annual events. Tables 3-1 and 3-2 provide a summary of the sampling locations and analyses. Each groundwater location is a cluster of three wells at different depth intervals. The groundwater wells are designated by depth and include “S” for shallow, “M” for intermediate, and “D” for deep wells. Surface water samples are also designated by depth but include “T” for top (1 ft below surface) and “B” for bottom (1 ft above bottom).

With a few exceptions, samples were collected at all locations in June/July 2010 and September 2010 and analyzed for the requested parameters. The first sampling event in June /July was designated as a semi-annual event since it was conducted halfway in the calendar year. The September event was designated as a quarterly event.

The majority of the samples were analyzed by Test America, Inc.; however, more specialized analysis was conducted by the following laboratories:

- University of Miami RSMAS Laboratory - carbon isotopes
- University of Miami L7 Isotope Laboratory - hydrogen & oxygen isotopes
- USGS Tritium Laboratory – tritium
- USGS Strontium Laboratory - strontium isotope
- KLN Laboratories, Inc. - gross alpha

Details of the analytical methodologies for each analyte are provided in the project QAPP.

The following subsections provide a brief overview of the methods used to collect the samples and discusses notable exceptions in data collection methodology, sample collection, and/or laboratory analysis. A summary of the field parameters and analytical results is also included along with preliminary observations. For greater details on the sampling methodology or laboratory procedures, refer to the project QAPP.

3.1 GROUNDWATER QUALITY

3.1.1 Sample Collection and Analysis

Groundwater samples were collected in accordance with the QAPP using a peristaltic pump and dedicated Teflon tubing that extended to the middle of each well screen interval. Figure 3-1 shows a typical set up for the groundwater sampling. Three equipment volumes were purged before stability readings were taken. When three consecutive readings were recorded that coincided with the FDEP criteria for parameter stabilization, sampling was initiated. Groundwater and surface water sampling logs for the two events are provided in Appendix F of this report.

In the first sampling event, a couple of wells had a parameter that was inadvertently not analyzed or there was a lab reporting error. These wells and parameters include TPGW-1D ($^{87}/^{86}$Sr), TPGW-3M ($^{87}/^{86}$Sr), TPGW-6 cluster (Ba and Fe).

The L and G series wells (L-3, L-5, G-21, G-28, and G-35) were sampled in October. The groundwater was analyzed for a broad suite of parameters consistent with the Monitoring Plan. However, results are still pending.

During the June/July sampling event, no samples were collected for the wells in Biscayne Bay (TPGW-10, -11, and -14) since the support structures had yet to be fully completed. These wells were sampled during the September event.

3.1.2 Results

Tables 3-3 and 3-4 provide a summary of the groundwater analytical results from the June/July and the September sampling events. Data Usability Reports for each event are provided in Appendix G and the detailed Level IV laboratory reports from Test America are included in Appendix I.

Figures 3-2 and 3-3 show chloride and sodium concentrations for both sampling events.

Chloride concentrations in TPGW-13 ranged from 26,000 to 37,000 milligrams per liter (mg/L). TPGW-10, -11, and -14, in September only, ranged from 19,000 to 25,000 mg/L with the exception of TPGW-14D with a concentration of 29,000 mg/L. TPGW-1, -2, -3, and -12 ranged from 23,000 to 31,000 mg/L with one exception of 14,000 mg/L (TPGW-12S) in June and two outliers of 11,000 mg/L (September, TPGW-1S), and 16,000 mg/L (TPGW-12S) in September. TPGW-4, -5, and -6 shallow wells ranged from 210 to 490 mg/L while the intermediate and deep wells ranged from 7,100 to 16,000 mg/L. The clusters TPGW-7, -8, and -9 had chloride concentrations of less than 50 mg/L.

Sodium results between the two events ranged from 9.6 to 19,000 mg/L. The highest concentrations were in TPGW-13 at 18,000 to 19,000 mg/L. The Biscayne Bay wells, TPGW-10, -11, and -14, ranged from 11,000 to 13,000 mg/L with the exception of TPGW-14D with a concentration of 16,000 mg/L. TPGW-1, -2, -3, and -12 ranged from 13,000 to 18,000 mg/L with one outlier of 7,700 mg/L (TPGW-12S) in June and two outliers of 5,700 mg/L (Sept TPGW-1S), and 7,400 mg/L (TPGW-12S) in September. TPGW-4, -5, and -6 shallow wells had 100 to 250 mg/L while the intermediate and deep wells ranged from 3,800 to 8,600 mg/L. The clusters TPGW-7, -8, and -9 ranged from 9.6 to 31 mg/L.

In reviewing the results, it is important to understand where the wells are actually screened since all wells of the same classification (shallow, intermediate or deep) are not at the same elevation (see Appendix H Well Construction Details). For example the bottom of the well screen in the deep well at TPGW-10 is at -122 feet NAVD 88 while the bottom of the well screen in the deep well at TPGW-5 is at -66.8 feet NAVD 88. It equally important to understand that the placement of the well screen was based on lithology (at or near contacts between the Miami Limestone and Fort Thompson Limestone Formations and the Fort Thompson Limestone and Tamiami Formations), presence of flow zones and geophysics and knowledge that the base of the Biscayne Aquifer shallows to the west. Figures 3-4 through 3-7 show cross sections of the aquifer, selected wells at the three depth intervals and associated chloride concentrations. The results typically show higher levels of chlorides/saltwater at depth and the highest levels in wells at or in close proximity to the CCS and Biscayne Bay. However, none of the newly installed shallow wells are screened less than 20 feet below ground surface. Based on the monitoring records of the historic L and G series wells (Golder 2005, 2006, 2007, 2008, 2009) and supported by induction logs conducted by the USGS for this project (JLA Associates 2010), it appears that the upper 15 to 20 feet of the aquifer is freshwater west of the Interceptor Ditch and this freshwater zone increases in depth towards Tallahassee Road. Beneath the freshwater lense is saltwater.

The presence of saltwater in the aquifer west of Turkey Point predates the CCS and was documented further inland in the 1940s (Klein 1957). This saltwater zone can move seasonally and year to year (Peters and Reynolds 2008). Figures 3-8 through 3-11 show cross sections similar to those presented above but are based on historic well locations and chloride data from the early 1970s before the CCS was fully constructed.

Since saltwater intrusion has been documented in south Miami-Dade County since the early 1900s and was far inland in the 1940s (Klein 1957), the challenge is in determining whether the saltwater is from Biscayne Bay, the CCS, or both, and ultimately, its relevance. Figure 3-12 shows the chloride concentrations at each well and how those concentrations compare to average Biscayne Bay bottom concentrations and average CCS bottom concentrations. The average Biscayne Bay and CCS concentrations are based on the analytical results from each sampling period.

A number of other constituents are being analyzed to better understand the geochemistry of the water from different sources and determine whether the water from the CCS can be fingerprinted. This analysis includes tritium and stable isotopes of water ($^{18}O/^{16}O$), hydrogen ($^{3}H/^{2}H$), carbon ($^{13}C/^{12}C$), strontium ($^{87}/^{86}Sr$) and dissolved inorganic carbon (DIC) as well as ions listed in Table 3-2 of this report and barium and iron.

IONS

The cations analyzed in both events include sodium, calcium, magnesium, potassium, boron, and strontium. Anions include bromide, chloride, fluoride, sulfate, alkalinity, and sulfides. While chloride and sodium results are discussed above, a brief synopsis of the other ions is presented below.

Calcium concentrations ranged from 400 to 870 mg/L in the wells associated with the CCS and Biscayne Bay. TPGW-4, -5, and -6 shallow wells and TPGW-7, -8, and -9 ranged from 80 to 210 mg/L. The wells associated with the CCS and the Biscayne Bay had similar results.

Potassium concentrations ranged from 410 to 800 mg/L in the wells associated with the CCS and Biscayne Bay. TPGW-4, -5, and -6 intermediate and deep well concentrations ranged from 120 to 420 mg/L. The TPGW-4, -5, and -6 shallow wells and all depths of TPGW-7, -8, and -9 potassium concentrations were much lower and ranged from 3.1 to 13 mg/L.

Magnesium concentrations were slightly higher in TPGW-13 (2, 100 to 2,500 mg/L) than in the canal perimeter and Biscayne well concentrations ranging from 690 to 2,100 mg/L. TPGW-4, -5, and -6 intermediate and deep well concentrations ranged from 450 to 1,100 mg/L, while the shallow wells ranged from 7.8 to 22 mg/L. TPGW-7, -8, and -9 ranged from 0.18 to 6.2 mg/L.

Boron results between both events ranged from 7.2 to 8.7 mg/L in TPGW 13. TPGW-1, -2, -3,-10, -11, -12, and -14 ranged from 2.2 to 7.1 mg/L. TPGW-4, -5, and -6 intermediate and deep wells ranged from 0.58 to 2.2 mg/L. Results in TPGW-4, 5, and -6 shallow wells and TPGW-7, -8, and -9 all depths were less than 0.1 mg/L.

Strontium results between both events ranged from 6.3 to 16 mg/L in wells associated with the CCS and Biscayne Bay. TPGW-4, -5, and -6 intermediate and deep wells ranged from 6.8 to 8.8 mg/L. Results in TPGW-4, -5, and -6 shallow wells and TPGW-7, -8, and -9 all depths were between 0.82 to 1.3 mg/L. The wells associated with the CCS and Biscayne Bay had overlapping results.

Bromide concentrations ranged from undetected to 120 mg/L in wells associated with the CCS and Biscayne Bay. TPGW-4, -5, and -6 shallow wells and TPGW-7, -8, and -9 had a range of undetected to 1.7 mg/L.

Sulfate concentrations in TPGW-13 ranged from 3,700 to 5,000 mg/L. TPGW-1, -2, -3, -10, -11, -12 and -14 ranged from 1,400 to 4,400 mg/L. TPGW-4, -5, and -6 shallow wells ranged from 13 to 20 mg/L while the intermediate and deep wells ranged from 800 to 1,900 mg/L. The clusters TPGW-7, -8, and -9 had sulfate concentrations less than 50 mg/L.

Fluoride concentrations were reported as not detected in TPGW-1, -2, -3, -11, -12, -13, and -14, [with the exception of -12S (0.17 mg/L)] and TPGW-4, -5, and -6 intermediate and deep wells. Fluoride in TPGW-4, -5, and -6 shallow wells and TPGW-7, -8, and -9 all depths ranged from 0.051 to 0.23 mg/L. Fluoride concentrations in TPGW-10S, -10M, and -10D were 39 mg/L, 130 mg/L, and not detected, respectively. The values in the shallow and intermediate depth wells were higher than any other fluoride values measured. These wells were not sampled in the June/July event as construction was not yet completed. Surface water samples collected near TPGW-10 (BBSW-1) had values of 0.3 and 0.77 mg/L between the two events. More data is necessary to evaluate whether these data are an accurate representation of the wells in that location.

TDS concentrations in TPGW-13 ranged from 58,000 to 75,000 mg/L. TPGW-10, -11, and -14, in September only, ranged from 32,000 to 37,000 mg/L with the exception of TPGW-14D with a concentration of 47,000 mg/L. TPGW-1, -2, -3, and -12 ranged from 43,000 to 64,000 mg/L with one exception of 26,000 mg/L (TPGW-12S) in June/July and two outliers of 20,000 mg/L (TPGW-1S), and 23,000 mg/L (TPGW-12S) in September. TPGW-4, -5, and -6 shallow wells ranged from 660 to 1,100 mg/L while the intermediate and deep wells ranged from 13,000 to 33,000 mg/L. The clusters TPGW-7, -8, and -9 were all less than 500 mg/L with the exception of TPGW-8S (570 mg/L) in September.

Alkalinity and bicarbonate (as $CaCO_3$) were analyzed in groundwater samples. Bicarbonate accounted for the majority if not all of the alkalinity detected in the groundwater samples. Alkalinity ranged from 110 to 330 mg/L for all wells with one outlier of 510 mg/L (TPGW-12S) in June/July and two outliers of 500 mg/L (TPGW-8S), and 480 mg/L (TPGW-12S) in September.

Sulfides were collected during the June/July semi-annual event. Sulfides were not detected in the majority of samples. The few detections included TPGW-3S (4.8 mg/L), -9S (1.1 mg/L), -12S (22mg/L), and -13S (19mg/L).

ISOTOPES

The results for δD between the two events ranged from 35‰ to -15.8‰. TPGW-13 had 26.7 to 35‰. TPGW-10, -11, and -14, in September only, ranged from 16‰ to 26‰. TPGW-1, -2, -3, and -12 ranged from 20.3 to 32.5‰ with one outlier of -15.8 (TPGW-12M) in June and two outliers of 8 (Sept TPGW-1S), and 11 (TPGW-12S) in September. TPGW-4, -5, and -6 shallow wells had -3.0 to -9.0‰ while the intermediate and deep wells ranged from -1.2 to 14.8‰. The clusters TPGW-7, -8, and -9 ranged from -2.9 to -13‰ with one outlier of 2.0 (TPGW-9S) in September. It should be noted the results for the outliers were within the stated ranges in the alternate event.

Oxygen isotope, $\delta^{18}O$, results between the two events ranged from 5.5‰ to -3.2‰. TPGW-13 ranged from 5.0 to 5.5‰. TPGW-10, -11, and -14, in September only, ranged from 1.5 to 4.3‰. TPGW-1, -2, -3, and -12 ranged from 1.1 to 5‰ with one outlier of -3.2‰ (TPGW-12M) in

June. The result for the outlier was within the stated range in the alternate event. TPGW-4, -5, and -6 shallow wells had -0.9 to -1.7‰ while the intermediate and deep wells ranged from -0.5to 2.5‰. The clusters TPGW-7,- 8, and -9 ranged from -1.0 to -1.8‰.

Carbon isotope results between the two events ranged from -14.29 to -14.3‰. TPGW-13 had values that ranged from -6.4 to -7.86‰. TPGW-10, -11, and -14, in September only, ranged from -4.39 to -11.45‰. TPGW-1, -2, -3, and -12 had values that ranged from -6.29 to -12.94‰. TPGW-4, -5, and -6 shallow wells had -9.79 to -11.95‰ while the intermediate and deep wells ranged from -6.6 to -9.67‰. The clusters TPGW-7, -8, and -9 ranged from -7.59 to -14.29‰.

Strontium isotope results had little variation, ranging from 0.70908‰ and 0.70923‰ in June/July and 0.70910‰ to 0.70919‰ in September.

Tritium results between the two events ranged from -2.7 (not detected) to 4,785 pico Curies per Liter (pCi/L) (see Figure 3-13). TPGW-13 which is in the CCS had tritium levels that ranged from 3,554 to 4,785 pCi/L. TPGW-1, -2, -3, and -12 had tritium levels that ranged from 236 to 3,732 pCi/L. TPGW-14 had tritium concentrations that ranged from 228 pCi/L in the shallowest well to 2,580 pCi/L in the deepest well. Tritium concentrations in TPGW-4, -5, and -6 ranged from 2.6 (not detected) to 611 pCi/L while TPGW-7, -8, and -9 ranged from –2.7 (not detected) to 16.0 pCi/L. The results less than one standard deviation were qualified as estimated not detected.

TRACE ELEMENTS

In addition to the ions and tracer suite constituents, trace elements were collected from three well clusters in or within close proximity to the CCS (TPGW-1, TPGW -3 and TPGW-13) during the semi-annual June/July event. Samples were not collected in TPGW-10 and TPGW-14 in June/July because the well infrastructure was not completed. Most concentrations were non-detected or low values between the MDL and quantitation limit. Iron and, to a lesser extent, manganese were several of the exceptions where values were above the quantitation limit. Iron was detected in all three well clusters but was also part of the tracer suite of constituents sampled in June/July and September in 11 to all 14 well clusters. Iron levels were consistently high throughout the area with the highest levels in the September sampling event at TPGW-1M (13 mg/L), TPGW-13M (7.8 mg/L), and TPGW-4D (10 mg/L). Of note is that the iron in the shallow well at TPGW-13S was only 0.22 mg/L. Manganese levels were considerably lower than iron with the highest value of 0.12 mg/L at TPGW-1M.

In addition to iron, barium was collected for all groundwater samples as part of the tracer suite constituents. Barium results between the two events ranged from not detected to 0.26 mg/L. With a few exceptions, the higher concentrations noted were from TPGW-1, -2, -3, -4, -5, -6, -12, and -13. Barium was not detected in the Biscayne Bay groundwater wells (TPGW-10, -11, and -14) during the only event they were sampled.

Dissolved inorganic carbon, also part of the tracer suite constituents, ranged from 27 to 87mg/L in groundwater wells TPGW-1, -2, -3, -10, -11, -12, and -13 with the exception of TPGW-12S

(130, 120mg/L) and TPGW-11D (890mg/L). TPGW-4, -5, -6, -7, -8, and -9 ranged from 44 to 75 mg/L, with outliers of 3.9 and 3.5 (TPGW-8S in June/July and September, respectively). TPGW-14 had concentrations of 770, 790, and 580 mg/L in the shallow, intermediate, and deep wells.

NUTRIENTS

Nutrients were collected for the three completed wells in close proximity to the CCS as part of the June/July semiannual event and include ammonia, ammonium, nitrate+nitrite, Total Kjeldahl Nitrogen (TKN), Total Nitrogen, Total phosphorous, and Soluble Reactive Phosphorous (SRP), and silicate. The Monitoring Plan Table 2-1 refers to "Ammonia (NH3) – calculated as NH3" which corresponds to "Unionized NH3" in Tables 3-3 and 3-4. In addition, the table refers to "Ammonium (NH4+) as N" which corresponds to "Ammonium Ion NH4+". To obtain these results, the total ammonia analysis must be performed and is reported. TKN is the sum of organic nitrogen (i.e., urea), ammonia, and ammonium. Total Nitrogen is the sum of TKN and nitrate+nitrite. SRP in the Monitoring Plan corresponds to ortho-phosphate in Tables 3-3 and 3-4.

The TPGW-1S and -1M were qualified as unusable for ammonium and TKN based on total nitrogen results being significantly lower. Total ammonia results in the three groundwater well clusters sampled had a range of 1.3 to 2.1mg/L. Ammonium ion, NH4, ranged from 1.285 to 2.08 mg/L. Unionized ammonia, NH3, ranged from 0.01 to 0.025 mg/L. Nitrate/nitrite ranged from not detected to 0.028 mg/L. TKN and TN concentrations were generally equal, ranging from 1.5 to 2.6 mg/L.

In many of the data packages from the June/July event, the ortho-phosphate results are significantly higher than the total phosphorous results. These include 35826, 35848, 35863, 35918, 35986, 36031, 36059, 36167, 36195, and 36274. Based on discussions with the SFWMD, this may be due to organic interferences which are sometimes endemic to south Florida. The SFWMD suggested an alternative method. Preliminary testing performed by Test America on a few porewater samples collected for the project has had some promising results using the method suggested by SFWMD. FPL is awaiting method documentation from SFWMD before formally revising the method for ortho-phosphate and total phosphorous.

The CCS sample results from the June/July semiannual event for total ammonia, TKN, and silica had similar results to the February 2009 synoptic sampling event. While total ammonia was analyzed in the synoptic sampling, ammonium and unionized ammonia were not. Similarly, soluble reactive phosphorous (SRP) was analyzed in the synoptic sampling, although total phosphorous was not. SRP was detected in CCS surface waters during the June/July semiannual at concentrations between 0.5 to 0.8 mg/L but was not detected in the synoptic sampling. Nitrate/nitrite results ranged from not detected to 0.028 mg/L where the synoptic sampling results ranged from not detected to 0.004 mg/L.

As noted above, in several data packages, the ortho-phosphate results are higher than the total phosphorous results. Until the alternative method is utilized on the next quarterly sampling event, the June/July and September 2010 ortho-phosphate and total phosphorus results are considered estimated.

Silica ranged from 3.5 to 7.1 mg/L with the highest concentration detected in TPGW-13D. Samples results generally overlapped among the three well clusters sampled for silica in June/July, both with location and depth.

3.2 SURFACE WATER QUALITY

3.2.1 Sample Collection and Analysis

For the purposes of this discussion, surface water includes canals, the CCS, and Biscayne Bay. Surface water samples were collected using a peristaltic pump and new Teflon® or polyethylene tubing that was affixed to rigid pipe to ensure the samples were collected at the appropriate depth. Once parameters had stabilized, water was extracted from the tubing and collected directly into the sample bottles. After each sample collection, the tubing was disposed and new tubing was used. Samples for surface water are typically collected from fixed platforms or from a boat.

Samples were collected at the surface water stations identified in Table 3-1 at the surface and bottom unless the water depths were less than three feet deep. Then, only one sample was collected at the bottom. For the first sampling event, samples were collected at the bottom only at stations TPCCS-1, TPCCS-2, TPCCS-3, TPCCS-7, TPCCS-8 (anomaly area), BBSW-2, and BBSW-3 due to the shallow depths that were typically less than three feet. The Monitoring Plan currently indicates a low water depth of three feet as the break point to collecting surface water samples at both the surface and bottom in the CCS, Interceptor Ditch, and canals.

There was some uncertainty whether this three-foot criteria applied in Biscayne Bay, so samples were collected at depth at all stations and at the surface and depth at BBSW-1, -4, and -5. However, it was clarified to the field team after the first sampling event that all Biscayne Bay samples were to be collected only at the bottom to coincide with the placement of the automated water quality probes; thus for the September event, samples were collected from the bottom only, regardless of depth.

In the first sampling event, a couple of wells had a parameter that was inadvertently not analyzed or there was a lab reporting error. These wells and parameters included BBSW-3, -4, and -5 ($^{87/86}$Sr, ^{3}H), TPSWC-6 (Ba and Fe), TPSWC-DUP1 (^{3}H), and 061710-FB1 (^{2}H, $O^{18/16}$). Only isotopes were analyzed for samples TPSWC-5T and -5B due to a sampling error. Samples were originally collected, but arrived at the laboratory above temperature requirements (>6°C for >24 hrs). FPL directed the laboratory not to analyze these samples. TPSWC-5T and -5B were sampled and analyzed as part of the September event.

For the September event, a few field blanks or duplicate samples did not get completely analyzed; these included 091110-FB1 (^{3}H), 092310-DUP1 (TDS), 092310-FB1 (TDS), and 092710-FB1 (^{2}H, $O^{18/16}$). Also the carbon isotope ($C^{13/12}$) was not analyzed for TPSWCCS-3B.

3.2.2 Results

Tables 3-5 and 3-6 provide a summary of the surface water analytical results from the June/July and the September sampling events. Data Usability Reports for each event are provided in Appendix G and the detailed Level IV laboratory reports from Test America are included in Appendix I.

Figures 3-14 and 3-15 detail surface water chloride and sodium concentrations for all surface water stations and are representative of saltwater influences.

Chloride concentrations ranged from 31,000 to 40,000 mg/L in the CCS samples. The Biscayne Bay samples had concentrations ranging from 11,000 to 21,000 mg/L. TPSWC-5T and -5B had concentrations of 15,000 to 23,000. TPSWC-4T and -4B had chloride concentrations of 460 and 860 mg/L in September and 9,300 to 13,000 mg/L in June. Surface water canal samples, except for TPSWC-4 and -5, ranged from 39 to 250 mg/L. Interceptor Ditch locations had concentrations ranging from 460 to 2,800 mg/L. Surface water standards are categorized into fresh and marine waters based on chloride concentration. Surface waters with chloride concentrations greater than 1,500 mg/L are defined as marine, while less than 1,500 mg/L are defined as fresh.

The highest sodium concentrations were in the CCS samples with a range of 16,000 to 22,000 mg/L. The Biscayne Bay surface water samples (BBSW) ranged from 8,000 to 12,000 mg/L with the exception of BBSW-2B with a concentration of 5,400 mg/L. The Interceptor Ditch samples (TPSWID-1, -2 and -3) ranged from 290 to 1,300 mg/L. The surface water canal samples (TPSWC-1, -2, -3, and -6) ranged from 27 to 120 mg/L. TPSWC-4T and -4B had values of 5,000 and 7,100 mg/L, respectively, in the June/July event while they were 290 and 400 mg/L in the September event (specific conductivity and chloride are lower as well at these locations in the second event).

The CCS surface water samples had a specific conductivity range of 70,000 to 83,000 µS/cm, which are indicative of hypersaline conditions. TDS concentrations were also generally high at 71,000 to 81,000 mg/L. Hypersaline waters are characterized by higher than normal specific conductivity as well as chloride, TDS, and other analyte concentrations depending on the nature of the waters. Typical seawater has specific conductance levels around 50,000 µS/cm and chloride concentrations of about 19,000 mg/L; however, there is no universally accepted definition of what defines water as hypersaline. For this sampling period, Biscayne Bay samples had a specific conductivity range of 42,000 to 50,000 µS/cm with one exception. In the September event, BBSW-2B had a specific conductivity of 30,000 µS/cm. For laboratory notification purposes, samples with a specific conductivity greater than 54,000 µS/cm were designated as hypersaline. This was necessary to alert the laboratory so they could use appropriate method modifications. The surface water samples collected at the canals and Interceptor Ditch locations had values well below the hypersaline designation.

IONS

The cations analyzed in both events are the same ones analyzed for the groundwater samples and include calcium, magnesium, potassium, sodium, boron, and strontium. Anions include bromide, chloride, fluoride, sulfate, alkalinity, and sulfides and are also consistent with what was analyzed for the groundwater samples. While chloride and sodium results are discussed above, a brief synopsis of the other ions is presented below.

Calcium concentrations in the CCS sample locations ranged from 650 to 950 mg/L. Biscayne Bay samples ranged from 260 to 470 mg/L. Interceptor Ditch calcium concentrations ranged from 94 to 210 mg/L. Concentrations detected in the canals ranged from 44 to 98 mg/L with the exception of TPSWW-4T and -4B which had concentrations in June/July of 340 and 410 mg/L respectfully and TPSWC-5T and -5B (only results for September), which had concentrations of 360 and 510 mg/L, respectively.

Potassium concentrations in the CCS sample locations ranged from 620 to 870 mg/L. Biscayne Bay samples ranged from 320 to 590 mg/L. TPSWC-4 in the June event had concentrations of 270 and 410 mg/L while in September the concentrations were 13 and 20 mg/L. TPSWC-4T and -4B had lower values in the September event compared to the June/July event. This may be due to the fact that this canal is tidally influenced as well as affected by freshwater discharges from S-20 discharge structure (S-20), thus resulting in a canal that takes on the characteristics of saltwater or freshwater depending on rainfall and the S-20 operations. Interceptor Ditch potassium concentrations ranged from 12 to 54 mg/L. The surface water canals TPSWC-1, -2, -3, and -6 ranged from 2.5 to 9.4 mg/L.

Magnesium concentrations in the CCS sample locations ranged from 2,100 to 3,000 mg/L. Biscayne Bay samples ranged from 650 to 1,500 mg/L. TPSWC-5 (in the September event) had results of 1,200 and 1,600 mg/L. TPSWC-4T and -4B had lower values in the September event compared to the June/July event. Interceptor Ditch potassium concentrations ranged from 28 to 150 mg/L. Concentrations detected in the canal locations TPSWC-1, -2, -3, and -6 ranged from 5.8 to 13 mg/L

Boron concentrations in the CCS sample locations ranged from 7.8 to 11 mg/L. Biscayne Bay samples ranged from 2.5 to 5.4 mg/L. TPSWC-5 (in the September event) had results of 4.2 and 5.4 mg/L. TPSWC-4T and -4B had lower values in the September event compared to the June/July event. Interceptor Ditch boron concentrations ranged from 0.11 to 0.47 mg/L. Concentrations detected in the canal locations TPSWC-1, -2, -3, and -6 ranged from 0.043 to 0.096 mg/L.

Strontium concentrations in the CCS sample locations ranged from 13 to 18 mg/L. Biscayne Bay samples ranged from 4.3 to 8.6 mg/L. TPSWC-5 (in the September event) had results of 6.3 and 9.1 mg/L. TPSWC-4 T and B had lower values in the September event compared to the June/July event. Interceptor Ditch strontium concentrations ranged from 1.0 to 2.6 mg/L. Concentrations detected in the canal locations TPSWC-1, -2, -3, and -6 ranged from 0.42 to 1.1 mg/L.

Bromide concentrations in the CCS sample locations ranged from 93 to 130 mg/L. Biscayne Bay samples ranged from 32 to 79 mg/L with one exception of not detected (BBSW-1B). TPSWC-5 (in the September event) had results of 56 and 76 mg/L. TPSWC-4 had values within the ranges stated for the Biscayne Bay samples. Interceptor Ditch bromide concentrations ranged from 1.5 to 9.4 mg/L. Concentrations detected in the canal locations TPSWC-1, -2, -3, and -6 ranged from not detected to 0.81 mg/L.

Sulfate concentrations in the CCS sample locations ranged from 3,900 to 5,400 mg/L. Biscayne Bay samples ranged from 2,100 to 3,300 mg/L with one exception of 1,200 mg/L (BBSW-2B). TPSWC-5 (in the September event) had results of 2,100 and 2,800 mg/L, within the range of Biscayne Bay samples. TPSWC-4T and -4B had lower values in the September event compared to the June/July event. Interceptor Ditch sulfate concentrations ranged from 30 to 300 mg/L. Concentrations detected in the canals locations TPSWC-1, -2, -3, and -6 ranged from 2.0 to 56 mg/L.

Fluoride was not detected in any of the CCS samples between the two events. Biscayne Bay samples ranged from not detected to 0.77 mg/L. Interceptor Ditch fluoride concentrations ranged from not detected to 3.2 mg/L. Concentrations detected in all canal samples ranged from not detected to 0.11 mg/L.

ISOTOPES

Deuterium concentrations in the CCS sample locations ranged from 23.0 to 36.5‰. Biscayne Bay samples ranged from 9.0 to 19.6‰. TPSWC-4 and -5 had results ranging from 13.0 to 24.2‰ with an outlier of 2.0‰ (TPSWC-4B). Interceptor Ditch and surface water canals locations TPSWC-1, -2, -3, and -6 had concentrations ranging from -2.1 to 10.1‰.

Oxygen isotope concentrations in the CCS sample locations ranged from 4.1 to 6.3‰. Biscayne Bay samples ranged from 0.7 to 2.8‰. TPSWC-4 and -5 had results within the range of the Biscayne Bay samples. Interceptor Ditch and surface water canal locations TPSWC-1, -2, -3, and -6 had concentrations ranging from -0.7 to 1.3‰.

Carbon isotope concentrations in the CCS sample locations ranged from -2.47 to -6.05‰. Biscayne Bay samples ranged from -1.82 to -5.60‰. TPSWC-4 and -5 had results ranging from -4.45 to -8.83‰. Interceptor Ditch and surface water canal locations TPSWC-1, -2, -3, and -6 had concentrations ranging from -6.55 to -11.86‰.

Strontium isotope results for surface waters had little variation, ranging from 0.70909 to 0.70920‰ between the two events.

Tritium concentrations in the CCS sample locations ranged from 2,339 to 5,260 pCi/L (see Figure 3-16). Biscayne Bay samples ranged from 6.9 to 16.9 pCi/L (did not collect tritium samples during the June event for BBSW-3, -4, and -5). TPSWC-5 had results ranging from 146 to 801 pCi/L. TPSWC-4 had lower values in the September event compared to the June/July event. As previously discussed, this may be due to the fact that TPSWC-4 experiences tidal fluctuations and has the potential to be flushed with fresh water by the S-20 discharge structure. Interceptor Ditch had concentrations ranging from 52 to 162 pCi/L. Surface water Canal locations TPSWC-1, -2, -3, and -6 had results ranging from 8.4 (not detected) to 92 pCi/L. The results less than one standard deviation were qualified as estimated not detected.

TRACE ELEMENTS

The trace elements barium and iron were collected for all surface water samples as part the tracer suite constituents with exception of TPSWC-5 and -6. The duplicate of TPSWC-5B (TPSWC-DUP1) was analyzed for barium and iron. Barium results between the two events ranged from not detected to 0.58 mg/L. With a few exceptions, the higher concentrations noted were from the CCS samples and TPSWC-5.

Iron results between the two events generally ranged from not detected to 3.6 mg/L with a few exceptions. Iron concentrations in the CCS sample locations ranged from not detected to 1.9 mg/L with one outlier at 3.6 (TPSWCCS-2B) in the September event. Samples BBSW-1 through -5, and TPSWC-5 had iron levels that ranged from 0.084 mg/L to 1.2 mg/L with the higher concentrations in September. TPSWC-1 through 4 and Interceptor Ditch samples ranged from 0.028 (not detected) to 0.54 mg/L.

Dissolved inorganic carbon (part of the tracer suite constituents) ranged from 20 to 39 mg/L in the CCS and Biscayne Bay samples. Interceptor Ditch and surface water canals ranged from 30 to 80 mg/L.

NUTRIENTS

The specific nutrients analyzed are described in the corresponding Groundwater Section 3.1.2. All surface water stations were sampled for nutrients in the June/July semi-annual event with the exception of TPSWC-5. Surface water samples for nutrients were not collected during the September event.

Total ammonia results in the CCS had a range of 0.08 to 0.18 mg/L. The majority of the total was consistently ammonium, NH_4^+. Nitrate/nitrite ranged from not detected to 0.08 mg/L. TKN concentrations ranged from 1.5 to 2.5 mg/L.

The ortho-phosphate results were higher than the total phosphorous results in a few surface water samples. Results where the ortho-phosphate was greater than the total phosphorous are qualified as estimated. As discussed in the groundwater results, this is very likely due to matrix effects from the organic matter, although this has not been confirmed. Regardless of the cause, the laboratory and FPL have explored method options that can provide reliable phosphorous results from the hypersaline matrix. Preliminary testing performed by Test America on a few porewater samples collected for the project has had some promising results using the method suggested by

SFWMD. FPL is awaiting method documentation from SFWMD before formally revising the method for ortho-phosphate and total phosphorous.

Silica ranged from not detected to 1.6 mg/L in the CCS samples. Biscayne Bay samples ranged from 0.33 to 1.4 mg/L. Interceptor Ditch samples ranged from 3.2 to 4.3 mg/L. Surface water canal samples ranged from 2.8 to 6.4 mg/L.

GROSS ALPHA

The CCS surface water locations were sampled for gross alpha during the June/July semiannual event. Concentrations ranged from 15.8 to 57 pCi/L.

TPSWCCS-8 (Anomalous Location)

This surface water location was sampled and analyzed for the same constituents as other CCS samples. The results for all analytes were within the ranges seen at the other CCS locations.

TABLES

Table 3-1. Groundwater and Surface Water Sampling Locations

Event	Locations (refer to Figure 1-1)	Analytes[1]
Quarterly	TPGW – 1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14; L-3, -5; G-21, -28, -35	GW
	BBSW – 1, 2, 3, 4, 5 TPSWC – 1, 2, 3, 4, 5, 6 TPSWID – 1, 2, 3	SW
	TPSWCCS – 1, 2, 3, 4, 5, 6, 7 and 8 (anomaly)[2]	CCS
Semiannual	TPGW – 3, 4, 5, 6, 7, 8, 9, 11, 13, L-3, L-5, G-21, G-28, G-35	GW
	TPGW – 1, 2, 10, 13, 14	GW - quarterly analytes plus nutrients & trace elements
	BBSW – 1, 2, 3, 4, 5 TPSWC – 1, 2, 3, 4, 5, 6 TPSWID – 1, 2, 3	SW - quarterly analytes plus nutrients
	TPSWCCS – 1, 2, 3, 4, 5, 6, 7	CCS - quarterly analytes plus nutrients and gross alpha[3]

Notes:
[1] = Excerpted from Table 3-2 plus field parameters (temperature, specific conductivity, DO, percent oxygen saturation, pH, ORP, and salinity) at all stations.
[2] = Anomaly sampled first event only unless directed otherwise.
[3] = Sampling performed for one year (2 semi annual events).

Key:

BBSW – Biscayne Bay Surface Water
CCS – Cooling Canal System
GW – Ground Water
SW – Surface Water
TPGW – Turkey Point Groundwater
TPSWC – Turkey Point Surface Water Canal
TPSWCCS – Turkey Point Surface Water Cooling Canal System
TPSWID – Turkey Point Surface Water Interceptor Ditch

Table 3-2. Analytes in Groundwater, Surface Water and Cooling Canal System for Analyses

Analyte	Monitoring Plan (Table 2-1) Label	GW	SW	CCS
Metals, Total Recoverable (Ar, Be, Cd, Cr (VI), Cu, Pb, Hg, Mn, Mb, Ni, Se, Th, Vn, Zn) [1]	Elements	SA	-	-
Iron and Barium [1]	Elements/Tracer	Q / SA	Q / SA	Q / SA
Anions (Cl^-, SO_4^{2-}, F^-, Br^-)	Ions	Q / SA	Q / SA	Q / SA
Cations (Ca^{2+}, Na^+, Mg^{2+}, K^+, Sr^{2+}, B^+)[2]	Ions	Q / SA	Q / SA	Q / SA
Alkalinity	Ions	Q / SA	Q / SA	Q / SA
Ammonia + unionized	Nutrients	SA	SA	SA
Nitrate+Nitrite	Nutrients	SA	SA	SA
Total Kjeldahl Nitrogen	Nutrients	SA	SA	SA
Total Phosphorus	Nutrients	SA	SA	SA
Soluble Reactive Phosphorus	Nutrients	SA	SA	SA
Silica	Nutrients	-	-	SA
Sulfides	Ions	Q / SA	Q / SA	Q / SA
TDS	Other	Q / SA	-	-
Dissolved Inorganic Carbon	Tracer	Q / SA	Q / SA	Q / SA
^{3}H	Tracer	Q / SA	Q / SA	Q / SA
$^{2}H/^{1}H$	Tracer	Q / SA	Q / SA	Q / SA
$^{18}O/^{16}O$	Tracer	Q / SA	Q / SA	Q / SA
$^{87}Sr/^{86}Sr$	Tracer	Q / SA	Q / SA	Q / SA
$^{13}C/^{12}C$	Tracer	Q / SA	Q / SA	Q / SA
Gross Alpha	Other	-	-	SA

Key:

[1] = Trace elements (arsenic, barium, beryllium, cadmium, hexavalent chromium, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, thallium, vanadium, and zinc) are referred to by the lab as “trace metals”. Barium and Iron are also part of tracer suite so broken out separately.

[2] = Cations referred to by the lab as “metals” due to analytical method specified for cations

Notes:

Q - Quarterly event.

SA - Semiannual event.

Table 3-3. Summary of Groundwater Analytical Results from the June/July 2010 Sampling Event.

Parameter	Units	TPGW-1S 7/12/2010		TPGW-1M 7/12/2010		TPGW-1D 7/12/2010		TPGW-2S 6/18/2010		TPGW-2M 6/18/2010		TPGW-2D** 6/21/2010		DUP 1** 6/21/2010	
Temperature	°C	26.66		26.59		26.49		26.31		27.33		27.12		N.A.	
pH	SU	7.08		7.04		7		7.29		6.94		6.86		N.A.	
Dissolved Oxygen	mg/L	1.6		11		3.7		3.7		2.7		1.7		N.A.	
Spec Cond	μS/cm	53720		61220		59870		65980		61080		65230		N.A.	
Turbidity	NTU	1.56		4.65		1.06		0.38		0.13		0.03		N.A.	
Arsenic	mg/L	0.012	U	0.013	I	0.012	U	0.012	UJ-	0.012	UJ-	0.012	U	0.012	U
Barium	mg/L	0.15		0.16		0.15		0.16		0.13		0.11	J	0.14	J
Beryllium	mg/L	0.0018	U	0.0018	U	0.0018	U	0.0018	U	0.0018	U	0.0018	U	0.0018	U
Cadmium	mg/L	0.0038	U	0.0038	U	0.0038	U	0.0038	U	0.0038	U	0.0038	U	0.0038	U
Copper	mg/L	0.0033	U	0.0033	U	0.0033	U	0.0033	U	0.0033	U	0.0033	U	0.0033 U	U
Iron	mg/L	0.78		1.2		0.63		3.1		0.32		0.9		0.91	
Lead	mg/L	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U
Manganese	mg/L	0.047		0.12		0.034		0.052	I	0.046	I	0.055	I	0.052	I
Molybdenum	mg/L	0.006	I	0.0073	I	0.0049	I	0.03	I	0.015	I	0.0047	U	0.0047	U
Nickel	mg/L	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U
Selenium	mg/L	0.034	U	0.034	U	0.034	U	0.034	UJ-	0.034	UJ-	0.034	U	0.034	U
Thallium	mg/L	0.016	U	0.016	U	0.028	I	0.016	U	0.016	U	0.016	U	0.016	U
Vanadium	mg/L	0.0094	I	0.0071	I	0.0075	I	0.021	I	0.016	I	0.014	I	0.016	I
Zinc	mg/L	0.047	I	0.051	I	0.054	I	0.018	U	0.018	U	0.017	U	0.017	U
Silica	mg/L	5		5.3		5.1		3.9		4.2		3.5		4.2	
Calcium	mg/L	620		660		650		870		660		680		680	
Magnesium	mg/L	1700		1900		2000		1800		2100		2000		2000	
Potassium	mg/L	490		570		590		730		780		540		550	
Sodium	mg/L	13000		15000		16000		17000	J-	18000	J-	16000		16000	
Boron	mg/L	5.2		6.2		6.2		5.8		7.1		6.6		6.6	
Strontium	mg/L	11		12		12		15		14		13		14	
Chromium VI	mg/L	0.002	U	0.002	U	0.006	I	0.002		0.002	U	0.002	UQ J	0.002	U
Mercury	mg/L	0.000072	UJ-	0.000072	UJ-	0.000072	UJ-	0.000072	UJ-	0.000072	U	0.000072	U	0.000072	U
Bromide	mg/L	69		82		82		98		100		100		100	
Chloride	mg/L	23000		27000		27000		29000		30000		29000		30000	
Fluoride	mg/L	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.2	U	0.2	UJ-
Sulfate	mg/L	3100		3600		3600		3700		4000		4000		4000	
Total Ammonia	mg/L as N	37	?	15	?	1.9		1.7		1.8		1.8		1.7	
Ammonium ion NH4	mg/L as N	36.66		14.87		1.886		1.675		1.787		1.79		--	
Unionized NH3	mg/L	0.34		0.13		0.014		0.025		0.013		0.01		--	
Nitrate/Nitrite as N	mg/L	0.0047	U	0.0047	U	0.0047	U	0.0047	U	0.0047	U	0.014		0.014	
TKN	mg/L	1.6	?	2.2	?	2.1		1.9		1.9		2		1.8	
TN[a]	mg/L	1.6		2.2		2.1		1.9		1.9		2		1.8	
Orthophosphate	mg/L	0.05	J	0.055	J	0.061	J	0.12	IJ	0.11	IJ	0.1	IJ	0.1	IJ
Phosphorus (P)	mg/L	0.021	J	0.023	J	0.023	J	0.036	J	0.082	IJ	0.059	J	0.057	J
Alkalinity	mg/L ($CaCO_3$)	200		180		180		120		190		190		180	
CaCO3	mg/L	200		180		180		120		190		190		180	
Sulfides	mg/L	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Total Dissolved Solids	mg/L	49000		51000		59000		62000		64000		62000		63000	
Dissolved Inorganic Carbon	mg/L	45		39		38		32		49		46		46	
d18O	‰	3.8		4.4		4.4		4.6		4.7		4.9		5	
d2H	‰	23		26		26		25.9		28.5		30.0		32.5	
d13C	‰	-6.51		-6.38		-6.29		-7.69		-6.85		-5.63		-6.44	
Gross Alpha	pCi/L														
Salinity	‰														
Sr 87/86	‰	0.70916		0.70914				0.70918		0.70913		0.70917		0.70917	
Tritium	pCi/L (1σ)	1580.8 (57.6)		2816.0 (96.0)		2579.2 (83.2)		3168.0 (96.0)		3328.0 (96.0)		3232.0 (96.0)		3732.3 (127.6)	

Parameter	Units	TPGW-3S 6/17/2010		TPGW-3M 6/17/2010		TPGW-3D 6/17/2010		TPGW-4S 6/24/2010		TPGW-4M 6/24/2010		TPGW-4D 6/24/2010		TPGW-5S 6/16/2010	
Temperature	°C	26.52		27.04		26.96		24.99		25.66		25.29		25.8	
pH	SU	6.74		6.99		6.92		7.31		6.88		6.92		7.47	
Dissolved Oxygen	mg/L	0.9		2.7		2.4		1.4		2.3		2.4		1.2	
Spec Cond	μS/cm	51890		62250		55570		1750		32010		37010		958	
Turbidity	NTU	0.35		0.53		2.3		2.52		2		0.02		5.27	
Arsenic	mg/L														
Barium	mg/L	0.12		0.11	J	0.092	I	0.024	I	0.15		0.14		0.04	
Beryllium	mg/L														
Cadmium	mg/L														
Copper	mg/L														
Iron	mg/L	0.32		1.7		0.33	I	0.22	I	4.7		5.9		0.56	
Lead	mg/L														
Manganese	mg/L														
Molybdenum	mg/L														
Nickel	mg/L														
Selenium	mg/L														
Thallium	mg/L														
Vanadium	mg/L														
Zinc	mg/L														
Silica	mg/L														
Calcium	mg/L	640	J-	640		640		120		620		620		130	
Magnesium	mg/L	1700	J+	1800		1800		19		900		1100		8.4	
Potassium	mg/L	450	J+	490	J	490	J	9.2		280		420		7.7	
Sodium	mg/L	13000	J+	15000		14000		250		7200		8600		110	
Boron	mg/L	5	J	5.9		5.8		0.064		1.4		2.2		0.054	
Strontium	mg/L	11	J+	12		12		1.3		8.3		8.8		1.3	
Chromium VI	mg/L														
Mercury	mg/L														
Bromide	mg/L	83		89		87		1.7		47		54		0.74	
Chloride	mg/L	24000		26000		26000		490		13000		16000		210	
Fluoride	mg/L	0.1	U	0.1	U	0.1	U	0.055		0.01	U	0.1	U	0.051	
Sulfate	mg/L	3200		3400		3500		20		1600		1900		19	
Total Ammonia	mg/L as N														
Ammonium ion NH4	mg/L as N														
Unionized NH3	mg/L														
Nitrate/Nitrite as N	mg/L														
TKN	mg/L														
TN[a]	mg/L														
Orthophosphate	mg/L														
Phosphorus (P)	mg/L														
Alkalinity	mg/L ($CaCO_3$)	330		220		220		200		210		200		240	
CaCO3	mg/L	330		220		220		200		210		200		240	
Sulfides	mg/L	4.8		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Total Dissolved Solids	mg/L	44000		48000		47000		1100		28000		33000		690	
Dissolved Inorganic Carbon	mg/L	83		55		87		54		48		45		62	
d18O	‰	3.5		4.1		2.1		-0.9		1.8		2.5		-1.2	
d2H	‰	20.3		32.3		14.2		-3.2		10.0		14.8		-4.9	
d13C	‰	-8.59		-8.07		-12.69		-11.10		-7.34		-7.00		-10.43	
Gross Alpha	pCi/L														
Salinity	‰														
Sr 87/86	‰	0.70917				0.70914		0.70917		0.70914		0.70908		0.70918	
Tritium	pCi/L (1σ)	854.4 (32.0)		1990.4 (73.5)		1990.4 (64.0)		8.64 (3.5)		325.38 (12.8)		505.6 (16.0)		10.208 (4.1)	

Parameter	Units	TPGW-5M 6/16/2010		TPGW-5D 6/16/2010		TPGW-6S 6/21/2010		TPGW-6M 6/21/2010		TPGW-6D 6/21/2010		TPGW-7S 6/24/2010		TPGW-7M 6/24/2010		TPGW-7D 6/24/2010	
Temperature	°C	24.61		24.69		24.75		24.92		24.83		24.8		25.05		25.12	
pH	SU	6.92		6.85		7.03		6.92		6.84		7.22		7.19		7.19	
Dissolved Oxygen	mg/L	1.1		4		4.8		2.1		4.6		2		1.5		2.3	
Spec Cond	μS/cm	21350		29980		1050		19640		20400		483		500		510	
Turbidity	NTU	0.16		0.46		2.32		0.46		0.29		3.81		2.29		1.34	
Arsenic	mg/L																
Barium	mg/L	0.26		0.22		--		--		--		0.0081	U	0.011	I	0.0081	U
Beryllium	mg/L																
Cadmium	mg/L																
Copper	mg/L																
Iron	mg/L	5.4		1.6		--		--		--		0.34	I	0.36	I	0.28	I
Lead	mg/L																
Manganese	mg/L																
Molybdenum	mg/L																
Nickel	mg/L																
Selenium	mg/L																
Thallium	mg/L																
Vanadium	mg/L																
Zinc	mg/L																
Silica	mg/L																
Calcium	mg/L	570		600		120		510		500		91		91		91	
Magnesium	mg/L	540		750		12		480		450		4.0		4.1		3.7	
Potassium	mg/L	120		210		4		130		130		9.9		9.4		4.8	
Sodium	mg/L	4900	J-	6500	J-	100		4000		3800		20		21		26	
Boron	mg/L	0.58		1.1		0.061	I	0.86		0.82		0.053		0.053		0.051	
Strontium	mg/L	6.8		7.8		1.2		8.6		8.3		0.91		0.92		0.88	
Chromium VI	mg/L																
Mercury	mg/L																
Bromide	mg/L	30		40		0.56		29		27		0.18		0.17		0.21	
Chloride	mg/L	8900		12000		210		8000		7600		36		35		41	
Fluoride	mg/L	0.04	U	0.04	U	0.087		0.1	U	0.1	U	0.17		0.23		0.14	
Sulfate	mg/L	860		1300		14		880		800		27		25		29	
Total Ammonia	mg/L as N																
Ammonium ion NH4	mg/L as N																
Unionized NH3	mg/L																
Nitrate/Nitrite as N	mg/L																
TKN	mg/L																
TN[a]	mg/L																
Orthophosphate	mg/L																
Phosphorus (P)	mg/L																
Alkalinity	mg/L ($CaCO_3$)	210		220		270		210		200		210		200		200	
CaCO3	mg/L	210		220		270		210		200		210		200		200	
Sulfides	mg/L	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Total Dissolved Solids	mg/L	17000		21000		660		18000		17000		300		310		320	
Dissolved Inorganic Carbon	mg/L	54		55		69		56		52		44		47		47	
d18O	‰	0.2		0.8		-1.6		-0.4		-0.4		-1.2		-1.2		-1	
d2H	‰	1.7		8.5		-8.9		1.9		-1.2		-8.2		-8.9		-7.0	
d13C	‰	-8.18		-7.52		-11.61		-6.60		-7.47		-9.09		-7.59		-8.92	
Gross Alpha	pCi/L																
Salinity	‰																
Sr 87/86	‰	0.70916		0.70915		0.70914		0.70916		0.70911		0.70923		0.70918		0.70918	
Tritium	pCi/L (1σ)	293.48 (9.6)		187.572 (8.0)		9.57 (4.1)		0.957 (4.8)	UJ	12.76 (4.1)		1.6 (3.5)	UJ	3.2 (3.5)	UJ	4.48 (3.5)	

NOTES:
I = value between the MDL and PQL
U = analyzed for but not detected at the reported value
J = estimated (+/- indicate bias)
V = Detected in method blank and sample value is less than 10x the blank value
(MCL) = Maximum Contaminant Levels
N.A. - not applicable
GW samples 1,2,10, 13, 14 are analyzed for trace metals and nutrients as well.
*SW and GW samples in same SDG
**Sample 062110-TPGW-Dup1 is a duplicate of 062110-TPGW-2D
***Sample 061810-TPGW-Dup1 is a duplicate of 061810-TPGW-12D

Table 3-3. Summary of Groundwater Analytical Results from the June/July 2010 Sampling Event.

Parameter	Units	TPGW-8S	TPGW-8M	TPGW-8D	TPGW-9S	TPGW-9M	TPGW-9D	TPGW-12S	TPGW-12M	TPGW-12D***	1***	TPGW-13S	TPGW-13M	TPGW-13D	TPGW-EBI	061710-FB1
		7/6/2010	6/25/2010	6/25/2010	6/25/2010	6/25/2010	6/25/2010	6/17/2010	6/17/2010	6/18/2010	6/18/2010	6/30/2010	6/30/2010	6/30/2010	6/18/2010	6/17/2010
Temperature	°C	24.99	25.29	25.23	25.82	25.1	25.09	27.16	26.85	27.04	N.A.	29.82	29.8	30.03	N.A.	N.A.
pH	SU	11.67	7.06	7.1	7.13	6.99	6.99	6.65	7.02	7.29	N.A.	6.89	7.07	7.02	N.A.	N.A.
Dissolved Oxygen	mg/L	5.3	10.9	1.6	2.6	1.5	2.4	5	2.6	3.1	N.A.	8.3	9.7	49.6	N.A.	N.A.
Spec Cond	µS/cm	1140	544	599	556	563	564	37380	52270	57910	N.A.	72860	70180	71970	N.A.	N.A.
Turbidity	NTU	7.5	1.18	4.04	9.27	8.49	0.83	0.44	0.28	3.02	N.A.	0.66	0.39	0.16	N.A.	N.A.
Arsenic	mg/L											0.016 IVJ	0.018 IV	0.012 U	0.0012 U	0.0012 U
Barium	mg/L	0.069 I	0.0081 U	0.012 I	0.012 I	0.0081 U	0.023 I	0.028 I	0.13	0.1	0.12	0.11	0.13	0.11	0.00081 U	0.00081 U
Beryllium	mg/L											0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U
Cadmium	mg/L											0.0038 U	0.0038 U	0.0038 U	0.0038 U	0.0038 U
Copper	mg/L											0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U
Iron	mg/L	0.042 IVJ+	0.55	0.31 I	0.19 I	0.6	0.76	0.16 I	1.5	0.5	0.52	0.13 I	8.6	1.3	0.0047 I	0.0027 U
Lead	mg/L											0.024 U	0.024 U	0.036 I	0.024 U	0.024 U
Manganese	mg/L											0.041 I	0.11	0.064 I	0.00046 U	0.00046 U
Molybdenum	mg/L											0.0047 I	0.0047 U	0.0047 U	0.0047 U	0.0047 U
Nickel	mg/L											0.014 U	0.014 U	0.014 U	0.014 U	0.014 U
Selenium	mg/L											0.034 U	0.034 U	0.034 U	0.0034 U	0.0034 U
Thallium	mg/L											0.03 I	0.016 U	0.016 U	0.0016 U	0.0016 U
Vanadium	mg/L											0.01 I	0.0093 I	0.011 I	0.00052 U	0.00052 U
Zinc	mg/L											0.017 U	0.017 U	0.036 I	0.0068 I	0.0026 I
Silica	mg/L											4.6	6	7.1	0.05 U	0.05 U
Calcium	mg/L	130	110	110	120	120	110	450	590	610	580	790	740	760	0.33	0.1 U
Magnesium	mg/L	0.59	3.8	6.2	2.9	3.1	3.6	980	1700	1700	1700	2500	2300	2400	0.15	0.02 U
Potassium	mg/L	13	9.2	8.5	11	6.7	3.3	440 J	470 J	640	600	800	740	750	0.19 U	0.19 U
Sodium	mg/L	21	20	31	14	15	22	7700	13000	15000 J	14000 J-	19000	19000	19000	1.5	0.31 U
Boron	mg/L	0.06	0.063	0.069	0.047 I	0.048 I	0.048 I	3.2	5.3	5.6	5.4	8.7	7.8	8.0	0.001 U	0.01 U
Strontium	mg/L	1	1.1	1.1	0.99	0.99	1.1	7.2	11	11	11	16	15	15	0.0015 I	0.001 U
Chronium VI	mg/L											0.003 IJ-	0.002 U	0.002 U	0.002 U	0.002 U
Mercury	mg/L											0.000072 UJ-	0.000072 UJ-	0.000072 UJ-	0.000072 U	0.000072 U
Bromide	mg/L	0.22	0.18	0.26	0.3	0.29	0.41	50	81	87	89	120	110	110	0.027 U	0.027 U
Chloride	mg/L	34	33	47	23	25	30	14000	24000	24000	25000	37000	36000	37000	0.22 I	0.2 U
Fluoride	mg/L	0.18	0.068	0.047 I	0.02 U	0.038 I	0.062	0.17 I	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U
Sulfate	mg/L	36	43	49	18	24	33	1900	3100	3400	3500	5000	4700	4800	0.2 U	0.2 U
Total Ammonia	mg/L as N											2.1	1.3	1.4	0.11	0.048 I
Ammonium ion NH4	mg/L as N											2.084	1.285	1.386		
Unionized NH3	mg/L											0.016	0.015	0.014		
Nitrate/Nitrite as N	mg/L											0.014	0.028	0.014	0.023	0.0068 I
TKN	mg/L											2.6	1.5	1.7	0.05 U	0.11 I
TN[9]	mg/L											2.6	1.5	1.7	0.25 U	0.21 U
Orthophosphate	mg/L											0.081 J	0.053	0.072 J	0.005 I	0.053 I
Phosphorus (P)	mg/L											0.049 J	0.046	0.035 J	0.0044 U	0.0044 U
Alkalinity	mg/L ($CaCO_3$)	240	230	220	250	270	250	510	190	180	180	180	140	150	2.3	2.0
CaCO3	mg/L	240	230	220	250	270	250	510	190	180	180	180	140	150	2.3	2.0
Sulfides	mg/L	1 U	1.0 U	1.0 U	1.1	1.0 U	1.0 U	22	1.0 U	1.0 U	1.0 U	19	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L	320	350	370	330	350	360	26000	44000	53000	53000	75000	70000	74000	5 U	5 U
Dissolved Inorganic Carbon	mg/L	3.9	51	49	62	60	58	130	49	46	46	38	30	30	1.5	1 U
d18O	‰	-1.7	-1.7	-1.7	-1.5	-1.4	-1.6	4.1	-3.2	4.2	4.3	5.5	5.2	5.3	-3.1	
d2H	‰	-7	-5.9	-8.5	-5.2	-2.9	-7.1	23.4	-15.8	27.1	22.3	34.0	26.7	32.5	-16.2	
d13C	‰	-14.29	-9.25	-9.25	-9.25	-8.53	-9.25	-7.20	-12.16	-7.05	-7.05	-7.86	-6.49	-7.20	-12.58	-12.16
Gross Alpha	pCi/L															
Salinity	‰															
Sr 87/86	‰	0.70912	0.70912	0.70916	0.70914	0.70916	0.70912	0.70917	0.70917	0.70914	0.70916	0.70913	0.70914	0.70915	no signal	no signal
Tritium	pCi/L (1σ)	4.48 (6.7) UJ	4.48 (3.5)	6.72 (3.8)	4.16 (3.2)	16.0 (3.5)	3.0 (3.5)	236.8 (9.6)	1795.2 (67.2)	1561.6 (44.8)	1764.1 (57.4)	4370.3 (127.6)	4178.9 (127.6)	4785.0 (159.5)	3.5 (4.1) UJ	9.9 (4.1)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the rep
J = estimated (+/- indicate bias)
V = Detected in method blank and sample v
(MCL) = Maximum Contaminant Levels
N.A. - not applicable
GW samples 1,2,10, 13, 14 are analyzed for
*SW and GW samples in same SDG
**Sample 062110-TPGW-Dup1 is a duplicat
***Sample 061810-TPGW-Dup1 is a duplica

Table 3-4. Summary of Groundwater Analytical Results from the September 2010 Sampling Event.

Parameter	Units	TPGW-IS 9/14/2010	TPGW-1M 9/14/2010	TPGW-1D 9/14/2010	TPGW-2S 9/20/2010	TPGW-2M 9/20/2010	TPGW-2D 9/20/2010	TPGW-3S 9/20/2010	TPGW-3M 9/20/2010	TPGW-3D 9/20/2010	TPGW-4S 9/17/2010	TPGW-4M 9/17/2010
Temperature	°C	26.52	26.79	26.99	27.29	27.74	27.81	26.45	26.84	26.68	25.37	25.5
pH	SU	6.79	7.11	6.88	7.04	6.75	6.8	6.65	6.75	6.79	6.85	6.8
Dissolved Oxygen	mg/L	0.11	0.13	0.11	0.18	0.36	0.09	0.13	0.09	0.09	0.52	0.16
Spec Cond	µS/cm	33,001	72,898	71,763	73,570	77,199	78,349	65826	71328	70500	2026	38628
Turbidity	NTU	0.7	1.53	0.71	2.57	0.7	0.18	1.21	0.84	0.78	1.53	0.47
Arsenic	mg/L											
Barium	mg/L	0.1 I	0.11 I	0.099 I	0.085 I	0.056 I	0.059 I	0.043 I	0.081 I	0.086 I	0.04 U	0.15 I V
Beryllium	mg/L											
Cadmium	mg/L											
Copper	mg/L											
Iron	mg/L	1.40	13.0	0.810 I	3.80	1.0	1.50	0.730 I	1.80	1.20	0.14 U	5.80
Lead	mg/L											
Manganese	mg/L											
Molybdenum	mg/L											
Nickel	mg/L											
Selenium	mg/L											
Thallium	mg/L											
Vanadium	mg/L											
Zinc	mg/L											
Silica, dissolved	mg/L											
Calcium	mg/L	400	610	650	720	690	690	660	630	640	140	600
Magnesium	mg/L	690	1900	1900	1900	2000	2100	1700	1900	1900	22	860
Potassium	mg/L	340	540	550	470	480	530	380 I	450	420	6.0	290
Sodium	mg/L	5700	15000	15000	14000	15000	17000	13000	14000	14000	210	7000
Boron	mg/L	2.2	6.1	6.0	6.2	6.5	6.8	5.1	6.0	5.9	0.07	1.4
Strontium	mg/L	6.3	11.0	11.0	14.0	14.0	14.0	11.0	12.0	12.0	1.3	7.9
ChromiumVI	mg/L											
Mercury	mg/L											
Bromide	mg/L	36	95	92	97 J	100	98	84	84	91	0.027 U	44
Chloride	mg/L	11000	28000	28000	30000 J	29000	31000	24000	26000	27000	420	12000
Fluoride	mg/L	0.020 U	0.020 U	0.020 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.076	0.020 U
Sulfate	mg/L	1400 J-	4400	3300	3400 J	3700	3500	3100	3100	3300	16	1400
Ammonia	N											
Ammonium ion NH4	mg/L											
Unionized NH3	mg/L											
Nitrate/Nitrite as N	mg/L											
TKN	mg/L											
TN	mg/L											
Orthophosphate	mg/L											
Phosphorus (P)	mg/L											
Alkalinity	mg/L	270	120	170	170 J	180	180	320	210	210	290	200
Bicarbonate Alkalinity as CaCO3	mg/L	270	120	170	170 J	180	180	320	210	210	290	200
Sulfide	mg/L											
Total Dissolved Solids	mg/L	20000	49000	48000	48000	50000	52000	43000	47000	46000	1100	24000
Dissolved Inorganic Carbon	mg/L	70	28	42	42	46	46	84	55	54	75	52
d18O	‰	1.1	4.3	4.4	4.4	4.6	4.6	3.2	3.9	4.1	-0.7	1.5
d2H	‰	8	28	28	28	29	24	22	25	24	-3	12
d13C	‰	-8.22	-7.27	-6.47	-7.41	-7.23	-6.44	-8.32	-7.45	-7.71	-9.79	-8.41
Gross Alpha	pCi/L											
Salinity	‰											
Sr 87/86	‰ / ug/L**	0.70911	0.70912	0.70914	0.70916	0.70913	0.70913	0.70916	0.70910	0.70916	0.70913	0.70911
Tritium	pCi/L (1σ)	455.7 (18.5)	2653 (92)	2272 (79)	3075 (92)	3460 (102)	3522 (105)	852 (28)	2178 (67)	1041 (60)	18.5 (5.7)	321 (13)

Parameter	Units	TPGW-4D 9/17/2010	TPGW-5S 9/14/2010	TPGW-5M 9/14/2010	TPGW-5D 9/14/2010	TPGW-6S 9/15/2010	TPGW-6M 9/15/2010	TPGW-6D 9/15/2010	TPGW-7S 9/17/2010	TPGW-7M 9/17/2010	TPGW-7D 9/17/2010	TPGW-8S 9/20/2010	TPGW-8M 9/20/2010	TPGW-8D 9/20/2010	TPGW-9S 9/15/2010
Temperature	°C	25.36	24.45	24.6	24.75	24.47	25.25	24.56	25.13	24.95	26.01	25.03	24.81	25.51	25.84
pH	SU	6.88	8.15	6.76	6.7	6.93	6.82	6.76	7.27	7.33	7.1	12.1	7.16	7.01	6.93
Dissolved Oxygen	mg/L	0.12	0.09	0.14	0.43	0.66	0.1	0.12	0.34	0.1	0.26	0.22	0.13	0.2	0.07
Spec Cond	µS/cm	44990	1239	30936	34157	1230	23667	24355	554	588	608	2648	654	699	609
Turbidity	NTU	0.09	2.02	0.32	0.29	0.41	0.54	0.34	0.39	0.33	0.5	1.85	0.45	1.13	4.92
Arsenic	mg/L														
Barium	mg/L	0.2 I V	0.018 I	0.23	0.19 I	0.040 U	0.16 I V	0.2 I V	0.054 I V	0.040 U	0.057 I V	0.12 I	0.016 U	0.016 U	0.04 U
Beryllium	mg/L														
Cadmium	mg/L														
Copper	mg/L														
Iron	mg/L	10.0	0.4 I	2.50	1.50	0.14 U	2.70	1.30 I	0.34 I	0.22 I	0.25 I	0.11 I	0.46 I	0.20 I	0.14 U
Lead	mg/L														
Manganese	mg/L														
Molybdenum	mg/L														
Nickel	mg/L														
Selenium	mg/L														
Thallium	mg/L														
Vanadium	mg/L														
Zinc	mg/L														
Silica, dissolved	mg/L														
Calcium	mg/L	590	140	620	610	120	520	520	80	88	90	210	100	100	120
Magnesium	mg/L	1000	7.8	650	740	12	480	500	3.4	3.9	3.7	0.18	3.7	5.9	2.6
Potassium	mg/L	420	7.2	160	220	4.7	150	150	10	8.6	4.9	11	8.5	7.8	4.3
Sodium	mg/L	8200	100	5200	5800	110	4100	4300	19	20	26	21	20	30	9.6
Boron	mg/L	2.0	0.048 I	0.78	1.2	0.06 I	0.87	0.91	0.049 I	0.051	0.051	0.032 I	0.062	0.068	0.034 I
Strontium	mg/L	8.2	1.3	7.1	7.5	1.2	8.6	8.7	0.82	0.86	0.87	1.1	1.1	1.1	0.89
ChromiumVI	mg/L														
Mercury	mg/L														
Bromide	mg/L	52	0.79	36	40	0.79 J-	28	28	0.18	0.027 U	0.19	0.21	0.20	0.27	0.18
Chloride	mg/L	15000	230	9500	11000	210	7100	7500	35	34	41 J-	33	34	46	20
Fluoride	mg/L	0.020 U	0.11	0.020 U	0.020 U	0.12	0.020 U	0.020 U	0.12	0.11	0.12	0.11	0.10	0.075	0.094
Sulfate	mg/L	1700	17	1000	1200	13 J-	1000	1100	23	22	25 J-	22	41	44	3.3
Ammonia	N														
Ammonium ion NH4	mg/L														
Unionized NH3	mg/L														
Nitrate/Nitrite as N	mg/L														
TKN	mg/L														
TN	mg/L														
Orthophosphate	mg/L														
Phosphorus (P)	mg/L														
Alkalinity	mg/L	190	230	220	210	250	190	210	180	200	190	500	210	210	270
Bicarbonate Alkalinity as CaCO3	mg/L	190	230	220	210	250	190	210	180	200	190	1.0 U	210	210	270
Sulfide	mg/L														
Total Dissolved Solids	mg/L	27000	720	19000	21000	680	13000	14000	280	310	300	570	350	380	340
Dissolved Inorganic Carbon	mg/L	49	59	58	55	67	50	54	45	51	51	3.5	58	57	70
d18O	‰	2.2	-1.4	0.5	0.9	-1.7	-0.5	-0.4	-1.3	-1.3	-1.2	-1.7	-1.7	-1.8	-1.0
d2H	‰	14	-8.0	5.0	7.0	-9.0	1.0	3.0	-5	-6	-5	-13	-11	-12	2.0
d13C	‰	-7.25	-9.95	-9.67	-8.69	-11.95	-8.07	-7.46	-9.77	-9.59	-9.33	-13.48	-9.97	-9.66	-10.6
Gross Alpha	pCi/L														
Salinity	‰														
Sr 87/86	‰ / ug/L**	0.70912	0.70916	0.70915	0.70913	0.70917	0.70911	0.70911	0.70919	0.70914	0.70915	0.70911	0.70915	0.70914	0.70916
Tritium	pCi/L (1σ)	611 (21)	20.4 (5.7) J	175 (9)	343 (13)	2.6 (7) UJ	4.7 (6.8) UJ	17.9 (7) J	3.2 (6.8) UJ	6.9 (6.8)	4 (6.7) UJ	12.6 (7) J	11.6 (6.9) J	-2.1 (6.6) UJ	6.9 (6.8) J

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the reported value
J = estimated (+/- indicate bias)
(MCL) = Maximum Contaminant Levels
N.A. - not applicable
V = Detected in method blank and sample value is less than 10x the blank value
*Sample 092310-Dup1 is a duplicate of 092310-TPGW-11M
**Sr 87/86 MDL for blanks is 0.01 ug/L

Table 3-4. Summary of Groundwater Analytical Results from the September 2010 Sampling Event.

		TPGW-9M	TPGW-9D	TPGW-10S	TPGW-10M	TPGW-10D	TPGW-11S	TPGW-11M*	92310-Dup 1	TPGW-11D	TPGW-12S	TPGW-12M	TPGW-12D
Parameter	Units	9/15/2010	9/15/2010	9/22/2010	9/22/2010	9/22/2010	9/23/2010	9/23/2010	9/23/2010	9/27/2010	9/16/2010	9/16/2010	9/16/2010
Temperature	°C	25.71	25.45	27.08	27.56	27.18	26.46	26.56	26.56	26.66	27.02	27.08	27.47
pH	SU	7.09	6.9	7.27	7.25	7.19	8.15	6.83	6.83	6.67	6.45	7.05	7.12
Dissolved Oxygen	mg/L	0.16	0.12	0.53	0.2	0.07	1.1	0.5	0.5	0.46	0.4	0.05	0.09
Spec Cond	µS/cm	679	654	52243	56762	56950	56504	58174	58174	59347	41222	66088	65920
Turbidity	NTU	0.97	0.41	0.12	0.06	0.28	0.03	0.1	0.1	0.97	2.07	0.36	7.4
Arsenic	mg/L												
Barium	mg/L	0.079 I V	0.04 U	0.016 U	0.016 U	0.016 U	0.016 U	0.016 UJ	0.016 U	0.016 U	0.041 I V	0.13 I V	0.063 I V
Beryllium	mg/L												
Cadmium	mg/L												
Copper	mg/L												
Iron	mg/L	0.37 I	0.20 I	0.71 I	0.74 I	0.85 I	0.71 I	0.82 I J3	0.72 I	1.20 V	0.25 I	0.84 I	0.79 I
Lead	mg/L												
Manganese	mg/L												
Molybdenum	mg/L												
Nickel	mg/L												
Selenium	mg/L												
Thallium	mg/L												
Vanadium	mg/L												
Zinc	mg/L												
Silica, dissolved	mg/L												
Calcium	mg/L	120	120	410	440	460	500	540	530	580	440	580	610
Magnesium	mg/L	3.4	3.7	1300	1400	1400	1400	1500	1400	1500	930	1600	1700
Potassium	mg/L	7.6	3.1	410	440	420	410	500	460	430	450	400	430
Sodium	mg/L	13	20	11000	11000	11000	11000	13000	12000	11000	7400	13000	13000
Boron	mg/L	0.052 I	0.049 I	4.7	5.1	5.0	5.1	5.2	5.2	5.2	3.1	5.1	5.2
Strontium	mg/L	1.0	1.1	7.6	8.7	9.1	8.4	9.0	9.0	9.9	6.8	11.0	11.0
ChromiumVI	mg/L												
Mercury	mg/L												
Bromide	mg/L	1.4	0.45	66	80	72	62	60	65	0.27 U	0.14 UJ	81	0.27 U
Chloride	mg/L	26	29	19000	21000	20000	21000	22000	22000	22000	16000 J	21000	25000
Fluoride	mg/L	0.077	0.086	39	130	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.020 UJ	0.020 U	0.020 U
Sulfate	mg/L	23	27	2400	2600	2600	2500	2700	2600	2700	1700 J	2900	3000
Ammonia	N												
Ammonium ion NH4	mg/L												
Unionized NH3	mg/L												
Nitrate/Nitrite as N	mg/L												
TKN	mg/L												
TN	mg/L												
Orthophosphate	mg/L												
Phosphorus (P)	mg/L												
Alkalinity	mg/L	260	250	130	110	110	270	320	310	300	480 J	190	170
Bicarbonate Alkalinity as CaCO3	mg/L	260	250	130	110	110	270	320	310	300	480 J	190	170
Sulfide	mg/L												
Total Dissolved Solids	mg/L	360	350	32000	35000	37000	37000	36000		36000	23000	43000	43000
Dissolved Inorganic Carbon	mg/L	68	64	33	27	29	74	85	84	890	120	47	44
d18O	‰	-1.5	-1.8	1.7	1.7	1.9	1.6	1.6	1.5	2.5	1.7	4	4.3
d2H	‰	-5.0	-7.0	16	23	17	20	17	18	18	11	27	27
d13C	‰	-10.9	-10.39	-5.1	-4.39	-7.24	-10.19	-10.88	-10.88	-11.45	-12.94	-7.1	-9.33
Gross Alpha	pCi/L												
Salinity	‰												
Sr 87/86	‰ / ug/L**	0.70914	0.70913	0.70918	0.70918	0.70916	0.70913	0.70912	0.70919	0.70912	0.70916	0.70916	0.70914
Tritium	pCi/L (1σ)	-2.7 (6.8) UJ	-0.6 (6.8) UJ	21.5 (6.2) J	7.8 (6.3) J	2.4 (6.6) UJ	14.9 (6.3)	26.6 (6.5) J	20.1 (8.2) J	347 (13)	262 (12)	1654 (58)	1830 (65)

	TPGW-13S	TPGW-13M	TPGW-13D	TPGW-14S	TPGW-14M	TPGW-14D	090910-EB1	091410-FB1	091510-FB1	091610-FB1	091710-FB1	092010-FB1	092310-FB1
Parameter	9/9/2010	9/9/2010	9/9/2010	9/27/2010	9/27/2010	9/27/2010	9/9/2010	9/14/2010	9/15/2010	9/16/2010	9/17/2010	9/20/2010	9/23/2010
Temperature	30.37	30.47	30.1	27.11	27.33	27.28							
pH	7.11	6.52	6.87	7.01	6.76	6.76							
Dissolved Oxygen	1	0.07	1.08	0.2	0.45	0.65							
Spec Cond	87606	83961	86058	60063	63756	75330							
Turbidity	0.33	0.71	0.34	0.93	2.68	0.98							
Arsenic													
Barium	0.033 I	0.13 I	0.11 IJ	0.016 U	0.016 U	0.016 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.001 I V	0.00081 U	0.0016 U
Beryllium													
Cadmium													
Copper													
Iron	0.22 I	7.80	1.70	0.97 I V	0.97 I V	1.10 V	0.011 I	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0054 U
Lead													
Manganese													
Molybdenum													
Nickel													
Selenium													
Thallium													
Vanadium													
Zinc													
Silica, dissolved													
Calcium	750	690	710	530	580	650	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Magnesium	2300	2100	2200	1500	1600	2000	0.020 U	0.020 U	0.020 U	0.024 I	0.020 U	0.020 U	0.020 U
Potassium	660	600	610	460	500	620	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Sodium	19000	18000	18000	12000	13000	16000	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Boron	8.3	7.2	7.4	5.2	5.4	6.7	10 U	10 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Strontium	14.0	14.0	14.0	9.5	10.0	13.0	1.0 U	1.0 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
ChromiumVI													
Mercury													
Bromide	110	100	49	0.27 U	0.27 U	0.27 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U
Chloride	33000	31000	26000	23000	25000	29000	0.20 U	0.20 U	0.20 U	0.36 I	0.20 U	0.20 U	0.20 U
Fluoride	0.020 U	0.020 U	0.020 U	0.20 U	0.20 U	0.20 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Sulfate	3900	3700	3900	2700	2700	3200	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Ammonia													
Ammonium ion NH4													
Unionized NH3													
Nitrate/Nitrite as N													
TKN													
TN													
Orthophosphate													
Phosphorus (P)													
Alkalinity	220	150	150	260	260	200	1.0 U	1.0 U	2.4	1.0 U	1.0 U	2.8	2.3
Bicarbonate Alkalinity as CaCO3	220	150	150	260	260	200	1.0 U	1.0 U	2.4	1.0 U	1.0 U	2.8	2.3
Sulfide							1.0 U	1.0 U					
Total Dissolved Solids	63000	58000	62000	35000	37000	47000			5.0 U	5.0 U	5.0 U	5.0 U	
Dissolved Inorganic Carbon	50	38	37	770	790	580	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
d18O	5.4	5	5.3	2.4	3.2	4.3		-1.1	-1.1	-1.0	-1.2	-1.2	-1.3
d2H	34	32	35	21	22	26		-7	-2.0	-7.0	-8.0	-5.0	-6.0
d13C	-6.4	-6.69	-7.43	-8.54	-10.29	-7.99	-11.67	-12.90	-12.8	-11.87	-24.8	-18.87	-18.84
Gross Alpha													
Salinity													
Sr 87/86	0.70910	0.70915	0.70914	0.70914	0.70916	0.70914	0.803	0.023	0.021	0.024	0.01 U	0.01 U	0.01 U
Tritium	3554 (120)	3986 (137)	4390 (150)	228 (10)	688 (26)	2580 (90)		21.3 (8.4)	11.6 (8.2)	16.5 (8.4)	1.3 (7.8)	19 (7.9)	0.5 (7.6)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the reporte
J = estimated (+/- indicate bias)
(MCL) = Maximum Contaminant Levels
N.A. - not applicable
V = Detected in method blank and sample valu
*Sample 092310-Dup1 is a duplicate of 092310-
**Sr 87/86 MDL for blanks is 0.01 ug/L

Table 3-5. Summary of Surface Water Analytical Results from the June/July 2010 Sampling Event.

Parameter	Units	BBSW-1T	BBSW-1B	BBSW-2T	BBSW-3B	BBSW-4T	BBSW-4B	BBSW-5T	BBSW-5B	TPSWD-1B	TPSWD-1T
		6/22/2010	6/22/2010	6/22/2010	6/23/2010	6/23/2010	6/23/2010	6/23/2010	6/23/2010	6/29/2010	6/29/2010
Temperature	°C	31.36	31.91	31.91	31.51	30.78	30.84	30.0	30.2	31.65	31.97
pH	SU	8.45	8.51	8.65	8.57	8.52	8.53	8.37	8.41	8.09	8.14
Dissolved Oxygen	mg/L	6.45	7.65	7.8	7.63	6.23	5.86	5.71	6.1	6.46	7.1
Spec Cond	µS/cm	45270	45670	48640	48300	47750	47860	45030	45040	5317	5287
Turbidity	NTU	0.94	0.9	0.91	1.12	3.41	3.68	1.17	1.27	1.08	1.15
Arsenic	mg/L										
Barium	mg/L	0.0081 U	0009 I	0.0085 I	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U
Beryllium	mg/L										
Cadmium	mg/L										
Copper	mg/L										
Iron	mg/L	0.12 I	0.13 I	0.098 I	0.084 I	0.11 I	0.093 I	0.084 I	0.12 I	0.071 I	0.07 I
Lead	mg/L										
Manganese	mg/L										
Molybdenum	mg/L										
Nickel	mg/L										
Selenium	mg/L										
Thallium	mg/L										
Vanadium	mg/L										
Zinc	mg/L										
Silica	mg/L	0.64	0.81	1.4	0.33 I	0.46 I	0.49 I	1.0	1.0	3.5	3.6
Calcium	mg/L	430	420	450	470	470	450	450	450	150	150
Magnesium	mg/L	1300	1400	1400	1500	1500	1400	1400	1400	110	100
Potassium	mg/L	360	370	390	420	410	400	370	380	38 J	37 J
Sodium	mg/L	10000	10000	11000	12000	12000	12000	11000	11000	920	980
Boron	mg/L	4.8	4.9	5.1	5.4	5.3	5.2	5.0	5.0	0.36 I	0.36 I
Strontium	mg/L	7.9	8.0	8.3	8.6	8.5	8.3	8.0	8.0	1.8	1.8
Chromium VI	mg/L										
Mercury	mg/L										
Bromide	mg/L	66	67	72	73	70	73	63	67	5.8	6.1
Chloride	mg/L	19000	19000	21000	19000	21000	20000	21000	19000	1800	1900
Fluoride	mg/L	0.33	0.39	0.1 U	0.1 UJ-	0.1 U	0.1 U	0.1 U	0.32	3.2	0.13 I
Sulfate	mg/L	2700	2700	2900	3000	2800	2900	2500	2700	210	220
Total Ammonia	mg/L as N	0.085	0082	0.08	0.12	0.036	0.05	0.042	0.14	0.15	0.16
Ammonium ion NH4	mg/L as N	0.064	0059	0.052	0.084	0.036	0.05	0.042	0.14	0.132	0.138
Unionized NH3	mg/L	0.021	0023	0.028	0.036	0.03 U	0.03 U	0.03 U	0.03 U	0.018	0.022
Nitrate/Nitrite as N	mg/L	0.0047 U	0.0062 I	0.0047 U	0.0047 U	0.0077 I	0.028	0.0098 I	0.0053 I	0.11	0.12
TKN	mg/L	0.25	0.36	0.26	0.11 I	0.24	0.3	0.32	0.41	0.89	0.78
TN[9]	mg/L	0.25	0.37	0.26	0.25 U	0.25	0.33	0.33	0.42	1	0.9
Orthophosphate	mg/L	0.042 IJ	0044 IJ	0.045 IJ	0.048 IJ	0.053 IJ	0.044 IJ	0.044 IJ	0.047 IJ	0.0036 I	0.0034 I
Phosphorus (P)	mg/L	0.013 J	0018 J	0.018 J	0.019 J	0.025 J	0.02 J	0.015 J	0.016 J	0.0054 I	0.006 I
Alkalinity	mg/L ($CaCO_3$)	110	110	110	100	110	100	120	120	230	230
Bicarbonate Alkalinity as CaCO3	mg/L	98	90	76	86	93	97	120	120	230	230
Sulfides	mg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L										
Dissolved Inorganic Carbon	mg/L	22	20	20	20	20	20	25	25	52	52
d18O	‰	2.2	2.2	2.3	2.4	2.3	2.3	2.8	2.6	1	1
d2H	‰	15.4	16.5	18.6	15.2	16.9	17.3	14.9	19.6	7.6	10.0
d13C	‰	-5.58	-45859	-4.2932	-1.82	-3.43	-2.62	-5.26	-3.63	-6.99	-6.55
Gross Alpha	pCi/L										
Salinity	‰										
Sr 87/86	‰	0.70918	0.70916	0.70917						0.70916	0.70912
Tritium (picocuries/L)	pCi/L (1σ)	16.3 (4.1)	8.0 (4.5)	11.5 (4.5)						153.28 (6.4)	162.24 (6.7)

Parameter	Units	TPSWD-2B	TPSWD-2T	TPSWD-3B	TPSWD-3T	TPSWC-1T	TPSWC-1B	TPSWC-2T	TPSWC-2B	TPSWC-3T	TPSWC-3B	TPSWC-4T
		6/29/2010	6/29/2010	7/1/2010	7/1/2010	7/7/2010	7/7/2010	7/7/2010	7/7/2010	7/7/2010	7/7/2010	7/1/2010
Temperature	°C	29	31.6	30.05	31.72	30.53	28.89	31.96	30.25	32.58	30.54	31.96
pH	SU	6.86	7.88	7.37	2.64	7.6	7.59	7.93	7.82	8.08	7.6	7.31
Dissolved Oxygen	mg/L	0.86	7.91	9.14	7.15	4.59	5.54	6.61	5.28	8.04	5.77	4.9
Spec Cond	µS/cm	7524	2994	2420	2437	512	470	597	596	877	1019	23040
Turbidity	NTU	5.06	2.03	0.74	0.52	1.17	1.19	1.79	7.12	1.21	1.55	5.17
Arsenic	mg/L											
Barium	mg/L	0.013 I	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.011 I	0.0081 U	0.013 I	0.043
Beryllium	mg/L											
Cadmium	mg/L											
Copper	mg/L											
Iron	mg/L	0.077 I	0.039 I	0.033 IVJ	0.037 IVJ	0.029 IVJ+	0.028 IVJ+	0.034 IVJ+	0.07 IVJ+	0.027 U	0.034 I	0.21 J+
Lead	mg/L											
Manganese	mg/L											
Molybdenum	mg/L											
Nickel	mg/L											
Selenium	mg/L											
Thallium	mg/L											
Vanadium	mg/L											
Zinc	mg/L											
Silica	mg/L	3.4	3.2	4.3	4.2	4	6.4	4.7	5	4.4	4.2	3.8
Calcium	mg/L	210	140	130	130	54	51	57	61	82	98	340
Magnesium	mg/L	150	50	40	40	8.4	8.3	9.3	9.3	10	11	630
Potassium	mg/L	54	17 J	14	14	5.2	5.4	5.0	5.0	5.1	5.2	270
Sodium	mg/L	1300	490	390	390	49	47	68	67	100	120	5000
Boron	mg/L	0.47 I	0.17 I	0.130	0.130	0.072	0.072	0.069	0.071	0.067	0.066	1.9
Strontium	mg/L	2.6	1.5	1.3	1.3	0.51	0.53	0.61	0.65	0.89	0.99	5.3
Chromium VI	mg/L											
Mercury	mg/L											
Bromide	mg/L	9.4	3.1	1.8	1.8	0.17	0.17	0.29	0.29	0.65	0.81	32
Chloride	mg/L	2800	940	720	740	85	84	130	120	200	250	9300
Fluoride	mg/L	0.1 U	0.1 U	0.11	0.098	0.04 I	0.081	0.075	0.04 I	0.1	0.068	0.1 U
Sulfate	mg/L	300	93	70	65	5.9	6.5	4.7	5.1	10	14	1200
Total Ammonia	mg/L as N	0.2	0.19	0.19	0.18	0.16	0.21	0.22	0.2	0.12	0.17	0.8
Ammonium ion NH4	mg/L as N	0.1975	0.175	0.1857	0.1717	0.1537	0.2028	0.2106	0.188	0.105	0.1634	0.782
Unionized NH3	mg/L	0.0025	0.015	0.0043	0.0083	0.0063	0.0072	0.0094	0.012	0.015	0.0066	0.018
Nitrate/Nitrite as N	mg/L	0.0047 U	0.011	0.016 J+	0.011	0.0047 U	0.0047 U	0.0047 U	0.0047 U	0.0047 U	0.0047 U	0.017
TKN	mg/L	1.1	0.8	0.86	0.88	1.1	1.2	1.3	1.4	1.2	1.1	1.7
TN[9]	mg/L	1.1	0.81	1.7	0.87	1.1	1.2	1.3	1.4	1.2	1.1	1.7
Orthophosphate	mg/L	0.005 I	0.0025 I	0.0022	0.0094 J	0.0023 I	0.002 I	0.0018 I	0.0026 I	0.0014 I	0.0018 I	0.024 IJ
Phosphorus (P)	mg/L	0.011	0.0057 I	0.0066	0.0044 UJ	0.0044 I	0.0072 I	0.0044 U	0.0065 I	0.0048 I	0.0046 I	0.011 J
Alkalinity	mg/L ($CaCO_3$)	310	220	200	200	140	140	120	130	160	180	240
Bicarbonate Alkalinity as CaCO3	mg/L	310	220	200	200	140	140	120	130	160	180	240
Sulfides	mg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L											
Dissolved Inorganic Carbon	mg/L	72	51	49	47	36	34	33	33	39	44	56
d18O	‰	0.7	0.8	0.4	0.6	0.3	0.7	1.1	1.3	0.9	0.4	1.7
d2H	‰	10.1	8.1	5.5	7.2	4	9	7	8	7	4	16.8
d13C	‰	-6.66	-6.96	-8.42	-7.63	-7.63	-7.42	-6.85	-6.91	-7.05	-8.33	-8.27
Gross Alpha	pCi/L											
Salinity	‰											
Sr 87/86	‰	0.70909	0.70915	0.7092	0.70918	0.70919	0.70918	0.70921	0.70917	0.70918	0.70921	0.70915
Tritium (picocuries/L)	pCi/L (1σ)	140.48 (6.1)	108.8 (8.6)	79.75 (5.7)	83.897 (5.7)	9.6 (6.7)	24.0 (6.7)	34.24 (7.0)	27.52 (6.7)	35.84 (7.0)	30.08 (7.0)	890.01 (31.9)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the reported value
J = estimated (+/- indicate bias)
V = Detected in method blank and sample value is less than 10x the blank value

* =SW and GW in same SDG
** = Sample TPSWC-Dup1 is a duplicate of TPSWC-5B

Table 3-5. Summary of Surface Water Analytical Results from the June/July 2010 Sampling Event.

Parameter	Units	TPSWC-4B 7/1/2010	TPSWC-5T 7/1/2010	TPSWC-5B*** 7/1/2010	DUP1*** 7/1/2010	TPSWC-6T 6/21/2010	TPSWC-6B 6/21/2010	TPSWCCS-1B 7/9/2010	TPSWCCS-2B 6/30/2010	TPSWCCS-3B 6/28/2010	TPSWCCS-4T 7/1/2010	TPSWCCS-4B 7/1/2010	TPSWCCS-5T 7/9/2010	TPSWCCS-5B 7/9/2010	TPSWCCS-6T 7/15/2010	TPSWCCS-6B 7/15/2010	TPSWCCS-7B 6/28/2010	TPSWCCS-8B 6/30/2010
Temperature	°C	28.64			N.A.	28.18	27.71	39.04	36.68	34.88	32.81	34.41	33.22	32.64	32.78	32.91	36.89	37.87
pH	SU	6.86			N.A.	7.32	7.27	8.2	8.25	8.19	7.96	8.28	8.15	8.14	8.18	4.25	8.24	8.29
Dissolved Oxygen	mg/L	0.27			N.A.	1.95	2.02	4.55	6.31	7.61	9.82	8.76	2.05	1.91	32.78	4.77	5.62	7.14
Spec Cond	µS/cm	32300			N.A.	839	892	76510	76910	70260	77500	77590	76420	76380	75290	74960	75940	78060
Turbidity	NTU	45.96			N.A.	0.55	1.25	3.5	8.46	8.57	4.83	5.7	3.45	4.6	3.56	4.25	6.42	14.14
Arsenic	mg/L																	
Barium	mg/L	0.057			0.026			0.082 I	0.083 I	0.073 I	0.057	0.041	0.097	0.1	0.082	0.078	0.041 I	0.073 I
Beryllium	mg/L																	
Cadmium	mg/L																	
Copper	mg/L																	
Iron	mg/L	0.29 J+			0.088			0.027 U	0.33 I	0.027 U	0.22	0.21	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.29 I
Lead	mg/L																	
Manganese	mg/L																	
Molybdenum	mg/L																	
Nickel	mg/L																	
Selenium	mg/L																	
Thallium	mg/L																	
Vanadium	mg/L																	
Zinc	mg/L																	
Silica	mg/L	4.6			1.9	2.8	2.8	0.43	1.4 I	1.6 I	1.1	1	0.25 U	0.38	0.5 U	0.5 U	1.3 I	1.2 I
Calcium	mg/L	410			500	96	95	810	840	790	950	940	810	830	800	810	830	860
Magnesium	mg/L	900			1500	12	13	2500	2600	2500	3000	3000	2500	2600	2500	2500	2600	2700
Potassium	mg/L	410			470	9.1	9.4	790	840	710	860	870	800	810	800	810	760	840
Sodium	mg/L	7100			12000	82	90	20000	21000	21000	21000	21000	20000	19000	20000	21000	22000	21000
Boron	mg/L	2.8			5.3	0.095 I	0.096 I	8.7	9.2	8.4	11	10	8.6	8.8	8.8	8.9	8.9	9.3
Strontium	mg/L	7			9.1	1.1	1.1	15	16	15	18	18	15	16	16	16	16	16
Chromium VI	mg/L																	
Mercury	mg/L																	
Bromide	mg/L	44			75	0.47	0.5	130	120	120	130	130	130	120	120	120	120	120
Chloride	mg/L	13000			22000	150	160	36000	38000	37000	37000	37000	37000 J-	37000	37000	36000	39000 J-	40000
Fluoride	mg/L	0.11			0.1 U	0.087	0.084	0.1 U	0.1 U	0.08 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UQ ?	0.1 UQ	0.1	0.1 U
Sulfate	mg/L	1700			3000	55	56	5000	5100	4300	5100	5000	5100	5000	4900	4900	5200	5400
Total Ammonia	mg/L as N	0.65			0.036	0.12	0.1	0.083	0.18	0.11	0.13	0.14	0.093	0.13	0.12	0.12	0.11	0.16
Ammonium ion NH4	mg/L as N	0.6458			0.036	0.1179	0.0985	0.064	0.14	0.09	0.099	0.111	0.079	0.111	0.101	0.12	0.086	0.119
Unionized NH3	mg/L	0.0042				0.0021	0.0015	0.019	0.04	0.02	0.031	0.029	0.014	0.019	0.019	0.000017 U	0.024	0.041
Nitrate/Nitrite as N	mg/L	0.014			0.0073	0.021	0.05	0.0047 U	0.015	0.0047 U	0.014	0.015	0.0047 U	0.0047 U	0.08	0.03	0.0047 U	0.017
TKN	mg/L	1.7			0.56	0.36	0.42	2.2	1.6	1.6	2.5	1.6	2.2	2.3	1.7	1.6	1.5	2.2
TN[9]	mg/L	0.89			0.57	0.38	0.47	2.2	2.6 J	1.6	0.87	1.7	2.2	2.3	1.8	1.6	1.5	1.5 J
Orthophosphate	mg/L	0.03 IJ			0.05 IJ	0.014 I	0.014 U	0.051 IJ	0.058 J	0.071 IJ	0.076 IJ	0.078 IJ	0.052 IJ	0.062 IJ	0.074 IJ	0.073 IJ	0.069 IJ	0.057 J
Phosphorus (P)	mg/L	0.02 J			0.021 J	0.0044 U	0.013	0.029 J-	0.028 J	0.026 J	0.024 J	0.024 J	0.024 J	0.024 J	0.016 J	0.019 J	0.025 J	0.03 J
Alkalinity	mg/L ($CaCO_3$)	240			160	200	190	150	150	160	150	150	160	150	150	150	150	150
Bicarbonate Alkalinity as CaCO3	mg/L	240			160	200	190	150	150	160	130	150	160	150	150	150	150	150
Sulfides	mg/L	1.0 U			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L							77000	80000	71000	79000	78000	75000	79000	78000	77000	77000	81000
Dissolved Inorganic Carbon	mg/L	53			30	49	49	30	27	32	25	27	32	32	31	29	30	22
d18O	‰	2.2	2.4	2.5	2.4	-0.6	-0.6	5.5	6.1	6	6.1	6.1	5.6	5.7	5.6	5.5	6.2	6.3
d2H	‰	15.5	24.2	20.4	23.9	-2.1	-0.9	31	31.2	27.5	32.9	34.0	31	31	32	29	36.4	36.5
d13C	‰	-8.83	-5.80	-5.25	-5.94	-9.67	-10.09	-3.79	-2.86	-3.97	-2.47	-2.69	-3.31	-3.91	-3.30	-3.20	-2.87	-2.69
Gross Alpha	pCi/L							15.8+-1.2	57 (+/-4)	52 (+/-5)	38+-3	54+-4	15.9+-1.3	16.5+-1.3	25+-2	21+-2	55 (+/-5)	55 (+/-4)
Salinity	‰																	
Sr 87/86	‰	0.70917	0.7092	0.70915	0.70918	0.70919	0.70915	0.70915	0.70910	0.70907	0.70909	0.70908	0.70916	0.70911	0.70912	0.70914	0.70911	0.70913
Tritium (picocuries/L)	pCi/L (1σ)	1276.0 (44.7)	146.7 (7.3)	261.6 (9.6)	--	11.803 (4.1)	7.975 (3.8)	2620.8 (32.0)	3248.0 (35.2)	3052.8 (35.2)	3171.2 (35.2)	3097.6 (35.2)	2582.4 (32.0)	2524.8 (28.8)	2380.8 (28.8)	2339.2 (28.8)	3260.8 (35.2)	3155.2 (35.2)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the repc
J = estimated (+/- indicate bias)
V = Detected in method blank and sample va

* =SW and GW in same SDG
** = Sample TPSWC-Dup1 is a duplicate of T

Table 3-6. Summary of Surface Water Analytical Results from the September 2010 Sampling Event.

		BBSW-1B	BBSW-2B	BBSW-3B	BBSW-4B	BBSW-5B	TPSWC-1T	TPSWC-1B	TPSWC-2T	TPSWC-2B	TPSWC-3T	TPSWC-3B	TPSWC-4T	TPSWC-4B	TPSWC-5T	TPSWC-5B	TPSWC-6T*	091410-DUP1	TPSWC-6B	TPSWCCS-1B	TPSWCCS-2B	TPSWCCS-3B	TPSWCCS-4T	TPSWCCS-4B	TPSWCCS-5T	TPSWCCS-5B	TPSWCCS-6T
Parameter	Units	9/28/2010	9/23/2010	9/27/2010	9/24/2010	9/24/2010	9/7/2010	9/7/2010	9/7/2010	9/7/2010	9/7/2010	9/7/2010	9/9/2010	9/9/2010	9/9/2010	9/9/2010	9/14/2010	9/14/2010	9/14/2010	9/8/2010	9/9/2010	9/8/2010	9/11/2010	9/11/2010	9/11/2010	9/11/2010	9/11/2010
Temperature	°C	28.83	27.9	29.69	28.07	27.71	31.37	29.94	33	30.37	31.45	30.46	30.79	30.61	31.21	33.11	28.37	28.37	28.3	38.25	36.31	33.75	33.7	33.54	32.81	32.9	33.3
pH	SU	7.92	8.16	8.29	8.02	7.7	7.69	7.59	8.05	7.93	8.83	7.84	7.3	7.34	7.66	6.53	7.23	7.23	7.19	8.4	8.23	8.34	8.34	8.34	8.28	8.28	8.3
Dissolved Oxygen	mg/L	4	6.81	7.55	5.23	4.48	5.06	3.65	6.72	6	6.07	3.7	4.54	4.2	6.36	0.32	0.98	0.98	1.21	3.88	7.35	3.42	6.7	6.12	3.91	4.12	4.99
Spec Cond	µS/cm	48233	30586	49871	48063	42063	429	422	521	509	588	584	2084	2970	46455	61032	735	735	734	82182	82550	80056	81626	81369	80967	80899	81050
Turbidity	NTU	3.25	0.89	1.12	2.7	2.79	1.14	1.1	1.17	1.3	1	2.1	2.42	4.55	0.67	12.6	0.59	0.59	0.63	4.74	7.34	7.05	5.8	4.2	3.98	5.9	4.1
Arsenic	mg/L																										
Barium	mg/L	0.016 U	0.016 U	0.016 U	0.016 U	0.016 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.081 U	0.081 U	0.130 I	0.270 I	0.016 U	0.016 U	0.016 U	0.160 I	0.580 I	0.370 I	0.054 I	0.034 I	0.043 I	0.038 I	0.036 I
Beryllium	mg/L																										
Cadmium	mg/L																										
Copper	mg/L																										
Iron	mg/L	0.410 I V	0.480 I	0.410 I V	0.780 I	0.550 I	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.270 U	0.270 U	0.720 I	1.20 I	0.054 U	0.054 U	0.054 U	1.50 I	3.60 I	1.60 I	0.160 I	0.200 I	0.260 I	0.180 I	0.230 I
Lead	mg/L																										
Manganese	mg/L																										
Molybdenum	mg/L																										
Nickel	mg/L																										
Selenium	mg/L																										
Thallium	mg/L																										
Vanadium	mg/L																										
Zinc	mg/L																										
Silica, dissolved	mg/L																										
Calcium	mg/L	400	260	410	380	340	46	46	46	44	55	55	59	65	360	510	79	82	80	730	650	740	680 J	680	690	680	670 J
Magnesium	mg/L	1200	650	1300	1200	990	6.0	5.8	6.9	6.6	6.1	6.2	35	52	1200	1600	8.0	8.6	8.2	2200	2200	2300	2200 J	2200	2200	2100	2100 J
Potassium	mg/L	540	330	590	360	320	4.3	4.3	3.0	2.8 I	2.5 I	2.5 I	13	20	350	470	8.0	8.1	8.0	670	670	660	670 J	640	620	670	650 J
Sodium	mg/L	9500	5400	9800	9200	8000	28	27	43	42	47	47	290	400	8700	12000	49	53	50	18000	17000	18000	17000 J	17000	16000	18000	17000 J
Boron	mg/L	4.30	2.50	4.5	4.2	3.6	0.055 IJ	0.057 IJ	0.046 IJ	0.043 IJ	0.044 IJ	0.045 IJ	0.14 I	0.2	4.2	5.4	0.072 I	0.083 I	0.075 I	7.8	8.0	7.8	7.8	7.8	7.8	7.8	7.8
Strontium	mg/L	6.80	4.30	7.1	6.8	5.9	0.42	0.43	0.47	0.47	0.54	0.54	0.69	0.8	6.3	9.1	0.85	0.86	0.86	14.0	13.0	14.0	14.0	14.0	14.0	14.0	14.0
Chromium VI	mg/L																										
Mercury	mg/L																										
Bromide	mg/L	0.27 U	32	60	79 J	54	0.027 U	0.027 U	0.18	0.19	0.24	0.25	1.6	2.9	56	76	0.46	0.46	0.47	93	100	110	100 J	110	110 J	98	110 J
Chloride	mg/L	16000	11000	16000 J+	18000 J	15000	39	42	72	88	92	92	460	860	15000	23000	87	88	88	31000	32000	31000	37000 J	34000	33000 J	33000	34000 J
Fluoride	mg/L	0.77	0.47 I	0.20 U	0.20 UJ	0.20 U	0.097	0.093	0.091	0.099	0.096	0.089	0.094	0.11	0.020 U	0.020 U	0.11	0.10	0.11	0.020 U	0.020 U	0.020 U	0.020 UJ	0.020 U	0.020 UJ	0.020 U	0.020 UJ
Sulfate	mg/L	2100	1200	2200 J-	3300 J	2200	6.3	6.6	3.1	2.7	2.0	2.1	44	96	2100	2800	33	34	33	4000	4000	3900	4800 J	4300 J-	4200 J	4200	4600 J
Ammonia	mg/L as N																										
Ammonium ion NH4	mg/L																										
Unionized NH3	mg/L																										
Nitrate/Nitrite as N	mg/L																										
TKN	mg/L																										
TN	mg/L																										
Orthophosphate	mg/L																										
Phosphorus (P)	mg/L																										
Alkalinity	mg/L	120	170	120	120 J	130	110	110	100	97	110	110	110	110	110	220	160	160	170	130	120	140	130 J	130	130 J	130	130 J
Bicarbonate Alkalinity as CaCO3	mg/L	120	170	120	120 J	130	110	110	100	97	110	110	110	110	110	220	160	160	170	130	120	140	130 J	130	130 J	130	110 J
Sulfide	mg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L																										
Dissolved Inorganic Carbon	mg/L	30	39	28	29	32	27	27	25	26	29	27	26	27	27	55	43	42	43	26	24	23	25	25	24	25	25
d18O	‰	1.60	0.70	1.60	1.60	1.40	-0.40	-0.50	0.30	0.40	0.50	0.50	0.40	0.40	1.4	2.7	-0.50 J	-0.8 J	-0.70	4.2	4.4	4.2	4.50	4.40	4.30	4.30	4.3
d2H	‰	11	9.0	13	9.0	13	3	6	8	5	4	9	13	2	15	23	1.00 J	-6.0 J	2	33	28	24	26	24	24	23	23
d13C	‰	-4.10	-5.60	-3.02	-2.57	-5.11	-8.02	-8.34	-7.5	-8.64	-8.49	-8.22	-8.58	-8.68	-4.45	-6.41	-11.79	-11.86	-11.8	-6.01	-4.94		-5.66	-5.52	-6.05	-5.73	-5.54
Gross Alpha	pCi/L																										
Salinity																											
Sr 87/86	‰/ ug/L**	0.70916	0.70917	0.70914	0.70916	0.70917	0.70919	0.70914	0.70914	0.70916	0.70917	0.70916	0.70915	0.70915	0.70913	0.70915	0.70917	0.70915	0.70914	0.70913	0.70914	0.7091	0.70915	0.70913	0.70908	0.70912	0.70917
Tritium	pCi/L (1σ)	16.9 (6.2)	12.6 (5.9)	13.6 (6)	6.9 (6.1)	15.2 (6.3)	8.4 (9.3) UJ	12.3 (9.2)	47.6 (10)	92 (10.5)	44.6 (10)	41 10.1)	55.9 (10.2)	74 (10.7)	178 (11)	801 (31)	17.3 (6.8)	15.3 (8.4)	43.3 (7.6)	5020 (175)	4980 (180)	4810 (170)	5250 (190)	4990 (170)	5140 (180)	5260 (190)	5240 (180)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the reported value
J = estimated (+/- indicate bias)
V = Detected in method blank and sample value is less than 10x the blank value
* =Sample 091410-DUP1 is a duplicate of TPSWC-6T
**Sr 87/86 MDL for blanks is 0.01 ug/L

Table 3-6. Summary of Surface Water Analytical Results from the September 2010 Sampling Event.

		TPSWCCS-6E	TPSWCCS-7E	TPSWID-1T	TPSWID-1B	TPSWID-2T	TPSWID-2B	TPSWID-3T	TPSWID-3E	090710-FB1	090810-FB1	090910-EB1	091110-FB1	091410-FB1	092410-FB1	092710-FB1	092810-FB1
Parameter	Units	9/11/2010	9/8/2010	9/8/2010	9/8/2010	9/8/2010	9/8/2010	9/8/2010	9/8/2010	9/7/2010	9/8/2010	9/9/2010	9/11/2010	9/14/2010	9/24/2010	9/27/2010	9/28/2010
Temperature	°C	33.47	37.14	31.84	30.77	30.82	29.16	30.98	28.91								
pH	SU	8.29	8.53	8.19	8.23	7.88	7.09	7.73	7.22								
Dissolved Oxygen	mg/L	5.01	5.61	6	5.88	5.68	0.2	5.09	0.22								
Spec Cond	µS/cm	81547	80784	3749	3815	2432	4473	2076	2576								
Turbidity	NTU	3.32	9.31	1.31	2.49	1.92	14.76	0.89	3.54								
Arsenic	mg/L																
Barium	mg/L	0.026 I	0.160 U	0.160 U	0.0081 U	0.0081 U	0.027 I	0.015 I	0.019 I	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U	0.00081 U
Beryllium	mg/L																
Cadmium	mg/L																
Copper	mg/L																
Iron	mg/L	0.220 I	1.90 I	0.540	0.037 I	0.038 I	0.062 I	0.034 I	0.030 I	0.0027 U	0.0027 U	0.011 I	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0035 I V
Lead	mg/L																
Manganese	mg/L																
Molybdenum	mg/L																
Nickel	mg/L																
Selenium	mg/L																
Thallium	mg/L																
Vanadium	mg/L																
Zinc	mg/L																
Silica, dissolved	mg/L																
Calcium	mg/L	670	730	120	120	98	180	94	130	0.10 U	0.10 U	0.10 U	0.25 I	0.10 U	0.10 U	0.10 U	0.12 I
Magnesium	mg/L	2100	2200	64	62	35	72	28	34	0.020 U	0.020 U	0.020 U	0.050 I	0.020 U	0.020 U	0.020 U	0.026 I
Potassium	mg/L	620	670	21	21	15	26	12	14	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Sodium	mg/L	17000	18000	550	540	330	670	290	340	0.31 U	0.31 U	0.31 U	0.34 I	0.31 U	0.31 U	0.31 U	0.31 U
Boron	mg/L	7.8	7.8	0.25 I	0.24 I	0.13	0.24 I	0.11 I	0.12 I	12 I	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Strontium	mg/L	14.0	14.0	1.30	1.30	1.10	1.90	1.0	1.2	1.0 U	1.0 U	1.0 U	1.9 I	1.0 U	1.0 U	1.0 U	1.0 U
Chromium VI	mg/L																
Mercury	mg/L																
Bromide	mg/L	110	100	3.0	3.2 J-	1.8	3.7	1.5	1.9	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U
Chloride	mg/L	33000	32000	960	960	510	1200	460	580	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Fluoride	mg/L	0.020 U	0.020 U	0.12	0.14	0.12	0.14	0.12	0.11	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Sulfate	mg/L	4200	3900	82	83 J-	40	93	30	41	0.20 U	0.27 I	0.20 U	0.20 U	0.20 U	0.20 U	0.20 I	0.20 U
Ammonia	mg/L as N																
Ammonium ion NH4	mg/L																
Unionized NH3	mg/L																
Nitrate/Nitrite as N	mg/L																
TKN	mg/L																
TN	mg/L																
Orthophosphate	mg/L																
Phosphorus (P)	mg/L																
Alkalinity	mg/L	130	130	200	210	170	280	160	210	1.0 U	1.7	1.0 U	2.3	1.0 U	1.5	1.2	1.6
Bicarbonate Alkalinity as CaCO3	mg/L	130	110	200	210	170	280	160	210	1.0 U	1.7	1.0	2.3	1.0 U	1.5	1.2	1.6
Sulfide	mg/L	1.0 U	1.0 U	1.4	1.0 U	1.1	1.1	1.0 U	1.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Total Dissolved Solids	mg/L																
Dissolved Inorganic Carbon	mg/L	24	27	54	53	48	80	46	57	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
d18O	‰	4.40	4.1	0.80	0.80	0.70	0.60	0.80	0.10	-1.3	-1.3	-1.0	-1.2	-1.1	-1.2		-1.2
d2H	‰	26	24	10	9	8	10	6	8	-6	-4	-1	-11	-7	-4		-6
d13C	‰	-5.6	-5.16	-7.12	-7.07	-7.81	-9.2	-8.12	-6.03	-9.32	-9.54	-11.67	-6.39	-12.90	-15.77	-14.30	-24.63
Gross Alpha	pCi/L																
Salinity																	
Sr 87/86	‰/ ug/L**	0.70913	0.70917	0.70913	0.70917	0.70915	0.70912	0.70914	0.70918	0.01 U	0.022	0.803	0.024	0.023	0.01 U	0.01 U	0.01 U
Tritium	pCi/L (1σ)	4030 (130)	5230 (180)	131.8 (10.7)	135.5 (12)	102.5 (11.3)	92.2 (10.9)	96.3 (10.8)	52.6 (7.5)	3 (8.4) UJ	6.8 (8.1) UJ	53.1 (8.9)		21.3 (8.4)	11.9 (8.2)	38 (7.7)	13.8 (7.4)

NOTES:
I = value betweeen the MDL and PQL
U = analyzed for but not detected at the reported value
J = estimated (+/- indicate bias)
V = Detected in method blank and sample value is less th:
* =Sample 091410-DUP1 is a duplicate of TPSWC-6T
**Sr 87/86 MDL for blanks is 0.01 ug/L

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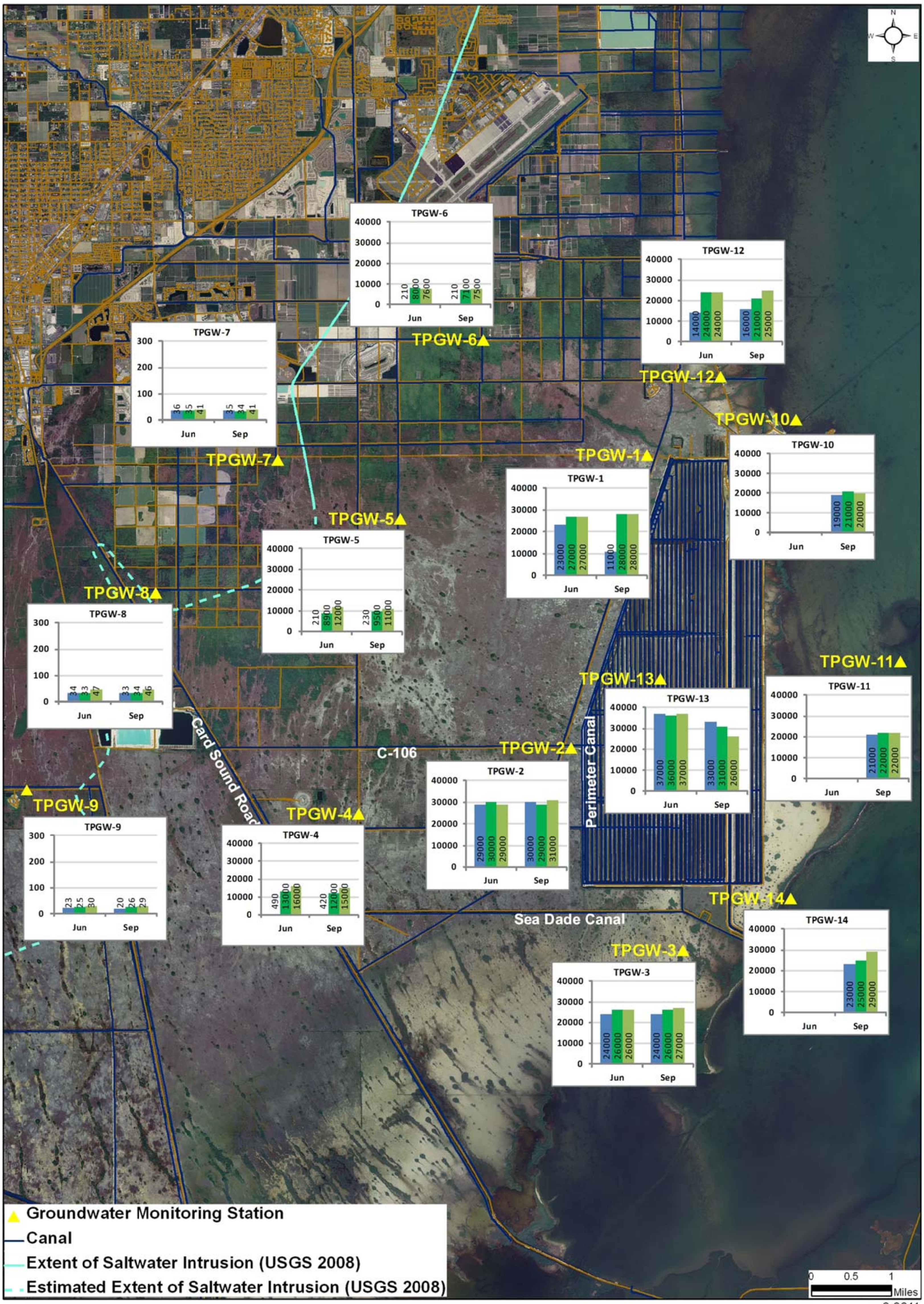
FIGURES

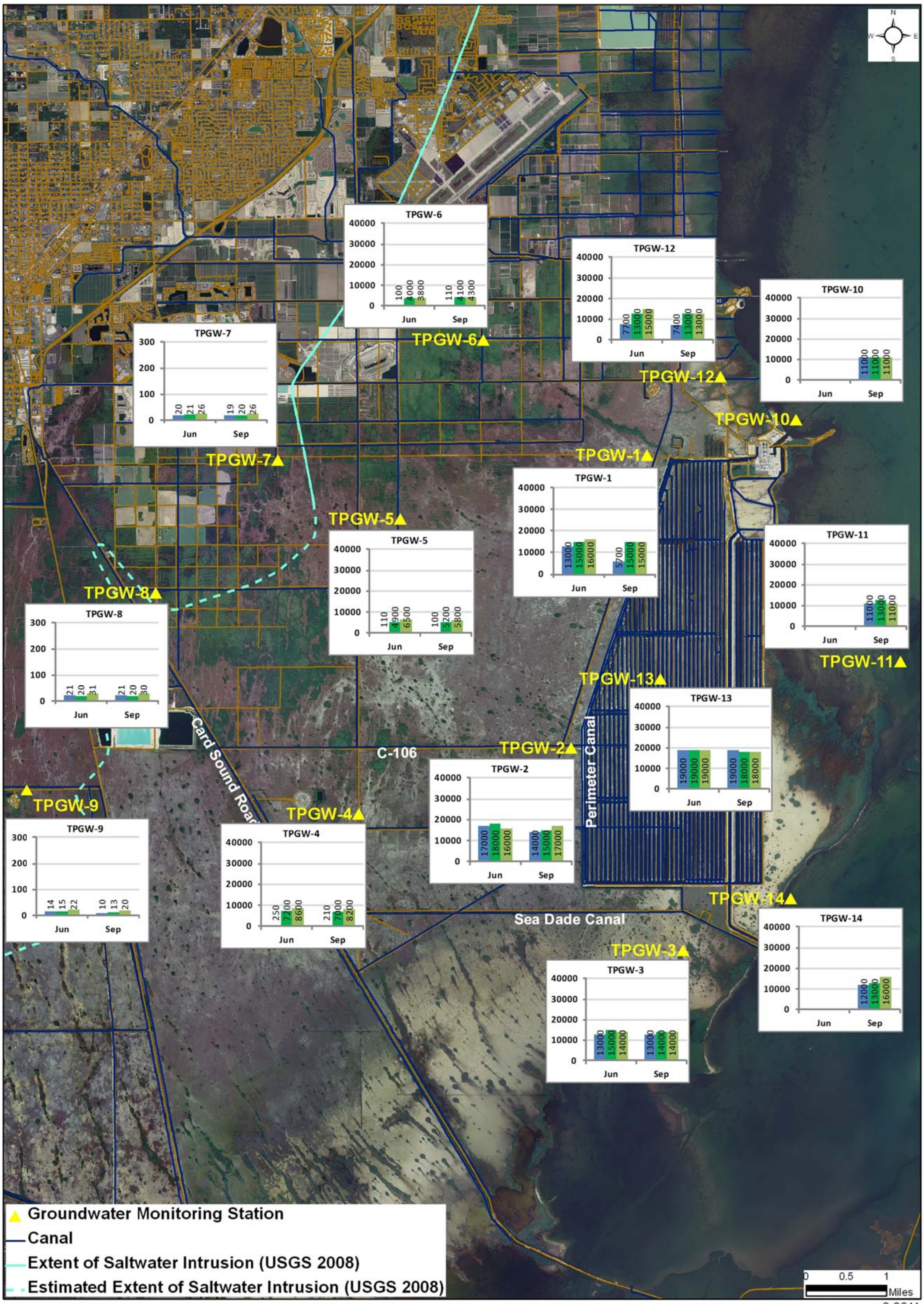
Figure 3-1. Groundwater Sampling Setup Using Peristaltic Pump, Flow Through Cell and Dedicated Well Tubing.



2-2011

Chloride Values (mg/L) for all groundwater samples taken at 3 depths (: shallow; : mid depth; : deep) for all 14 stations in June and September 2010

Figure 3-2. Chloride Concentration in Groundwater (June/July and September 2010).



Sodium Values (mg/L) for all groundwater samples taken at 3 depths (: shallow; : mid depth; : deep) for all 14 stations in June and September 2010

Figure 3-3. Sodium Concentration in Groundwater (June/July and September 2010).

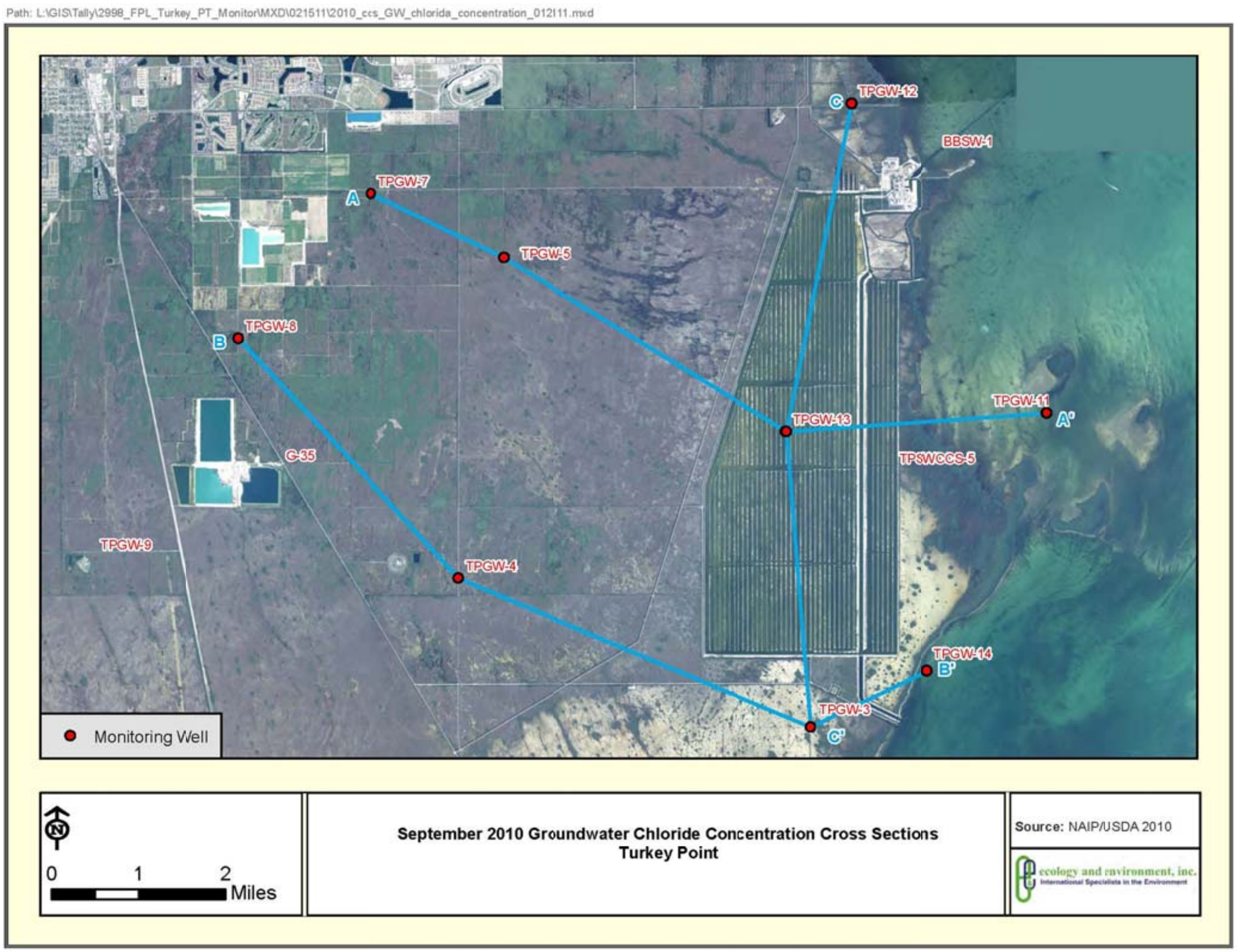


Figure 3-4. Aquifer Cross Section Locations for September 2010 Groundwater Chloride Concentrations.

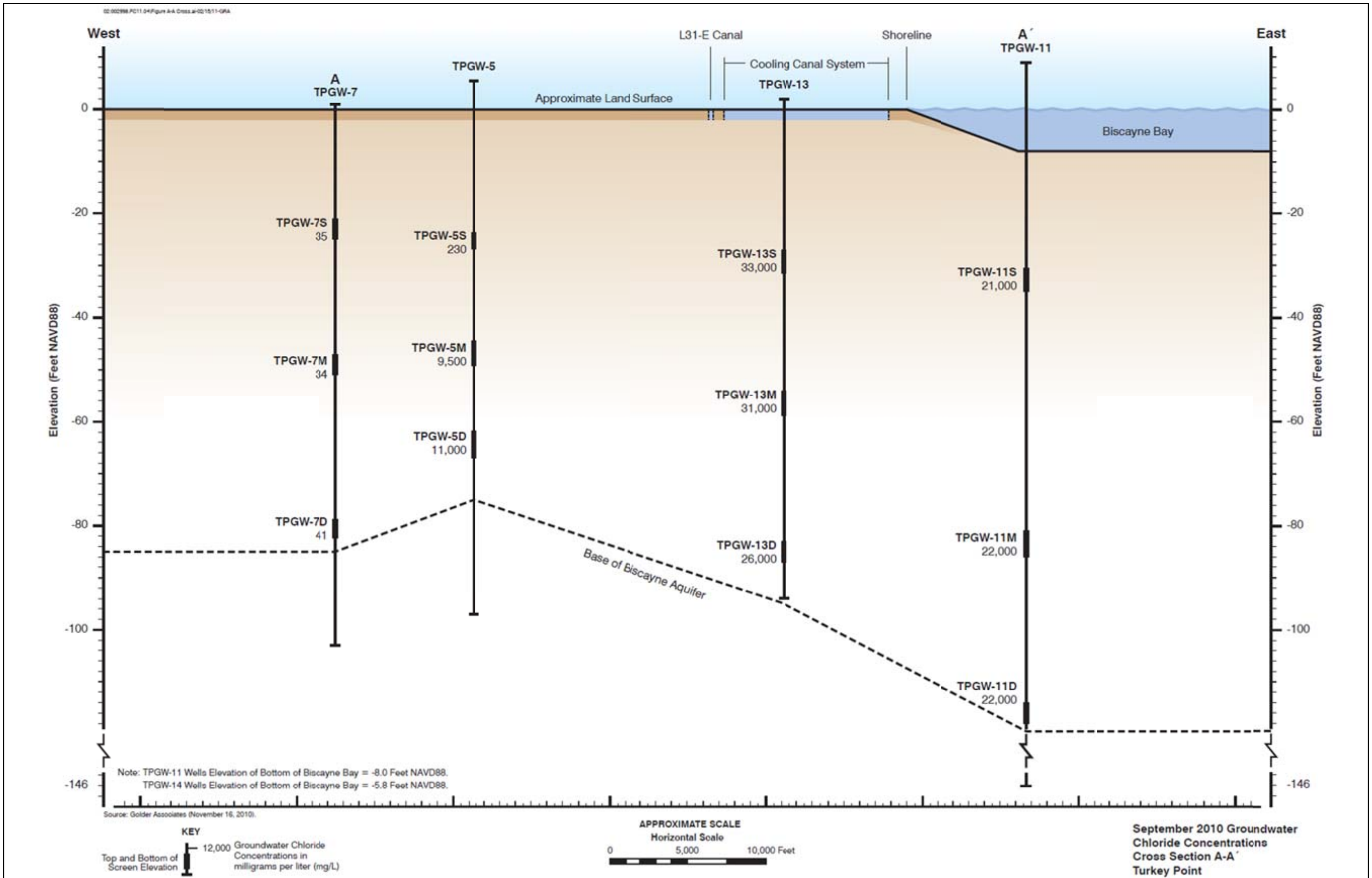


Figure 3-5. Cross Section A-A Showing September 2010 Groundwater Chloride Concentrations.

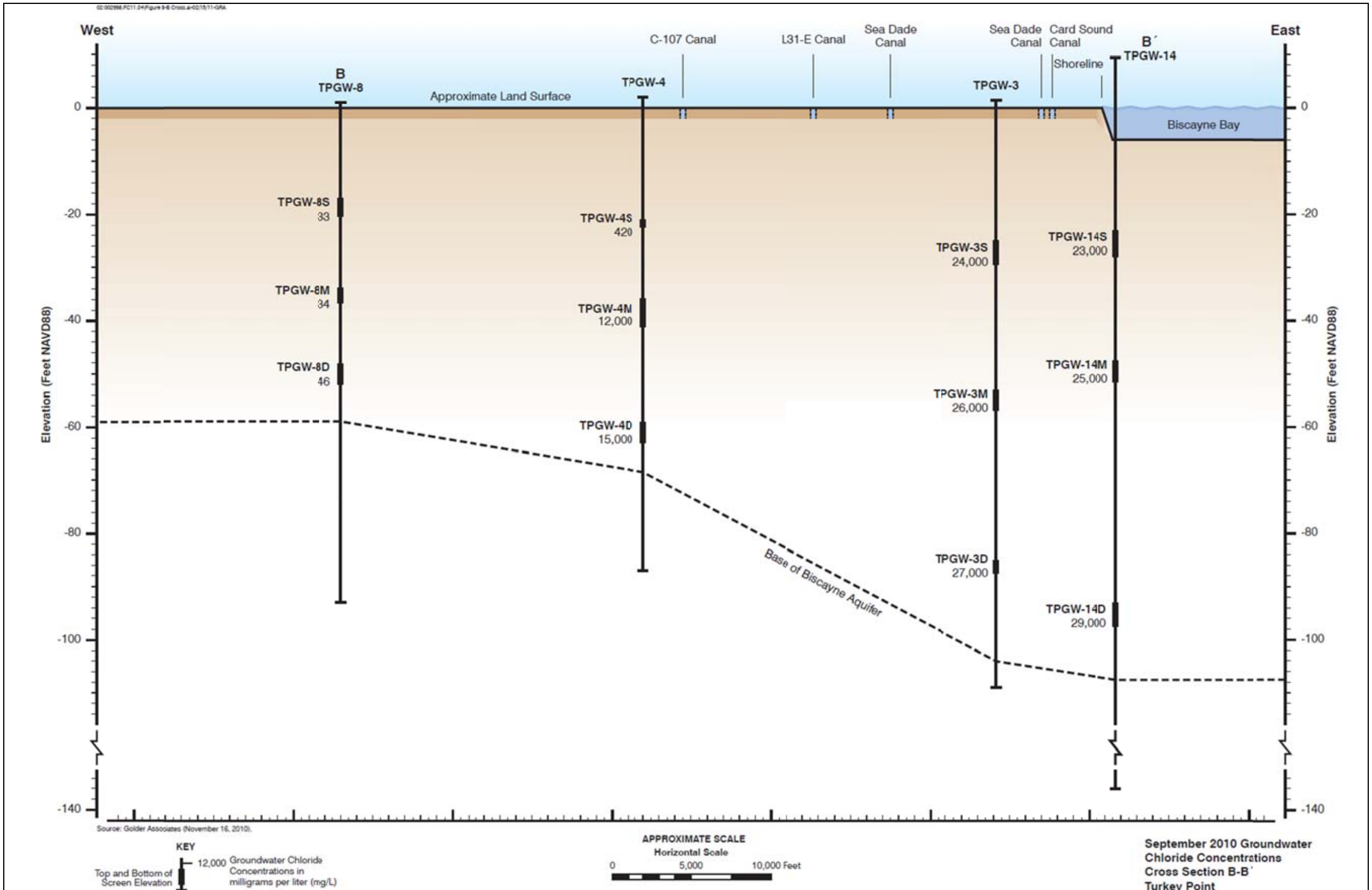


Figure 3-6. Cross Section B-B Showing September 2010 Groundwater Chloride Concentrations.

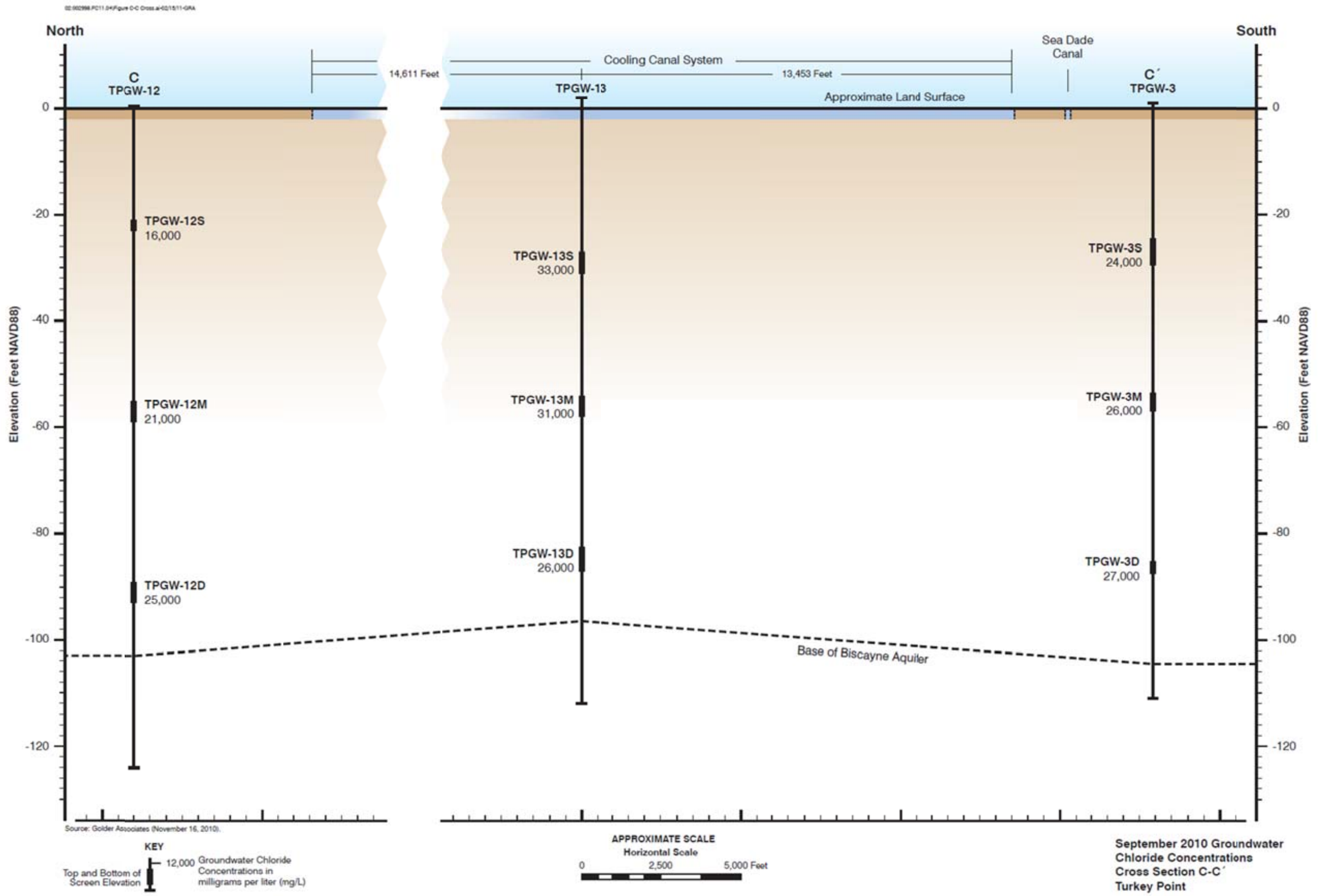


Figure 3-7. Cross Section C-C Showing September 2010 Groundwater Chloride Concentrations.

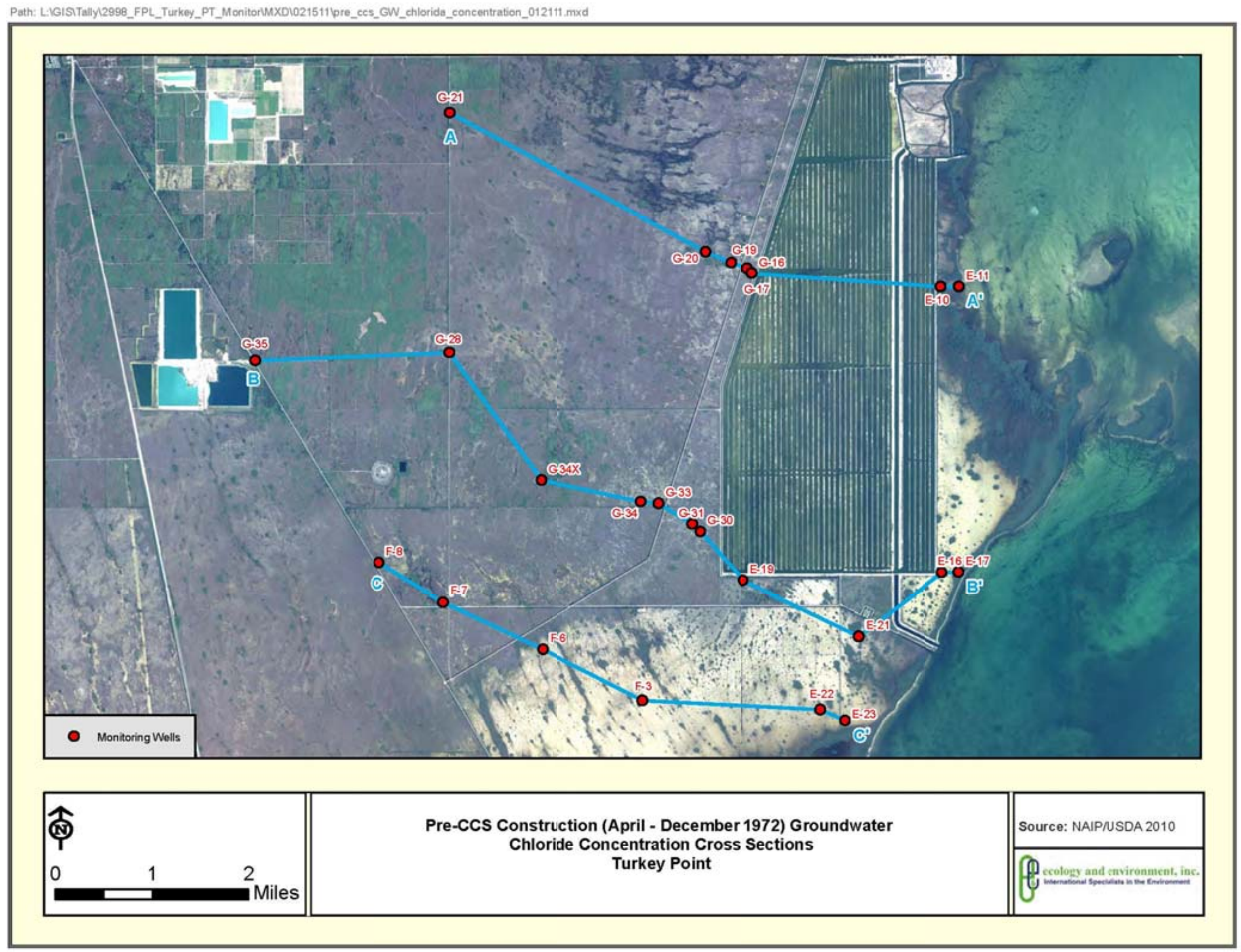


Figure 3-8. Aquifer Cross Section Locations for Early 1970s Chloride Concentrations in Groundwater.

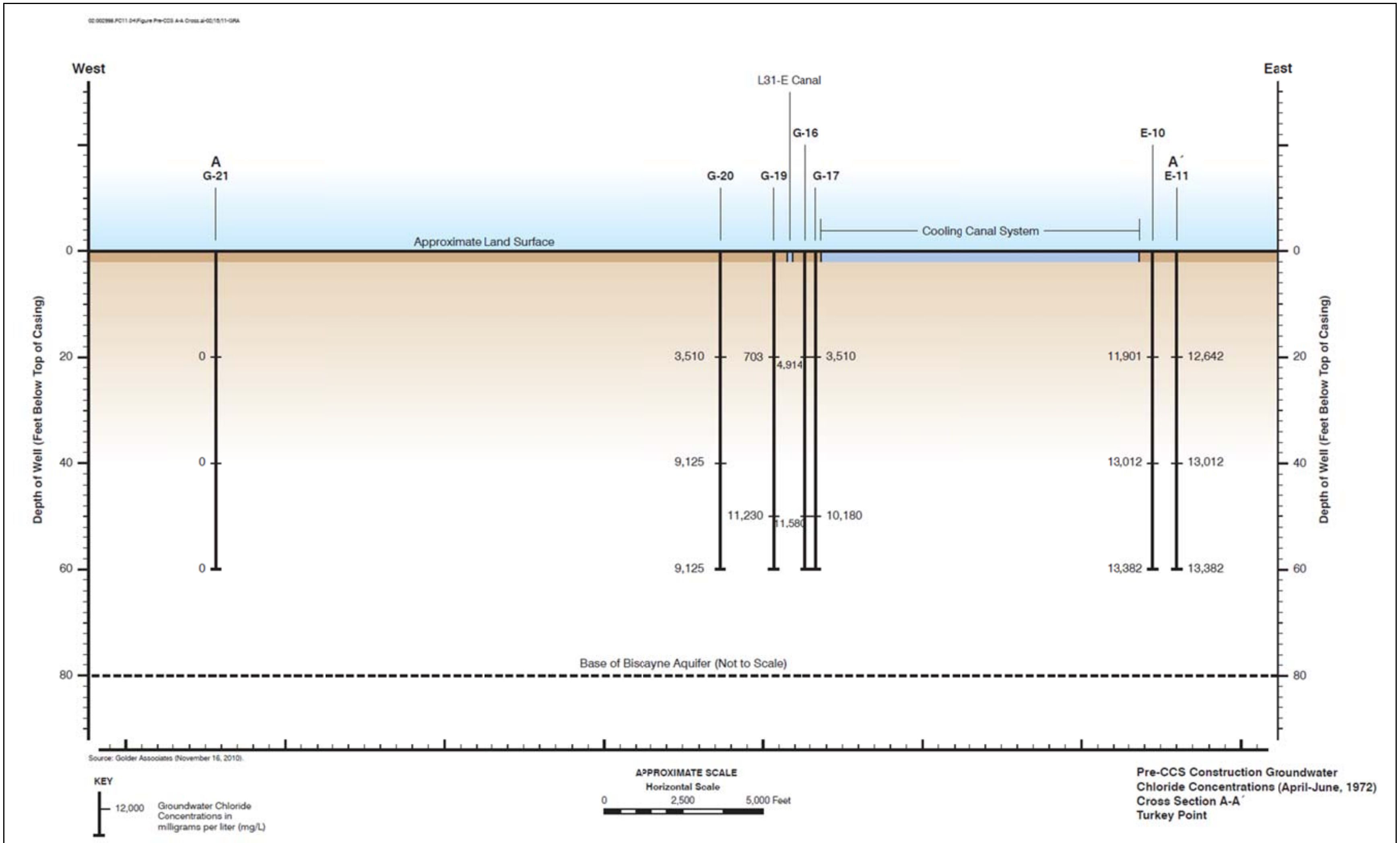


Figure 3-9. Cross Section A-A Showing Early 1970s Chloride Concentrations in Groundwater.

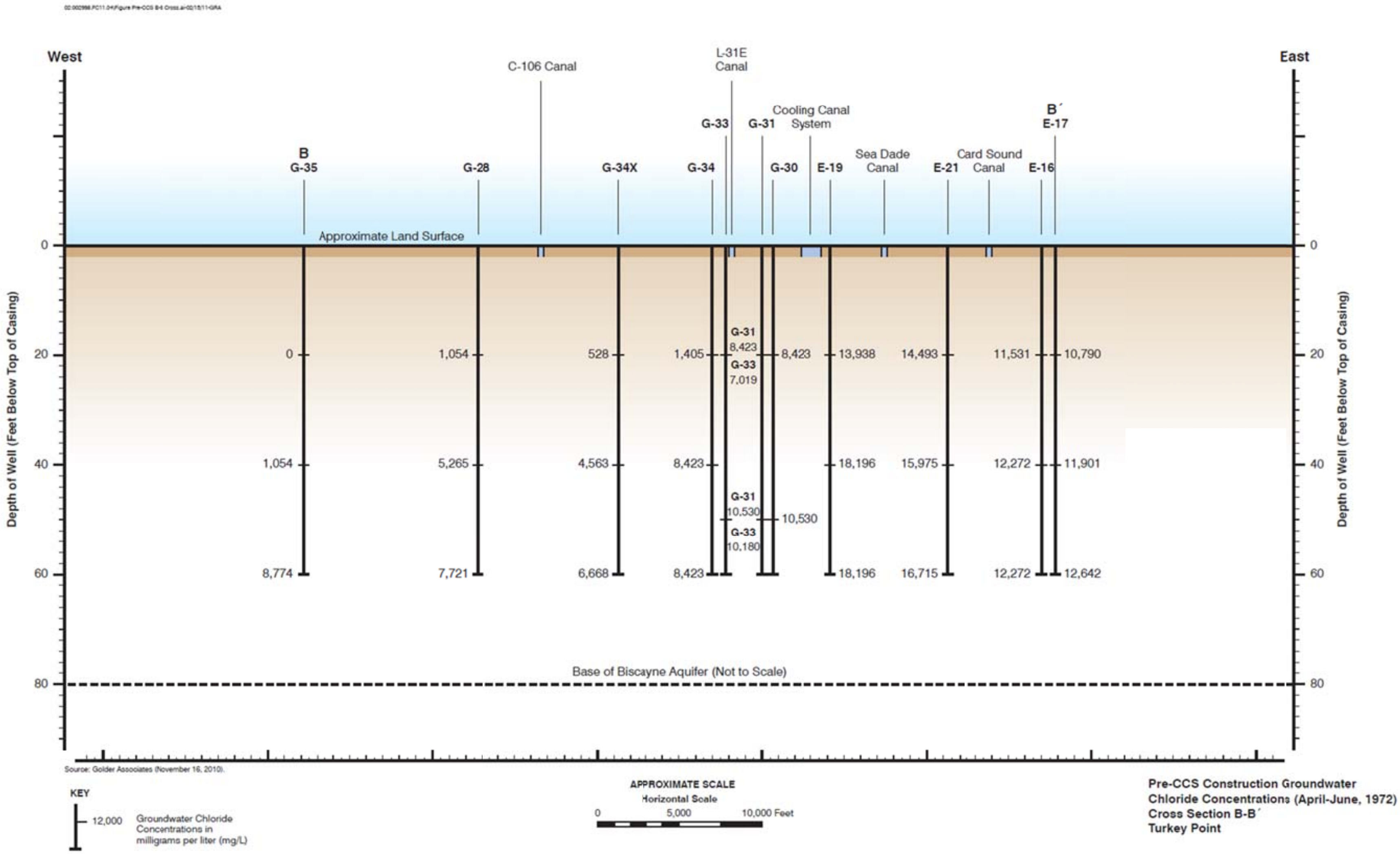


Figure 3-10. Cross Section B-B Showing Early 1970s Chloride Concentrations in Groundwater.

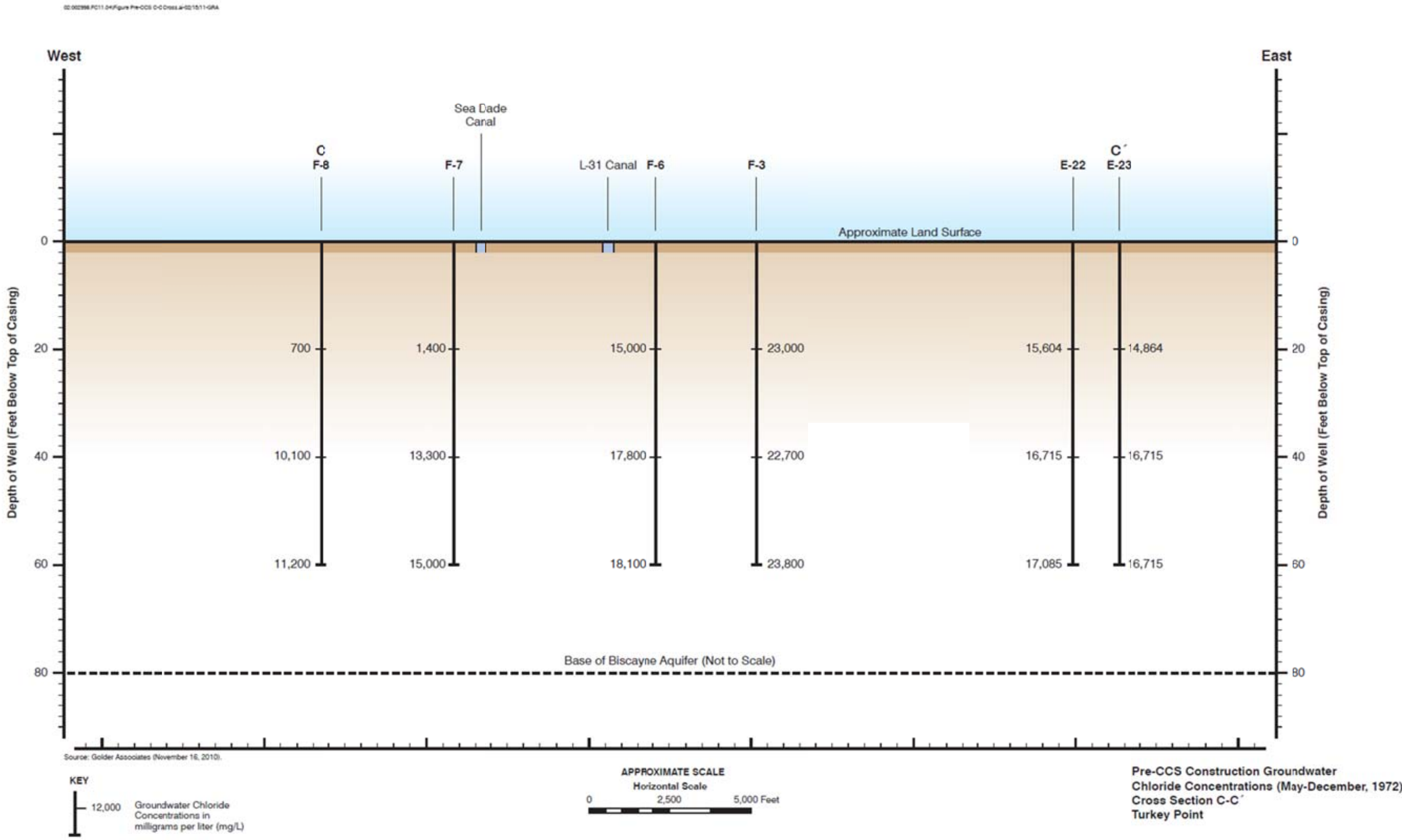


Figure 3-11. Cross Section C-C Showing Early 1970s Chloride Concentrations in Groundwater.

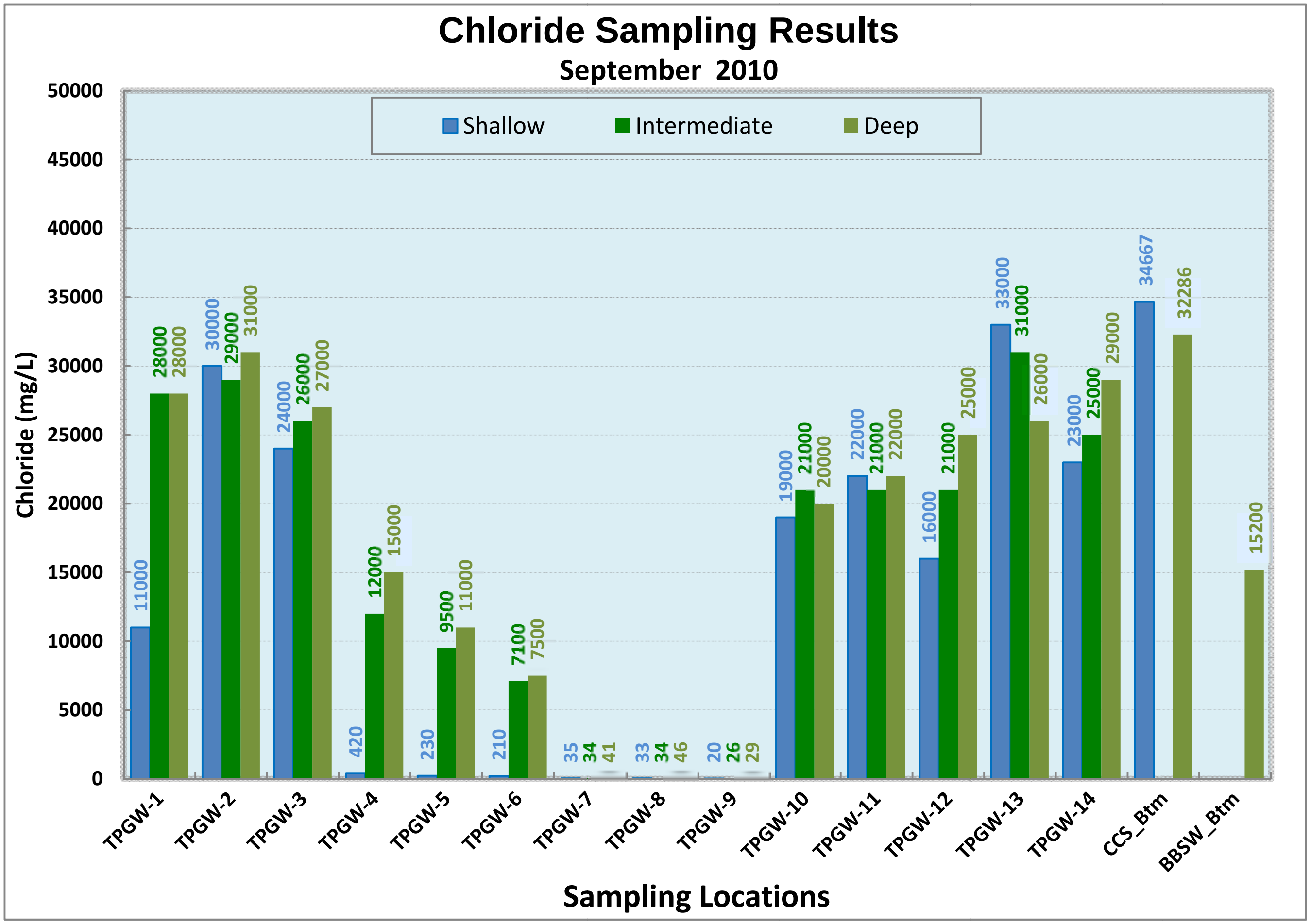


Figure 3-12. Chloride Concentrations at Each Well and How Those Concentrations Compare to Averaged Biscayne Bay Bottom Concentrations and Average CCS Bottom Concentrations from September Sampling Event.

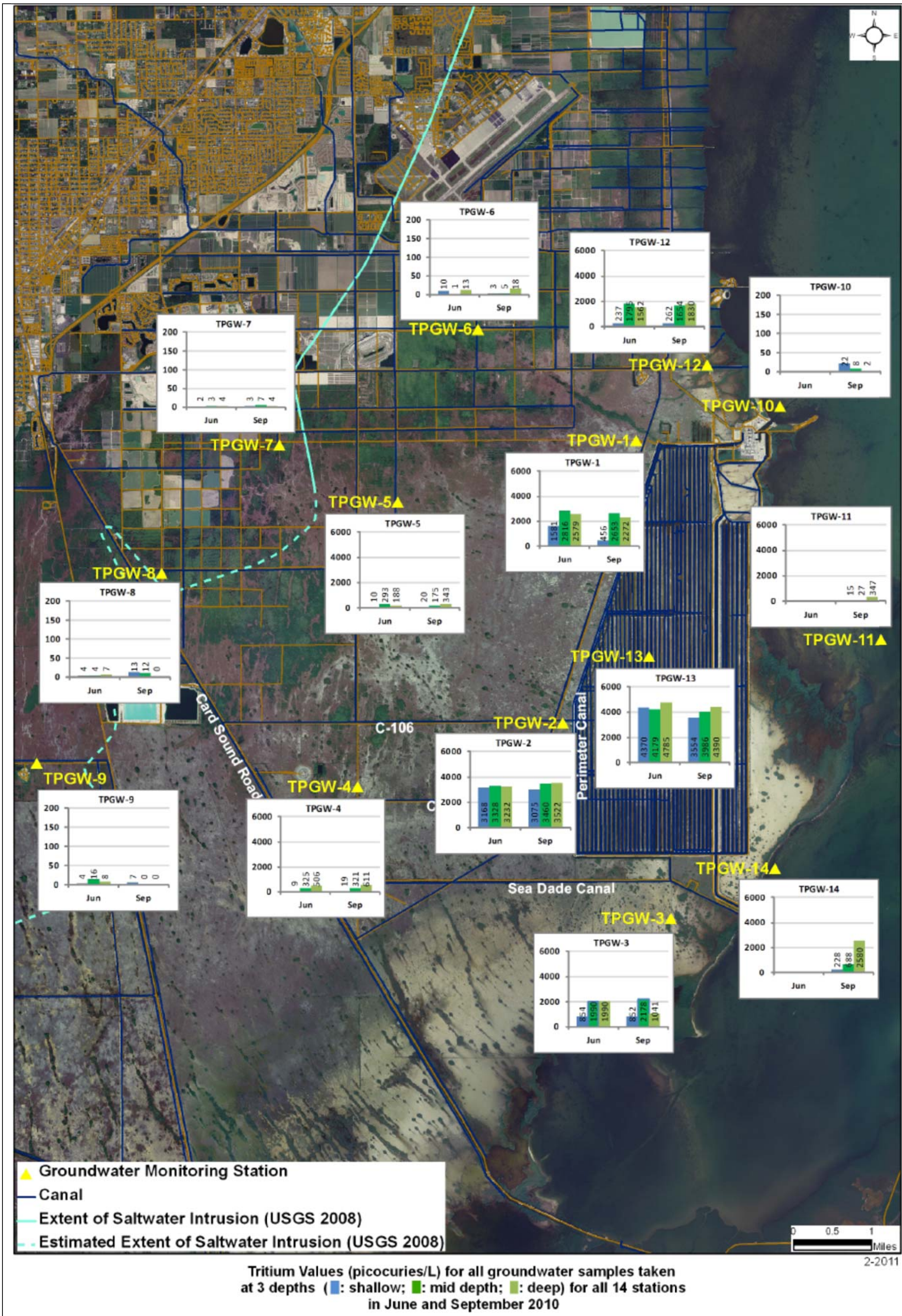
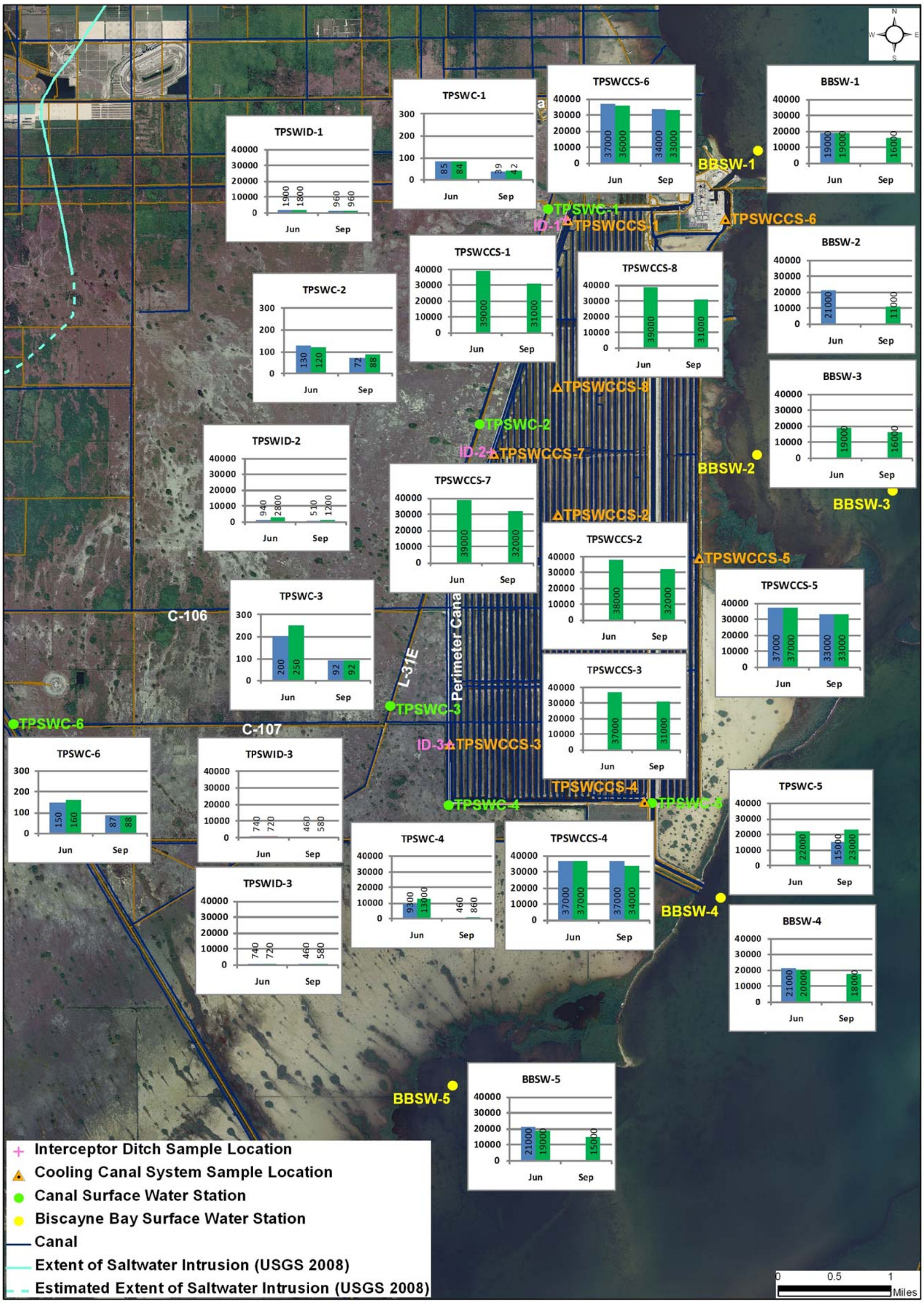


Figure 3-13. Tritium Concentrations in Groundwater (June/July and September 2010).



Chloride Values (mg/L) for surface water samples
(: top; : bottom)
in June and September 2010

Figure 3-14. Chloride Values (mg/L) in Surface Water from June/July and September 2010.

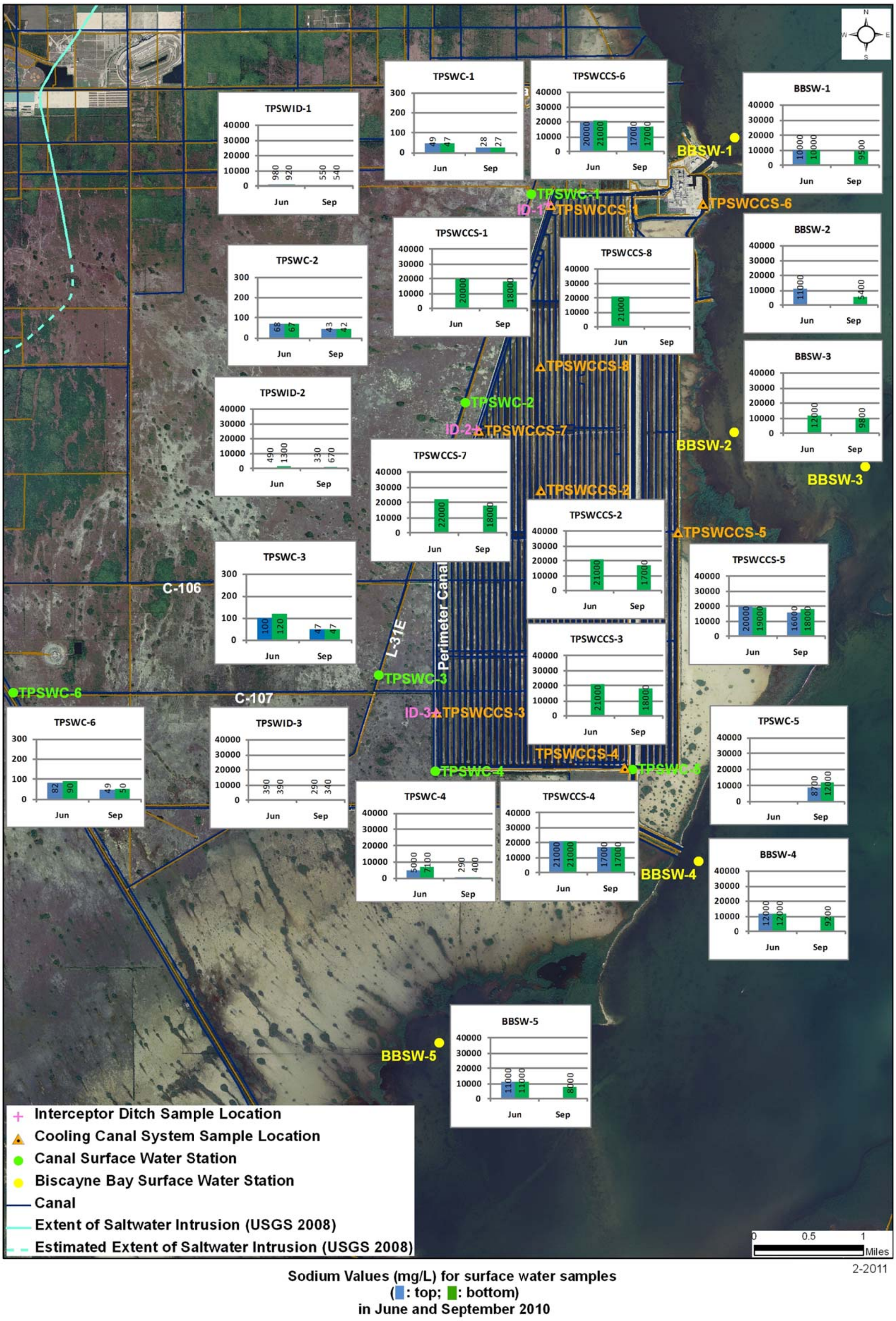
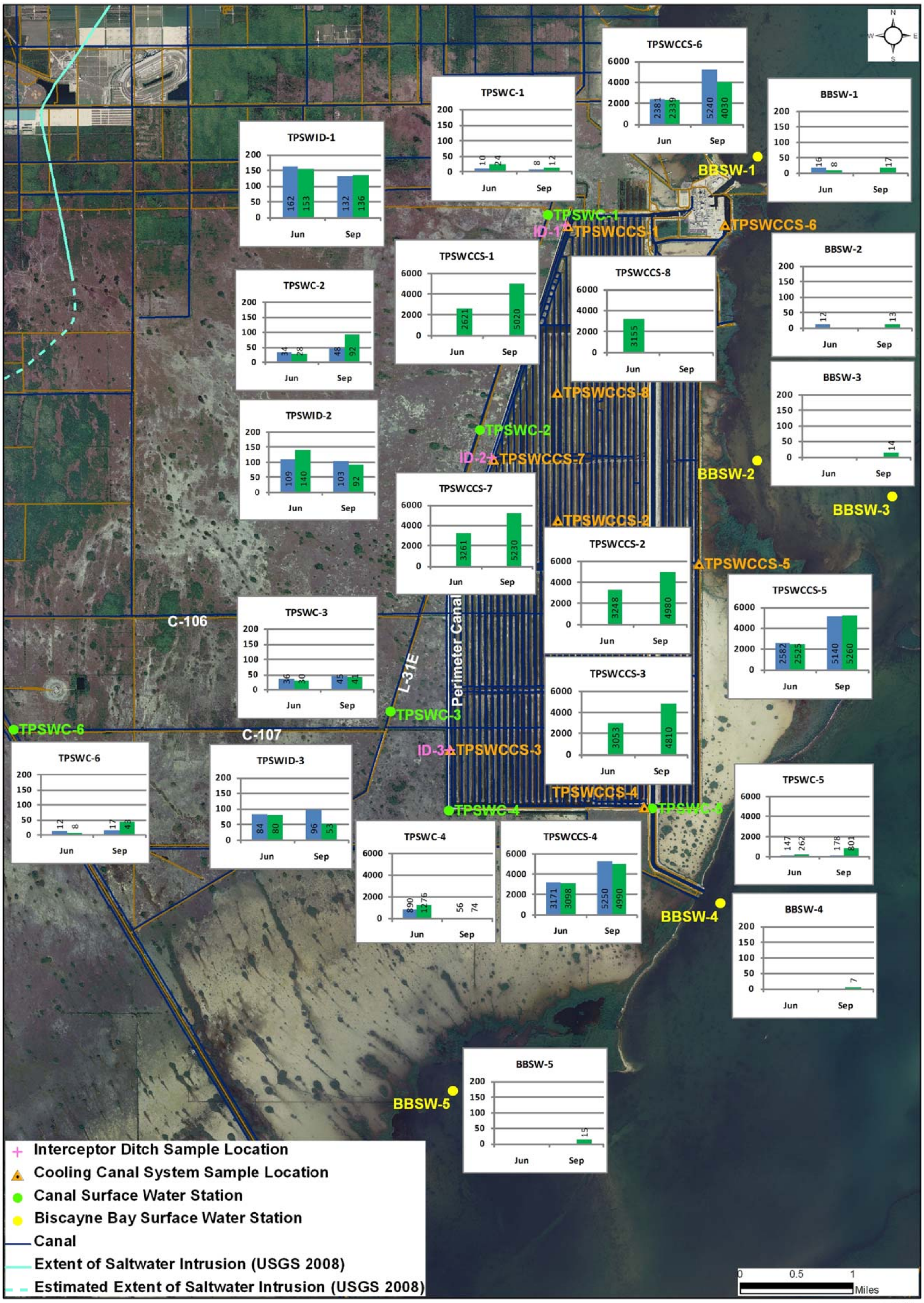


Figure 3-15. Sodium Values (mg/L) in Surface Water from June/July and September 2010.



Tritium Values (picocuries/L) for surface water samples
(■: top; ■: bottom)
in June and September 2010

2-2011

Figure 3-16. Tritium Concentrations (piC/L) in Surface Water (June/July and September 2010).

4.0 ECOLOGICAL MONITORING

The purpose of the ecological monitoring is to identify existing baseline conditions and evaluate potential impacts as a result of the Uprate. Ecological monitoring is being conducted to establish the current, pre-Uprate status of ecological conditions and biotic components, the extent to which CCS operations may be impacting conditions and components, and the extent to which Uprate implementation may result in further impacts and changes to these conditions and components. Biotic components of primary interest are marsh vegetation in adjacent wetlands, mangroves, submersed aquatic vegetation (SAV), and benthic fauna in and adjacent to Biscayne Bay.

4.1 MARSH, MANGROVES AND TREE ISLANDS

Per the Monitoring Plan, a total of 12 transects were designed to capture ecological characteristics and changes over time across the landscape surrounding the Turkey Point Power Plant (Figure 2-6 in Monitoring Plan). Originally, the design in the Monitoring Plan included the following: six marsh and six mangrove transects. Twenty 20 x 20 meter (m) plots were proposed in the marsh and 12 plots in the mangroves; of the 32 plots, six were proposed for the reference transects (four in the marsh and two within the mangroves). In conjunction with Agency staff, changes were proposed and implemented to the transect design in May 2010 where tree islands were included into the transect design. These changes have been reflected in the QAPP; plot locations can be found in Figure 4-1 and transect locations in Figure 4-2.

4.1.1 Methods and Materials

METHODS

Overall Setup and Challenges

Along each transect, either two or three 20 x 20 m plots (depending on transect length) were set up within the marsh habitats. In the longer marsh transects (F2, F3, F4, and reference transect F6), three plots were set up in the marsh while the fourth plot was set up in nearby tree islands. In the shorter marsh transects (F1, F5, and mangrove transects M1 to M6), two 20 x 20 m plots were set up. Plots were numbered one through four, beginning with the plot closest to the CCS per the QAPP. In the fall of 2010, each transect was visited by airboat, Argo (off-road track vehicle), or by foot. Plots were set up at least 50 m from the end of the transect and in the marsh transects, plots were set up at 50 m , 500 m, 1000 m from the end of the L-31E. The only exception to this was at transect F4 where the end of the transect was on DERM property; the location of plot F4-3 was subsequently moved to 950 m from the end of the L-31E Canal. Concurrent with the plot setup, a survey of surface water and porewater temperature and specific conductance at 30 and 60 cm depth was completed every 200 or 500 m along each transect.

Some logistical challenges and a significant health issue were encountered while setting up the four tree island plots. The westernmost plots of transects F2, F3, and F4, and the northernmost plot of F6 were all set up on tree islands. Tree island selection was based on size (it had to be large enough to fit a 20 m x 20 m [20x20] plot), biodiversity and high native plant populations (islands with high numbers of non-native plants were avoided), and location (near the transect and at least 50 m from man-made disturbances). No tree islands near transect F2 met these requirements, so an island closer to F3 was selected. No suitable tree islands near F4 were large enough to fit a 20 m x20 m plot, so the eastern half of F4-4 (subplots F4-4.1 and F4-4.4) was set up on one tree island, and the western half was set up on a nearby island. Many of the tree islands have widespread *Toxicodendron radicans* (poison ivy), to which several of the biologists are allergic. Extra care and time had to be spent avoiding contact with this plant, which was especially problematic to identify and avoid once the leaves abscised and the vine looked similar to many others growing on the islands. Continued sampling on the tree islands will be re-evaluated by E & E and Agency staff in May 2011 to determine the feasibility of monitoring in the presence of excessive poison ivy.

All of the plots were completely set up with the exception of M6 where access and land ownership issues resulted in having to reevaluate the location of these plots. Potential plot locations were visited with DERM staff in late November 2010 and new locations identified for M6 plots. A permit request to DERM for access and monitoring on Environmentally Endangered Lands was approved mid-January 2010 and plot setup of M6 will occur during the next quarterly sampling during February 2011.

Plot Setup

Each plot was divided into quadrants (NE, SE, SW, NW). A 1 x 1 m (hereafter referred to as 1x1) subplot was established in each quadrant containing emergent herbaceous plants, and a 5 x 5 m (hereafter referred to as 5x5) subplot was placed in quadrants containing woody plants. Both subplots were established in quadrants containing woody and herbaceous plants. Table 4-1 shows the community type of each plot and which subplots were established. Common and scientific names of plant species found during the monitoring effort are included in Appendix K.

The location of each subplot within the quadrant was determined by two randomly generated numbers. The numbers (generated in Microsoft [MS] Excel), represented the distance in meters to the west and south of the quadrant's northeast corner. For example, given the numbers 7 and 3 for a 1x1 subplot, the northeast corner of the subplot would be placed 7 m west and 3 m south of the quadrant's northeast corner (Figure 4-3). For a 5x5 subplot, a number between one and four was generated, where one designated placement in the northeast corner, two in the southeast corner, three in the southwest, and four in the northwest. If 1x1 and 5x5 subplots overlapped, new random numbers were generated until a non-overlapping design was produced. Some subplots were shifted on-site to avoid disturbances such as vehicle tracks.

To mark the corners of plots and subplots, 1/2" galvanized pipes were inserted into the soil and the corners of each plot marked with fluorescent paint and/or flagging (Figure 4-4). Subplots were marked by tying string around the corner poles of each subplot to prevent people from walking across and disturbing the areas. Once established, plots were photographed using a digital camera. Pictures were taken from the northeast corner facing southwest (e.g., Figure 4-5).

An overall coverage and average height was estimated for the plot as a whole, and for each individual subplot. For herbaceous subplots, all individuals of the dominant herbaceous emergent plants were counted, and either 30% of the plants or 15 individuals (whichever value was greater) were tagged. Tagged plants were measured for the parameters needed to obtain biomass estimates based on regression equations created by Daoust and Childers (1998). Parameters required for the biomass equations varied with species (Table 4-2), but possible measurements included length, width, diameter at base, diameter at tip, and number of live leaves.

Measurements were recorded on field sheets and entered into a MS Access database. In addition to measurements, notes were taken to document significant observations. For example, live *Cassytha filiformis*, a parasitic plant, was periodically found growing on live *Cladium jamaicense* leaves. Its presence was noted when growing on tagged plants.

For woody species, three trees in each 5x5 subplot were tagged. Tree selection was made based on the dominance of each species, and individuals of a species were chosen based on which general tree sizes represented the highest percentages of biomass in the subplot. For example, if 60% of the coverage of *Rhizophora mangle* in a subplot was made up of small trees and 40% was large trees, 2 small trees and 1 large tree were tagged.

In woody subplots not located on tree islands, height, canopy width and length, stem diameter, and number of branches were recorded for each tagged tree (Table 4-3). Leaf, flower, and fruit count were recorded for up to six individually tagged branches of a tagged tree. On tree islands, parameters observed for tagged trees were height, canopy width and length, and main stem diameter (diameter at breast height [DBH]).

SAMPLE COLLECTION

Two soil samples were obtained from outside of each plot (one each from outside the northeast 1x1 and 5x5 subplots) using 3-inch diameter, clear, acrylic tubes. Each sample was at least 30 centimeters long, and by comparing the depth of the hole made, was found to have less than 10% compression. Notes were taken on each of the samples, after which a composite sample was made by combining two cores from each plot and sent to a lab for analysis.

Leaves were collected outside of all plots and analyzed for wet mass, dry mass, surface area, and nutrient data. Three leaves, stems, or culms of each dominant species were collected to represent each subplot. Plant samples were collected from no more than 5 m outside of the plot, near the respective subplot. For broadleaf plants (e.g., *R. mangle*, *Myrica cerifera*), the second mature leaf was pulled from a stem. Leaves were kept moist, cool, and away from light before processing. Individual leaves were measured for wet mass and were scanned alongside a ruler for analysis in ImageJ (v. 1.44u, National Institutes of Health). ImageJ is an open-source program that calculates an area when a user defines a pixel-based scale and selects an area (e.g., the margin of a leaf; Figure 4-6). Petioles were not included in leaf surface area measurements.

For non-broadleaf plants, stems or culms were first measured for length (all species) and diameters (*C. jamaicense* and *Eleocharis cellulosa*) using plastic calipers, then severed just above soil level for collection. As with broadleaf plants, samples were collected from outside of the plot near each subplot and wet mass was obtained. All plant material was dried in an oven at ≤ 65° C for at least a week before measuring dry mass. Dry plant material was retained to be sent for nutrient analysis.

4.1.2 Results

Results presented in this Semi-Annual Monitoring Report encompass community and species-level field data collected during plot setup. *Cladium jamaicense* occurs in all marsh subplots while *E. cellulosa* was found in nearly half of marsh subplots (Table 4-4). *R. mangle* was the most frequently occurring woody plant in both marsh and mangrove communities. In tree island plots, *Blechnum serrulatum* and *M. cerifera* were the most frequently occurring herbaceous and woody plants, respectively.

Leaf, soil, and porewater data from this first sampling effort will be discussed in the first Annual Report when all the laboratory analyses have been completed.

Marsh

Dominant herbaceous species in F2, F3, and F4 marsh subplots were *C. jamaicense* and *E. cellulosa*. When comparing proximity to the CCS, there was no significant difference in cover among subplots (Table 4-5). However, there were significant differences in height, with the plots closer to the CCS having the greatest height and the further plots having the shortest height. Similarly, when comparing transects, no significant difference was found in percent cover, but there was a difference in height (Table 4-6); Transect F4 had the tallest dominant herbaceous plants. *C. jamaicense* was the most frequent dominant herbaceous plant in the marsh subplots. In a comparison of *C. jamaicense* percent cover and height, there was no significant difference in cover based on proximity to the CCS, but there was a significant difference in height, with closer plots having taller *C. jamaicense* (Table 4-7). Again, when comparing transect percent cover and height, there was no significant difference in cover, but there was a difference in height for *C. jamaicense* (Table 4-8). Transect F4 had the greatest average height.

Mangroves

In scrub mangrove subplots, the dominant woody species were *R. mangle* and *A. germinans*. Other woody species did appear in these plots, such as *L. racemosa* and *C. erectus*. All woody species were taken into account for percent cover, although height is based only on measurements of tagged individuals of dominant species. Like with the herbaceous subplots, no differences were found in percent cover when comparing proximities to the CCS or among transects (Table 4-9 and Table 4-10). Both comparisons, however, yielded significant differences in height with greater heights further from the CCS and in F1, M3, M4, and M5.

R. mangle was most frequently the dominant woody species in mangrove subplots. When comparing percent cover and height of only this species, there was no significant difference in percent cover based on proximity to the CCS, but based on transect, M1 had significantly great percent cover than F1, which had the lowest percent cover (Table 4-11 and Table 4-12). Height was significant in both comparisons, with greatest height closer to the CCS and in F1, M3, and M5 transects.

Tree Islands

The most common species on the tree island was *M. cerifera* followed by *I. cassine, C. icaco, R. mangle* and *M. virginica*. All these freshwater species with the exception of *R. mangle* are species common to tree islands in the freshwater Everglades. The presence of some canopy *R. mangle* (~4 m tall) is indicative of the presence of marine influence (probably from storms) in the past century that resulted in *R. mangle* propagules being transported to, and becoming established on these islands. Despite a comparison of tree islands across the landscape and with the reference transect over 5 km away from the nearest Model Lands plot, no significant differences in percent cover or height were found among transect cover or height (Table 4-13).

4.2 BISCAYNE BAY

4.2.1 Transect/Plot Setup, Sampling Methods and Materials

METHODS

Site Location

The FPL QAPP for the Turkey Point Monitoring Project established four areas within Biscayne Bay, Card Sound, and Barnes Sound for ecological sampling (Figure 4-2). The northern-most area, designated BB1, is located in Biscayne Bay near the northern end of the CCS. Areas BB2 and BB3 are located in Card Sound near the central and southern portions of the CCS, respectively. Area BB4 is the control site and is located on the western side of northern Barnes Sound north of Middle Key.

Within each area, five 2-kilometer-long, shore parallel transects were established. The first transect was located 250 m from shore followed by transects 500 m, 1000 m, 2000 m, and 3000 m from shore. These transects were designated "*a*" through "*e*", with *a* being closest to shore. Each transect was divided into eight 250 m long segments. A random number generator was then used to choose a 1 m^2 point along each of these segments as the permanent sampling point for future sampling events (Table 4-14). The points were numbered 1-8 along each transect.

General Methodology

All field sampling activities and record keeping followed the QAPP. A field notebook was used for documenting sampling activities, including station location, times of sampling, sampling personnel, and weather conditions. Customized field data sheets were utilized for recording data for each type of sampling activity. The data sheets were reviewed for completeness by the field team leader prior to leaving each sampling point.

Water quality meters were calibrated prior to the start of daily sampling activities, and continuing calibration verifications were performed throughout the day. Calibrations were recorded in the appropriate calibration log.

A 25-ft Parker boat was used for sampling activities. The boat was equipped with a GPS, depth finder, and a davit for retrieving the faunal throw trap. Its shallow draft allowed access to sampling areas.

A Trimble ®GeoXT™ GPS, pre-loaded with all sampling points, was used to navigate to each location. When the vessel was on station, a weight with an attached float was deployed to precisely mark the sampling point. The boat was then anchored in a manner that positioned the boat near the marker. Depending on wind and current conditions, a second anchor was sometimes deployed to help maintain position at the sampling point.

SAMPLING AND SURVEYS

Environmental Data

Environmental data were collected at each sample point. The tidal cycle (high, low, ebb, or flood tide) was recorded based on published tide tables. A National Institute of Standards and Technology (NIST) certified thermometer was used to determine ambient air temperature. Wind speed was estimated, and wind direction was determined by use of a compass. Sky conditions were noted as Clear (0-25% cloud cover), Partly Cloudy (25-50% cloud cover), Mostly Cloudy (50-75% cloud cover) or Overcast (more than 75% cloud cover). Notes were made of precipitation during sampling.

Water Quality Sampling

Water quality was documented at each porewater conductivity and SAV sampling monitoring site. Daily calibration and continuing calibration checks were conducted and recorded as described above. A Hach Quanta water quality meter was used to measure specific conductivity (mS/cm), temperature (°C), salinity (as a function of conductivity; practical salinity units; PSU), turbidity (nephelometric turbidity units [NTU]), dissolved oxygen (mg/L), and oxidation reduction potential (ORP; millivolts [mV]). At each sampling point, measurements were taken approximately 30 cm below the surface and 30 cm above the bottom. At both depths, the meter was allowed to stabilize before readings were taken.

Porewater Temperature and Specific Conductivity Measurements

Porewater temperature and specific conductivity measurements were taken concurrently with SAV, porewater nutrient, and tracer suite sampling. Temperature data were collected using a ThermoWorks TCTemp1000 thermocouple datalogger, and specific conductance was measured using a Hach Quanta water quality meter (Figure 4-7).

Upon arrival at the sampling location a diver with a 4-foot long section of rebar would probe the area immediately around the sample point to determine if there was sufficient unconsolidated sediment to permit insertion of a 30-cm porewater sampler to depth. If refusal was less than 30 cm at the sampling point, the bottom within a 2-5 meter radius of the sampling point was probed until the target depth could be reached. Once a suitable location was found, the temperature probe and the porewater sampler were inserted to a depth of 30 cm and the time noted. The temperature probe remained in place for a minimum of 10 minutes and temperature was electronically recorded every 15 seconds. The data were later downloaded and the stabilized temperature near the end of the sampling period used as the porewater temperature for that station.

The porewater sampler consisted of a stiffening rod to facilitate insertion into the sediment and a sipper to extract the porewater. After the sampler was inserted to depth, the stiffening rod was removed and a flexible tube attached to the sipper. A 60-cc syringe was used to pull out and discard a minimum of 120 cc of water. That volume is greater than the volume of the porewater sipper and attached tubing and assures that the water used for porewater analysis is collected from the appropriate depth. An additional 90-120 cc of porewater was then extracted and measured for conductivity, which was recorded to the nearest 0.1 mS/cm.

Submerged Aquatic Vegetation Surveys

SAV surveys were conducted at each of the eight sampling points on every transect. Four quarter-meter quadrats were dropped from near the surface roughly equidistant around each of the sites used to collect porewater (Figure 4-7). The quadrats generally landed within one to three meters of the porewater sampling apparatus. The SAV within each of the four quadrats were examined and recorded on underwater datasheets. Twenty-six pre-established categories used by the SFWMD were each scored using the Braun-Blanquet Cover Abundance Index methodology (Table 4-15). The Braun-Blanquet method assigns a code to each species or taxonomic group based on its contribution to bottom coverage, as follows:

0	=	bare
0.1	=	<5% cover with a solitary individual/shoot
0.5	=	<5% cover with few individuals/shoots
1	=	<5% cover with numerous individuals/shoots
2	=	≥5% cover and ≤25% cover
3	=	>25% cover and ≤50% cover
4	=	>50% cover and ≤75% cover
5	=	>75% cover

Categories on the data sheet not represented in the quadrat (bare) were left blank. Corals, gorgonians, and sponges were noted as present or absent but not scored. For each sampling station, an average estimate of percent cover for each species was calculated for the four quadrats combined using the formula:

$$C_a = \sum S_{ab}/4$$

where C_a = coverage of taxon *a*, *b* = quadrat number from 1 to 4, S_{ab} = the Braun-Blanquet score for taxon *a* in quadrat *b*.

One set of quadrats along each transect was scored by a second diver for QA purposes. The quadrats were left in place while the independent scoring was compared between the two surveyors. If there were differences between the scoring, both surveyors re-evaluated the quadrats until 100% agreement was reached. The final result from the QA was recorded separately from the original two scorings. All SAV surveys were done by a diver that attended the Interagency Calibration Exercise hosted by the SFWMD in Key Largo on May 18, 2010.

Faunal Throw Traps

Faunal Throw Trap (FTT) surveys were conducted at every other point along each transect (four per transect). Sampling points alternated between transects, with even numbered points sampled on Transect *a,* odd numbers on Transect *b* and so on. Upon completion of porewater conductivity and SAV sampling, a 1 x 1 m FTT was thrown over the side of the boat. As the FTT descended in the water, a diver followed and covered the top of the trap with one of two net panels attached to opposite sides of the trap. Once the trap had settled, the net panel on the top was partially retracted and a hinged sweep net used to collect fish and invertebrates. The sweep net was inserted and pushed along the bottom from front to back within the trap. After each pass, the net was closed and transported to the boat for processing (Figure 4-8). A minimum of five net sweeps of the FTT was made at each sampling point. Additional sweeps were made if the fifth sweep contained any organisms.

On the boat, any fish, penaeid shrimp, or portunid crabs were removed from the net and preserved in 10% formalin for later species-level identification and measurement at the laboratory. Other organisms were identified to Order or Family level and counted. Samples returned to the laboratory remained in formalin for a minimum of 5 days before being stepped into 70% ethanol for storage, identification and archiving. Target organisms were identified to species level and measured. Both standard (SL) and total (TL) lengths were recorded for fish, while post-orbital carapace length (CL) and carapace width (CW) were used for penaeid shrimps and portunid crabs, respectively.

Light Attenuation

Light attenuation was measured at one point (Point 4) along each transect. A LI-Cor LI-1400 data logger was connected to a LI-Cor LI-193 spherical sensor and a LI-Cor LI-190 quantum sensor to measure light (µmols/m^2/sec) at depth and at the surface simultaneously. The LI-193 sensor was mounted in a weighted black frame, while the LI-190 sensor was placed in an unshaded area on the boat. In water depths less than 1.5 m, three measurements were taken:

0.3 m below the surface, mid-depth, and 0.3 m above the bottom. In water depths greater than 1.5 m, five measurements were taken at equidistant depths starting at 0.3 m below the surface and finishing at 0.3 m above the bottom. Records of light measurements were made as the sensor was lowered to each depth, and again as the sensor was raised for a total of 6-10 readings per sampling point. The depth of reading, time, and paired surface and underwater readings were recorded for all depths. For this report, only surface, mid-depth, and bottom values are presented.

Porewater Nutrient Sampling

After completing sampling for all stations on a transect, porewater conductivity data were reviewed. The point with the highest conductivity reading was then selected as the point for porewater nutrient and tracer suite sampling. At each of these points, the porewater sampler was inserted to a depth of 30 cm and the tubing attached to the sipper was connected to a peristaltic pump on the boat. Sufficient water was pumped to clear the volume of the tube three times before 500-750 ml of water were collected. The porewater sampler was then removed from the substrate and reinserted within 0.5 meters of the first point and the process repeated. After collection, the two porewater samples were combined and homogenized prior to placing sub-samples into pre-labeled containers for subsequent laboratory analyses. Depending on the type of analysis, some containers were spiked with a preservative while others were not. All sample labels were completed with the date of sampling, time of sampling, sample number, and initials of the personnel collecting the samples. The sample bottles were then either placed on ice or left unchilled depending on the laboratory protocol.

After sampling at each point, the tubing was acid washed with 10% HCL prior to use at the next station. At the end of the day, a chain-of-custody form was completed and samples transferred to a laboratory courier for transport to the analytical lab for analysis.

Soil Coring

Two sites were selected along each transect for soil coring. Samples were collected at Points 1 and 4 on Transect *a*, 2 and 5 on Transect *b*, 3 and 6 on Transect *c*, 4 and 7 on Transect *d*, and at 5 and 8 on Transect *e* for all areas. A 70-mm cylindrical corer was used to collect the samples. At each sample location, a diver with a length of rebar would probe the bottom for a suitable location to allow penetration of the core to a depth of at least 30 cm. In many areas, the substrate would not allow a full 30-cm core to be taken, so the deepest possible core was collected. A mallet was used to drive the corer to depth of refusal. The upper end was then capped and the corer carefully extracted to retain the core. As the bottom of the corer was close to the substrate surface, a second cap was placed on the bottom of the corer and both top and bottom held in place as the diver took the core to the boat. The depth of the hole was measured and compared to the length of the core to verify the sample had less than 10% compression. Once on board, the caps were secured with electrical tape and the PVC corer labeled with the date and sample number (Figure 4-9). The date, sample number, time of collection, and length of the soil core were also recorded on the field data sheet. The soil cores were then transported to the lab where they were sub-divided into 10-cm horizons. The similar horizons for both samples on each transect were combined into a single sample resulting in a total of three samples per transect. A chain-of-custody form was completed and the samples transferred to an analytical lab for analysis.

Seagrass Leaf Collection for Nutrient Analysis

Seagrass leaf collections were made at the same two points along each transect used for collecting soil cores. At each point, divers collected blades of the dominant seagrass (*Thalassia testudinum*) by clipping the grass at the substrate. Samples were placed in plastic bags with an internal label and the sample number written on the outside of the bag. The bags were kept on ice and transported to the laboratory for analysis. Prior to drying, the blades were scrapped of epiphytes and the sample weighed. Each sample was then oven dried at 105ºC for a minimum of 24 hours and weighed. The dried leaves were ground to a powder and a sufficient quantity placed in a labeled plastic bag for subsequent nutrient analysis. A chain-of-custody form was completed and accompanied the samples during each step in the process.

4.2.2 Results

Water Quality

Mean, minimum, and maximum values of each measured water quality variable are presented in Tables 4-16 through 4-22. These data were collected between October 5 and 22, 2010. Differences in time of day at the time of collection and changes in prevailing weather conditions over the period of monitoring preclude meaningful statistical analysis of data among transects and sampling areas.

Average water temperatures along each transect ranged from 23.4 to 28.8°C during the period of monitoring (Table 4-16). There was little difference between surface and bottom mean temperatures along any transect nor were there appreciable differences among the four sampling areas.

Mean specific conductivity measurements for each transect varied from 28.4 to 48.9 (mS/cm), with the highest overall conductivity found in BB2 (mean = 42.6 mS/cm) and the lowest in BB1 (mean = 35.5 mS/cm; Table 4-17). Similarly, mean salinity values were highest in BB2 (mean = 27.3 PSU) and lowest in BB1 (mean = 22.4 PSU; Table 4-18). Average salinity values along each transect ranged from 18.5 to 31.8 PSU. There was a slight difference in either conductivity or salinity values between surface and bottom waters

Mean DO values at each transect ranged from 4.4 to 16.0 mg/L (Table 4-19). Lowest average values were obtained at BB4 (mean = 5.5 mg/L) and highest values at BB1 and BB2 (mean = 7.1 and 7.0 mg/L, respectively). Within each study area, the average overall bottom DO was generally less than 1 mg/L lower than the mean surface value.

Minimum and maximum average pH values for transects ranged from 4.9 to 8.2 (Table 4-20).

Average ORP values for each transect ranged from -50 to 302 mV (Table 4-21). The highest average value for all sampling points combined was in BB1 (mean = 150.2 mV), and the lowest was in BB3 (mean = 65.3 mV).

Mean turbidity values were considerably higher in BB1 (mean = 3.9 NTU) than in the other three sampling areas, with the lowest value in BB2 (mean = 0.2 NTU; Table 4-22). Average values along each transect ranged from 0 to 30.6 NTU.

Porewater Temperature and Specific Conductivity Measurements

Average porewater temperatures at each transect ranged from 22.7 to 28.7°C (Table 4-23).

Average specific conductivity of porewater was highest in BB2 (mean = 48.4 mS/cm) and lowest in BB1 and BB4 (mean = 43.4 and 43.7 mS/cm, respectively; Table 4-24). Mean values for each transect ranged from 35.8 to 55.0 mS/cm.

Submerged Aquatic Vegetation

In sampling area BB1, there were no differences in mean seagrass coverage among transects (Table 4-25). However, average macroalgae coverage was significantly greater on Transect d (mean BB = 1.4) than on Transect e (mean BB = 0.8). None of the other transects, which had intermediate values, differed significantly. Average macrophyte coverage differed significantly only between Transects b (mean BB = 1.1) and c (mean BB = 2.1) in BB1.

Within sampling area BB2, Transects a (mean BB = 1.1) and b (mean BB = 1.0) had significantly lower mean seagrass coverage than Transect e (mean BB = 3.0), while none of the other transects differed significantly from one another (Table 4-25). Average macroalgae coverage was highest on Transect c (mean BB = 1.9) and was significantly greater than on any other transect but Transect d. Lowest average macroalgae coverage occurred on Transect e (mean BB = 0.9). There was no significant difference in total macrophyte coverage among any transects in BB2.

Mean seagrass coverage in sampling areas BB3 was significantly higher on Transect *d* (mean BB = 2.6) than on Transects *b* (mean BB = 0.7), *c* (mean BB = 1.0), and *d* (mean BB = 1.2), although it did not differ significantly from Transect *a* (mean BB = 1.7; Table 4-25). However, average macrophyte coverage in BB3 only differed significantly between Transects *b* (mean BB = 1.3) and *e* (mean BB = 3.1). There were no significant differences in mean macroalgae coverage between any of the transects in BB3.

Average total macrophyte coverage in sampling area BB4 ranged from 1.4 to 2.1, mean seagrass coverage from 0.7 to 1.6, and mean macroalgae coverage from 0.9 to 1.3 (Table 4-25). None of these coverages differed significantly between any transects. When data for all sampling points within a sampling area were compared, BB2 was found to have significantly greater mean total macrophyte coverage (mean BB = 2.6) than either BB1 or BB4 (mean BB = 1.7 for both; Table 4-26). Sampling area BB3 had an intermediate mean macrophyte coverage of 2.2, which was not significantly different from any of the other sampling areas. This same relationship was found for total seagrass coverage, with BB2 (mean BB = 2.0) having significantly greater mean seagrass coverage than either BB1 (mean BB = 1.3) or BB4 (mean BB = 0.9), while BB3 (mean BB = 1.4) did not differ significantly from any other transect. None of the sampling areas differed significantly in mean macroalgae coverage.

The distribution of macrophytes, particularly seagrasses, within the study area is to a large degree affected by sediment. Consequently, a qualitative assessment of the substrate was made at each SAV sampling point. Four categories were used to characterize sediments: sandy, silty, shell hash, and rubble. If a quantity of substrate was picked up, released and settled relatively quickly with little drift, it was classified as sandy. If a plume was evident and it settled more slowly, it was classified as silty. Pockets of shell fragments mixed in with the sand were classified as shell hash, while rocks or hardbottom either exposed or just beneath a veneer of sediment were classified as rubble. Each sampling point could have any or a combination of these components.

One hundred sixteen (116) of the 160 sampling points were classified as sandy, shell hash (73%). A total of 40 sampling points had a silty component. Area BB4 accounted for 26 of all silty occurrences (65%) while BB1, BB2, and BB3 had only 14 total points combined that were silty. Fourteen (14) points included rubble in the description, 13 of which were in area BB4. Thus, the "control" area for this study, BB4, was somewhat different from the other areas in that it had a higher percentage of stations with both silty and rubble conditions.

Faunal Throw Traps

Eighty points were sampled with faunal throw traps with a total of 326 organisms representing 16 taxa captured (Table 4-27). No organisms were captured in 31% of the traps (25 points). Nine species of fish were collected with *Gobiosoma robustum* collected most frequently (25 points, Table 4-28) and in the highest numbers (49 total,). Three fish species (*Lagodon rhomboides*, *Paraclinus marmoratus*, and *Synganthus louisianae*) were collected only once from all traps combined. Minimum and maximum lengths (SL, CL, CW) for measured organisms are shown in Table 4-28.

Four taxa of shrimp were collected. Caridean shrimp were present in 39% of the throw traps (31 points, Table 4-28) and accounted for 43% of the total number of organisms collected (Table 4-27). The penaeid shrimp, Farfantepenaeus duorarum, occurred in 17% of the throw traps (14 points) with a total of 16 collected.

Portunid crabs were rarely captured in the throw traps (2 points, Table 4-28) with only 3 total for this sampling period. Epialtid crabs were collected in 12% of the throw traps (10 points) and were the fourth-most numerous taxa caught (17 specimens; Table 4-27).

When comparing numbers of organisms caught by total area, the northern-most and southern-most areas, BB1 and BB4, had the fewest number of organisms (31 and 52, respectively; Table 4-27). Both Card Sound sampling areas had higher total catches with BB2 having the highest total of all areas (139).

When comparing distance from shore for all sampling areas combined, Transect *c*, located 1000 m from shore, had the fewest organisms captured (17), while Transects *d* (101) and *e* (113) had the highest capture rates (Table 4-29).

Light Attenuation

Photosynthetic Photon Flux (PPF) is a unit of measure used to express the light quantum in photons of solar energy related specifically to photosynthesis and is measured with a quantum meter in units called micro-moles. Micro-moles reflect the number of photons per meter squared per second. Differences in the amounts of radiation striking a meter sensor on the boat and another sensor suspended within the water column allows determination of light attenuation within depth.

Above-water measurements taken at each transect ranged from 127 to 2279 and bottom values from 108 to 1849µmols m^{-2} sec^{-1} (Table 4-30). Average of attenuation values were greater in sampling areas BB3 (mean = 585 µmols m^{-2} sec^{-1}) and BB4 (mean = 512 µmols m^{-2} sec^{-1}) than in BB1 (mean = 287 µmols m^{-2} sec^{-1}) and BB2 (mean = 250 µmols m^{-2} sec^{-1}). The occurrence of some negative attenuation values requires further review and refinement of sampling techniques.

TABLES

Table 4-1. Plot Location, Community Description, Dominant Vegetation, and Subplot Occurrence

Transect	Plot	Latitude (NE)	Longitude (NE)	Community	Herbaceous Dominant Species	Woody Dominant Species	Set up 1x1	Set up 5x5
F1	**1**	25.43503	-80.34692	Marsh/Mangrove	*Cladium jamaicense*	*Rhizophora mangle*	Y	Y
F1	**2**	25.44027	-80.34042	Freshwater marsh	*C. jamaicense*	*R. mangle*	Y	Y
F2	**1**	25.43310	-80.35403	Freshwater marsh	*C. jamaicense*	NA	Y	N
F2	**2**	25.43286	-80.35864	Freshwater marsh	*C. jamaicense*	*R. mangle*	Y	Y
F2	**3**	25.43328	-80.36346	Freshwater marsh	*C. jamaicense* *Eleocharis cellulosa*	NA	Y	N
F2	**4**	25.41342	-80.37015	Hammock	*B. serrulatum*	*Chrysobalanus icaco* *Myrica cerifera* *R. mangle* *Conocarpus erectus*	Y	Y
F3	**1**	25.40840	-80.36248	Freshwater marsh	*C. jamaicense*	NA	Y	N
F3	**2**	25.40824	-80.34716	Freshwater marsh	*C. jamaicense*	NA	Y	N
F3	**3**	25.40806	-80.37231	Freshwater marsh	*C. jamaicense* *E. cellulosa*	NA	Y	N
F3	**4**	25.40583	-80.37246	Hammock	*B. serrulatum* *Thelypteris sp.*	*C. icaco* *M. cerifera* *C. erectus*	Y	Y
F4	**1**	25.38657	-80.37074	Freshwater marsh	*C. jamaicense* *E. cellulosa*	NA	Y	N
F4	**2**	25.38669	-80.37492	Freshwater marsh	*C. jamaicense*	NA	Y	N
F4	**3**	25.38655	-80.37908	Freshwater marsh	*C. jamaicense*	NA	Y	N
F4	**4**	25.38601	-80.37723	Hammock	*B. serrulatum*	*M. cerifera* *Ilex cassine* *C. erectus*	Y	Y
F5	**1**	25.35570	-80.36692	Scrub mangrove	*Distichlis spicata*	*Laguncularia racemosa* *R. mangle*	Y	Y
F5	**2**	25.35304	-80.35600	Scrub mangrove	*D. spicata* *Juncus roemerianus*	*R. mangle*	Y	Y
F6	**1**	25.35469	-80.43848	Freshwater marsh	*C. jamaicense* *E. cellulosa*	NA	Y	N

Table 4-1. Plot Location, Community Description, Dominant Vegetation, and Subplot Occurrence

Transect	Plot	Latitude (NE)	Longitude (NE)	Community	Herbaceous Dominant Species	Woody Dominant Species	Set up	
							1x1	5x5
F6	**2**	25.34966	-80.43619	Freshwater marsh	*C. jamaicense* *E. cellulosa*	None	Y	N
F6	**3**	25.34413	-80.43097	Freshwater marsh	*C. jamaicense* *E. cellulosa*	*C. erectus*	Y	N
F6	**4**	25.37166	-80.44778	Hammock	*B. serrulatum* *Peltandra virginica*	*C. icaco* *I. cassine* *M. cerifera* *M. virginiana*	Y	Y
M1	**1**	25.44296	-80.33598	Scrub mangrove	None	*R. mangle*	N	Y
M1	**2**	25.44716	-80.33269	Scrub mangrove	None	*R. mangle*	N	Y
M2	**1**	25.40535	-80.33070	Scrub mangrove	None	*R. mangle*	N	Y
M2	**2**	25.40521	-80.32990	Scrub mangrove	None	*R. mangle*	N	Y
M3	**1**	25.38628	-80.33083	Scrub mangrove	None	*R. mangle*	N	Y
M3	**2**	25.38450	-80.32794	Scrub mangrove	None	*R. mangle*	N	Y
M4	**1**	25.35630	-80.33138	Scrub mangrove	None	*R. mangle*	N	Y
M4	**2**	25.34568	-80.32911	Scrub mangrove	None	*R. mangle*	N	Y
M5	**1**	25.35186	-80.35543	Scrub mangrove	*D. spicata*	*R. mangle* *Avicennia germinans*	Y	Y
M5	**2**	25.34507	-80.33381	Scrub mangrove	None	*R. mangle*	Y	Y
M6	**1***							
M6	**2***							

* Plot has not been set up.

Table 4-2. Parameters Recorded for Each Dominant Herbaceous Species

Herbaceous Species	Length: Base to Tip (Excluding Flower)	Length: Base to Tallest Live Leaf	Diameter		# Leaves	
			At Base	At Tip	Live	Dead
C. jamaicense	√		√		√	√
D. spicata		√			√	
Eleocharis cellulosa	√		√	√		
B. serrulatum		√				
Thelypteris sp.		√				

Table 4-3. Parameters Recorded for Woody Species

Growth Habit	Canopy				Number of:			
	Height	Width	Length	Diameter: Main Stem	Branches	Leaves	Flowers	Fruit
Scrub	√	√	√	√	√	√	√	√
Tree Island	√	√	√	√				

Table 4-4. Species Occurrence in Subplots

Community	Vegetation Type	Species	Frequency of Dominance
			52 Total Subplots
Marsh	Herbaceous	*Cladium jamaicense*	52
		Eleocharis cellulosa	24
		Cassytha filiformis	17
		Juncus roemerianus	1
		Rhynchospora tracyi	1
		Typha domingensis	2
	Woody	*Rhizophora mangle*	17
Mangrove	Herbaceous	*C. jamaicense*	3
		Distichlis spicata	11
		J. roemerianus	3
	Woody	*R. mangle*	50
		Avicennia germinans	1
			16 Total Subplots
Tree Island	Herbaceous	*Blechnum serrulatum*	15
		Thelypteris sp.	1
		Parthenocissus quinquefolia	1
		Peltandra virginica	1
		Osmunda regalis	1
		Toxicodendron radicans	1
	Woody	*Chrysobalanus icaco*	8
		Rapanea punctata	1
		Myrica cerifera	9
		Conocarpus erectus	7
		Ilex cassine	7
		Magnolia virginiana	1
		R. mangle	3

Table 4-5. ANOVA of Percent Cover and Height (cm) for Dominant Herbaceous Plants in 1x1 Marsh Subplots for Combined F2, F3, and F4 Transects Based on Plot Proximity to the CCS. For ANOVA p-values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Proximity to CCS	% Cover		Height (cm)	
	(Mean ± SE)	ANOVA	(Mean ± SE)	ANOVA
Closer	7.4±1.6	p=0.71 df = 2, 65 f=0.34	94.0±2.0 a	p<0.01 df=2, 646 f=17.1
Middle	6.0±1.3		84.2±3.7 b	
Further	7.7±1.7		75.4±1.5 c	

Table 4-6. ANOVA of Percent Cover and Height (cm) for Dominant Herbaceous Plants in 1x1 Marsh. Comparisons Among Subplots along a Transect, and Comparison among Transects were Conducted for the F2, F3, F4, and F6 Transects. For ANOVA p-values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison. (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Transect	Plot	% Cover				Height (cm)			
		Subplot comparisons within a transect		Among-transect comparisons		Subplot comparisons within a transect		Among-transect comparisons	
		Mean ± SE	ANOVA	Mean ± SE	ANOVA	Mean ± SE	ANOVA	Mean ± SE	ANOVA
F2	1	7.3±2.5	p=0.93			96.3±1.6 a	p<0.01		
	2	8.2±2.8	df = 2, 23	8.1±1.6 a		89.6±2.2 a	df = 2, 245	81.6±1.4 b	
	3	8.8±3.1	f=0.07			64.8±1.7 b	f=92.3		
F3	1	3.1±0.9	p=0.06			64.2±2.1 a	p=0.09		
	2	4.6±1.0	df = 2, 19	6.7±1.6 a		83.0±10.6 a	df = 2, 210	75.7±3.4 b	
	3	11.1±3.4	f=3.3		p=0.7 df = 3, 92 f=0.4	78.4±3.0 a	f=2.49		p<0.01 df = 3, 854 f=15.7
F4	1	11.9±3.5 a	p=0.02			116.7±3.4 a	p<0.01		
	2	4.4±1.6ab	df = 2, 21	6.2±1.5 a		79.9±1.6 c	df = 2, 189	96.3±1.9 a	
	3	2.7±0.8 b	f=4.7			89.1±1.7 b	f=60.5		
F6	1	5.1±1.2 ab	p=0.03			108.7±2.2 a	p<0.01		
	2	4.6±0.9 b	df = 2, 26	6.2±0.9 a		77.9±1.5 b	df = 2, 397	80.7±1.5 b	
	3	10.1±2.6 a	f=3.9			78.5±1.5 b	f=97.1		

Table 4-7. ANOVA of Percent Cover and Height (cm) for *C. jamaicense* in 1x1 Marsh Subplots among F2, F3, and F4 Transects based on Plot Proximity to the CCS. For ANOVA P values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison. (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Proximity to CCS	% Cover		Height (cm)	
	Mean ± SE	ANOVA	Mean ± SE	ANOVA
Closer	11.9±2.0	p=0.8 df = 2, 35 f=0.25	94.0±2.0 a	p=0.02 df = 2, 550 f=4.0
Middle	10.0±1.6		84.2±3.7 b	
Further	10.3±2.5		90.4±1.3 ab	

Table 4-8. ANOVA of Percent Cover and Height (cm) for *C. jamaicense* in 1x1 marsh subplots. For ANOVA p-values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Transect	Plot	% Cover				Height (cm)			
		Between Plot Comparison		Among Transect Comparison		Between Plot Comparison		Among Transect Comparison	
		Mean±SE	ANOVA	Mean±SE	ANOVA	Mean±SE	ANOVA	Mean±SE	ANOVA
F2	1	13.7±1.3	p=0.3	13.3±1.6	p=0.4 df = 3, 47 f=1.1	96.3±1.6 a	p<0.01	90.3±1.2 ab	p<0.01 df =3, 702 f=6.53
	2	16.3±2.4	df =2, 11			89.6±2.2 b	df =2, 189		
	3	10.0±3.5	f=1.5			80.4±1.9 c	f=16.4		
F3	1	4.8±1.0	p=0.05	9.0±2.4		64.2±2.1 a	p<0.01	81.8±4.0 b	
	2	5.5±0.7	df =2, 11			83.0±10.6 ab	df =2, 170		
	3	16.8±5.5	f=4.37			101.1±2.3 b	f=7.35		
F4	1	17.3±3.6 a	p=0.01	9.9±2.0		116.7±3.4 a	p<0.01	96.3±1.9 a	
	2	8.3±1.4 ab	df =2, 11			79.9±1.6 c	df =2, 189		
	3	4.3±0.8 b	f=8.76			89.1±1.7 b	f=60.52		
F6	1	8.0±1.2	p=0.2	9.3±1.5		99.3±2.3 a	p<0.01	90.4±1.4 ab	
	2	7.0±1.1	df =2, 11			87.9±2.3 b	df =2, 151		
	3	13.0±3.9	f=1.79			81.5±1.7 b	f=18.91		

Table 4-9. ANOVA of Percent Cover and Height for Dominant Woody Plants in 5x5 Mangrove Subplots among M1, M2, M3, M4, and M5 Transects based on Plot Proximity to the CCS. For ANOVA p-values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Proximity to CCS	% Cover		Average Height (cm)	
	Mean ± SE	ANOVA	Mean ± SE	ANOVA
Closer	20.6±3.2	p=0.15 df = 1, 52 f=2.15	78.8±2.5 a	p<0.01 df = 1, 117 f=8.0
Further	27.5±3.4		89.7±3.0 b	

Table 4-10. ANOVA of Percent Cover and Height (cm) for Dominant Woody Plants in 5x5 Mangrove Subplots among F1, F5, M1, M2, M3, M4, and M5 Transects. For ANOVA P values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Transect	Plot	% Cover				Height (cm)			
		Between Plot Comparison		Within Transect Comparison		Between Plot Comparison		Within Transect Comparison	
		Mean ± SE	ANOVA	Mean ± SE	ANOVA	Mean ± SE	ANOVA	Mean ± SE	ANOVA
F1	**1** **2**	27.1±9.6 7.5±2.8	p=0.12 df = 1, 8 f= 3.1	18.4±6.2	df = 6, 74 f=1.0 p=0.5	112.9±7.2 a 90±3.4 b	df = 1, 20 f=7.8 p=0.01	102.0±4.7 a	df =6, 162 f=6.6 p<0.01
F5	**1** **2**	22.5±4.6 31.2±9.2	p=0.37 df = 1, 12 f=0.88	25.9±4.5		66.9±9.9 59.3±6.6	p=0.5 df = 1, 23 f=0.40	63.1±5.9 c	
M1	**1** **2**	31.0±7.7 32.8±10.3	p=0.89 df = 1, 10 f=0.02	32.0±6.3		71.7±2.3 a 84.6±3.6 b	p<0.01 df = 1, 23 f=9.0	78.1±2.5 bc	
M2	**1** **2**	5.2±2.3 a 36.1±9.2 b	p=0.01 df = 1, 10 f=12.8	19.2±6.4		88.8±5.0 a 69.8±2.4 b	p<0.01 df = 1, 22 f=10.9	79.7±3.5 bc	
M3	**1** **2**	30.0±9.6 18.3±2.7	p=0.36 df = 1, 9 f=0.94	25.3±5.9		84.8±4.9 97.1±7.4	p=0.2 df = 1, 23 f=1.9	90.1±4.5 ab	
M4	**1** **2**	27.5±3.2 23.5±5.4	p=0.60 df = 1, 9 f=0.30	25.1±3.4		82.1±7.3 83.7±5.8	p=0.87 df = 1, 22 f=0.03	82.9±4.5 abc	
M5	**1** **2**	14.6±2.9 23.8±3.8	p=0.09 df = 1, 10 f=3.7	17.9±2.6		66.7±5.8 b 111.5±5.7 a	p<0.01 df = 1, 23 f= 30.8	89.1±6.1 ab	

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Table 4-11. ANOVA of Percent Cover and Height for *R. mangle* in 5x5 Subplots among M1, M2, M3, M4, and M5 Transects Based on Plot Proximity to the CCS. For ANOVA P values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Proximity to CCS	% Cover		Height (cm)	
	Mean±SE	ANOVA	Mean ±S E	ANOVA
Closer	27.6±3.2	p=0.2 df = 1, 39 f=1.6	78.4±2.5 a	p<0.01 df = 1, 116 f=8.3
Further	**33.2±3.2**		89.7±2.9 b	

Table 4-12. ANOVA of Percent Cover and Height for *R. mangle* in 5x5 Mangrove Subplots. For ANOVA P values < 0.05, letters represent statistically different means as determined by a Bonferroni pairwise comparison (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Transect	Plot	% Cover				Height (cm)			
		Between Plot Comparison		Among Transect		Between Plot Comparison		Among Transect Comparison	
		Mean±SE	ANOVA	Mean±SE	ANOVA	Mean±SE	ANOVA	Mean±SE	ANOVA
F1	**1** **2**	33.8±9.0 a 7.5±2.8 b	p=0.03 df =1, 7 f=7.8	20.6±6.6 b	p=0.04 df =6, 55 f=2.4	112.9±7.2 a 90.0±3.35 b	p=0.01 df =1, 20 f=7.8	102.0±4.7 a	p<0.01 df =6, 154 f=4.8
F5	**1** **2**	20.0±3.5 38.8±6.9	p=0.05 df =1, 7 f=5.9	29.4±5.0 ab		83.2±21.4 59.3±6.6	p=0.2 df =1, 16 f=2.0	66.3±7.9 c	
M1	**1** **2**	38.5±2.2 48.8±3.8	p=0.06 df =1, 7 f=5.6	43.6±2.8 a		71.7±2.3 b 84.6±3.6 a	p<0.01 df =1, 23 f=9.0	78.1±2.5 bc	
M2	**1** **2**	7.5±2.7 b 45.0±2.9 a	p<0.01 df =1, 7 f=89.3	26.3±7.3 ab		88.8±5.0 a 69.8±2.4 b	p<0.01 df =1, 22 f=10.9	79.7±3.5 bc	
M3	**1** **2**	44.5±4.3 a 18.3±2.7 b	p=0.002 df =1, 7 f=26.9	31.4±5.5 ab		84.8±4.9 97.1±7.4	p=0.2 df =1, 23 f=1.9	91.0±4.5 ab	
M4	**1** **2**	27.5±3.2 30.0±4.1	p=0.7 df =1, 7 f=0.2	28.8±2.5 ab		82.1±7.3 83.7±5.8	p=0.9 df =1, 22 f=0.03	82.9±4.5 bc	
M5	**1** **2**	20.0±2.0 23.8±3.8	p=0.4 df =1, 7 f=0.8	21.9±2.1 ab		64.0±5.6 b 111.5±5.6 a	p<0.01 df =1, 22 f=35.4	88.8±6.4 ab	

Table 4-13. ANOVA of Percent Cover and Height (cm) for Dominant Woody Plants in Tree Islands

Transect	% Cover		Height (cm)	
	Mean±SE	ANOVA	Mean±SE	ANOVA
F2-4	21.7±4.4	p=0.7 df =3, 57 f=0.5	410.4±21.9	p=0.5 df =3, 46 f=0.85
F3-4	28.0±8.5		438.6±29.7	
F4-4	19.4±3.4		493.8±43.1	
F6-4	26.6±5.9		434.6±51.5	

Table 4-14. Latitude and Longitude of Biscayne Bay, Card Sound and Barnes Sound Ecological Sampling Points

Point	Latitude	Longitude	Point	Latitude	Longitude
BB1-a-1	25.42632	80.32344	BB2-a-1	25.37277	80.30706
BB1-a-2	25.42355	80.32348	BB2-a-2	25.37171	80.30782
BB1-a-3	25.42296	80.32346	BB2-a-3	25.37021	80.30888
BB1-a-4	25.41888	80.32347	BB2-a-4	25.36822	80.31030
BB1-a-5	25.41664	80.32343	BB2-a-5	25.36692	80.31122
BB1-a-6	25.41644	80.32344	BB2-a-6	25.36490	80.31265
BB1-a-7	25.41217	80.32345	BB2-a-7	25.36334	80.31375
BB1-a-8	25.41074	80.32344	BB2-a-8	25.36009	80.31604
BB1-b-1	25.42769	80.32095	BB2-b-1	25.37296	80.30388
BB1-b-2	25.42335	80.32097	BB2-b-2	25.37088	80.30538
BB1-b-3	25.42116	80.32096	BB2-b-3	25.36808	80.30740
BB1-b-4	25.42049	80.32096	BB2-b-4	25.36702	80.30816
BB1-b-5	25.41750	80.32094	BB2-b-5	25.36481	80.30966
BB1-b-6	25.41514	80.32094	BB2-b-6	25.36344	80.31065
BB1-b-7	25.41306	80.32094	BB2-b-7	25.36159	80.31196
BB1-b-8	25.41130	80.32095	BB2-b-8	25.35886	80.31391
BB1-c-1	25.42668	80.31597	BB2-c-1	25.36943	80.30046
BB1-c-2	25.42545	80.31597	BB2-c-2	25.36876	80.30094
BB1-c-3	25.42265	80.31597	BB2-c-3	25.36619	80.30273
BB1-c-4	25.41907	80.31597	BB2-c-4	25.36413	80.30421
BB1-c-5	25.41709	80.31597	BB2-c-5	25.36190	80.30580
BB1-c-6	25.41626	80.31597	BB2-c-6	25.36146	80.30609
BB1-c-7	25.41294	80.31597	BB2-c-7	25.36004	80.30710
BB1-c-8	25.41097	80.31597	BB2-c-8	25.35743	80.30896
BB1-d-1	25.42776	80.30600	BB2-d-1	25.36569	80.29147
BB1-d-2	25.42519	80.30600	BB2-d-2	25.36426	80.29251
BB1-d-3	25.42207	80.30600	BB2-d-3	25.36154	80.29439
BB1-d-4	25.41909	80.30600	BB2-d-4	25.35935	80.29598
BB1-d-5	25.41689	80.30600	BB2-d-5	25.35895	80.29626
BB1-d-6	25.41594	80.30600	BB2-d-6	25.35572	80.29853
BB1-d-7	25.41311	80.30600	BB2-d-7	25.35434	80.29953
BB1-d-8	25.41173	80.30600	BB2-d-8	25.35232	80.30095
BB1-e-1	25.42738	80.29607	BB2-e-1	25.36028	80.28339
BB1-e-2	25.42353	80.29607	BB2-e-2	25.35832	80.28483
BB1-e-3	25.42201	80.29607	BB2-e-3	25.35688	80.28588
BB1-e-4	25.42071	80.29607	BB2-e-4	25.35472	80.28749
BB1-e-5	25.41863	80.29607	BB2-e-5	25.35272	80.28898
BB1-e-6	25.41573	80.29607	BB2-e-6	25.35165	80.28976
BB1-e-7	25.41312	80.29607	BB2-e-7	25.34946	80.29140
BB1-e-8	25.41017	80.29607	BB2-e-8	25.34767	80.29273

Table 4-14. Latitude and Longitude of Biscayne Bay, Card Sound and Barnes Sound Ecological Sampling Points

Point	Latitude	Longitude
BB3-a-1	25.35211	80.32451
BB3-a-2	25.35034	80.32586
BB3-a-3	25.34834	80.32731
BB3-a-4	25.34671	80.32854
BB3-a-5	25.34400	80.33055
BB3-a-6	25.34172	80.33224
BB3-a-7	25.34089	80.33284
BB3-a-8	25.33927	80.33405
BB3-b-1	25.35051	80.32288
BB3-b-2	25.34832	80.32450
BB3-b-3	25.34663	80.32575
BB3-b-4	25.34426	80.32749
BB3-b-5	25.34346	80.32808
BB3-b-6	25.34202	80.32914
BB3-b-7	25.33996	80.33068
BB3-b-8	25.33817	80.33199
BB3-c-1	25.34858	80.31828
BB3-c-2	25.34651	80.31978
BB3-c-3	25.34398	80.32159
BB3-c-4	25.34213	80.32293
BB3-c-5	25.33995	80.32450
BB3-c-6	25.33916	80.32507
BB3-c-7	25.33620	80.32719
BB3-c-8	25.33442	80.32849
BB3-d-1	25.34335	80.31044
BB3-d-2	25.34053	80.31248
BB3-d-3	25.33901	80.31358
BB3-d-4	25.33764	80.31457
BB3-d-5	25.33514	80.31637
BB3-d-6	25.33371	80.31742
BB3-d-7	25.33165	80.31889
BB3-d-8	25.33121	80.31921
BB3-e-1	25.33736	80.30289
BB3-e-2	25.33698	80.30317
BB3-e-3	25.33404	80.30533
BB3-e-4	25.33295	80.30612
BB3-e-5	25.33108	80.30749
BB3-e-6	25.32836	80.30948
BB3-e-7	25.32621	80.31106
BB3-e-8	25.32586	80.31130

Point	Latitude	Longitude
BB4-a-1	25.28361	80.38995
BB4-a-2	25.28203	80.39109
BB4-a-3	25.28096	80.39186
BB4-a-4	25.27843	80.39368
BB4-a-5	25.27762	80.39426
BB4-a-6	25.27576	80.39561
BB4-a-7	25.27357	80.39718
BB4-a-8	25.27135	80.39879
BB4-b-1	25.28255	80.38793
BB4-b-2	25.28035	80.38951
BB4-b-3	25.27996	80.38978
BB4-b-4	25.27821	80.39103
BB4-b-5	25.27587	80.39272
BB4-b-6	25.27476	80.39350
BB4-b-7	25.27293	80.39482
BB4-b-8	25.27068	80.39641
BB4-c-1	25.28008	80.38355
BB4-c-2	25.27795	80.38512
BB4-c-3	25.27716	80.38567
BB4-c-4	25.27580	80.38667
BB4-c-5	25.27384	80.38809
BB4-c-6	25.27152	80.38977
BB4-c-7	25.26974	80.39108
BB4-c-8	25.26788	80.39242
BB4-d-1	25.27501	80.37554
BB4-d-2	25.27356	80.37659
BB4-d-3	25.27311	80.37694
BB4-d-4	25.27060	80.37874
BB4-d-5	25.26912	80.37982
BB4-d-6	25.26687	80.38145
BB4-d-7	25.26584	80.38219
BB4-d-8	25.26361	80.38381
BB4-e-1	25.27146	80.36615
BB4-e-2	25.26796	80.36876
BB4-e-3	25.26660	80.36974
BB4-e-4	25.26541	80.37062
BB4-e-5	25.26345	80.37209
BB4-e-6	25.26167	80.37343
BB4-e-7	25.25893	80.37544
BB4-e-8	25.25798	80.37616

Table 4-15. Categories of Submerged Aquatic Vegetation Scored with Braun-Blanquet Method at Each Sampling Point

Totals	Algae	Seagrasses	Calcareous Algae	Fleshy Green Algae	Corals/ Sponges [1]
Total Macrophytes	Total Macroalgae	*Thalassia testudinum*	*Penicillus*	*Batophora/ Dasycladus*	Corals
Total Drift Red	Total Calcareous	*Halodule wrightii*	*Rhipocephalus*	*Andyomene*	Gorgonians/ Soft Corals
Total Macrophytes minus Drift Red	Total Green Other (Fleshy)	*Syringodium filiforme*	*Halimeda*		Sponges
Total Seagrass	Total Red Other	*Ruppia martima*	*Udotea*		
	Total Brown	*Halophila engelmannii*	*Acetabularia*		
		Halophila johnsonii			
		Halophila decipiens			

[1] Presence/absence only

Table 4-16. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water Temperature (°C) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	a	28.4	± 0.17	27.6	28.8	28.4	± 0.16	27.6	28.8
	b	25.8	± 0.33	23.5	26.2	25.8	± 0.33	23.5	26.2
	c	23.9	± 0.09	23.6	24.3	23.9	± 0.10	23.6	24.4
	d	24.0	± 0.15	23.6	24.6	23.9	± 0.16	23.4	24.5
	e	24.4	± 0.13	24.1	25.0	24.3	± 0.13	23.5	24.6
BB2	a	25.2	± 0.18	24.4	25.7	25.2	± 0.19	24.4	26.0
	b	25.3	± 0.07	25.1	25.6	25.5	± 0.16	25.2	26.6
	c	26.0	± 0.09	25.6	26.4	26.0	± 0.07	25.8	26.3
	d	25.9	± 0.08	25.7	26.4	26.1	± 0.06	25.9	26.3
	e	26.3	± 0.05	26.2	26.6	26.5	± 0.02	26.4	26.6
BB3	a	26.2	± 0.12	25.8	26.7	26.6	± 0.02	26.5	26.7
	b	26.0	± 0.05	25.8	26.2	26.5	± 0.09	26.1	26.8
	c	25.6	± 0.12	25.4	26.4	25.7	± 0.14	25.4	26.5
	d	25.5	± 0.10	25.2	25.8	25.6	± 0.04	25.4	25.8
	e	25.5	± 0.02	25.4	25.5	25.5	± 0.01	25.5	25.6
BB4	a	25.4	± 0.08	25.1	25.8	25.5	± 0.06	25.3	25.8
	b	25.9	± 0.06	25.7	26.1	26.0	± 0.09	25.6	26.4
	c	26.3	± 0.07	26.1	26.7	26.3	± 0.08	26.1	26.7
	d	26.1	± 0.06	25.8	26.3	26.2	± 0.04	26.0	26.3
	e	26.7	± 0.06	26.5	27.0	26.7	± 0.06	26.5	27.0

Table 4-17. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water Specific Conductivity (mS/cm) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	a	37.9	± 0.24	37.1	38.8	37.9	± 0.24	37.3	38.9
	b	33.9	± 0.25	32.5	34.5	33.9	± 0.25	32.5	34.5
	c	33.4	± 0.61	31.4	36.1	33.6	± 0.59	31.8	36.3
	d	34.4	± 0.51	32.0	35.6	34.6	± 0.38	32.7	35.6
	e	37.3	± 0.54	35.3	39.2	38.4	± 0.52	36.0	41.0
BB2	a	39.2	± 0.94	34.7	41.6	39.7	± 1.08	34.7	42.6
	b	40.7	± 0.18	40.1	41.5	41.2	± 0.28	40.1	42.3
	c	42.1	± 0.17	41.5	42.8	42.5	± 0.15	42.0	43.0
	d	43.0	± 0.14	42.5	43.6	45.3	± 0.69	43.3	47.7
	e	43.5	± 0.21	42.9	44.8	48.3	± 0.23	47.4	48.9
BB3	a	34.8	± 1.35	28.4	38.9	40.0	± 0.38	38.3	41.4
	b	37.2	± 1.00	33.2	40.6	41.2	± 0.27	39.8	42.0
	c	38.9	± 0.21	38.1	40.0	39.5	± 0.61	38.4	43.7
	d	39.7	± 0.05	39.5	39.9	40.1	± 0.06	39.8	40.3
	e	40.3	± 0.35	38.6	41.2	40.6	± 0.16	40.0	41.1
BB4	a	34.0	± 0.60	31.5	36.5	38.6	± 0.05	38.4	38.8
	b	35.9	± 0.72	33.3	38.2	38.8	± 0.12	38.2	39.2
	c	38.7	± 0.07	38.4	38.9	38.8	± 0.07	38.5	39.0
	d	38.8	± 0.17	37.9	39.3	39.2	± 0.07	38.8	39.4
	e	38.4	± 0.32	37.5	39.3	38.4	± 0.33	37.4	39.3

Table 4-18. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water Salinity (PSU) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Mean	SE	Min	Max	Mean	SE	Min	Max
BB1	a	24.1	± 0.14	23.7	24.8	24.1	± 0.18	23.7	24.9
	b	21.3	± 0.18	20.2	21.7	21.3	± 0.18	20.2	21.7
	c	20.9	± 0.42	19.4	22.7	21.0	± 0.39	19.8	22.8
	d	21.5	± 0.35	19.9	22.4	21.7	± 0.25	20.3	22.4
	e	23.6	± 0.39	22.2	24.9	24.3	± 0.39	22.4	26.3
BB2	a	24.9	± 0.67	21.8	26.6	25.3	± 0.74	21.9	27.0
	b	26.0	± 0.14	25.6	26.6	26.3	± 0.21	25.6	27.2
	c	27.1	± 0.11	26.8	27.6	27.4	± 0.11	27.0	27.7
	d	27.8	± 0.11	27.4	28.1	29.4	± 0.49	28.0	31.1
	e	28.0	± 0.14	27.7	29.0	30.9	± 0.32	29.4	31.8
BB3	a	22.7	± 1.13	18.5	28.3	26.2	± 0.49	25.1	29.3
	b	23.5	± 0.74	20.3	26.0	26.3	± 0.21	25.2	27.0
	c	24.7	± 0.14	24.2	25.6	25.2	± 0.46	24.5	28.5
	d	25.3	± 0.04	25.2	25.4	25.6	± 0.04	25.4	25.7
	e	25.7	± 0.25	24.5	26.4	25.8	± 0.14	25.2	26.3
BB4	a	21.5	± 0.42	19.5	23.2	24.5	± 0.04	24.4	24.6
	b	22.4	± 0.53	21.0	24.3	24.7	± 0.07	24.3	25.0
	c	24.6	± 0.04	24.4	24.8	24.7	± 0.04	24.5	24.9
	d	24.7	± 0.11	24.1	25.1	25.0	± 0.07	24.6	25.1
	e	24.4	± 0.21	23.8	25.1	24.4	± 0.21	23.8	25.1

Table 4-19. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water Dissolved Oxygen (mg/L) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	**a**	7.0	± 0.16	6.4	7.63	6.8	± 0.10	6.5	7.34
	b	6.4	± 0.12	6.0	6.92	6.1	± 0.07	5.8	6.40
	c	7.2	± 0.21	6.6	8.54	6.7	± 0.18	6.2	7.76
	d	8.4	± 0.54	6.7	11.68	7.3	± 0.17	6.7	8.12
	e	7.8	± 0.08	7.4	8.19	7.3	± 0.14	6.6	7.81
BB2	**a**	7.1	± 0.25	5.9	7.72	6.9	± 0.28	5.7	7.89
	b	7.0	± 0.09	6.7	7.37	6.7	± 0.09	6.5	7.19
	c	8.4	± 0.91	7.0	14.42	7.0	± 0.13	6.5	7.51
	d	7.9	± 1.17	6.0	16.02	6.5	± 0.20	5.7	7.18
	e	6.7	± 0.46	5.5	9.76	5.3	± 0.15	4.8	5.99
BB3	**a**	6.6	± 0.58	4.7	9.74	5.3	± 0.27	4.3	6.70
	b	8.0	± 0.87	5.9	11.84	6.0	± 0.11	5.6	6.41
	c	7.1	± 0.30	6.1	8.14	6.2	± 0.09	5.9	6.57
	d	7.1	± 0.33	6.1	8.96	6.0	± 0.08	5.8	6.35
	e	5.9	± 0.10	5.5	6.27	5.6	± 0.05	5.4	5.80
BB4	**a**	6.1	± 0.30	4.9	7.39	5.2	± 0.21	4.5	6.09
	b	5.9	± 0.39	4.5	7.76	5.5	± 0.27	4.6	6.45
	c	5.5	± 0.39	4.9	8.15	5.0	± 0.06	4.7	5.16
	d	5.9	± 0.15	5.2	6.65	5.8	± 0.10	5.3	6.20
	e	5.3	± 0.31	4.4	6.89	5.3	± 0.29	4.2	6.57

Table 4-20. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom pH by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	a	8.0	± 0.02	8.0	8.1	8.1	± 0.01	8.0	8.2
	b	6.8	± 0.05	6.6	7.1	6.9	± 0.03	6.8	7.1
	c	7.1	± 0.03	7.0	7.3	7.2	± 0.01	7.1	7.2
	d	7.6	± 0.08	7.1	7.8	7.8	± 0.09	7.2	7.9
	e	7.8	± 0.04	7.7	8.0	7.9	± 0.03	7.8	8.0
BB2	a	7.6	± 0.16	6.9	7.9	7.7	± 0.15	7.0	8.1
	b	8.0	± 0.02	7.9	8.1	8.1	± 0.02	8.0	8.1
	c	7.9	± 0.03	7.8	8.0	8.0	± 0.03	8.0	8.1
	d	8.0	± 0.02	7.9	8.1	8.0	± 0.02	7.9	8.1
	e	8.0	± 0.02	7.8	8.0	8.0	± 0.02	7.9	8.0
BB3	a	7.7	± 0.18	6.5	8.0	7.9	± 0.05	7.6	8.0
	b	7.9	± 0.05	7.6	8.0	8.0	± 0.01	8.0	8.1
	c	7.5	± 0.36	5.0	8.0	8.0	± 0.01	7.9	8.0
	d	7.7	± 0.05	7.5	7.9	7.9	± 0.02	7.9	8.0
	e	7.8	± 0.02	7.7	7.9	7.5	± 0.37	4.9	7.9
BB4	a	7.9	± 0.03	7.7	8.0	7.9	± 0.01	7.8	7.9
	b	7.9	± 0.03	7.8	8.0	8.0	± 0.01	7.9	8.0
	c	8.0	± 0.03	7.8	8.1	8.0	± 0.01	8.0	8.1
	d	7.8	± 0.02	7.7	7.9	7.8	± 0.02	7.8	7.9
	e	7.8	± 0.02	7.7	7.9	7.9	± 0.02	7.8	7.9

Table 4-21. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water ORP (mV) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	**a**	200.8	± 29.88	2.7	258.0	201.0	± 29.59	256.0	7.3
	b	180.4	± 31.75	1.4	302.0	192.3	± 19.59	286.0	9.5
	c	135.1	± 11.60	86.0	166.0	136.1	± 10.09	165.0	12.8
	d	121.5	± 13.29	54.0	171.0	118.1	± 13.09	165.0	30.6
	e	110.8	± 12.71	54.0	183.0	106.4	± 12.19	179.0	13.7
BB2	**a**	146.9	± 22.27	97.0	261.0	139.4	± 22.14	86.0	258.0
	b	91.6	± 13.44	49.0	161.0	88.3	± 13.35	48.0	158.0
	c	108.6	± 16.19	47.0	183.0	96.8	± 19.17	9.0	176.0
	d	122.3	± 18.22	56.0	198.0	114.8	± 16.74	57.0	194.0
	e	26.8	± 11.08	-8.0	84.0	28.9	±10.41	-1.0	85.0
BB3	**a**	102.1	± 14.49	43.0	149.0	99.6	± 13.44	46.0	149.0
	b	20.8	± 22.17	-50.0	142.0	30.4	± 19.04	-16.0	142.0
	c	96.5	± 22.83	6.1	189.0	90.3	± 20.18	6.3	174.0
	d	59.6	± 22.93	-18.0	155.0	56.3	± 21.48	-14.0	151.0
	e	46.4	± 28.14	-48.0	169.0	50.6	± 25.28	-37.0	161.0
BB4	**a**	46.6	± 23.53	-38.0	152.0	51.4	± 20.72	148.0	52.0
	b	66.8	± 25.65	-8.0	206.0	68.4	± 24.03	204.0	3.8
	c	100.4	± 29.84	0.0	265.0	97.6	± 25.88	246.0	1.3
	d	107.1	± 18.10	32.0	182.0	103.0	± 16.73	172.0	2.6
	e	126.0	± 23.95	10.0	235.0	120.5	± 20.87	221.0	2.9

Table 4-22. Mean, Standard Error (SE), Minimum, and Maximum Values for Surface and Bottom Water Turbidity (NTU) by Transect and Sampling Area

Area	Transect	Surface				Bottom			
		Average	SE	Min	Max	Average	SE	Min	Max
BB1	**a**	4.5	± 1.93	0.0	16.0	3.5	± 1.12	0.0	7.3
	b	1.7	± 0.91	0.0	7.8	1.6	± 1.15	0.0	9.5
	c	3.0	± 2.06	0.0	16.9	2.7	± 1.54	0.0	12.8
	d	6.7	± 3.40	0.1	29.5	9.1	± 4.22	0.2	30.6
	e	4.2	± 3.28	0.0	26.6	2.4	± 1.68	0.0	13.7
BB2	**a**	1.5	± 1.70	0.0	11.6	0.1	± 0.07	0.0	0.6
	b	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
	c	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
	d	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
	e	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
BB3	**a**	0.5	± 0.17	0.0	1.2	0.2	± 0.06	0.0	0.4
	b	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
	c	0.6	± 0.63	0.0	5.0	0.0	± 0.00	0.0	0.0
	d	1.6	± 1.07	0.0	7.8	0.8	± 0.75	0.0	6.0
	e	0.0	± 0.00	0.0	0.0	0.0	± 0.00	0.0	0.0
BB4	**a**	1.9	± 0.11	1.2	2.2	2.1	± 0.28	1.3	3.5
	b	1.2	± 0.25	0.0	2.4	1.4	± 0.39	0.3	3.8
	c	0.5	± 0.11	0.0	1.1	1.0	± 0.10	0.6	1.3
	d	0.9	± 0.08	0.6	1.2	1.4	± 0.24	1.0	2.6
	e	1.4	± 0.20	0.5	2.2	1.9	± 0.20	1.2	2.9

Table 4-23. Mean, Standard Error (SE), Minimum, and Maximum Values for Porewater Temperature (°C) by Transect and Sampling Area

Area	Transect	Avg	SE	Min	Max
BB1	a	28.3	± 0.15	27.5	28.7
	b	27.8	± 0.24	26.3	28.4
	c	25.7	± 0.45	22.7	26.6
	d	25.9	± 0.10	25.5	26.4
	e	25.5	± 0.06	25.3	25.8
BB2	a	26.2	± 0.06	26.0	26.5
	b	26.1	± 0.07	25.9	26.3
	c	26.4	± 0.08	26.1	26.8
	d	26.5	± 0.01	26.4	26.5
	e	26.6	± 0.02	26.6	26.7
BB3	a	26.9	± 0.06	26.8	27.3
	b	26.9	± 0.03	26.8	27.1
	c	26.7	± 0.04	26.5	26.9
	d	26.5	± 0.07	26.2	26.8
	e	26.6	± 0.03	26.5	26.7
BB4	a	26.6	± 0.05	26.4	26.8
	b	26.5	± 0.04	26.3	26.7
	c	26.5	± 0.04	26.4	26.7
	d	26.5	± 0.02	26.4	26.6
	e	26.7	± 0.02	26.6	26.8

Table 4-24. Mean, Standard Error (SE), Minimum, and Maximum Values for Porewater Specific Conductivity (mS/cm) by Transect and Sampling Area

Area	Transect	Avg	SE	Min	Max
BB1	a	43.0	± 1.50	39.7	51.2
	b	43.2	± 1.38	35.8	46.7
	c	43.2	± 1.40	36.7	48.0
	d	44.0	± 1.30	37.9	48.9
	e	43.5	± 1.64	38.7	52.0
BB2	a	46.8	± 1.93	41.0	55.0
	b	48.6	± 1.38	44.1	53.5
	c	48.5	± 1.64	40.3	53.7
	d	49.0	± 1.37	42.4	53.9
	e	49.4	± 0.50	47.0	51.2
BB3	a	44.2	± 0.90	40.1	48.0
	b	48.4	± 0.80	45.8	52.1
	c	44.0	± 0.93	39.7	47.0
	d	46.9	± 0.57	44.1	49.0
	e	48.3	± 0.31	47.0	49.1
BB4	a	43.1	± 0.90	38.5	46.4
	b	44.4	± 1.04	39.8	46.8
	c	43.8	± 1.32	39.9	49.9
	d	44.8	± 1.15	39.0	48.6
	e	42.4	± 1.11	38.7	47.3

Table 4-25. Analysis of Variance (ANOVA) of Mean Braun-Blanquet Scores among Transects within Each Study Area. For p values ≤0.05, letters represent statistically different means, as determined by a Tukey mulitple-means comparison test (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Area	Transects	Total Macrophytes			Total Seagrass			Total Macroalgae		
		Mean	SE	ANOVA	Mean	SE	ANOVA	Mean	SE	ANOVA
BB1	a	1.6a	± 0.2	df = 4, 35	1.3	± 0.3	df = 4, 35	1.0a	± 0.1	df = 4, 35
	b	1.1ab	± 0.1	f = 3.09	1.0	± 0.1	f = .94	0.9a	± 0.1	f = 2.96
	c	2.1ac	± 0.3	p = 0.03	1.6	± 0.4	p = 0.45	1.2a	± 0.1	p = 0.03
	d	2.1a	± 0.3		1.3	± 0.1		1.4ab	± 0.2	
	e	1.4a	± 0.2		1.1	± 0.2		0.8ac	± 0.1	
BB2	a	2.2	± 0.5	df = 4, 35	1.1a	± 0.3	df = 4, 35	1.2a	± 0.2	df = 4, 35
	b	1.8	± 0.4	f = 2.33	1.0a	± 0.4	f = 5.32	1.1a	± 0.1	f = 7.49
	c	2.5	± 0.4	p = 0.08	2.3ab	± 0.4	p = 0.002	1.4ab	± 0.2	p = <0.001
	d	3.3	± 0.4		2.3ab	± 0.4		1.9b	± 0.2	
	e	3.4	± 0.4		3.0b	± 0.2		0.9a	± 0.1	
BB3	a	2.5a	± 0.5	df = 4, 35	1.7a	± 0.4	df = 4, 35	1.1	± 0.1	df = 4, 35
	b	1.3ab	± 0.1	f = 4.71	0.7ab	± 0.1	f = 7.07	1.0	± 0.1	f = 0.70
	c	2.1a	± 0.3	p = 0.004	1.0ab	± 0.2	p = <0.001	1.4	± 0.2	p = 0.60
	d	1.8a	± 0.1		1.2ab	± 0.3		1.3	± 0.1	
	e	3.1ac	± 0.4		2.6ac	± 0.3		1.3	± 0.3	
BB4	a	1.5	± 0.1	df = 4, 35	0.7	± 0.1	df = 4, 35	1.2	± 0.1	df = 4, 35
	b	2.1	± 0.3	f = 1.16	0.7	± 0.2	f = 1.61	1.3	± 0.1	f = 0.89
	c	1.4	± 0.2	p = 0.34	0.7	± 0.1	p = 0.19	1.2	± 0.2	p = 0.48
	d	2.0	± 0.4		1.5	± 0.5		1.3	± 0.2	
	e	1.5	± 0.3		1.2	± 0.3		0.9	± 0.1	

Table 4-26. Analysis of Variance (ANOVA) of Mean Braun-Blanquet Scores among Study Areas. For P values <u><</u>0.05, letters represent statistically different means, as determined by a Tukey mulitple-means comparison test (i.e., means denoted by like letters are not statistically different [e.g., a is different than b, but not different than a or ab]).

Area	Total Macrophytes			Total Seagrass			Total Macroalgae		
	Mean	SE	ANOVA	Mean	SE	ANOVA	Mean	SE	ANOVA
BB1	1.7a	± 0.13	df = 3, 156	1.3a	± 0.10	df = 3, 156	1.1	± 0.07	df = 3, 156
BB2	2.6b	± 0.21	f = 8.14	2.0b	± 0.20	f = 8.06	1.3	± 0.09	f = 1.54
BB3	2.2ab	± 0.16	p = <0.001	1.4a,b	± 0.16	p = <0.001	1.2	± 0.08	p = 0.21
BB4	1.7a	± 0.13		0.9a	± 0.13		1.2	± 0.07	

Table 4-27. Total Number of Each Taxon Collected within (n=20) and among (n=80) Study Areas and the Percentage of Total Catch by Taxon

Taxa	BB1	BB2	BB3	BB4	Total	% of Total Catch
Caridea	10	84	37	9	140	43%
Gobiosoma robustum	2	15	22	10	49	15%
Alpheidae	1	12	11	15	39	12%
Epialtidae		9	4	4	17	5%
Farfantepenaeus duorarum	1	3	8	4	16	5%
Diplogrammus pauciradiatus	3	4	7		14	4%
Anarchopterus criniger	3	5	2	3	13	4%
Hippocampus zosterae	1	2	6	3	12	4%
Paguroidea	8				8	2%
Paraclinus fasciatus		1	1	3	5	2%
Opsanus beta		2	2		4	1%
Callinectes ornatus	2		1		3	1%
Xanthoidea		2	1		3	1%
Lagodon rhomboides			1		1	0.3%
Paraclinus marmoratus			1		1	0.3%
Syngnathus louisianae				1	1	0.3%
Total	**31**	**139**	**104**	**52**	**326**	**100%**

Table 4-28. Frequency of Occurance of Fish and Invertebrates Captured by Faunal Throw Traps (n=80)

Taxa	Frequency of Occurrence[1]	Length[2] (mm)	
		Minimum	Maximum
Caridea	31		
Gobiosoma robustum	25	7.7	20.5
Alpheidae	21		
Farfantepenaeus duorarum	14	5.0	18.4
Diplogrammus pauciradiatus	10	7.0	22.8
Epialtidae	10		
Hippocampus zosterae	8	14.3	30.7
Anarchopterus criniger	6	27.3	55.8
Paraclinus fasciatus	5	25.7	31.2
Opsanus beta	4	20.2	83.2
Xanthoidea	3		
Callinectes ornatus	2	31.0	40.4
Paguroidea	2		
Lagodon rhomboides	1	64.9	64.9
Paraclinus marmoratus	1	39.3	39.3
Syngnathus louisianae	1	140.0	140.0

Notes:
[1] Percentage of all traps in which taxon occurred.
[2] Fish = standard length, shrimp = caapace length, and crabs = carpace width.

Table 4-29. Total Number of Each Taxon Collected with Increasing Distance from Shore, All Study Areas Combined. Distance from shore for each transect: a = 250 m; b = 500 m; c = 1000 m; d = 2000 m; e = 3000 m.

Taxa	Transect					Total
	a	b	c	d	e	
Caridea	12	23	8	48	49	140
Gobiosoma robustum	4	1	2	18	24	49
Alpheidae	4	11		10	14	39
Epialtidae	5	4		5	3	17
Farfantepenaeus duorarum	4	2	1	3	6	16
Diplogrammus pauciradiatus	3		4	7		14
Anarchopterus criniger	3	6		4		13
Hippocampus zosterae		2	1		9	12
Paguroidea	7	1				8
Paraclinus fasciatus		1	1	1	2	5
Opsanus beta				2	2	4
Callinectes ornatus	1			2		3
Xanthoidea		1			2	3
Lagodon rhomboides					1	1
Paraclinus marmoratus					1	1
Syngnathus louisianae				1		1
Total	**43**	**52**	**17**	**101**	**113**	**326**

Table 4-30. Light Readings (μmols/m²/sec) Taken in Air and at Each of Three Water Depths at One Point along Each Transect. Attenuation (ATN) is the difference between the air and water readings.

Area	Transect	Sub-Surface				Mid-Depth				Off-Bottom			
		Depth (m)	Air	Water Column	ATN	Depth (m)	Air	Water Column	ATN	Depth (m)	Air	Water Column	ATN
BB1	a	0.3	2033	1425	608	0.6	1996	1335	661	0.9	2008	1471	537
	b	0.3	543	557	-14	1.1	506	380	127	1.7	549	284	266
	c	0.3	1559	1170	390	1.1	1314	2165	-851	2.0	1074	1409	-335
	d	0.3	1684	1319	365	0.8	1704	1144	560	1.2	1670	1164	506
	e	0.3	1334	868	466	1.0	1348	833	516	1.7	1376	913	463
BB2	a	0.3	2046	1050	996	1.2	2167	968	1200	2.1	2175	1216	959
	b	0.3	1568	1865	-298	1.2	1308	1855	-548	2.3	1357	1849	-492
	c	0.3	2156	1146	1011	1.5	2210	1005	1206	2.9	2272	1366	907
	d	0.3	432	662	-230	1.4	448	692	-244	2.6	483	664	-181
	e	0.3	127	87	40	1.7	147	56	91	2.7	165	108	58
BB3	a	0.3	1363	813	551	1.2	1176	538	638	2.3	1156	663	493
	b	0.3	1625	911	714	1.5	1648	776	872	2.7	1672	918	754
	c	0.3	857	516	341	1.7	817	446	371	2.9	826	528	298
	d	0.3	2229	1186	1043	1.5	2243	1106	1137	3.1	2239	1136	1104
	e	0.3	496	246	251	1.8	584	237	347	3.2	649	370	279
BB4	a	0.3	1281	830	451	1.1	1296	775	522	1.8	1299	879	420
	b	0.3	206	79	127	1.1	284	138	146	1.8	283	174	110
	c	0.3	951	443	508	1.1	932	391	541	2.0	928	360	568
	d	0.3	1169	530	640	1.2	1167	238	929	2.1	1209	655	554
	e	0.3	1927	1082	845	1.5	1926	831	1096	2.7	1922	1014	909

FIGURES

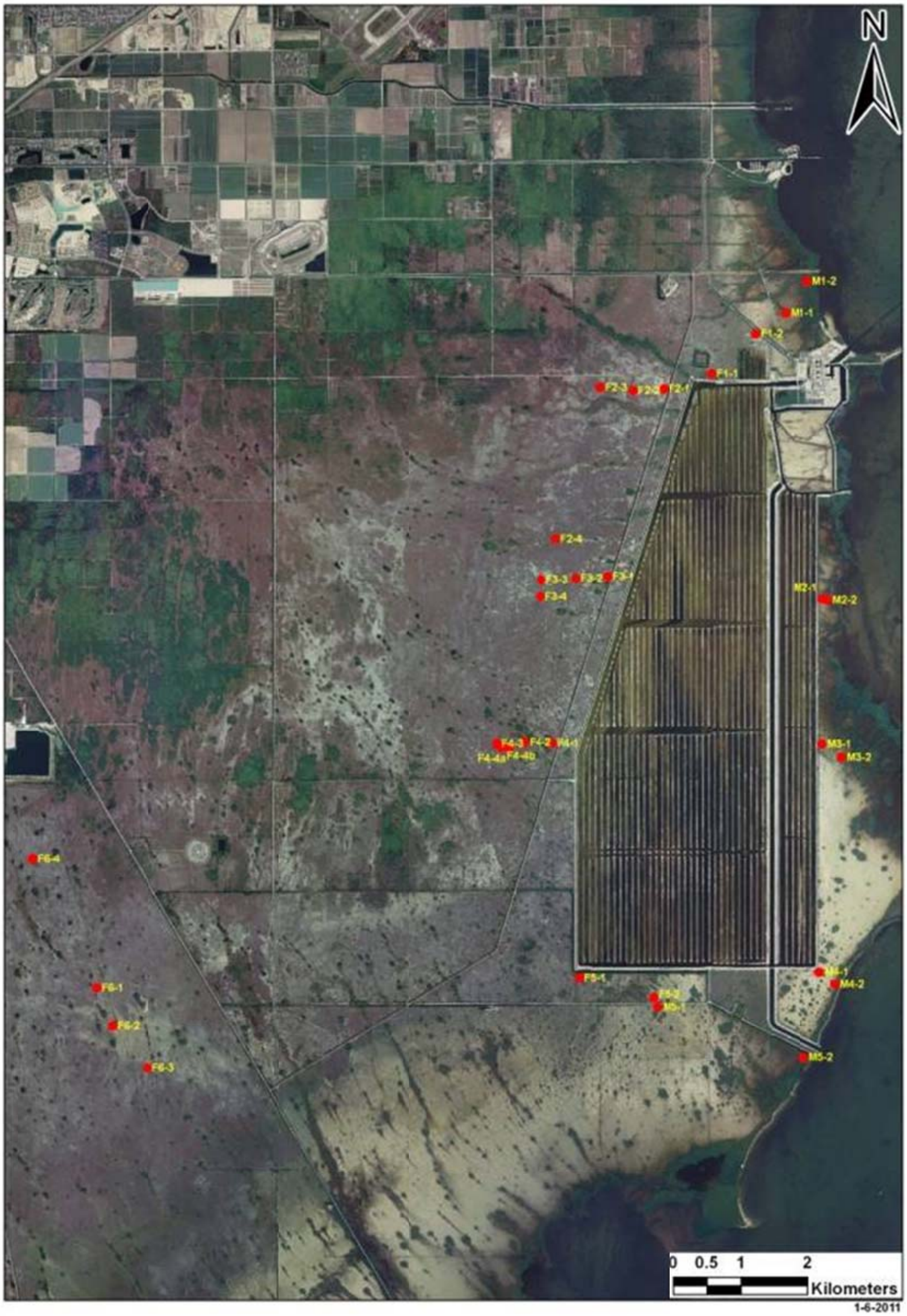


Figure 4-1. Map of Plot Locations.

Figure 4-2. Ecological Transect Locations.

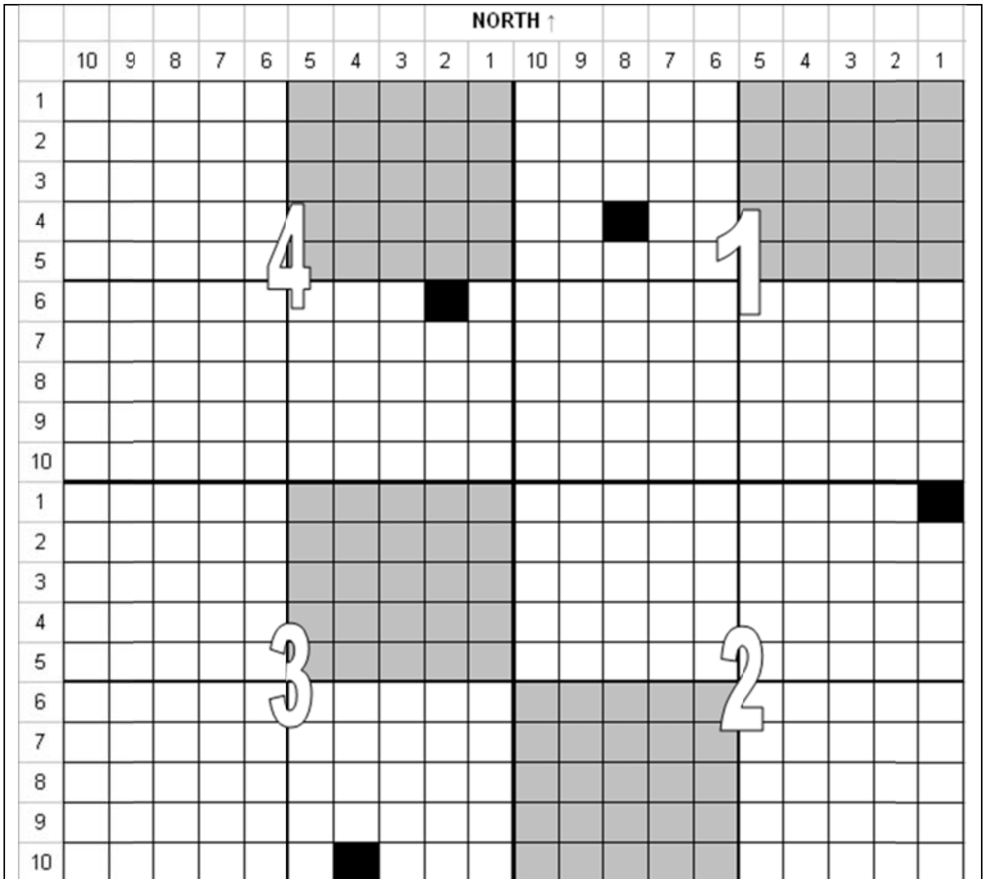


Figure 4-3. Example of Plot Design. One square represents one square meter. Gray areas represent 5x5 woody subplots; black squares represent 1x1 herbaceous subplots.

Figure 4-4. 1m x 1m Marsh Subplot.

Figure 4-5. Picture of Plot F3-3 Taken from the Northeast Corner Facing Southwest.

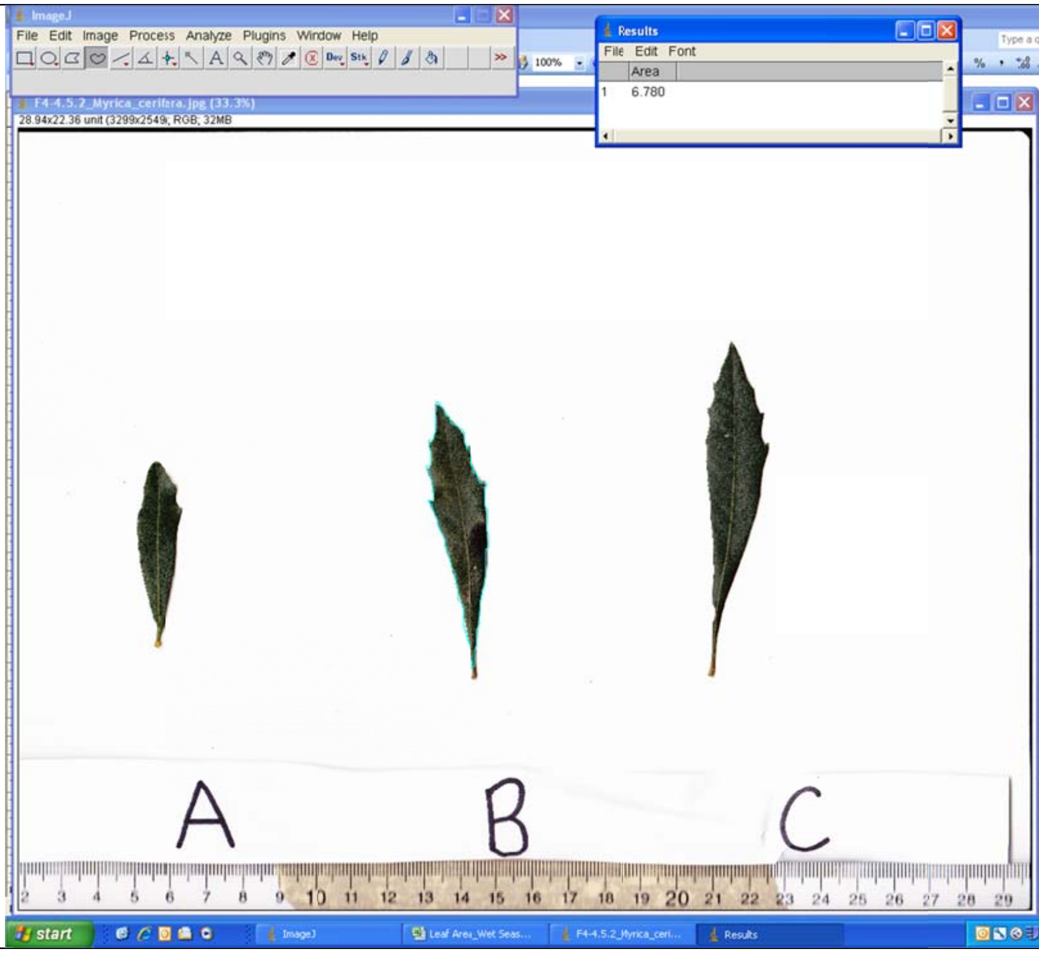
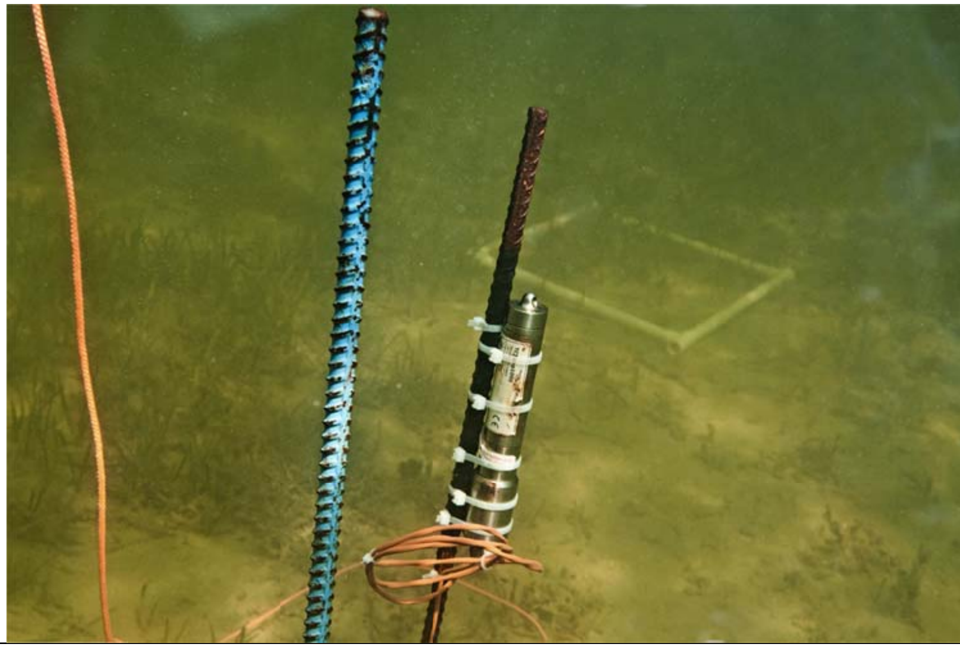


Figure 4-6. Screenshot of ImageJ with a Leaf Outlined for Surface Area Measurement.



(Photo courtesy of Ecological Associates, Inc.)

Figure 4-7. A ThermoWorks TCTemp 1000 thermocouple datalogger inserted to 30 cm in the substrate to measure *in-situ* porewater temperature. A quarter-meter quadrat used to estimate SAV coverage is visible in the background**.**

(Photo courtesy of Ecological Associates, Inc.)

Figure 4-8. A faunal throw trap sweep net on board with the contents of a single sweep of the throw trap.

(Photo courtesy of Ecological Associates, Inc.)

Figure 4-9. Soil cores capped and ready for transport to the lab for processing.

5.0 SUMMARY AND INITIAL OBSERVATIONS

FPL has undertaken a substantial effort to implement the Monitoring Plan that was approved in October 2009. These efforts include, but are not limited to, the following:

- Hired contractors to support the monitoring efforts including drillers, geologists, biologist, engineers, and surveyors;
- Finalized monitoring station locations with the Agencies based on field conditions, logistical considerations, and environmental constraints;
- Obtained necessary permits to install monitoring stations in Biscayne Bay and in wetlands;
- Obtained permits to install stations in SFWMD, FDOT, and Miami-Dade County rights-of-way;
- Obtained permits to conduct investigations in Biscayne National Park;
- Installed 42 monitoring wells following rigorous protocol to enhance the implementation of borehole geophysics and collection of discrete groundwater samples;
- Completed borehole geophysics and established subsurface geologic characteristics;
- Purchased automated instrumentation for over 70 automated groundwater, surface water, flow, and meteorological stations;
- Constructed infrastructure (boardwalks, platforms, well vaults, mounting posts) and installed instrumentation;
- Surveyed monitoring stations to vertical and horizontal control;
- Conducted a bathymetric survey;
- Developed and refined a data management system to allow the storage of information developed for this project, interactive query of automated data, and quarterly laboratory results;
- Started up and troubleshot automated systems;
- Recorded millions of automated data points from June 2010 through December 20, 2010, and reviewed and validated automated data;
- Maintained and calibrated automated station probes;
- Implemented collection of quarterly groundwater and surface water samples and conducted laboratory analysis for two events;

- Conducted validation of laboratory results;
- Developed indexing factors for Acoustic Doppler flow meters;
- Inspected wetland and Biscayne Bay areas, established ecological transects, set up plots and implemented first quarterly ecological monitoring event;
- Worked with the Agencies to ensure proper standards and quality objectives are met (e.g., Agency site visits to automated stations, field ecological site visits, Agency field inspection of surface and groundwater sampling efforts); and
- Commenced the design of the water budget methodology and met with the Agencies to discuss.

The intent of the Monitoring Plan is to help establish a baseline and to determine the effects of the Uprate, if any, on surface water, groundwater, and the ecology surrounding Turkey Point. This Semi-annual Report focuses on the collection and presentation of the automated data from startup though this initial reporting period ending December 20, 2010 as well as the collection and reporting of the semi-annual and quarterly water quality sampling efforts (June/July and September 2010), and the ecological monitoring through December 20, 2010. Herein, FPL presents the data and observations that can be surmised from the currently available data.

While there have been some issues with a few probes, mostly in higher saline locations, a robust set of data has been collected that includes specific conductivity, temperature, salinity, density and water level. Specific conductivities in the CCS were between 55,000 and 88,000 µS/cm and values ranged from 25,000 µS/cm to a little over 50,000 µS/cm in Biscayne Bay. In groundwater, specific conductivities greater than 50,000 µS/cm (typical seawater) were consistently found in TPGW-1 (M and D), TPGW-2 (S, M and D), TPGW-3 (S, M and D), TPGW-12 (M and D), TPGW-13 (S, M and D), and TPGW-14 (S, M and D). Also TPGW-10 and -11, which are located in Biscayne Bay, have specific conductivities between 50,000 and 60,000 µS/cm but are within the range of what might be naturally encountered in Biscayne Bay. Water in Biscayne Bay and shallow mangrove tidal fringes are known to be hypersaline at times and can also influence the specific conductivity levels in groundwater.

In addition to automated monitoring stations, groundwater and surface water samples were collected in June/July 2010 and September 2010 at 64 locations and analyzed for a broad suite of parameters in the laboratory. The parameters included but were not limited to various ions, trace metals, nutrients, stable isotopes and tritium. The results showed that the constituents of primary interest are still those related to saltwater (chloride, sodium and specific conductance). Specifically, the wells to the west, TPGW-7, -8 and -9, have fresh groundwater throughout the entire well depth. Various parameters are being used to help determine if a suitable tracer can be established that distinguishes CCS water from Biscayne Bay.

Ecological monitoring was initiated in the marsh and Biscayne Bay, and efforts included but were not limited to:

- Setting up 30 ecological monitoring plots (20 x 20 m) and subplots (5 x 5 m and 1 x 1 m) in the marsh, mangroves and tree islands;
- Measuring vegetation structure, density, and composition in all 240 subplots;
- Collecting, measuring and drying over 720 plant samples for nutrient analysis;
- Collecting 60 soil cores and cutting each core into 10 cm pieces for nutrient analysis;
- Conducting over 500 SAV and 80 faunal sampling points along the Bay transects; and
- Collecting 40 bags (~50 g/bag) of seagrass leaves for drying and nutrient analysis.

In Biscayne Bay, the benthic sampling design was modified in May 2010 from the proposed method of 30 throw traps between Mangrove Point and Turkey Point to coincide with the seagrass transect design.

Baseline observations during initial setup indicate that the marsh vegetation composition was typical of Everglades freshwater marshes, dominated by *C. jamaicense* with *E. cellulosa* being a secondary dominant. Marsh plots vegetation height decreased away from the CCS (i.e., closer plots had taller vegetation). Although the marsh vegetation was alive during measurements, the parasitic love vine (*C. filiformis*) was observed twining on some of the plants; where the vine was found, the plants appeared less vigorous and healthy. Further consideration will be given to quantifying the presence of this vine and to document its impact on the marsh vegetation. In the mangrove habitat, most of the vegetation consisted of scrub *R. mangle* and were similar to those found in other areas of South Florida where limited tidal fluxes and/or low nutrients have been encountered. Data from vegetation and soil analysis currently pending will provide more insight into these preliminary observations.

The reference wetland transect has not yet been set up due to land ownership issues on Environmentally Endangered Lands (EEL). FPL has recently obtained permission from DERM to set up plots and conduct monitoring efforts on the County land where the reference transect is located.

In addition to the issues encountered during the normal logistics of plot setup, several site-specific problems associated with setting up plots in the tree islands: 1) there were limited tree islands along the F2 transect; and 2) some of the tree islands were too small for plot establishment. As a result, plot F4-4 was split among two islands. Additionally, poison ivy (*Toxicodendron radicans*) was discovered on all islands and although care was taken to minimize the exposure to poison ivy, field staff had adverse reactions to working in and among this vine. The tree island component of this work will most likely be revisited in the near future.

Observations in Biscayne Bay indicate that distribution of macrophytes, particularly seagrasses, within the study area is to a large degree affected by sediment. Consequently, a qualitative assessment of the substrate was made at each SAV sampling point. One hundred sixteen (116) of the 160 sampling points were classified as sandy, shell hash (73%) and 40 points had a silt component.

A total of 326 organisms representing 16 taxa captured with faunal throw traps in Biscayne Bay. When comparing numbers of organisms caught by total area, the northern-most and southern-most sampling locations (BB1 and BB4 respectively) had the fewest number of organisms. Both Card Sound sampling areas had higher total catches with BB2 having the highest total of all areas.

Groundwater and surface water data collection will continue at all stations for the next two quarters unless there are modifications as agreed to by the Agencies. Automated data collection will continue as before; however, the stage probe at two Biscayne Bay stations (TPGW-10 and -14) has recently been replaced with one that records stage and water quality parameters and transmits the data via telemetry. Quarterly sampling will continue for all parameters with samples being collected in December 2010 (data pending) and March 2011, and those results will be made available to the Agencies as soon as they are received from the laboratories. The data will also be included in the Annual Monitoring Report, if available. Data being collected for the water budget will be synthesized and a water budget will be calculated for the CCS. Ecological monitoring will continue along transects set up in Biscayne Bay, mangrove and wetland plots with the next field events tentatively occurring in February/March 2011 and May 2011. The first Annual Monitoring Report will be submitted in August 2011.

6.0 REFERENCES

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