Tillamook Estuaries Partnership
A National Estuary Project

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December 4, 2013

Tom Shafer, North Coast Regional Representative
OREGON WATERSHED ENHANCEMENT BOARD
13408 East Alsea Highway
Tidewater, Oregon 97390

Dear Tom,

This correspondence serves as Tillamook Estuaries Partnership's (TEP) second interim effectiveness monitoring report for the Miami Wetlands Effectiveness Monitoring grant (OWEB Grant No. 211-1012-8406). It meets requirements for interim monitoring reports established in Exhibit B, Section 3(b) of our OWEB grant agreement. Specifically, this document responds to paragraphs 1-4 in Exhibit C of the original grant agreement.

Construction efforts at the site began during summer 2010 and were concluded during summer 2011. Planting of native trees, shrubs and herbaceous wetland plants began in spring 2011. Most areas that we were unable to plant due to ongoing construction activities were planted during spring 2012, with the exception of three small areas that were planted during spring 2013. The 2013 effort completed enhancement plantings within the delineated wetland portion of the property A small number of additional plans also were planted in previously planted zones during spring 2013 (to replace mortalities and increase densities). Plant release (clearing of undesirable vegetation surrounding planted specimens during the growing season) began during summer 2011. Two rounds of plant release work were completed during summer 2013. Plant release efforts will continue through at least summer 2015.

We reported baseline conditions at the Miami Wetlands site (the site) in a November 2011 document[1] and completed our first interim effectiveness monitoring report during fall 2012[2]. The information provided in this letter report expands upon the 2011 and 2012 reports. We have collected a considerable amount of data at the site and continue to build upon are still in the process of analyzing this information. This information will be incorporated into a larger, more formal report at a later date, but at this time we are providing information required by our grant agreement in this abbreviated and less formal format. For example, this report does not include a full Methods section describing protocols used to collect and analyze monitoring data. Instead we reference applicable sections in the 2011 and 2012 reports where this information is provided in full. The sections on the following pages quote paragraphs 1-4 of Exhibit C and provide responses to these reporting requirements.

Thank you for your support of the Miami Wetlands Restoration Project and this monitoring effort. If you have any questions or require additional information, please do not hesitate to contact me or Rachel Hagerty.

Sincerely,

Scott Jay Bailey

Scott Jay Bailey
Project Manager

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[1] Bailey, S.J. 2011. Miami Wetlands Enhancement Project: Baseline Monitoring Report. Unpublished report prepared for Tillamook Estuaries Partnership. 79pp. + appendices.

[2] Bailey, S.J. 2012. Miami Wetlands Enhancement Project: Interim Monitoring Report #1. Unpublished letter report prepared for Oregon Watershed Enhancement Board. 10pp. + attachments.

1. **Summary of Monitoring that was completed including:**

A. Protocols Used

We are monitoring a variety of physical and biological attributes at the site (Physical attributes = water elevation, water quality, soils, and channel cross sections. Biological attributes = vegetation, macroinvertebrates, secretive marsh birds, and fishes). Methods used to collect and analyze these data are described fully in Sections 2.1 and 2.2 of the 2011 report (pages 10-29).[3] Methods not utilized during pre-construction studies, but conducted during post-construction efforts are described under question #1 of our 2011 interim report. Unless otherwise noted, methods followed to collect and analyze post-construction data presented below do not differ from those described in the aforementioned reports.

We have completed the following monitoring activities since construction activities ended in 2011:

1. Vegetation Monitoring
    a. line-intercept transects (spring 2012),
    b. 1m^2 herbaceous plots (spring 2012),
    c. 5m radius tree/shrub plots (spring 2012), and
    d. restoration planting survival monitoring (fall 2011, 2012 and 2013)
2. Channel Cross Sections
    -Hobson-Struby creeks channel and tidal channels (fall 2012)
3. Snorkel survey for juvenile fishes
    -Hobson-Struby creeks and tidal channels (spring 2012 and spring 2013)
4. Water elevation monitoring with data loggers at eight well sites
    -Continuous and ongoing since pre-construction
5. Water quality monitoring with data loggers at stations in the Hobson-Struby creeks channel and tidal channels north of the river
    -Several two week intervals (summer 2012 and summer 2013)
6. Marsh bird survey
    -Spring 2012

In this report we discuss only those data collected since our fall 2012 report was submitted: Snorkel Surveys, Water Elevation Monitoring, Water Quality Monitoring, and Restoration Planting Survival Monitoring.

B. Sampling Design

We are following a Before-After sampling design for this project: we are collecting pre- and post-construction data on a set of physical and biological parameters at the restoration site only. No control or reference sites are being monitored for this study.

C. A description and explanation of any changes to the original proposal

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This section duplicates Section 1C of our 2012 interim report. No other changes to our original proposal have been implemented since that report was submitted. OWEB raised concerns regarding these changes that were addressed via correspondences between TEP and Tom Shafer, OWEB North Coast Regional Representative. No further actions were required.

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In our original OWEB grant request we promulgated the following monitoring goals:

1. Monitor wetland hydrology, water quality, and aquatic and terrestrial habitat variables to document project related effects on water quality and aquatic and terrestrial habitats
2. Assure success of native vegetation plantings designed to restore the historical character of site vegetation.
3. Evaluate the efficacy of channel designs and construction techniques and track changes to channel profiles over time.
4. Inform future wetland enhancement projects by providing data to validate or improve design concepts and implementation and monitoring techniques used for this project.

These goals remain applicable for our monitoring efforts at the site.

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[3] 2011 report is available on the home page of our website, www.tbnep.org

We also established the following objectives for our monitoring efforts in our original grant request:

1. Establish 13 permanent linear transects along which a variety of data collection methods will be implemented over a minimum five-year period. Along these transects we will:
    a. Collect vegetation data within a minimum of 65 l-m^2 quadrats for herbaceous plants and 13 0.02-acre circular plots (5 m radius) for woody vegetation during years 1, 3, and 5 post-construction to evaluate and assure planting success and document changes in on-site plant communities over time.
    b. Collect 3 to 5 soil samples (at least one per elevation/hydrologic stratified zone) during years 1, 3, and 5 post-construction to evaluate changes, if any, to on-site soil conditions.
    c. Continuously monitor water levels to determine project-related effects on site hydrology.
    d. Monitor water quality at 10 sampling stations during years 1, 3 and 5 post-construction to determine if the project improves conditions for salmonids and other aquatic life (sampling will include quarterly grab samples at each site and logging recorders will be deployed among stations on a one or two week rotation).
    e. Measure the longitudinal profile of each transect during years 1, 3, and 5 post-construction to track changes, if any, to surface elevations and channel profiles.
2. Conduct snorkel surveys and/or other fish sampling techniques during years 1-5 post-construction to monitor salmonid use of on-site aquatic habitats and evaluate the influence of large wood structures on fish use.
3. Evaluate and report information collected during the monitoring effort annually (with more extensive reporting during years 1, 3 and 5 post-construction) to inform future tidal wetland enhancement projects and monitoring efforts and satisfy grant requirements.

Our monitoring efforts at the site have deviated somewhat from these original objectives. Specific differences are:

1. We established nine permanent linear transects instead of 13. A 10th transect was established for plant survival monitoring in Fall 2012.
2. We did not collect and analyze soil samples during year 1.
3. Post-construction water quality monitoring was conducted using continuous logging devices only, no grab samples were obtained.
4. To date, we have not collected longitudinal profile information from along the entire length of each monitoring transect. We have, however, completed channel cross sections where transects cross stream channels.

D. Use of graphs, charts, maps, and photographs to convey information where appropriate.
These items are provided below along with a summary of what has been learned to date.

E. A description of where data can be obtained.
Information collected during monitoring efforts at the site is housed at the Tillamook Estuaries Partnership office in Garibaldi, Oregon. We prepared an extensive report documenting our baseline data collection and analysis efforts. An electronic version of this document can be obtained from our website, www.tbnep.org. Future full reports also will be available on our website. Interim reports and raw data will likely not be made available on our website. Instead, these reports and data can be obtained by contacting Scott Bailey, TEP Project Manager via phone or email.

2. An explanation of how the information collected is to be used to inform future actions
We believe that the information collected during this monitoring effort will inform future actions in two general ways: it will guide future actions at the Miami Wetlands site, and it will inform future tidal wetland projects at other sites.

With respect to future actions at the Miami Wetlands site, we are using information obtained from our monitoring efforts to help guide our revegetation efforts. For example, we used our baseline water elevation and water quality data to assist with identifying planting zones and selecting plant pallets for the various zones. In addition, we are using our vegetation planting survival monitoring data to guide our replanting efforts.

With respect to informing future wetland projects, we anticipate that our monitoring efforts at the Miami Wetlands will influence our baseline data collection efforts (e.g., selecting monitoring parameters, protocols, data collection sites, etc.) and will likely be considered during other aspects of planning for and implementing such projects. For example, our channel cross section data may inform future tidal wetland channel designs and our vegetation monitoring data will be used in the development of future restoration planting actions.

3. A summary of what has been learned.

Before the Miami Wetlands Restoration project began, the site was highly modified from historical conditions. It was once a tidally-connected, spruce-dominated wetland with a network of natural channels. Through human manipulation, it became a densely vegetated herbaceous wetland dominated by non-native, Reed canarygrass with a muted tidal signature and a reduced and highly modified channel system. In addition, baseline site characterization data indicates that, in this modified condition the wetland was primarily a precipitation-driven, fresh water wetland with limited salt water intrusion (Bailey 2011).

The goal of the restoration project is to restore the site to a semblance of its former self, with increased woody cover, native-dominated vegetation communities, and more natural and well-connected hydrological conditions. We are monitoring a variety of variable to document how the project is influencing the site and evaluate the effectiveness of the project in meeting the stated goals.

It has been slightly over two years since construction activities were completed at the site and vegetation restoration actions are still being implemented. Some aspects of the site were immediately altered as a result of the project and resulted in very pronounced visual changes to the site, but other aspects will change more gradually and long-term monitoring will be required to fully understand and demonstrate these changes. For example, channel construction resulted in dramatic and immediate visual and hydrologic changes to the site, but long-term monitoring will be needed to fully understand how the modified channels change over time and influence hydrological conditions. Similarly, although a considerable amount of plant material has been added to the site, only after this material has had an opportunity to grow and reproduce will we be able to understand how vegetation community distribution, composition and structure has responded to project activities.

As noted earlier, we have completed the following monitoring activities since construction activities ended in summer 2011:

1. Vegetation Monitoring
   e. line-intercept transects (spring 2012),
   f. 1m^2 herbaceous plots (spring 2012),
   g. 5m radius tree/shrub plots (spring 2012), and
   h. restoration planting survival monitoring (fall 2011, 2012 and 2013)
2. Channel Cross Sections
   -Hobson-Struby creeks channel and tidal channels (fall 2012)
3. Snorkel survey for juvenile fishes
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6. Marsh bird survey
   -Spring 2012

Through these monitoring activities we have collected a large volume of information. For example, we have obtained thousands of water level and temperature readings at each of the eight water elevation monitoring wells annually since construction activities were completed (i.e., hourly readings with Solinst Levelogger data loggers since 2008). At this time, we have not fully analyzed all of the data we have collected and it is too soon to document significant changes in vegetation composition and structure and other factors whose transitions will likely occur over several years. Therefore, in this section we will provide some preliminary results from our monitoring data for each of the above activities and elaborate on our general impressions of how the site has responded since summer 2011.

1. Vegetation – Vegetation at the site appears to be responding positively to project actions. Native species are increasing in stature and area covered and, although still very abundant, non-native and invasive species appear to be declining. The increase in diversity and abundance of woody plant species has been particularly noticeable.

   After this summer's growing season, trees and shrubs planted at the site have increased in size to the point where many individuals are well above the height of the grasses and other plants that previously dominated much of the site. As a result, there has been a marked visual change in the vertical structure of vegetation on the site and it is clear that the site is in the process of transitioning from grass-dominated to one where trees and shrubs are more prominent.

In addition, beaver activities are dramatically influencing vegetation and hydrology at the site. Numerous dams and trails (that are becoming water conveyance channels) have been constructed and evidence of beaver predation on woody plants is widespread, particularly on existing and planted willows. Through their dam building and trailing efforts, beavers have altered hydrological conditions of the site and many areas that were relatively dry during the first couple of years post-construction are now continuously inundated. This is influencing vegetation at the site because only those species tolerant of continuous inundation are persisting in these areas. Further, beaver actions are affecting the hydrology of the constructed channel system. Some channels are receiving reduced (or at least altered) flows, while others are getting additional input from overland flows spilling into them. Beaver activities have been particularly pronounced in the northwest corner of the parcel north of the Miami River (see below).

a. Vegetation composition and structure --Line intercept transects and other protocols to monitor vegetation response to the restoration project (e.g., $1m^2$ herbaceous vegetation plots and 5m radius tree and shrub plots) were not completed during 2013, so no information regarding these studies is included in this report. We completed these studies during spring 2012 and discussed the results of this effort in our 2012 annual report. We will complete these studies again during 2014 monitoring efforts and provide a synopsis of that effort in next year's report.

b. We have completed restoration planting survival monitoring during each of three years (fall 2011, 2012 and 2013). The protocols followed for this monitoring effort was detailed in our 2012 annual report. We have planted container-grown trees, shrubs and wetland forbs and graminoids (e.g., red alder, black cottonwood, Sitka spruce, twin berry, red osier dogwood, Douglas spirea, slough sedge, small-fruited bulrush, cow parsnip, etc.) and cuttings (primarily willows) each winter/spring since 2011. In addition, we have completed 2-3 plant release sessions (i.e., using mechanical methods to control competing plants around planted specimens to give them a competitive advantage) during each summer since 2011.

   In general, plant survival and growth has been excellent and a change in the structure and composition of on-site vegetation is becoming visually discernible. Below we provide the results of our annual survival monitoring efforts for each of our general planting zones: (1) the Wetland Zone (interior portions of the site), and (2) Riparian Zone (a narrow band along both banks of the Miami River).

   Data from our survival monitoring efforts will inform our mortality replacement plantings in areas where we have observed greater than acceptable tree, shrub and/or forb mortality. For example, in the areas recently affected by beaver activities we will likely replant with species more tolerant of very wet conditions. We also may need to use cages on species that we haven't typically caged in other plantings. This information also will inform the density-increase plantings we have planned for some of the wetland zones.

   i. Wetland Planting Zones (Figure 1, Zones A, B, C, D, E, F, G, J, K, L, M and P)

      2011 Survival Monitoring - We sampled 20 0.1-acre plots in our wetland restoration planting zones during fall 2011 (approximately 10% of the wetland area planted during spring 2011). In general, tree and shrub survival was very high during this sampling effort (93% and 88%, respectively). In addition, we did not record a single mortality among cuttings (predominantly willow stakes) during this first year. Forb and graminoid species planted during spring 2011 (slough sedge, small-fruited bulrush, and cow parsnip), however, did not fare as well (overall survival rate = 45%). We believe that the high mortality among these plants was, at least in part, due to unusually cold weather that occurred shortly after the plants were delivered to the site, but before they were planted. During this time, the plants were stored in boxes and each individual plant was in a small propagation container. As a result, roots were above ground and vulnerable. We believe that their roots were damaged by the cold and this resulted in the high mortality we observed among these plants.

2012 Survival Monitoring - Because additional wetland planting zones were planted during spring 2012, we increased the number of survival monitoring sample plots during fall 2012 to 31 0.1-acre plots. In addition to analyzing survival rates for all wetland planting zones combined, we also completed separate survival analyses for areas planted during 2011 and those planted during 2012.

A combined analysis of 2011 and 2012 plantings revealed that survival rates for planted trees, shrubs, cuttings, and forbs/graminoids in the wetland planting zones) remained fairly high (74%, 71%, 92%, and 61%, respectively).

When analyzed separately, survival rates for the 2011 planting zones remained similar to our year-one results: trees = 83%, shrubs = 80%, cuttings = 93% and forbs = 59%[4].

Results for the 2012 planting zones, however, varied from this pattern. These plantings occurred entirely in the northwest portion of the project site (Figure 1). While cuttings and forbs/graminoids fared well in this area (89% and 77% survival, respectively), tree and shrub survival was quite low (45% and 39%, respectively). We attribute these low rates primarily to beaver activity. Trees were caged to protect them from beaver predation, but shrubs were not. There was some evidence of beaver predation (particularly among shrub species), but considerable tree and shrub mortality appeared to be associated with prolonged inundation caused by beaver dam construction. As noted above, this portion of the site has been substantially influenced by beaver activities and the planting zones in this area became considerably wetter than they were before they were planted. It appears that the area was just too wet for the young trees and shrubs to survive. In drier portions of the areas planted during 2012, survival of tree and shrub species was similar to survival rates in our 2011 planting zones.

2013 Survival Monitoring - In 2013, we sampled 31 – 0.1 acres circular plots (Figure 1 - 20 north of the river and 11 south of the river). At this point, plantings have occurred during each of three years and replacement and/or density increase planting has occurred within many previously planted areas. As a result, it is impractical to break down survival results based on the year of first planting for a majority of the site (as we did for our 2012 analysis). Therefore, for this report we provide overall survival rates for container-grown plants by growth form (i.e., trees, shrubs, and forbs and graminoids) and for hardwood cuttings. We also provide survival rates by species to provide a more thorough understanding of our restoration planting efforts.

In general survival of planted specimens remains quite high. When figured across all wetland planting zones and inclusive of all planting years, survival rates for trees (77%), shrubs (82%), forbs and graminoids (70%), and cuttings (66%) were at levels indicative of a successful planting effort and suggest that there is only limited need for replacement plantings.

Analyzing our plant survival data by species allows for a more thorough understanding of survival rates and better illustrates how each species performed. These analyses also allow for determination of whether some species/planting types are more suitable than others and where replacement planting may be needed.

In general, survival for all tree species planted as container-grown specimens at the site remains high (red alder = 78%, black cottonwood = 74%, Sitka spruce = 97%, and Western red cedar = 80%). Primary causes of mortality appear to be inundation (primarily a result of beaver dam building activities that inundated areas that were

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[4] We attribute the rise in survival between 2011 and 2012 (and on into 2013) among forb and graminoid species to vegetative reproduction by surviving plants. We planted herbaceous plants in groups of three and each planting site was marked with a bamboo stake. During sampling, we recorded the number of surviving plants around each stake (from 0 to 3 individuals). In 2011, it was easy to identify the individual specimens we planted and where these had died or were missing. However, in 2012 and 2013 surviving plants had often reproduced and it was difficult to discern between planted individuals and rhizomatous growth (which was often dense and covered the entire area where the original plantings occurred). In such instances, we would count three live plants. It is likely that at some of these sites we were counting reproductive growth and not the original planted specimens.

relatively dry immediately post-construction) and predation by rodents. In some cases predation resulting in mortality was clearly a result of beavers, but we noted several recently dead specimens that apparently died because they were "girdled" by smaller rodents (in 2013 we observed that the latter was the cause of death for several otherwise robust and healthy looking hardwood trees).

We have observed considerably more variability in survival rates for planted container-grown shrubs than trees. Twinberry, Douglas spirea, cascara and Pacific crabapple have very high to acceptable survival rates (91, 83, 70, and 69% survival, respectively), whereas red osier dogwood and Pacific ninebark have survived at considerably lower rates (62 and 43%, respectively).

All three non-woody species planted as container-grown specimens at the site (i.e., small-fruited bulrush, slough sedge and cow parsnip) have reproduced vegetatively since 2011 and current estimated survival rates for these species are quite high (small-fruited bulrush = 87, slough sedge = 82, and cow parsnip = 71%).

We planted three different types of hardwood cuttings at the Miami site: willows (several species), Pacific ninebark, and Douglas spirea. Willows were by far the most common cuttings used at the Miami site and nearly 81% of the willow cuttings we inspected during our 2013 study have survived. Our results with regard to willow cuttings are not surprising. There is a long and well-studied history of deploying willows in restoration plantings and the preferred method for deploying willows is through the use of cuttings. Survival for Pacific ninebark and Douglas spirea cuttings has been extremely poor. In fact, we did not encounter a single live specimen of either species planted as cuttings during our 2013 monitoring effort and have noted a very low success rate for these cuttings incidental to other work on the site.

ii. Riparian Planting Zones (Figure 1, Zones H and I)

As noted in our 2012 report, we did not sample restoration plantings in the Riparian Planting Zones (Zones H and I). Instead, our restoration planting contractor has conducted a complete census of these plantings. He did not differentiate among species or growth form (i.e., trees and shrubs), but instead simply counted live and dead individuals within these zones. Both of these planting zones were planted during spring 2011 and no replanting has occurred within these zones. Survival monitoring for these zones was completed during fall 2011, 2012 and 2013.

Results for 2011 were:

	Plants Inventoried	Plants Alive	Percent Survival
Zone H -	1,273	1,166	92%
Zone I	408	397	97%

Results for 2012 were:

	Plants Inventoried	Plants Alive	Percent Survival
Zone H -	1,273	1,147	90%
Zone I	408	390	96%

Results for 2013 were:

	Plants Inventoried	Plants Alive	Percent Survival
Zone H -	1,273	1,114	88%
Zone I	408	388	95%

As you can see, survival within the riparian planting zone is extremely high, and has remained so over the three years of post-planting monitoring we have conducted. As a result, we do not anticipate any mortality replacement plantings or density increase plantings for either of these zones.

2. Channel Cross Sections

   We did not sample channel cross sections during our 2013 data collection efforts. We will complete this protocol again during our 2014 monitoring efforts.

3. Snorkel survey for assessing fish use

   We completed two snorkel surveys (primarily for juvenile salmonids) at the site in 2013: one survey on March 14, and one on April 25, 2013. Figure 2 depicts areas where these efforts were conducted.

   We only attempted to snorkel the tidal channels (Figure 2 – E channels) during our March survey effort. Visibility in the tidal channels was once again extremely poor (i.e., less than one foot) and, as a result, we did not spend much time attempting to survey these channels nor did we observe any fishes in these channels during the survey. We did, however, observe approximately 20 unidentified salmonids in the lower tidal channel while completing other field tasks on the same day as our March snorkel survey effort. This is not unusual. We have often observed small salmonids (some coho, but most unidentified) and large schools of stickleback in these channels from the banks while performing fieldwork at the site. Given that we have encountered such poor visibility within these channels during every survey attempted to date, we will likely no longer attempt to snorkel these channels. Instead, we will explore other techniques to assess fish use of these channels.

   We snorkeled portions of the Hobson-Struby channel complex (Figure 2-channels A, B, C, and D) during both the March and April survey sessions. We surveyed a blind tributary of the Hobson-Struby channel (G channel) only during the April session. Visibility was moderate to good in the channels conveying the flows of Hobson and Struby creeks (i.e., channels A, B, C and D), but quite poor in the tributary channel (G channel). We have regularly observed salmonids in the Hobson-Struby channel complex incidental to other field work since completion of construction activities at the site. We have observed fish throughout much of this channel system, particularly near the large wood structures and in the pool at the outlet of the culvert that passes Hobson Creek under Miami-Foley Road.

   We observed few fish during our March survey effort, even around the in-channel wood structures where fish have typically been common during previous surveys. In fact, we recorded fewer fish during this effort than during any snorkel survey effort completed at the site since 2011. Although visibility was somewhat lower and flows somewhat swifter during this survey than during other surveys, it is unclear why apparently so few fish were present during this effort. All of the fish we observed during the March effort were within the Hobson-Struby creeks channel complex (Channels A, C and D) and most were in close proximity to in-stream wood. We observed the following during the March survey effort:

   10 – unidentified salmonids[5]
   5 – coho par[6]
   1 – salmonid fry (species unidentified)

   We observed considerably more fish during the April survey effort. In fact, we recorded more fish during this effort than during any previous post-construction survey at the site. As during previous efforts, most fish were observed in close proximity to in-channel wood structures. However, we also observed nearly 20 unidentified salmonids while walking in-channel between areas that we snorkeled. With the exception of two unidentified salmonids near the mouth of channel G, all fish observed during the April survey were in the Hobson-Struby channel complex (Channels A, B, C and D). During the April survey effort, we observed the following:

   17 – unidentified salmonids
   97 – coho parr
   7 – cutthroat adults
   1 – steelhead fry

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[5] This was a single group of fish. Most were larger individuals, so it seems likely that they were adult cutthroat trout, but the observation was too brief and the fish retreated into an inaccessible area. As a result, positive identification was not possible.

[6] Parr-The developmental life stage of salmon and trout between alevin and smolt, when the young have developed parr marks and are actively feeding in fresh water.

Fry-An early stage of development in young salmon or trout. During this stage the fry is usually less than one year old, has absorbed its yolk sac, is rearing in the stream, and is between the alevin and parr stage of development.

Smolt-Refers to the salmonid or trout developmental life stage between parr and adult, when the juvenile is at least one year old and has adapted for life in the marine environment.

Similar to other efforts, we observed most fish during these surveys in proximity to in-stream large wood structures, but some were observed in pools not associated with large wood (e.g., beaver impoundments) and some were observed in areas with other stream bed types (e.g., riffles, etc.). We observed 20-50 juvenile coho at two of the large wood structures along the Hobson-Struby channel. During the 2005-2007 rapid bio-assessment juvenile snorkel surveys (Bio-Surveys, LLC. 2005, 2006 and 2007), the largest single group observed at stations within the Miami Wetlands site was nine (eight coho and one cutthroat). They also reported very poor visibility at many survey stations.

4. Water elevation monitoring with data loggers at eight well sites

   We have continuously monitored water elevation and temperature at eight well sites since before construction activities began at the site (Figure 3 - six sites north of the river, one in the river channel, and one in channel south of the river). Loggers are set to collect data on a one hour interval. As a result, we have gathered thousands of data points annually at each station since before project implementation.

   We have not completed our analysis of all of the water level data we have collected to date. However, based on preliminary analyses of this data it appears that:

   a. Precipitation remains the primary driver of water surface elevations at the site.
   b. Water surface elevations remain similar to pre-construction levels at most wells that are not in close proximity to the pre-construction ditch system (see Figure 4, wells MW-7, MW-9 and MW-12).
   c. Water surface elevations generally dropped post-construction at wells in proximity to the original channel system despite the fact that many of these wells are located in close proximity to new channels (see Figure 4, wells MW-4, MW-5, and MW-6). This makes sense when one considers that the old ditch system (including the old Hobson-Struby creeks channel) supported several well-established beaver impoundments. As a result, areas in proximity to the old channels were regularly inundated, pre-construction. For the first 1+ years post-construction the new channel system was largely devoid of beaver-constructed impoundments and, as a result water levels at wells in proximity to the channels remained slightly to substantially lower than pre-construction (except during periods of high precipitation). However, beavers remained active in the extreme northwest portion of the site and we are now observing evidence of their actions in many portions of the site (especially within the Hobson-Struby channel system). Several new dams have been constructed and some beaver movement paths have become full-fledged water conveyance channels. These features have resulted in some dramatic and sudden changes in water levels and surface water hydrology at the site. For example, a dam constructed at the confluence of channels A and B during summer 2013 has created a pond that is over a meter deep with a surface area of several hundred square feet. The influence of this dam on water surface elevations at well MW5 is graphically displayed on the 2012-13 post-construction graph provided in Figure 4.
   d. Water surface elevations in the channel south of the river (well LL-2) are consistently higher than during pre-construction monitoring (Figure 4). In fact, average water depth in this channel has gone from 1.8 ft pre-construction to 2.8 ft post-construction. In a related matter, we also have noticed that a substantial portion of the parcel south of the river is wetter than it was pre-construction. Beaver activities also appear to be contributing to this phenomenon. There is evidence of past and ongoing beaver activity at the outlet to the channel (at its confluence with the Miami River) and recent beaver activity is evident in other areas of this parcel where they have not previously been observed.

5. Water quality monitoring

   We have collected post-construction water quality data in two ways: 1) we have deployed dissolved oxygen (DO) and conductivity/temperature loggers at different locations within the site, and 2) the water level loggers discussed earlier also record temperature data, so we have collected water temperature data at the eight well sites discussed above continuously since before construction activities were initiated at the site. As deployed, we are collecting groundwater temperature data with a majority of these loggers.

We have established seven in-channel, water quality monitoring stations at the site (Figure 5 - six within newly constructed channels, one at a station established in the lower tidal channel during pre-construction monitoring, and one in the Miami River [co-located with Levelogger LL1-we did not deploy any water quality monitoring devices at this location during summer 2013]). Most stations consist of a 4-5 ft section of perforated 4-inch PVC pipe that is held in place near the edge of a channel with two steel t-posts. Loggers (DO and Conductivity/Temperature loggers) are hung within the pipe with stainless steel wire attached to a lid which screws onto the top of the pipe. In 2013, we established an additional logger station (Station A1), but have not yet installed a PVC apparatus at that station. Instead, we simply hung loggers from a metal t-post during the single 2013 session (thus far) that we deployed loggers at this site.

We conducted six separate deployments of DO and Conductivity/Temperature loggers during 2013: June 19 to July 8, July 10 to July 29, July 30 to August 13, August 20 to September 5, September 9 to September 24, and October 9 to October 23. Prior to the October deployment, we had two DO loggers (RBR Model DO-1050) and three conductivity loggers (Solinst Model 3001 LTC F30/M10) at our disposal for this project. For the first five deployments of 2013, we paired a DO and conductivity/temperature logger at each of two stations and sampled conductivity alone at a single station. Just before the October deployment we acquired two additional DO loggers (HOBO Model U26-001) and one additional Solinst Model 3001 LTC F30/M10. For that deployment we paired a DO logger with a Conductivity/Temperature logger at each of four stations. This will be our standard deployment method going forward for as long as we have equal numbers of each logger type.

We sampled at six different logger stations north of the river during our 2013 effort. We sampled station L-2 (at the downstream end of the on-site channel system) during all sampling periods so that we could better understand tidal influences on the site. During most 2013 deployments we sampled Conductivity/Temperature only at station L-2 (due to the unequal number of DO and Conductivity/Temperature loggers we had during most of 2013, as described above). The other stations were sampled less regularly to allow us to collect data from as many stations as possible over the course of our summer sampling effort, but both DO and Conductivity/Temperature were sampled at these stations.

We have not yet completed our analysis of these data collected over the past three years. However, preliminary analyses suggest that:

a. Since construction activities ended in 2011, DO concentrations within the channels during the critical summer months are often at or above the State of Oregon water quality standard for estuarine and cool-water habitats (6.5 mg/l). However, during the summers of 2012 and 2013, after prolonged dry and warm conditions, DO levels in all channels were regularly lower than 6.5 mg/l. During these periods, DO often would peak at or above 6.5 mg/l coinciding with high tide events, but would drop to sub-standard levels at low tide and during much of the ebb and flood periods. Figure 6 provides graphs depicting dissolved oxygen levels recorded by in-channel loggers during summer/fall 2013.
b. Water temperatures within the channels and ground water temperatures at the site typically remain below State of Oregon seasonal water quality standards during all seasons (Spawning Use [Oct 15-May 15] = 13°C and Rearing and Migration [year –round standard] = 18°C). Figure 7 depicts in-channel water temperature data collected during 2013. Figure 7 provides graphs depicting water temperature levels recorded by in-channel loggers during summer/fall 2013. Figure 8 depicts water temperature data collected at the water level monitoring wells during portions of 2012 and 2013.
c. The site is predominantly inundated by fresh water. Saline waters from the bay enter the site only during high tide events exceeding approximately 7.5 ft (but not during periods of high precipitation).
d. When saline water enters the site, it is typically confined to the tidal channels and the lower Hobson-Struby Channel (Figure 5, Stations L-2, E-1, E2-1, and D1). During much of our post-construction water quality monitoring, high-conductivity water at these stations persisted for the duration of high tide events and conductivity would return to within the freshwater range once high tides began to recede (typically these high saline spikes lasted approximately

3-4 hours). However, a beaver dam constructed in the historical tidal channel (just below the E Channel/D Channel confluence) during June 2013 affected this pattern during our 2013 in-channel monitoring efforts. After construction of this dam, saline waters persisted in the E channel system throughout most of each ebb tide period and spiked at near estuarine levels at each high tide (see Figure 9 graphs with E channel data).

e. The Hobson-Struby channel system is fresh water for its entire length, except when high tides exceed approximately 8.75 ft during periods of little or no precipitation. When this occurs, saline water occupies the lower portion of the channel and can flood adjacent ground lateral to the channel (Figure 9, station D-1, D-2 and A-1). It seems likely that the beaver dam mentioned in Section 5.d above also will influence this phenomenon, but our analyses to date are insufficient to fully understand its effect (if any).

f. The upper portions of the tidal channels (Figure 5, Stations E2-1 and E-2) are inundated only when tides exceed approximately 6.5 ft (during periods of little or no precipitation). During these periods, water in this portion of the channel is typically brackish. However, conductivity often remains slightly lower in the upper reaches than in the lower portions of the same channels (Figure 9, stations E1 and E2-1)

6. Marsh bird survey (Spring 2012)

We did not complete species-specific surveys for secretive marsh birds during spring 2013. However, we detected Sora (auditory and visual detections) while performing other field work on site during multiple visits in 2013. We also heard a Virginia Rail calling from within the wetland area north of the Miami River on two occasions during 2013. We have now detected this species incidental to other field work during two consecutive years.

4. Inform the OWEB Monitoring and Reporting Program if the data collected were used or will be used in any published report

To date, none of the data collected has been used in a published report. It is unknown at this time whether information collected at the site will be used in for any future publications.

Figure 1. Aerial photograph of Miami Wetlands Restoration Project site depicting the locations of vegetation survival monitoring plots and restoration planting zones .

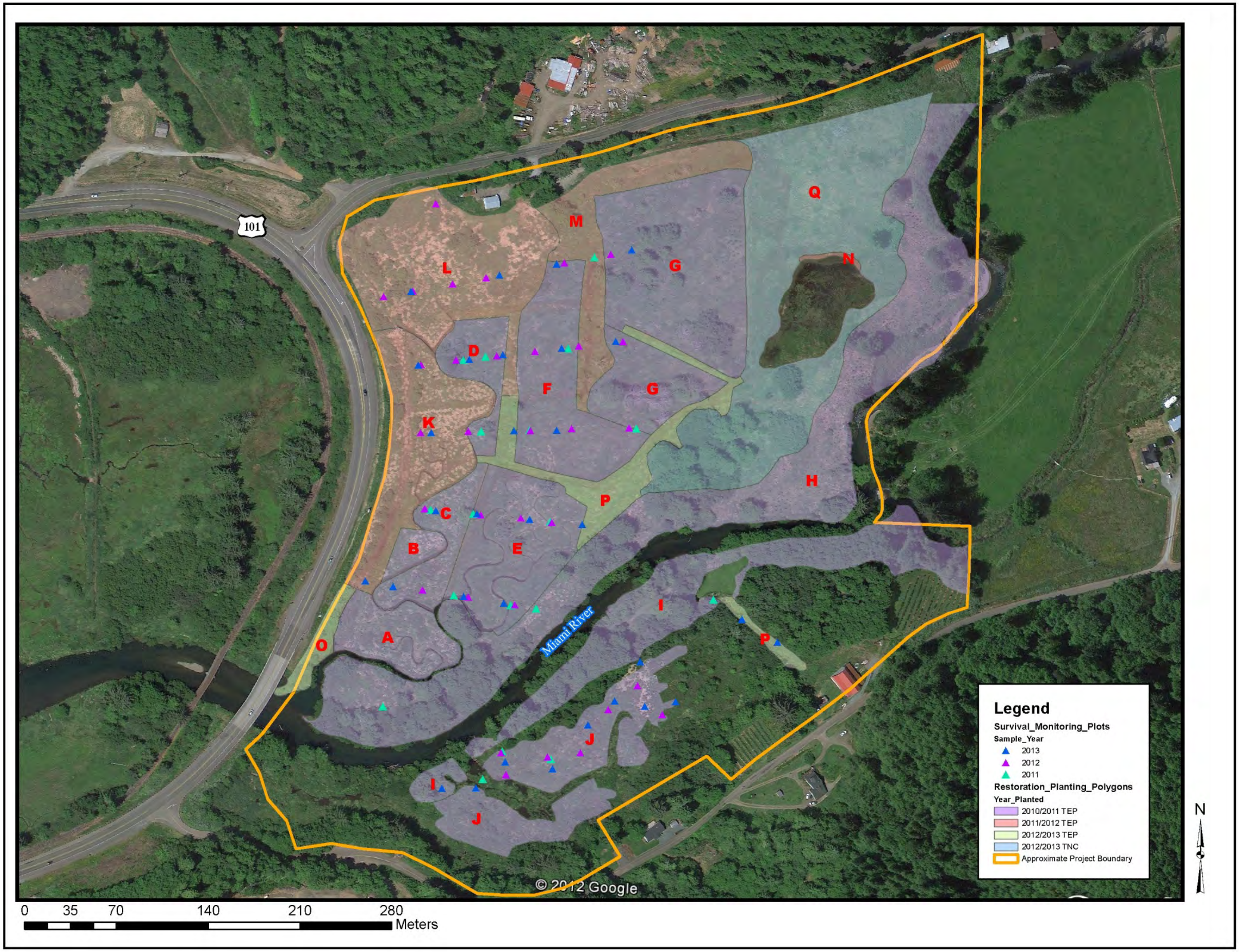


Figure 2. Aerial photograph of Miami Wetlands Restoration Project site depicting constructed stream channels and reaches where snorkel surveys were conducted during spring 2013.

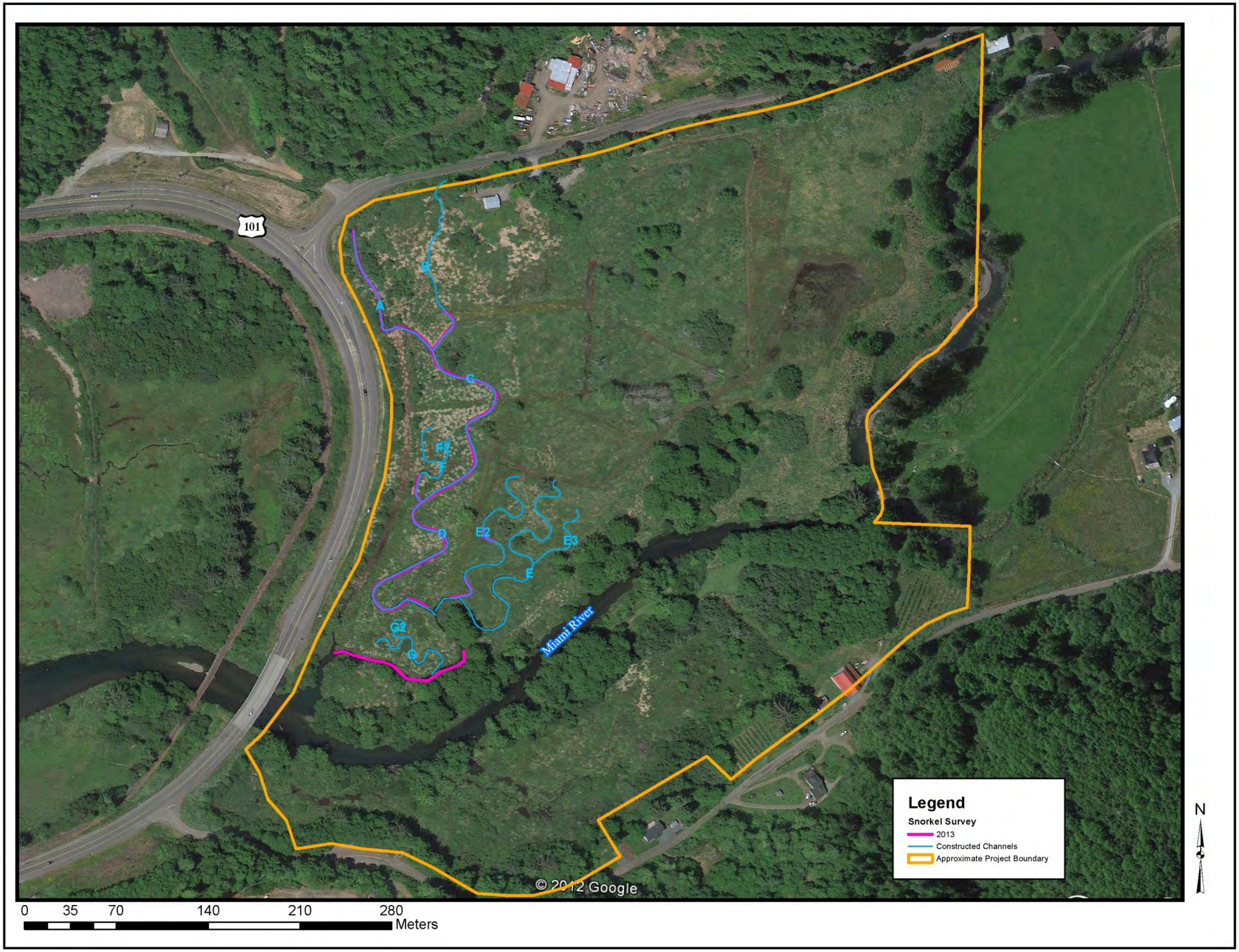


Figure 3. Aerial photograph of Miami Wetlands Restoration Project site depicting locations of water level monitoring wells. Labels that do not include a triangular marker are wells not monitored with continuous data loggers.

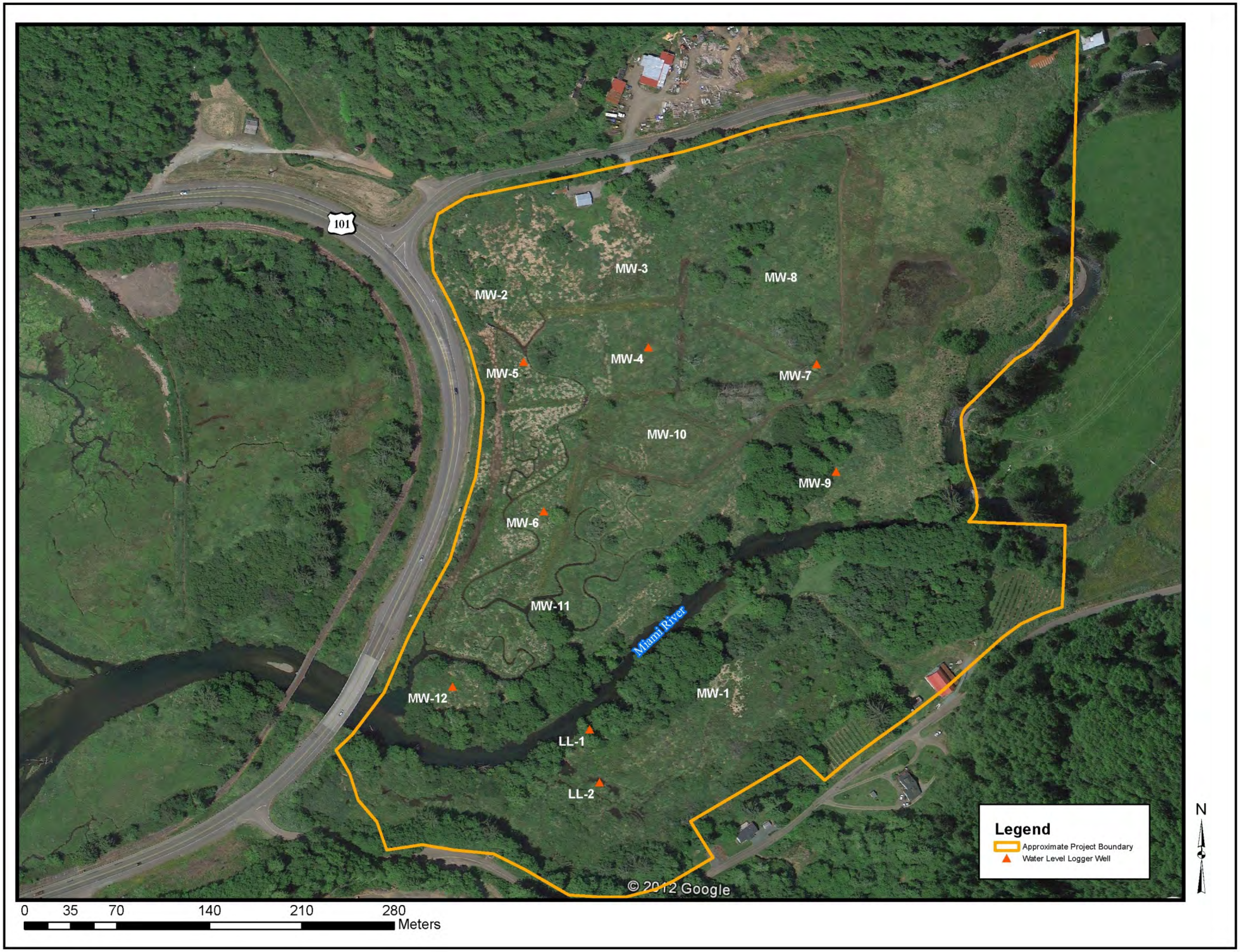
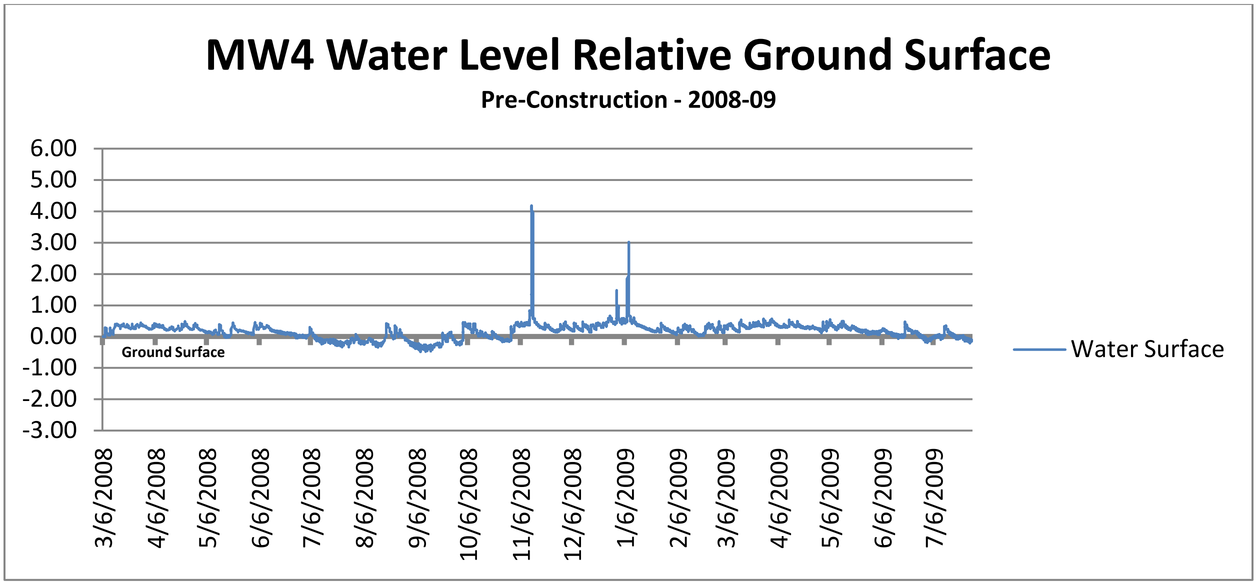
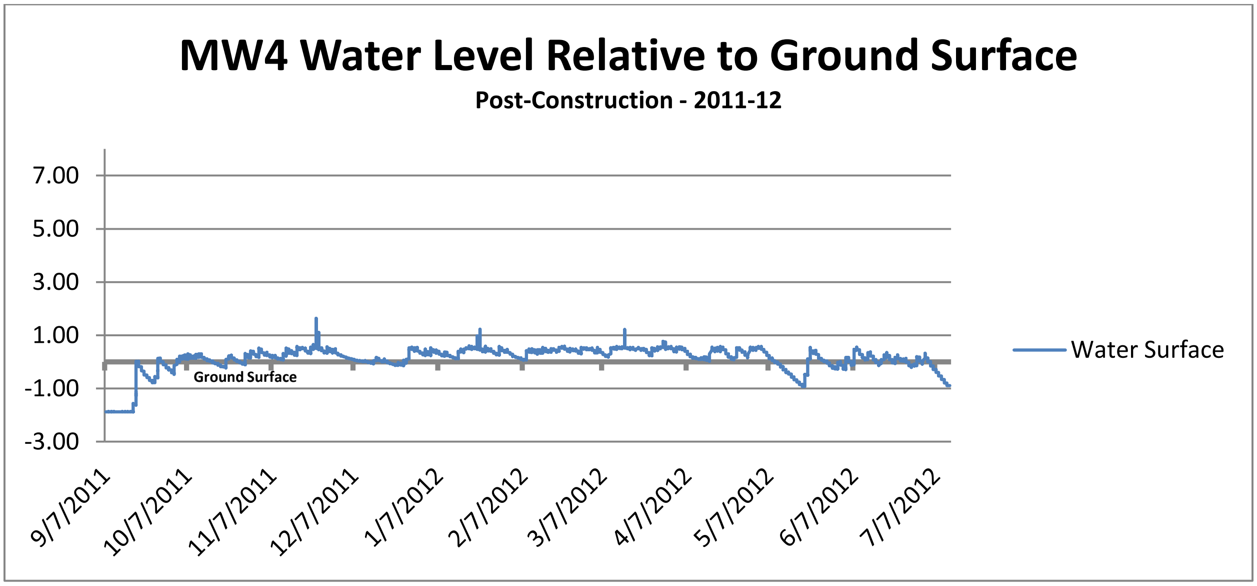


Figure 4. Water surface relative to ground surface for six ground water level monitoring wells at the Miami Wetlands Restoration site. Top graphs on each page are pre-construction and middle and lower graphs are one and two years post-construction.





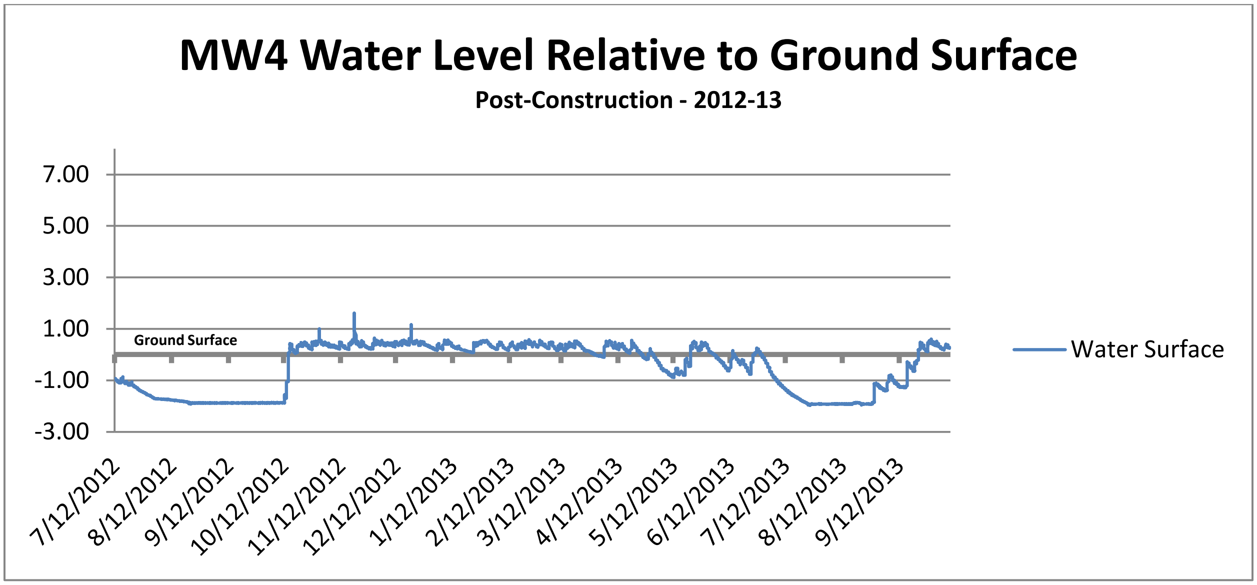
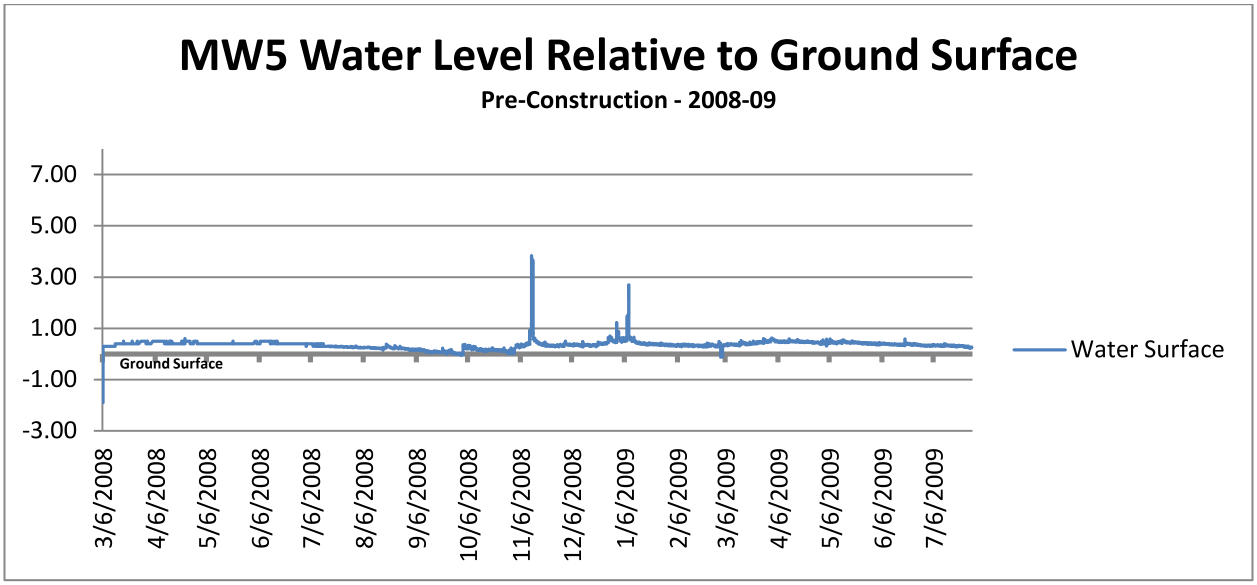
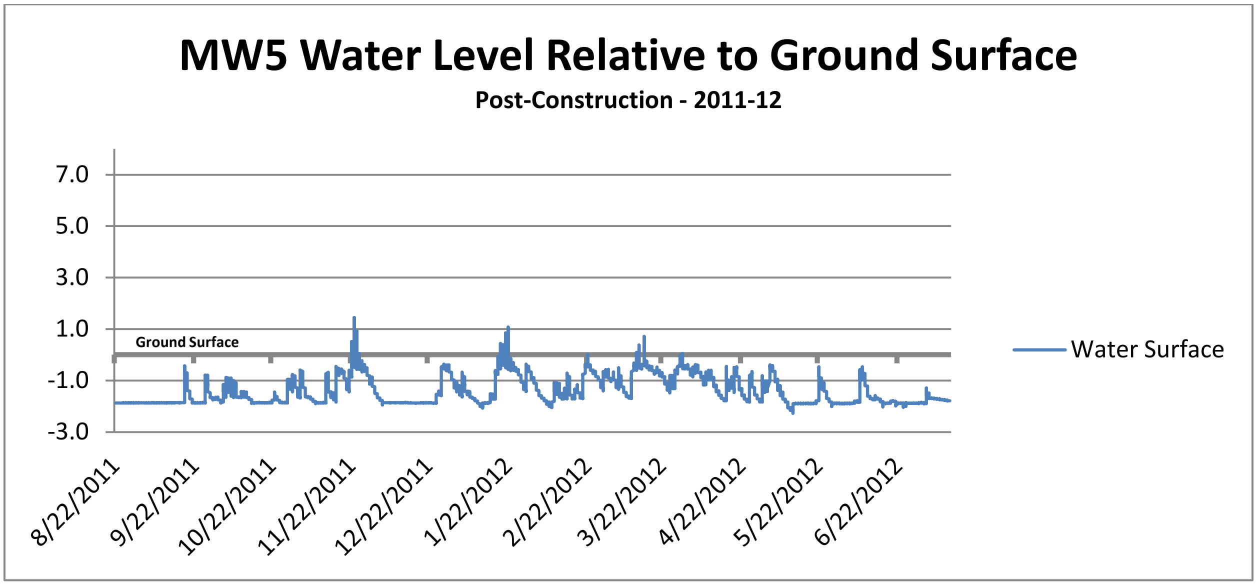


Figure 4. Continued



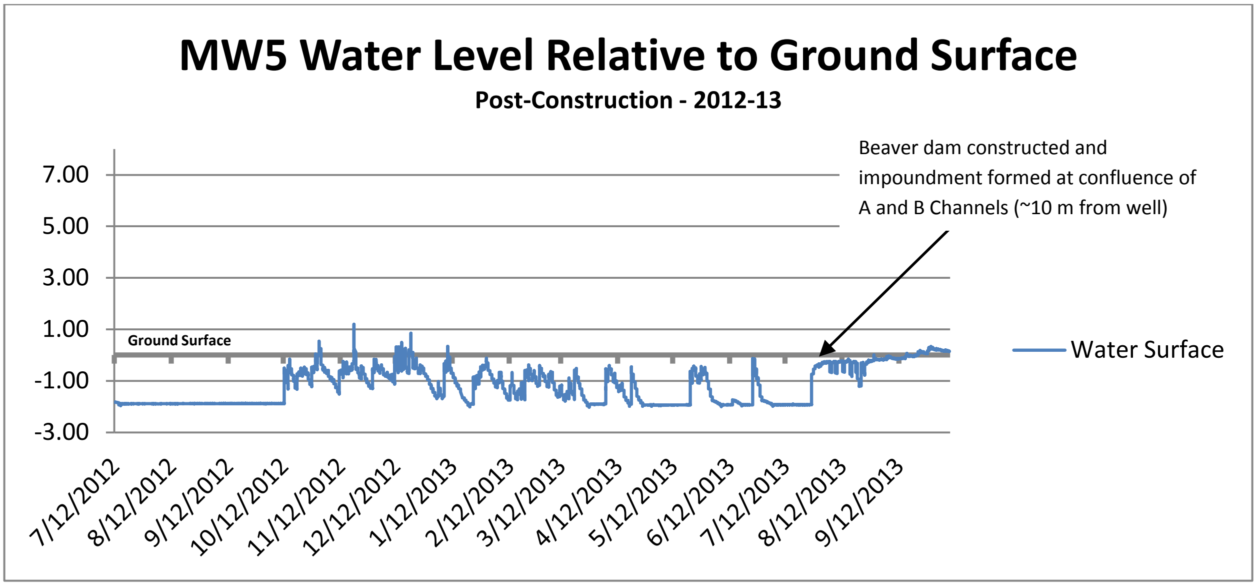
MW5 Water Level Relative to Ground Surface

Pre-Construction - 2008-09



MW5 Water Level Relative to Ground Surface

Post-Construction - 2011-12

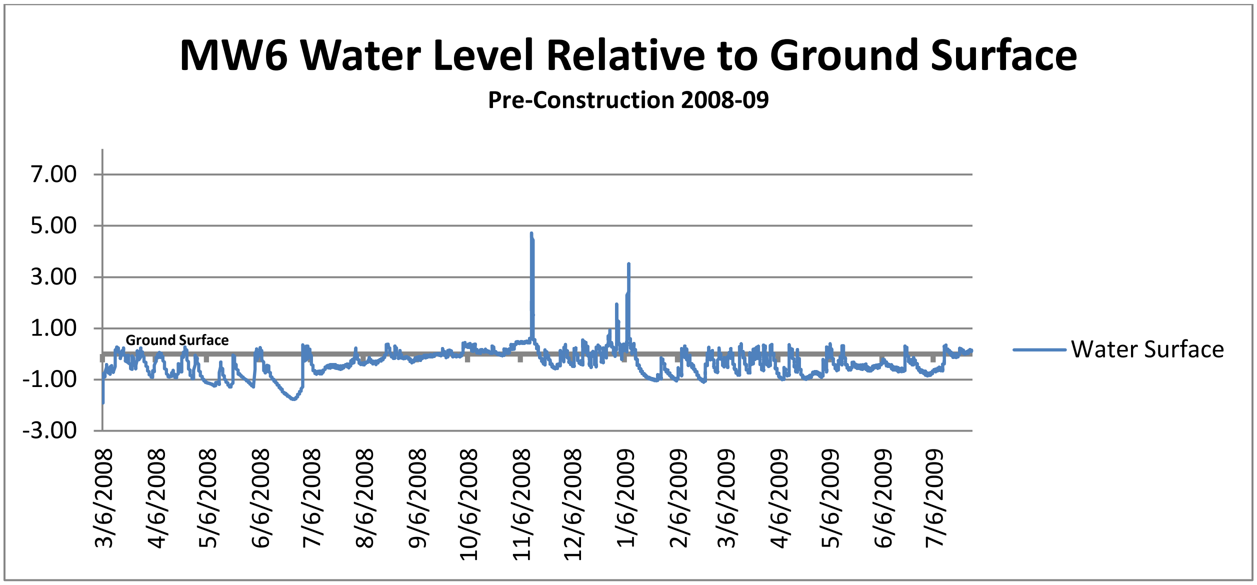


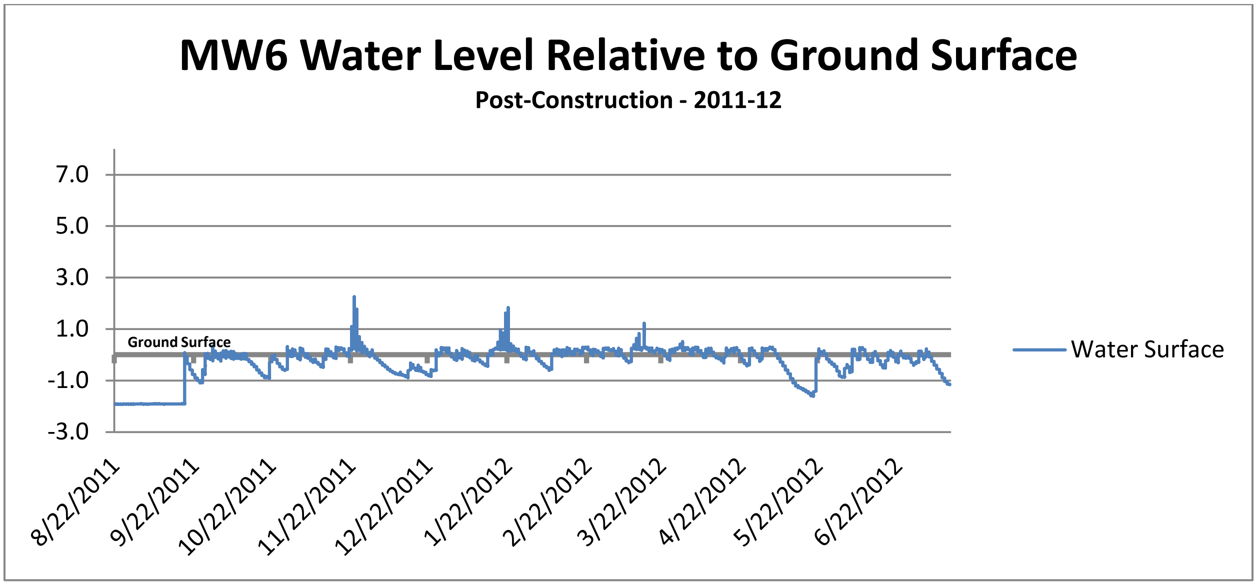
MW5 Water Level Relative to Ground Surface

Post-Construction - 2012-13

Beaver dam constructed and impoundment formed at confluence of A and B Channels (~10 m from well)

Figure 4. Continued





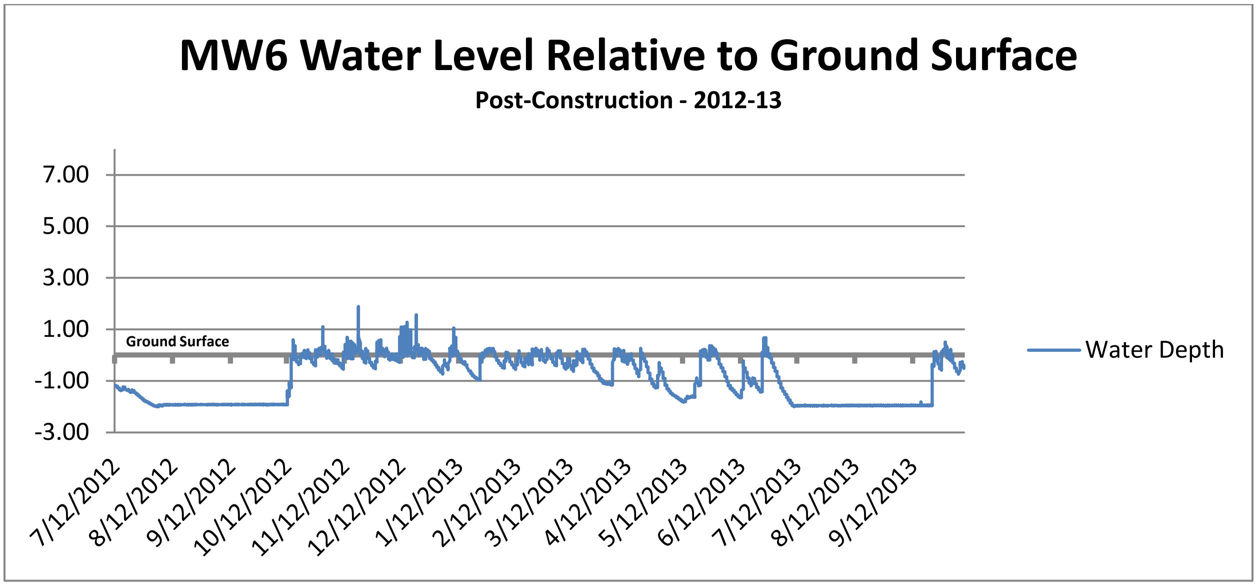
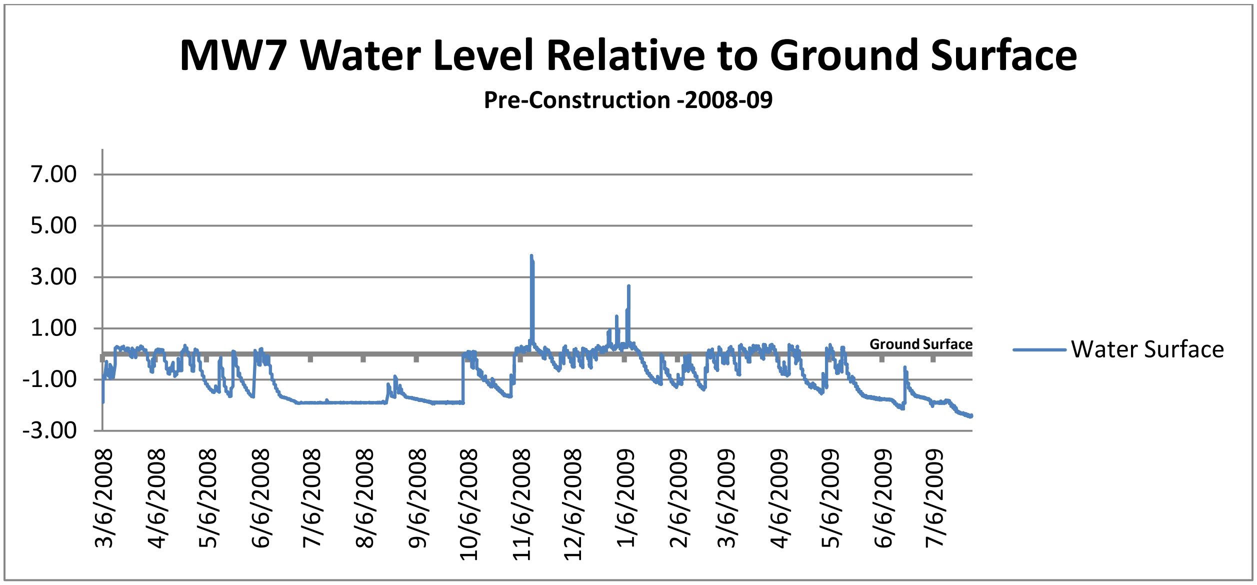
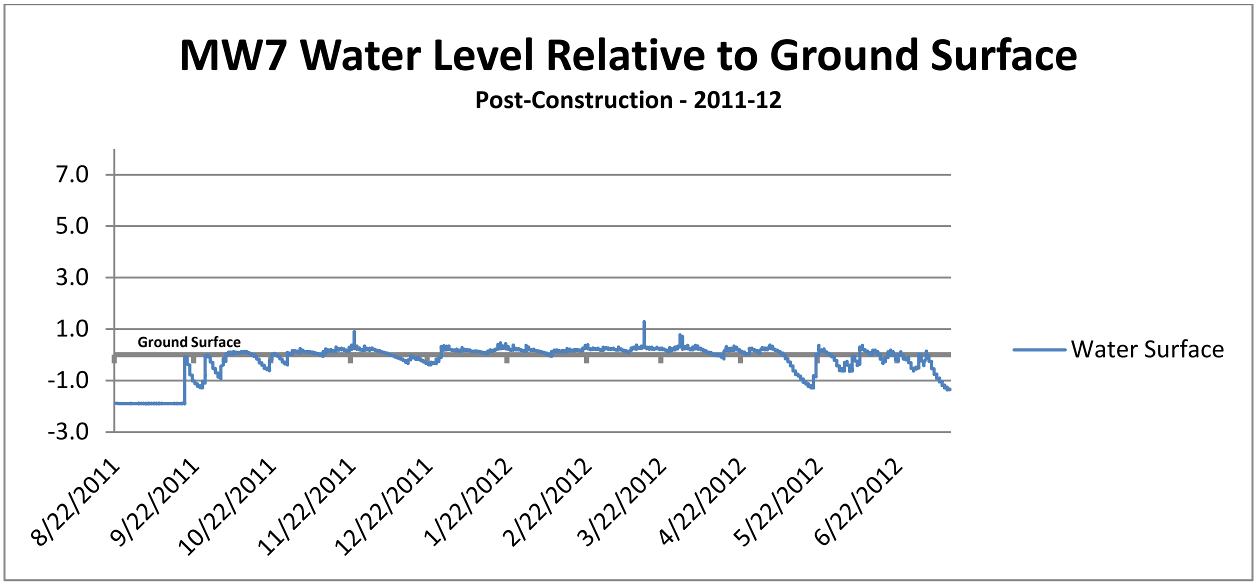


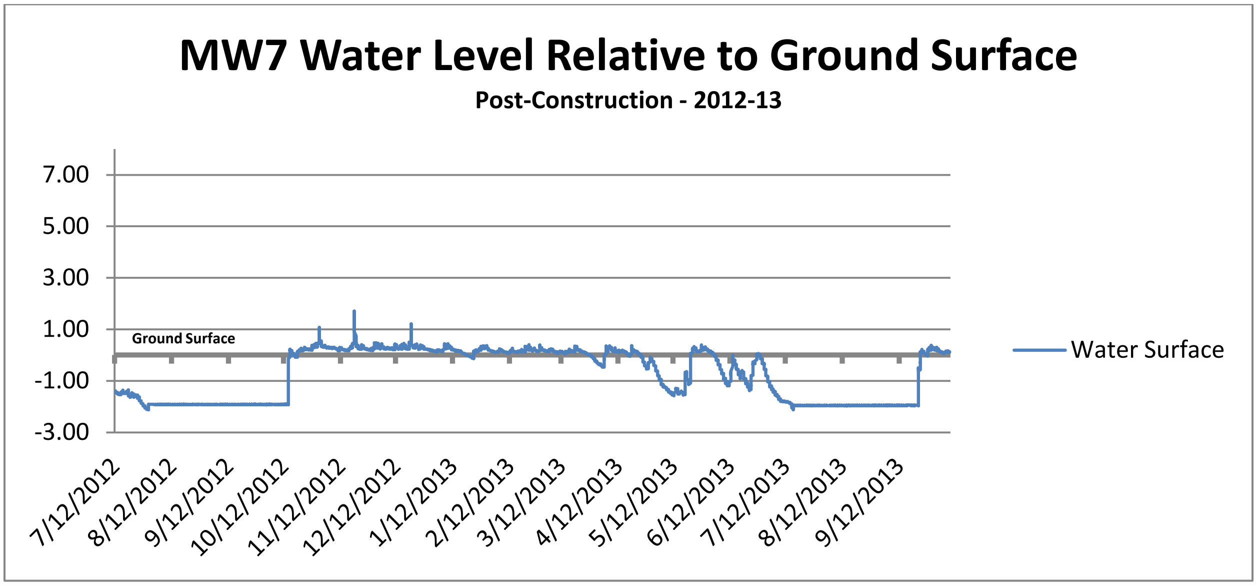
Figure 4. Continued


MW7 Water Level Relative to Ground Surface

Pre-Construction -2008-09

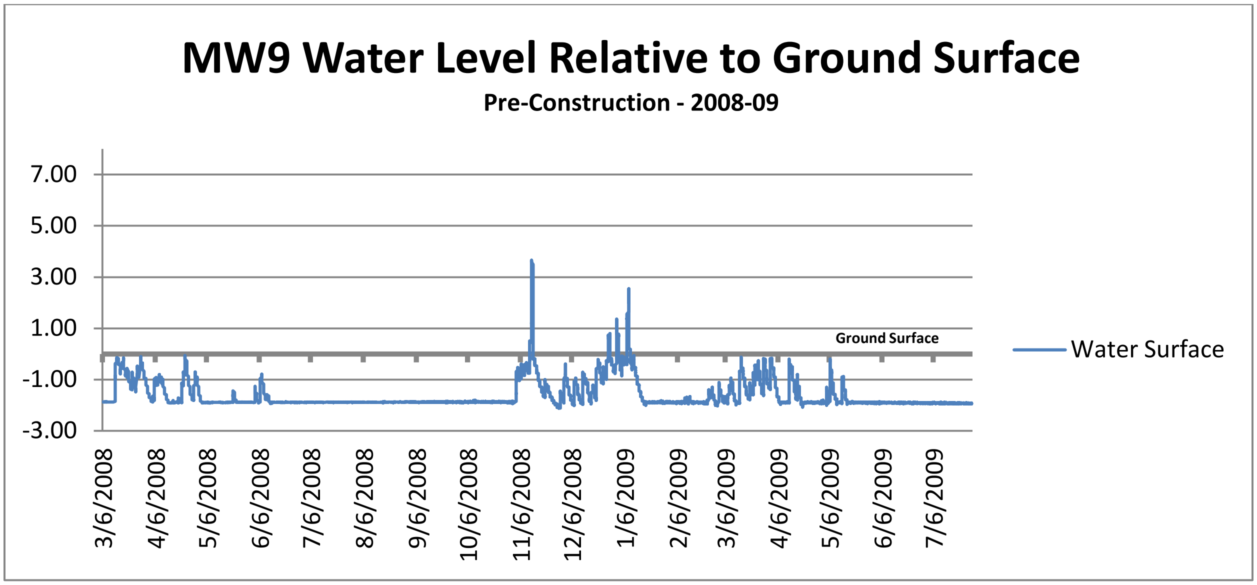

MW7 Water Level Relative to Ground Surface

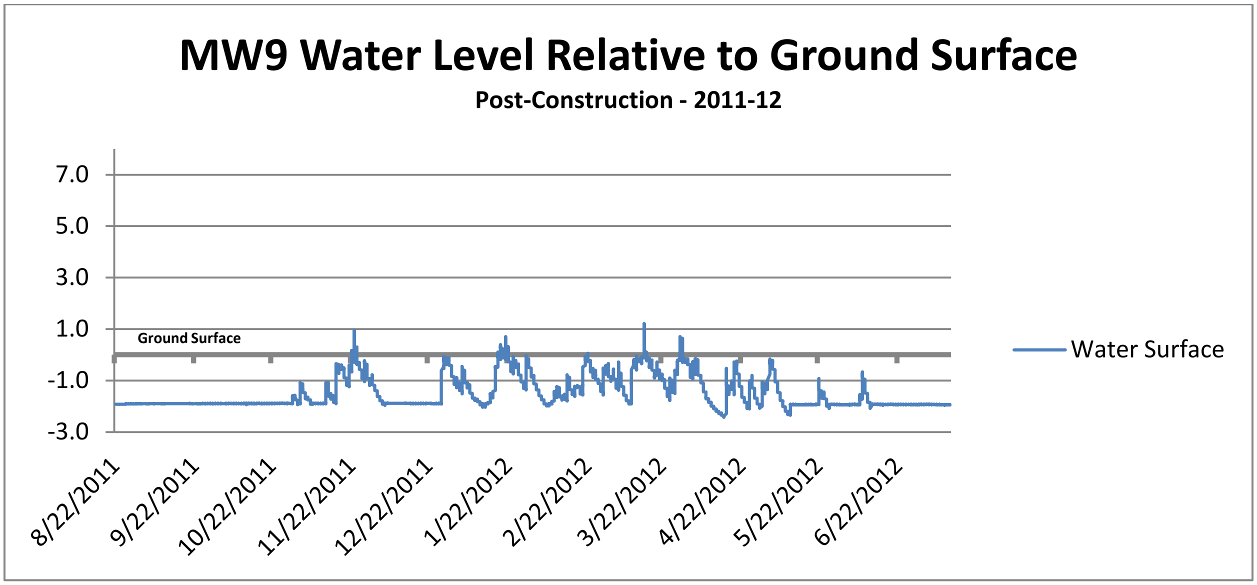
Post-Construction - 2011-12


MW7 Water Level Relative to Ground Surface

Post-Construction - 2012-13

Figure 4. Continued





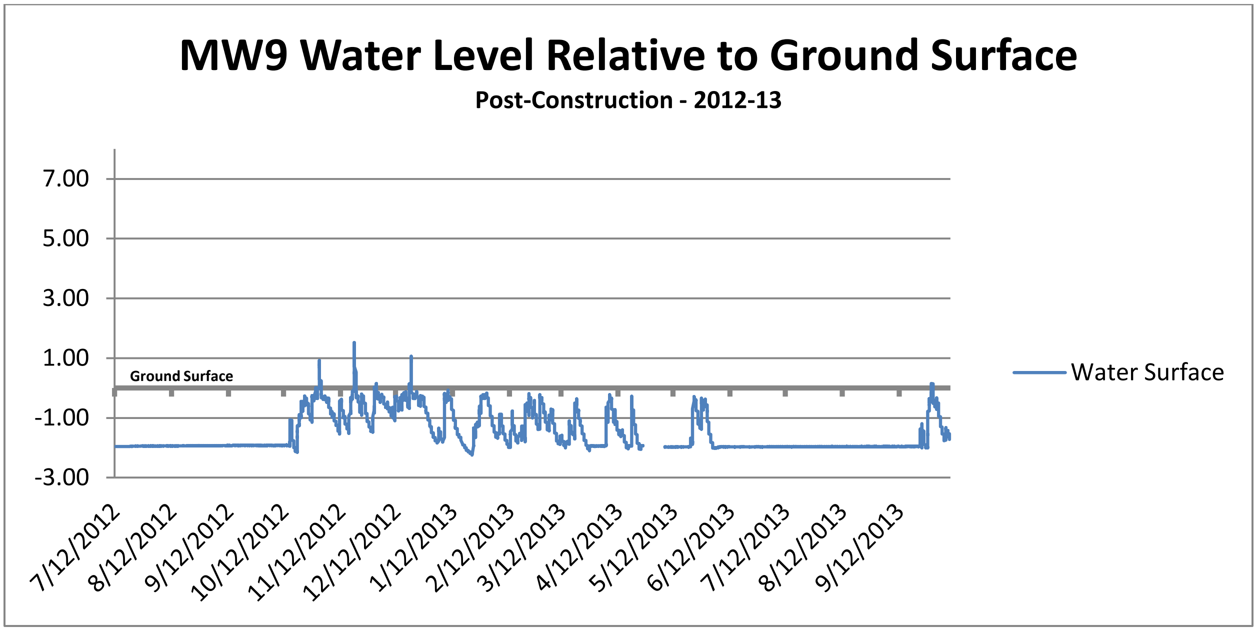
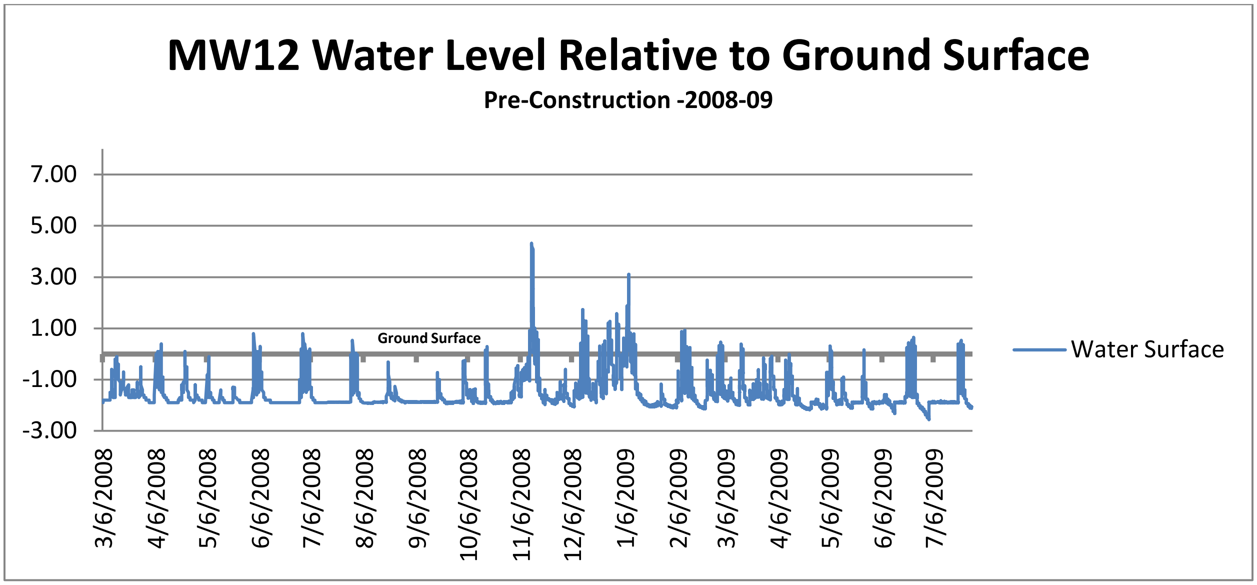
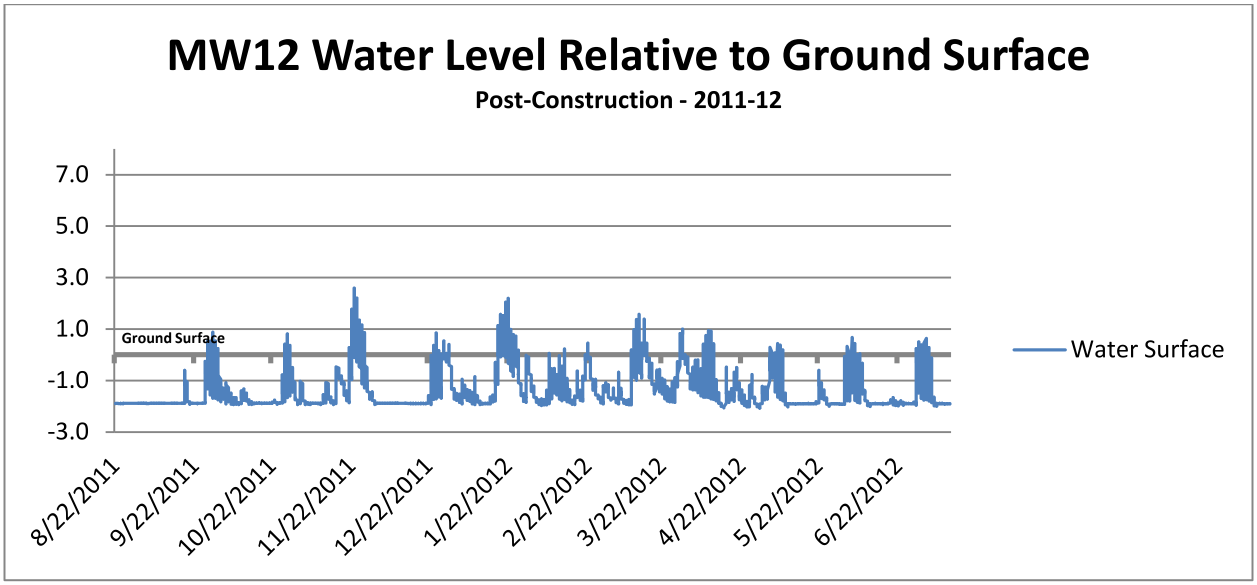


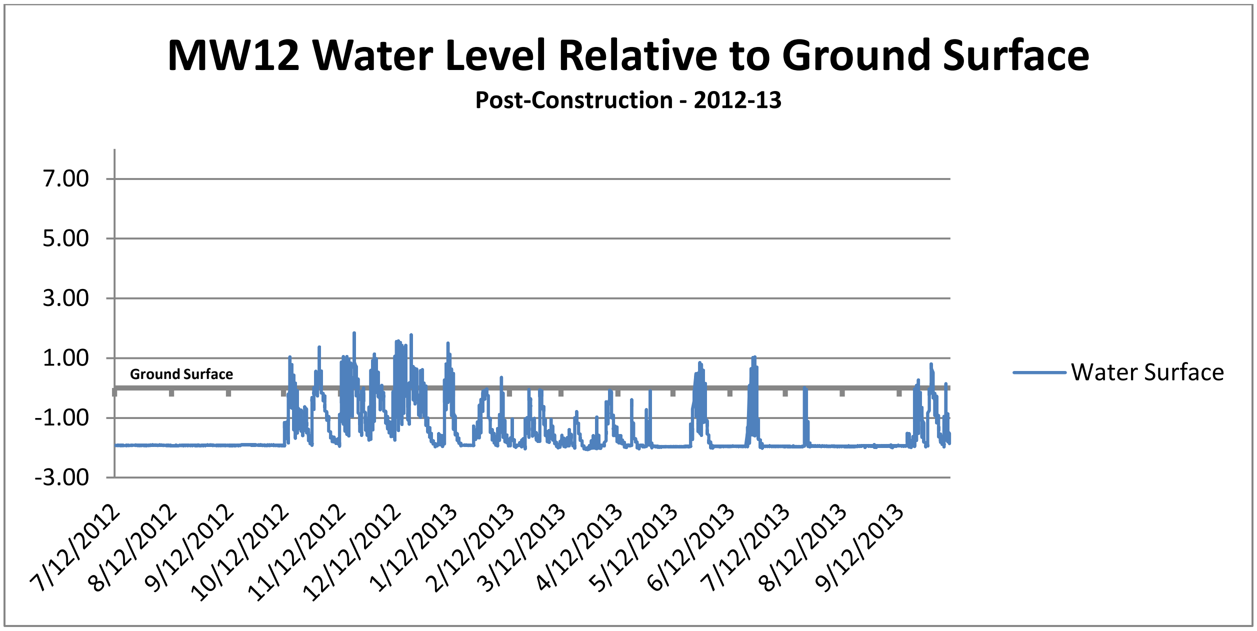
Figure 4. Continued


MW12 Water Level Relative to Ground Surface

Pre-Construction -2008-09

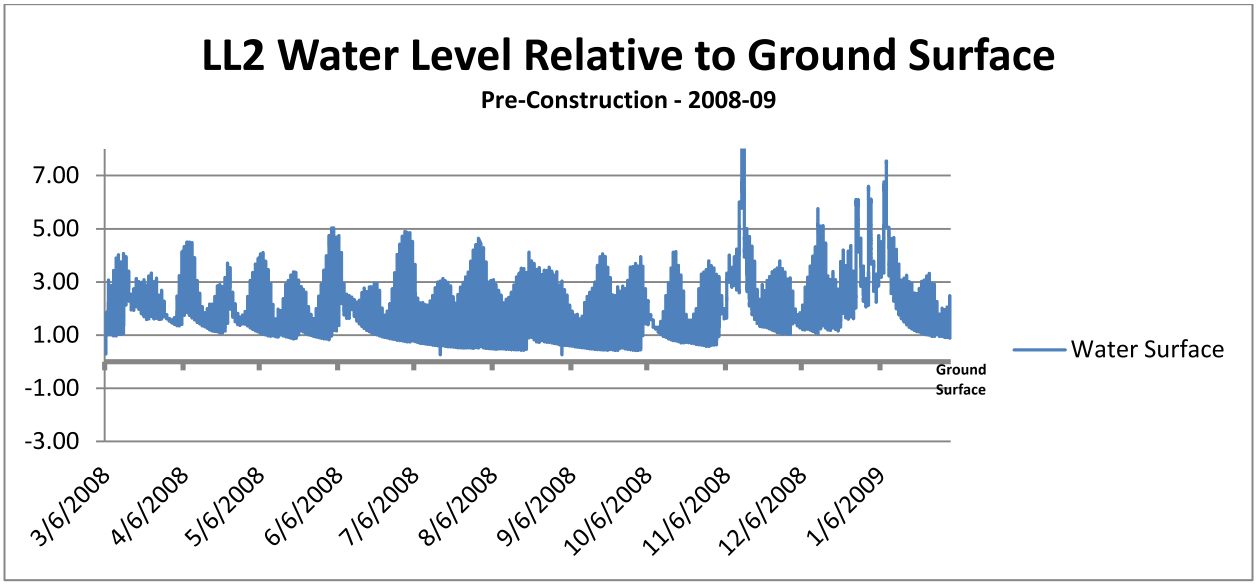

MW12 Water Level Relative to Ground Surface

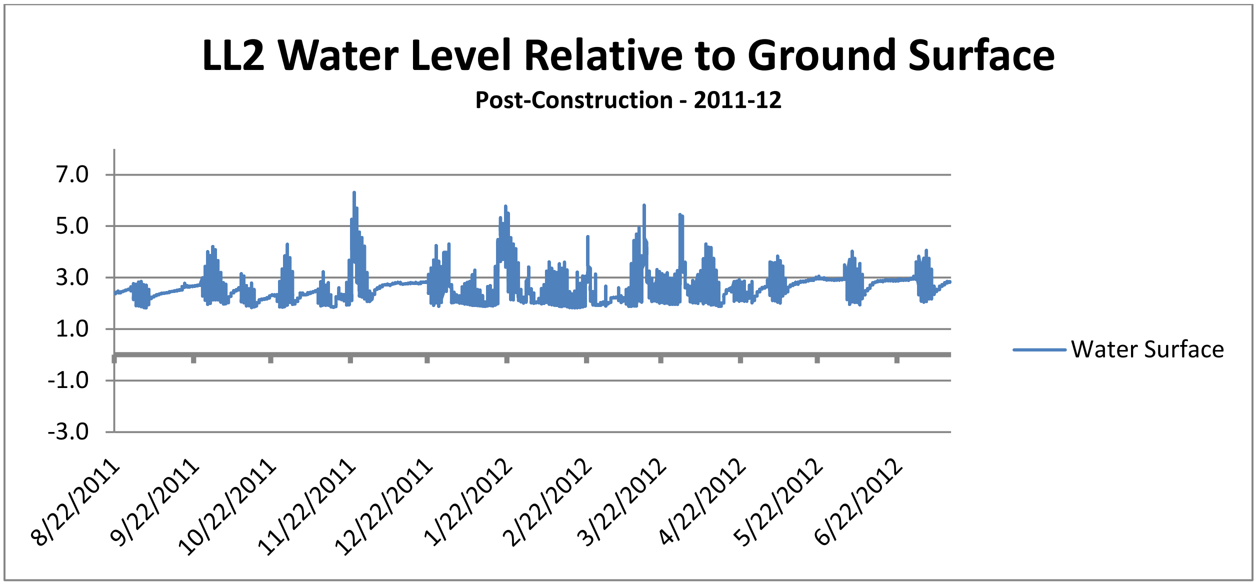
Post-Construction - 2011-12


MW12 Water Level Relative to Ground Surface

Post-Construction - 2012-13

Figure 4. Continued





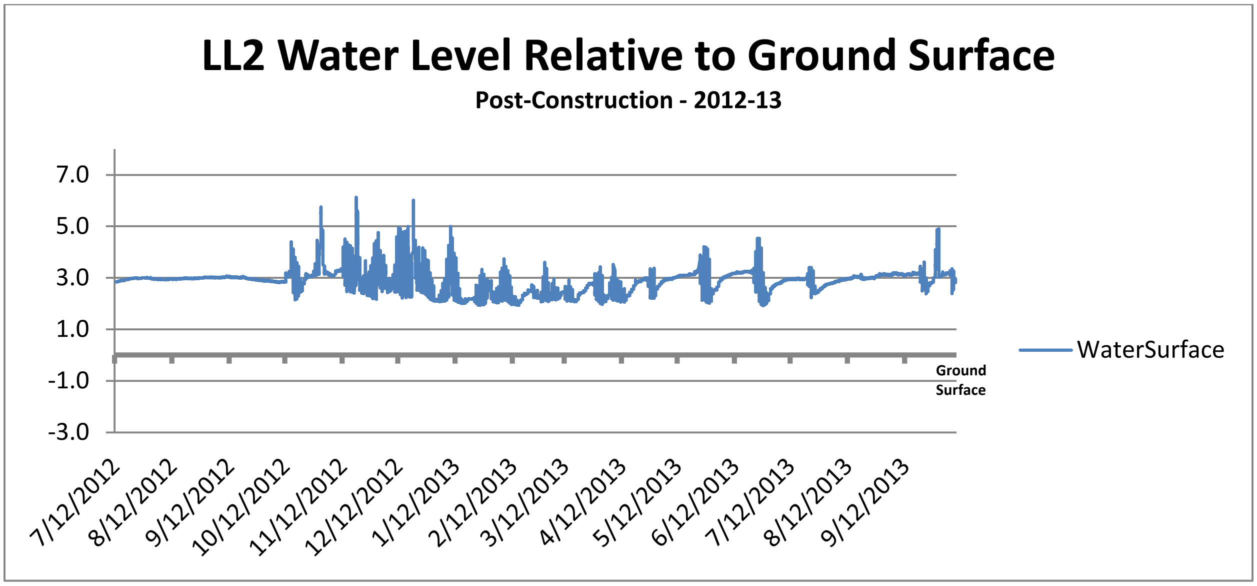


Figure 5. Aerial photograph of Miami Wetlands Restoration Project site depicting locations of post-construction, in-channel, water quality monitoring station.

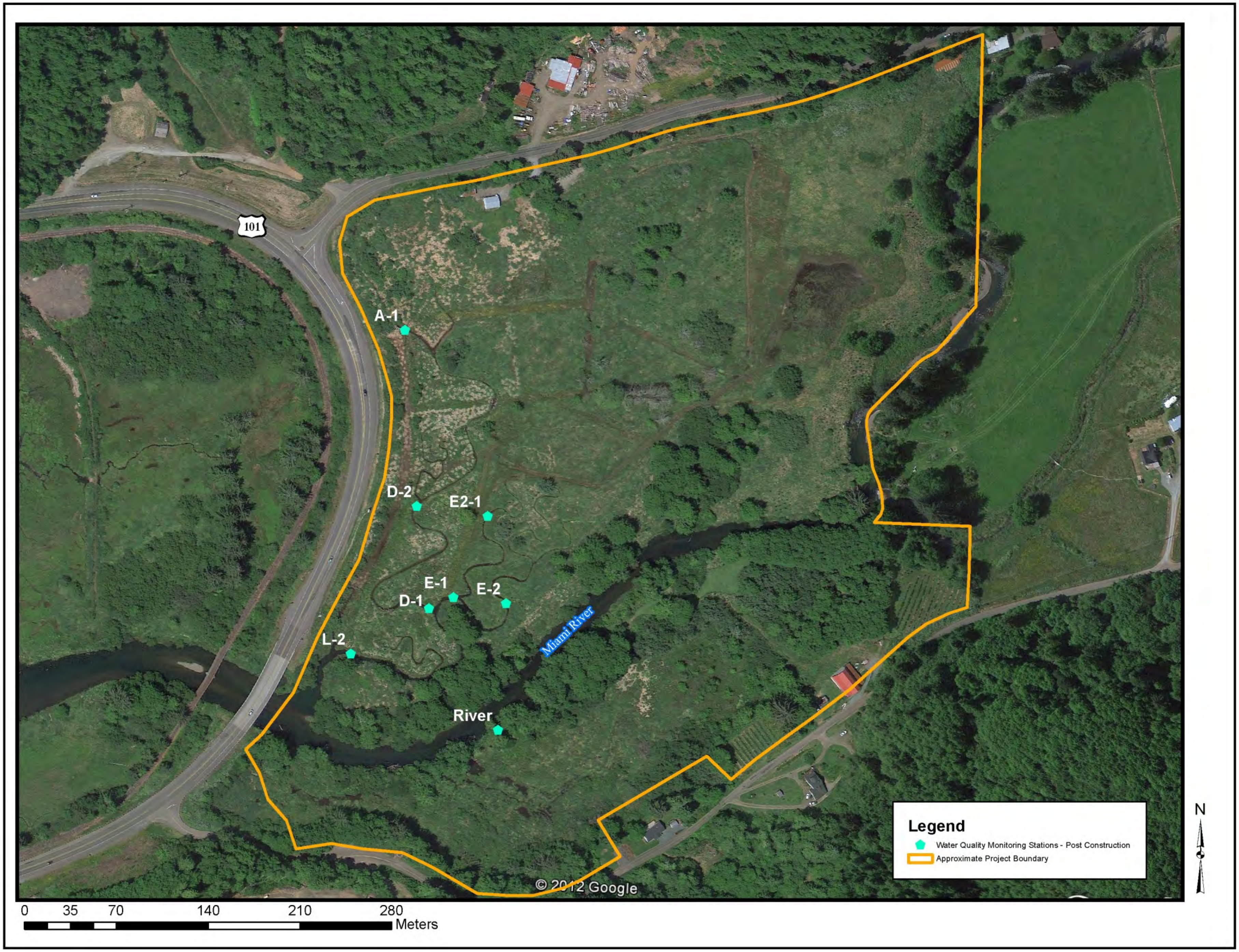


Figure 6. Graphs depicting in-channel dissolved oxygen data collected at the Miami Wetlands Project Site during summer 2013. Station locations are depicted on Figure 5.

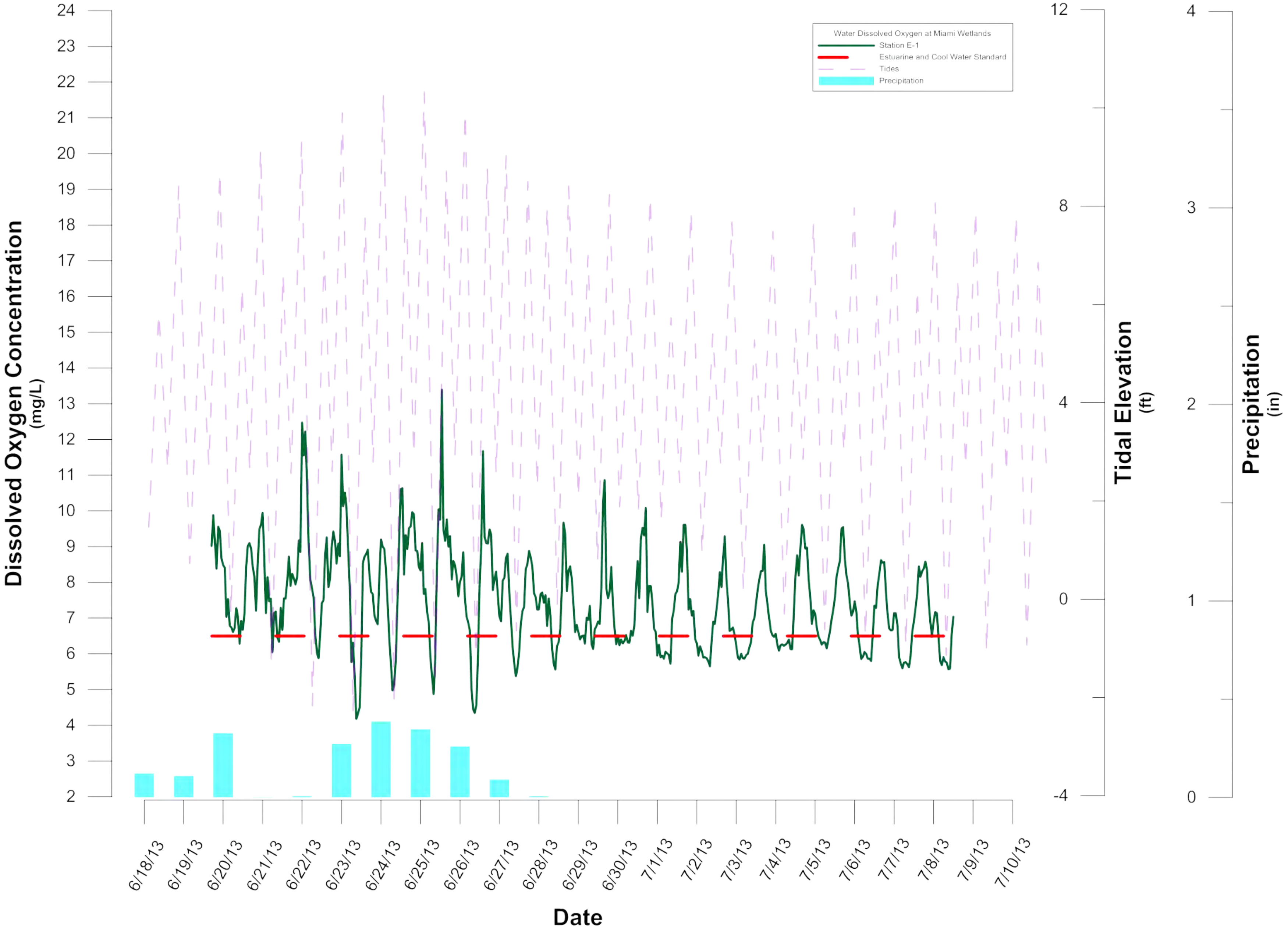
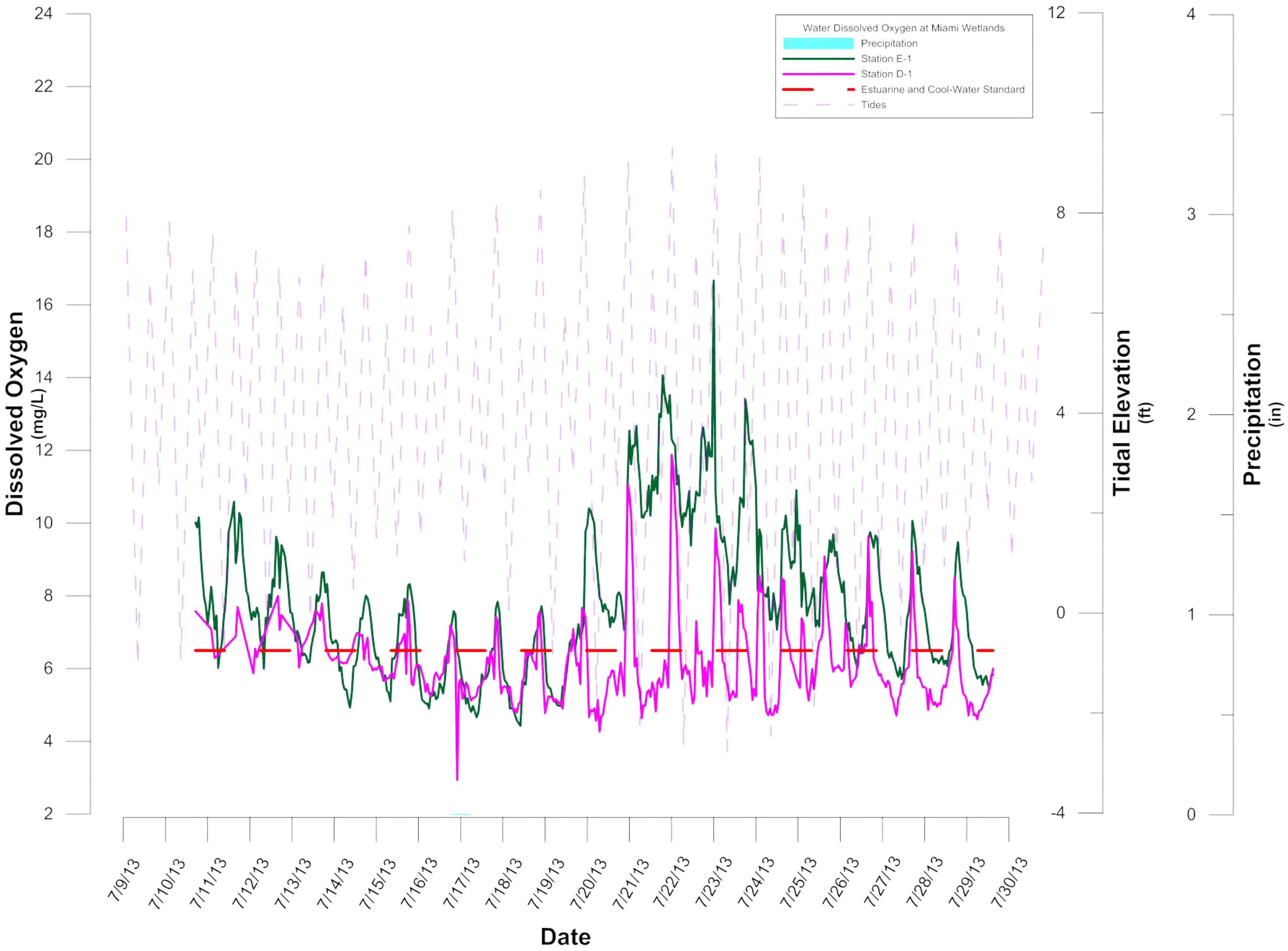


Figure 6. Continued



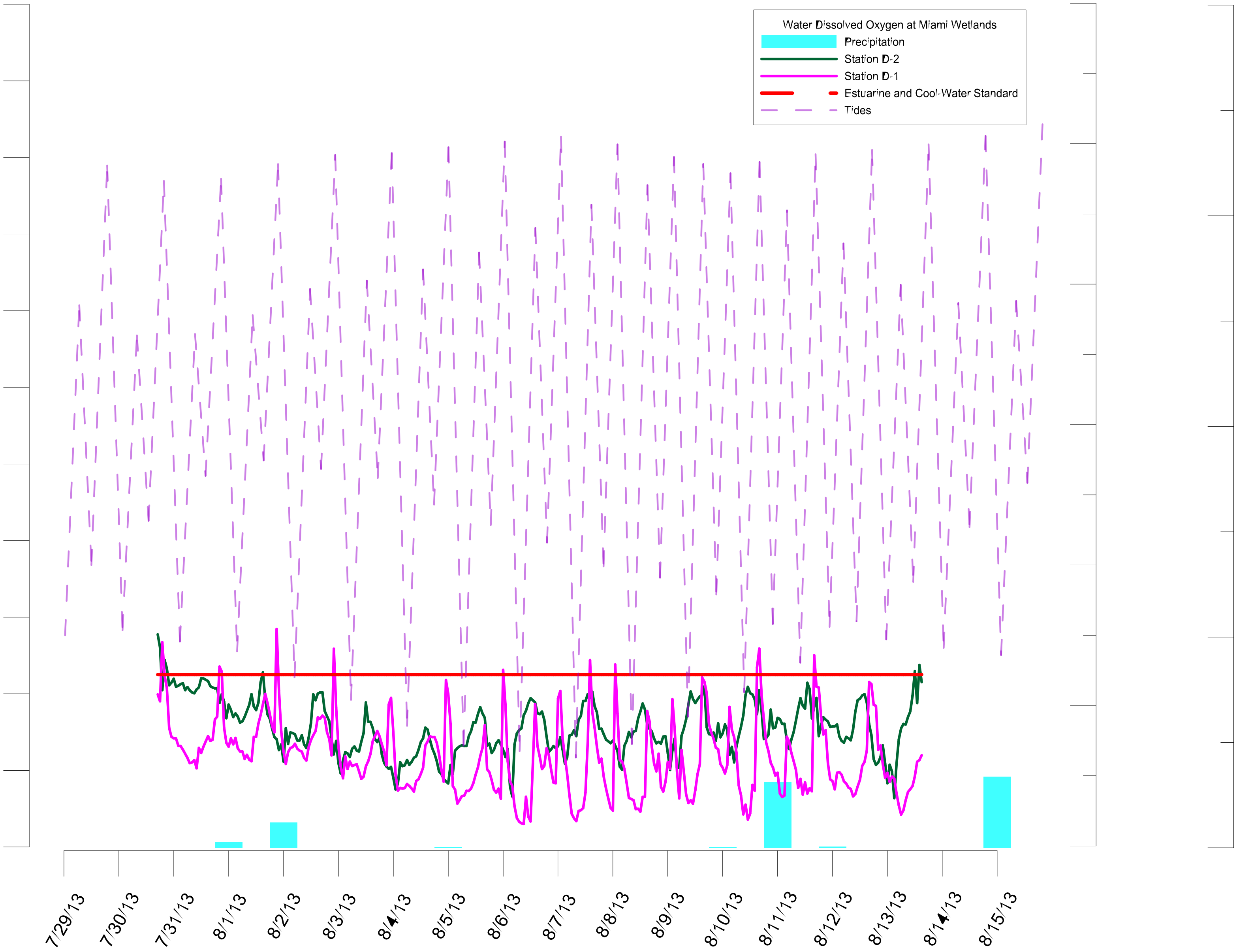

Water Dissolved Oxygen at Miami Wetlands
Precipitation
Station D-2
Station D-1
Estuarine and Cool-Water Standard
Tides
7/29/13
7/30/13
7/31/13
8/1/13
8/2/13
8/3/13
8/4/13
8/5/13
8/6/13
8/7/13
8/8/13
8/9/13
8/10/13
8/11/13
8/12/13
8/13/13
8/14/13
8/15/13

Figure 6. Continued

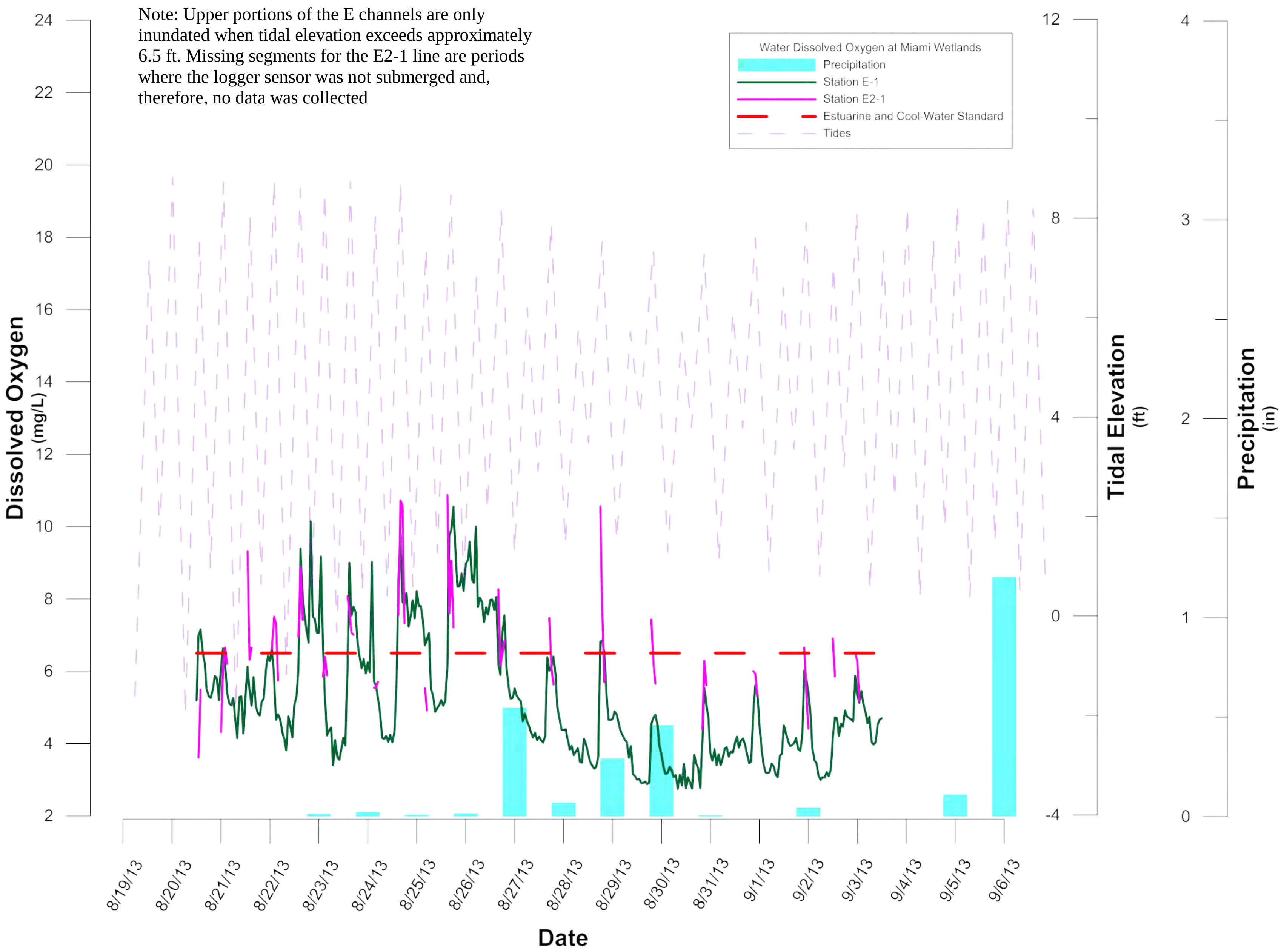


Figure 6. Continued

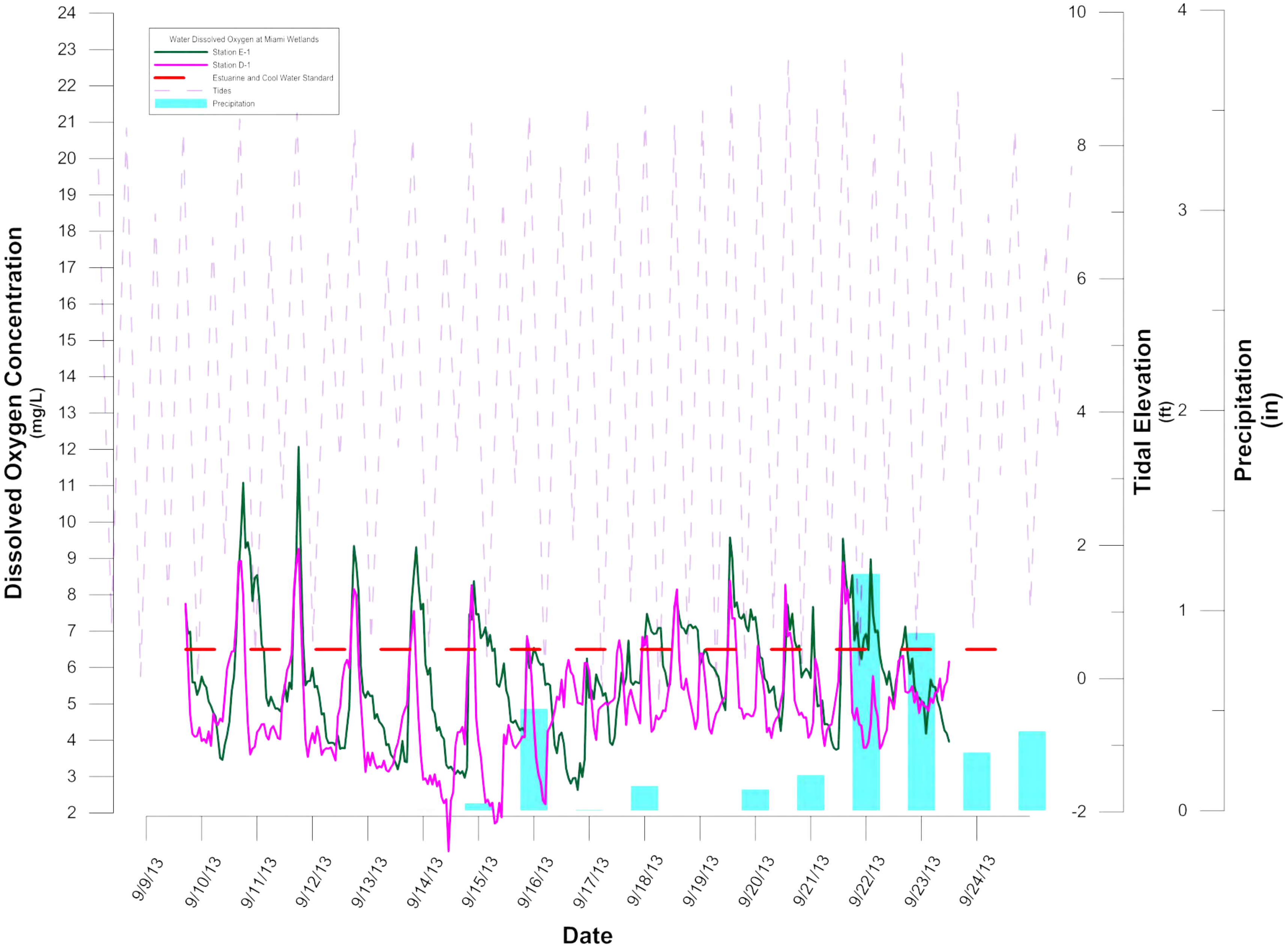


Figure 6. Continued

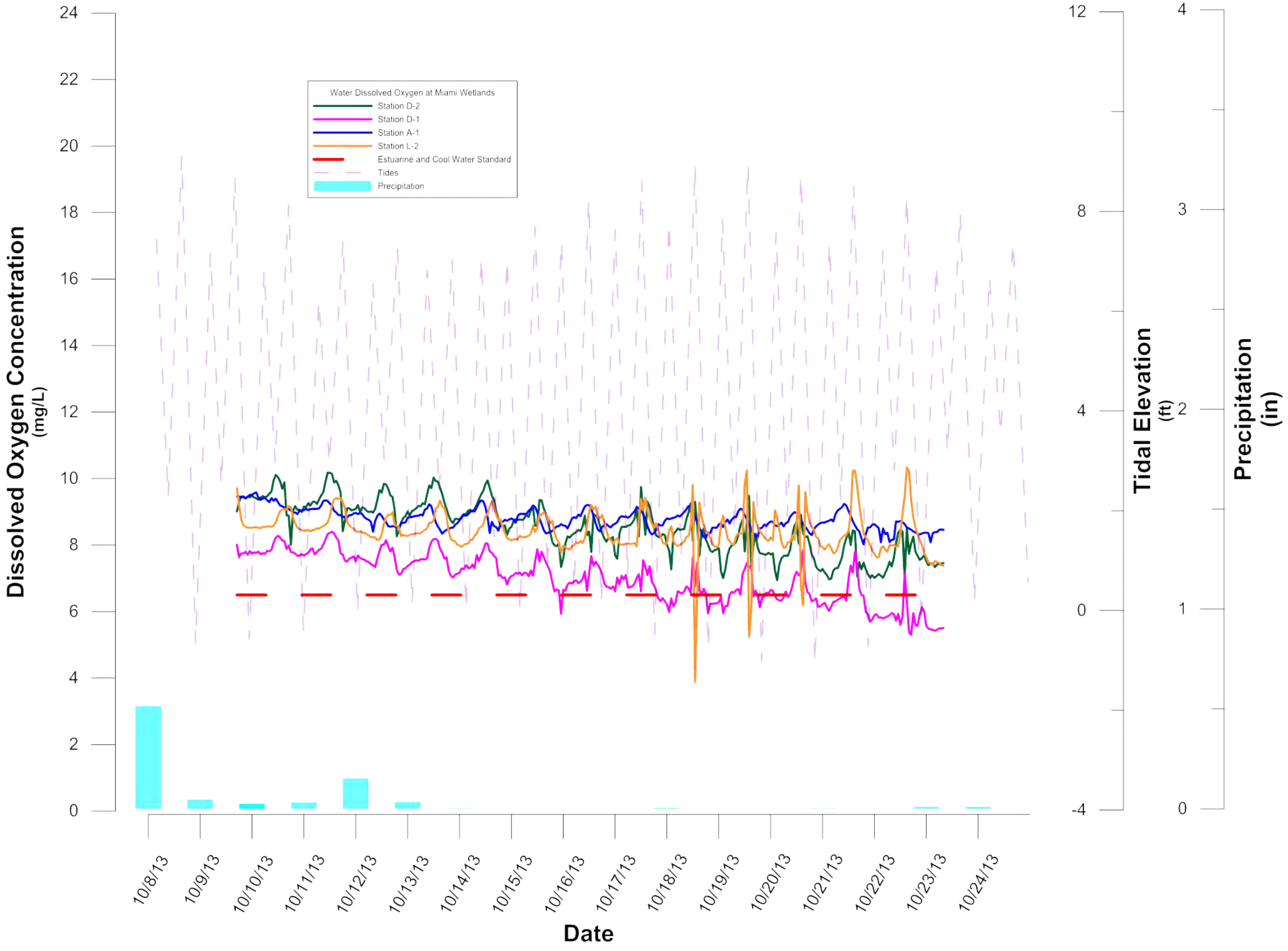


Figure 7. Graphs depicting in-channel water temperature data collected at the Miami Wetlands Project Site during summer 2013. Station locations are depicted on Figure 5.

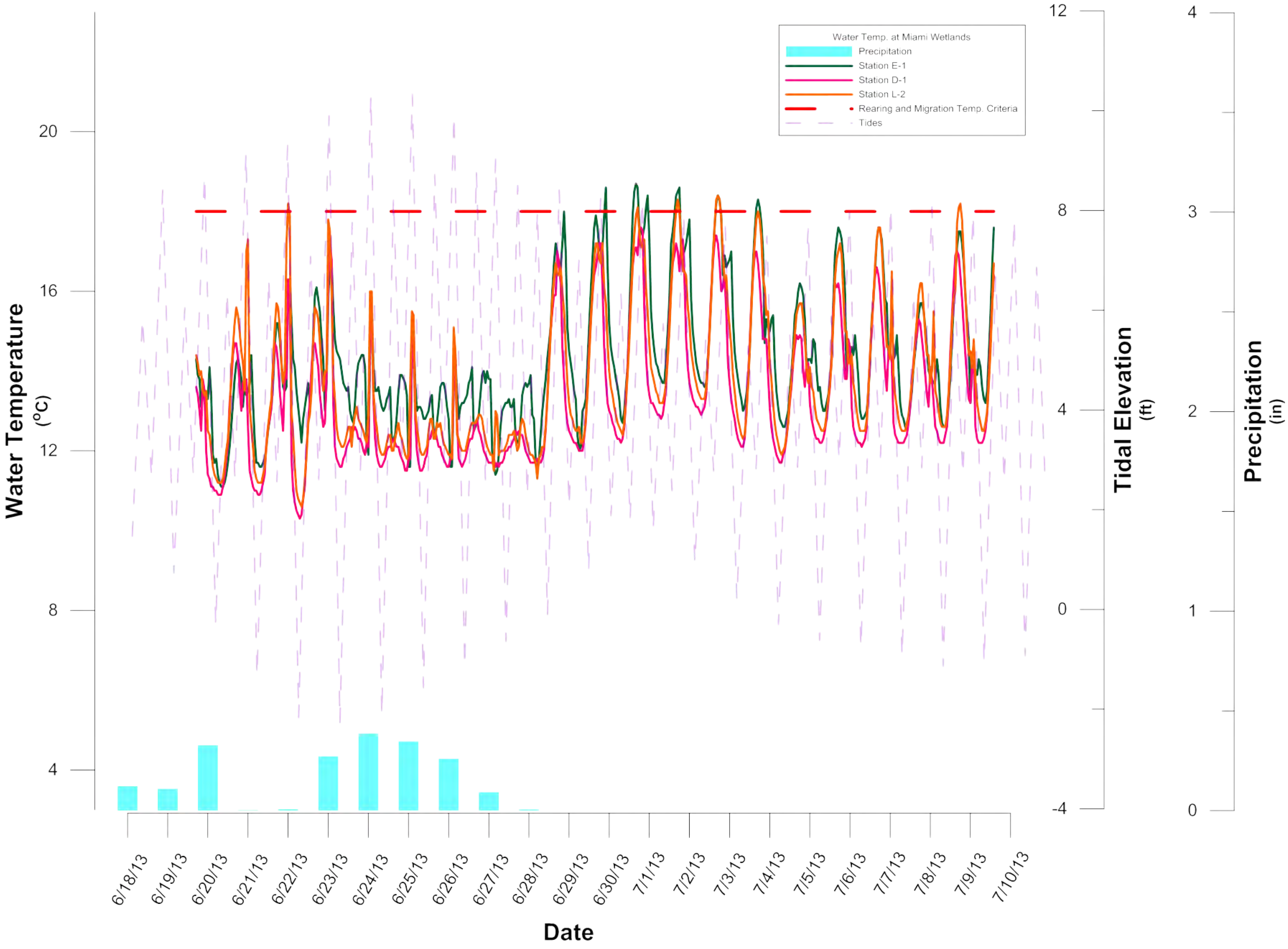


Figure 7. Continued

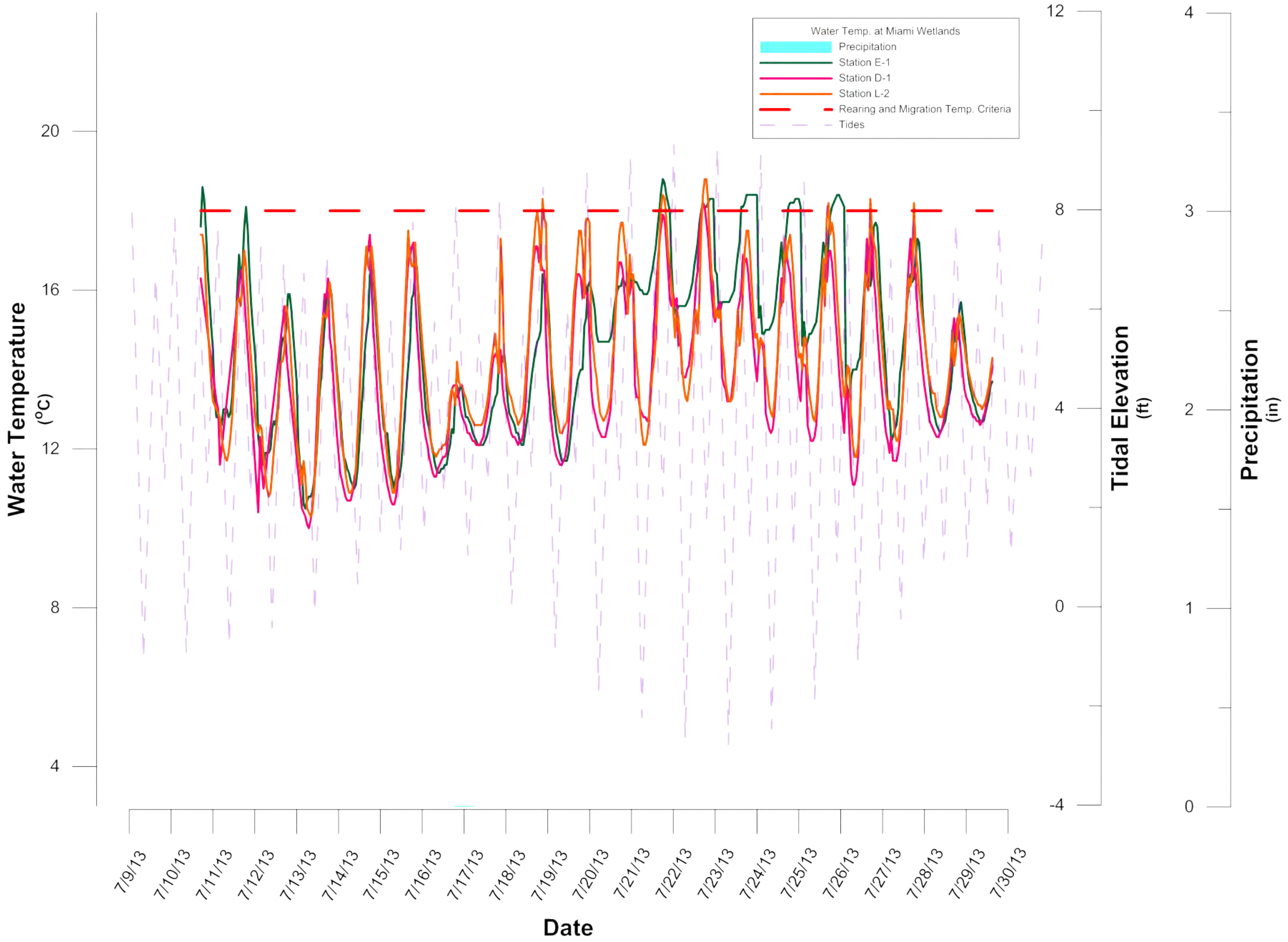


Figure 7. Continued

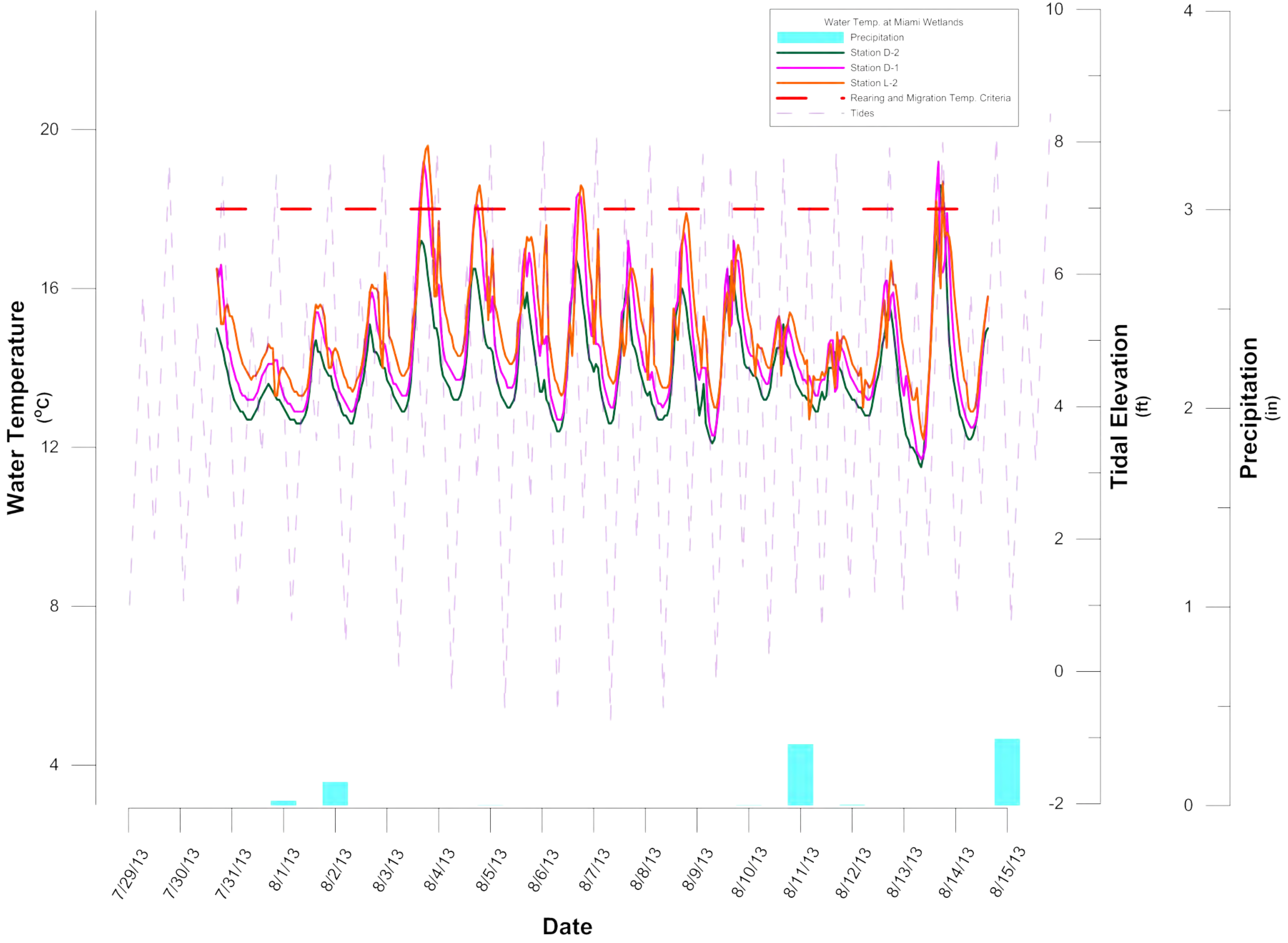
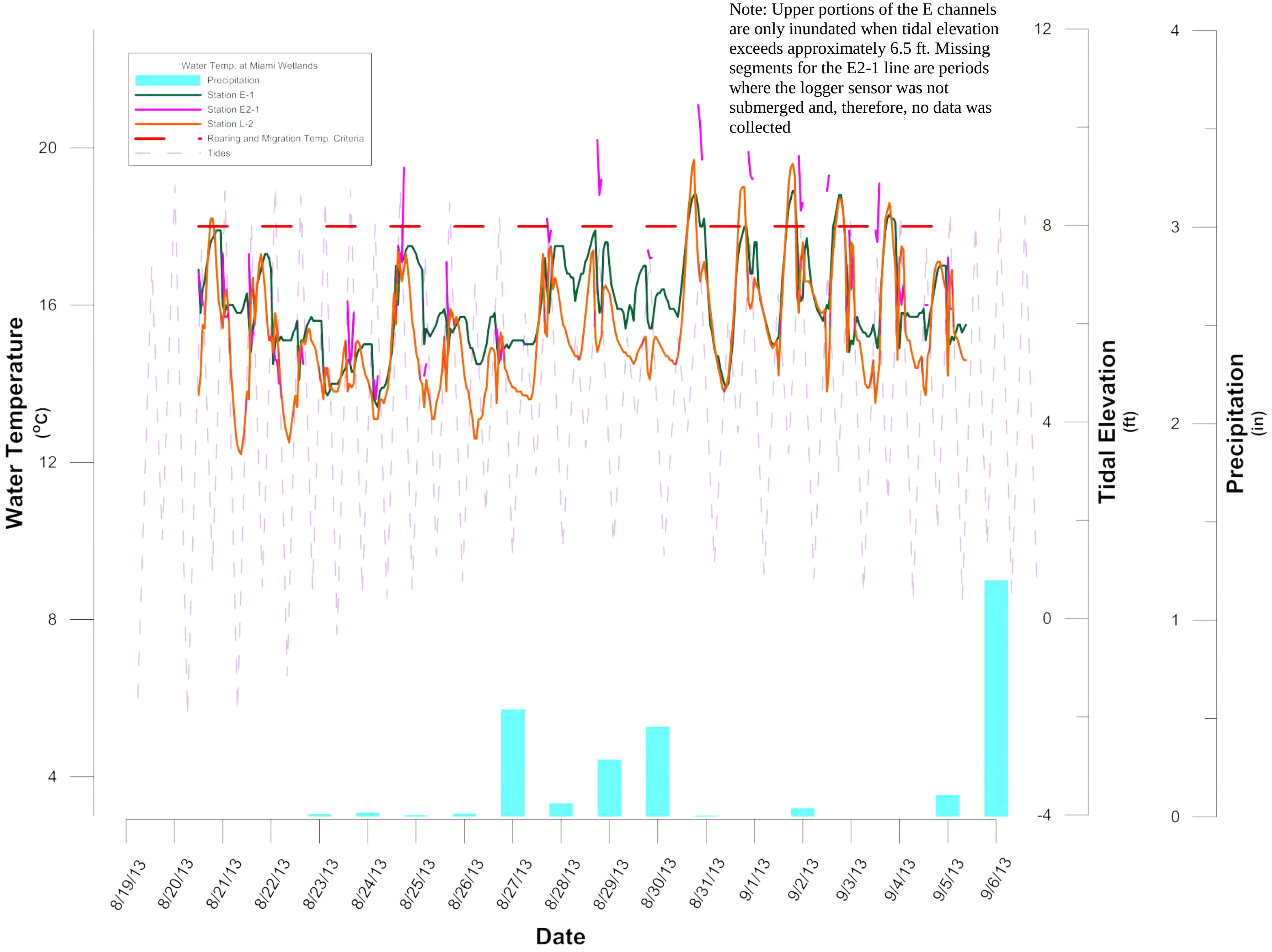


Figure 7. Continued



Note: Upper portions of the E channels are only inundated when tidal elevation exceeds approximately 6.5 ft. Missing segments for the E2-1 line are periods where the logger sensor was not submerged and, therefore, no data was collected

Figure 7. Continued

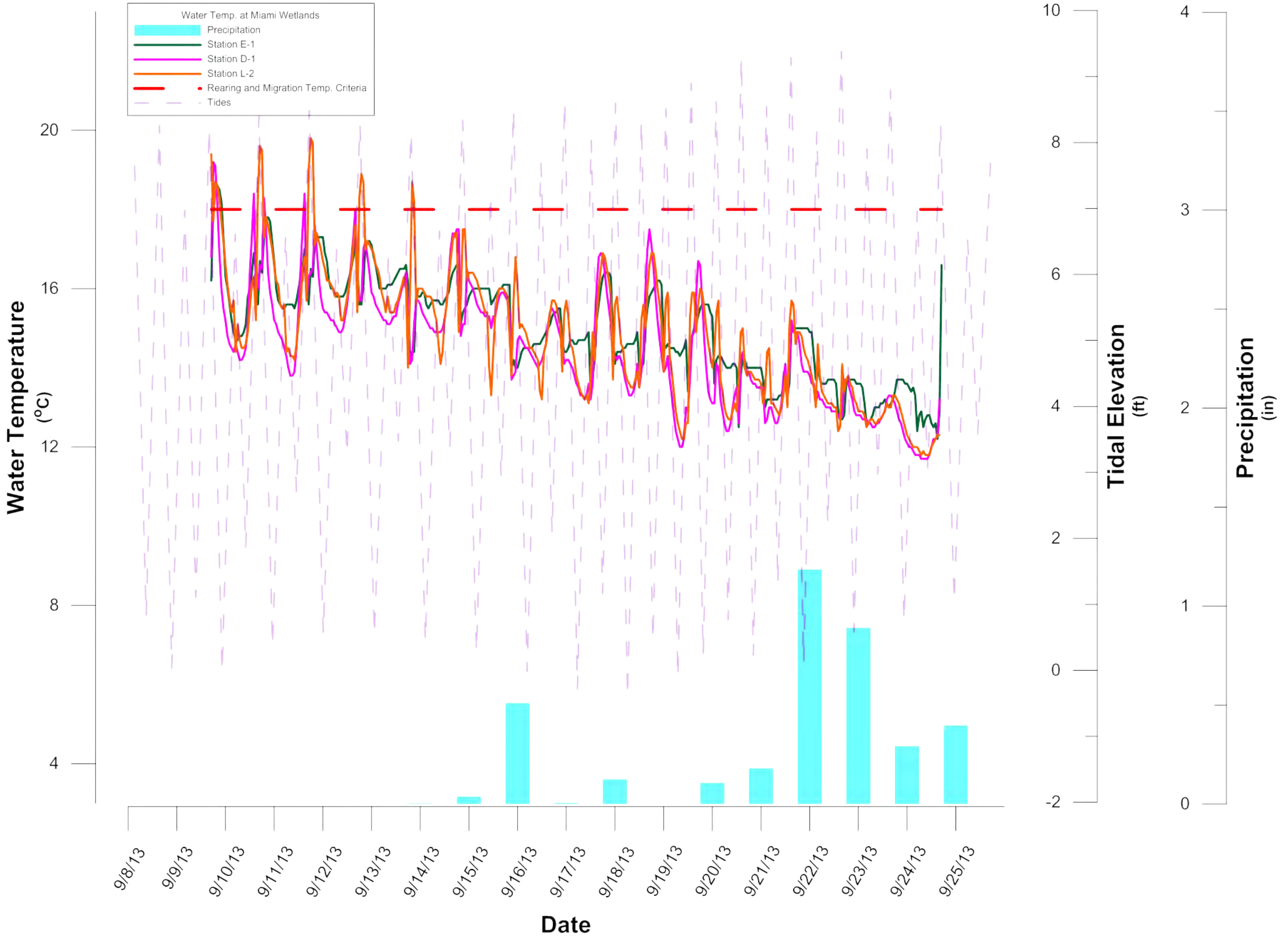


Figure 7. Continued

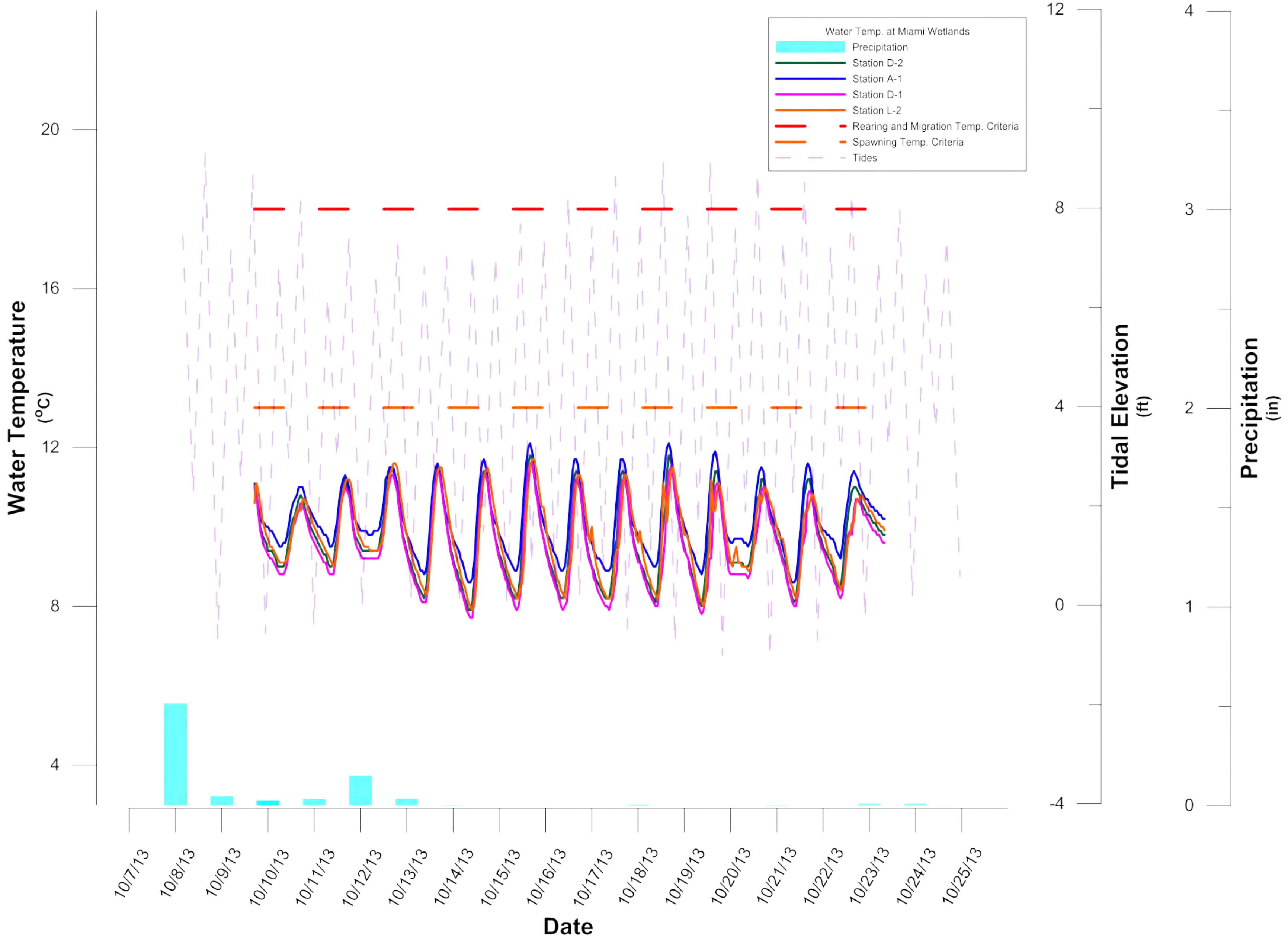
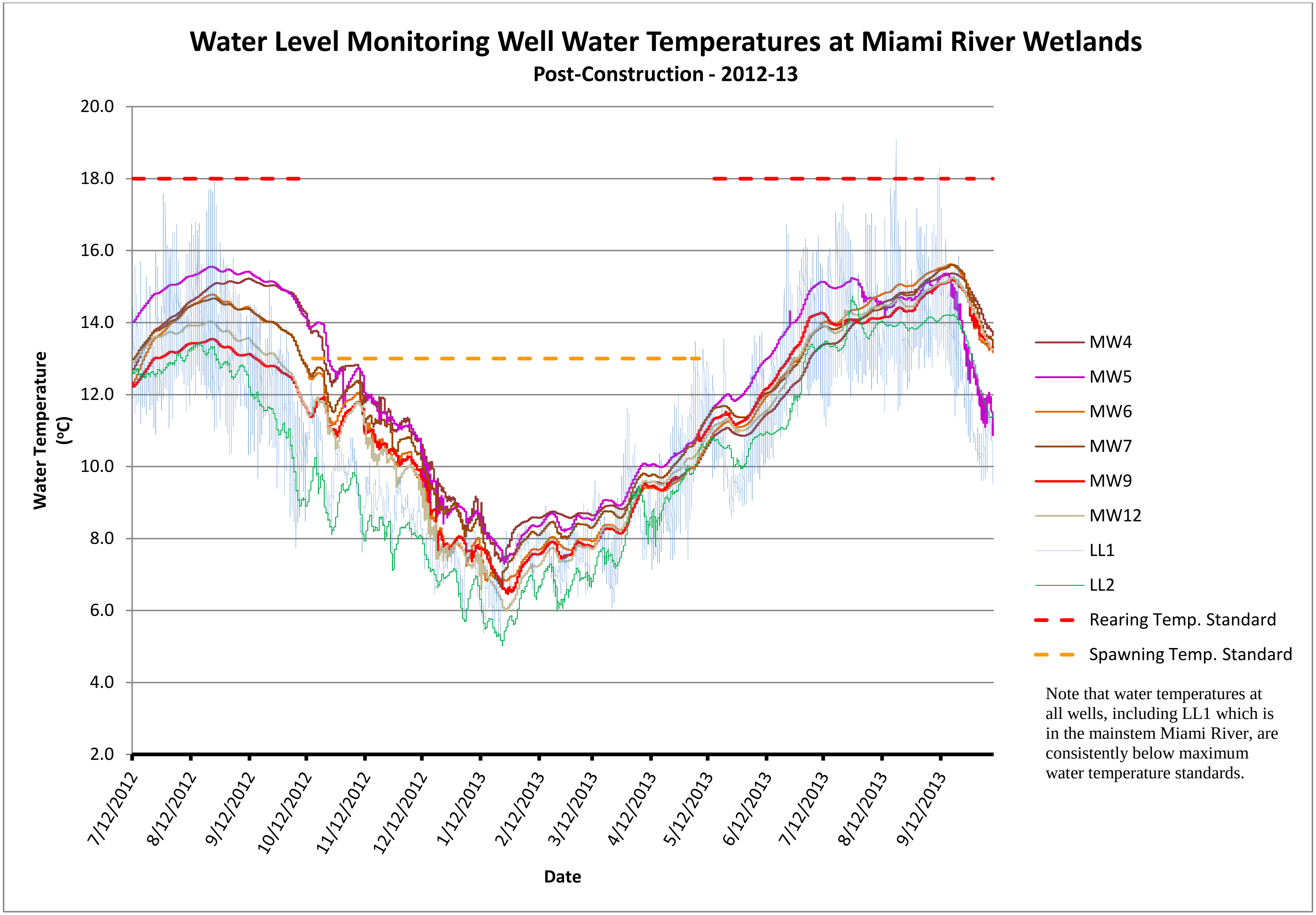


Figure 8. Graph depicting water temperature data collected at water level monitoring wells at the Miami Wetlands Project Site during 2012-13. Station locations are depicted on Figure 3.



Note that water temperatures at all wells, including LL1 which is in the mainstem Miami River, are consistently below maximum water temperature standards.

Figure 9. Graphs depicting in-channel water conductivity data collected at the Miami Wetlands Project Site during summer 2013. Station locations are depicted on Figure 5.

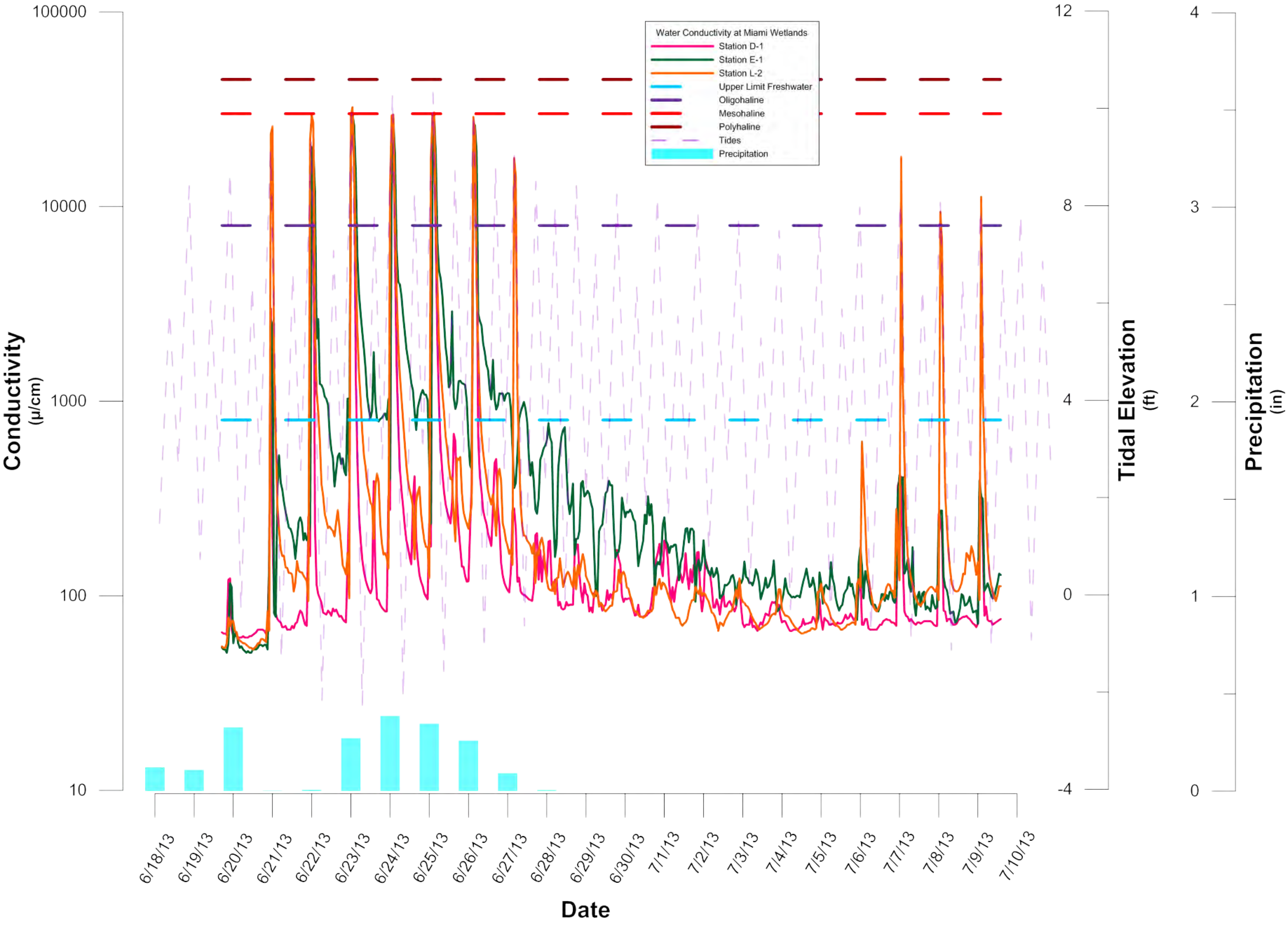


Figure 9. Continued

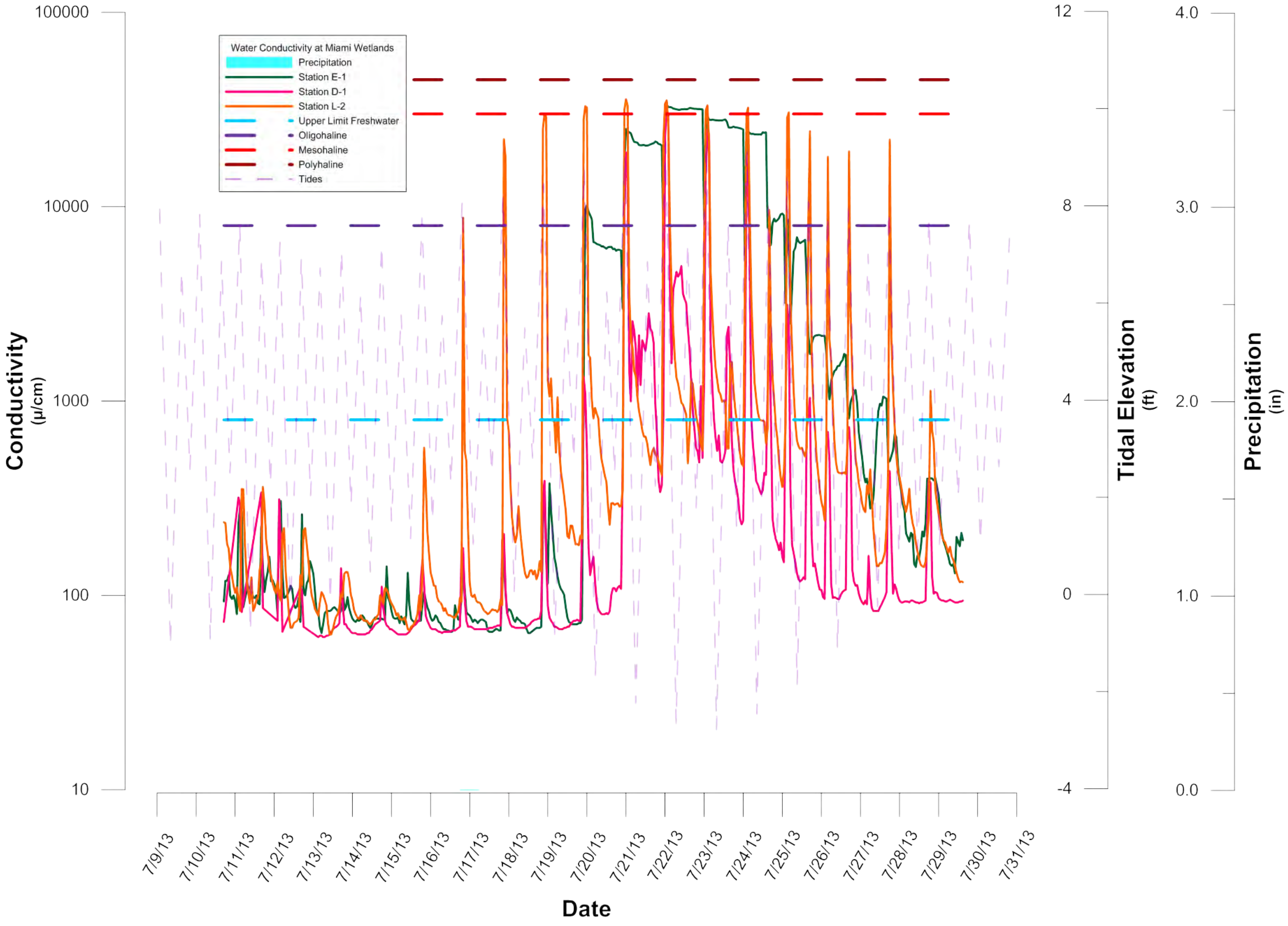


Figure 9. Continued

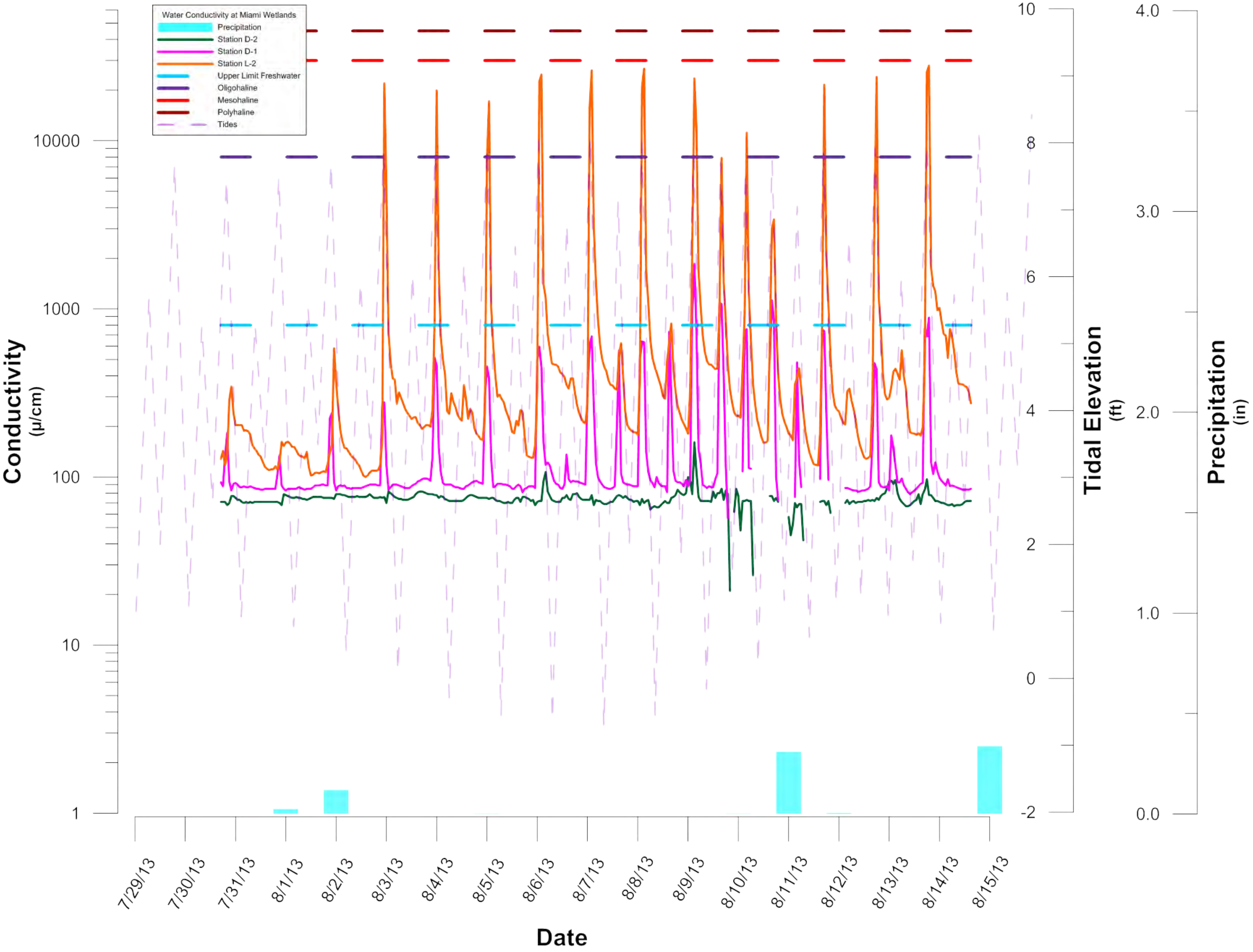
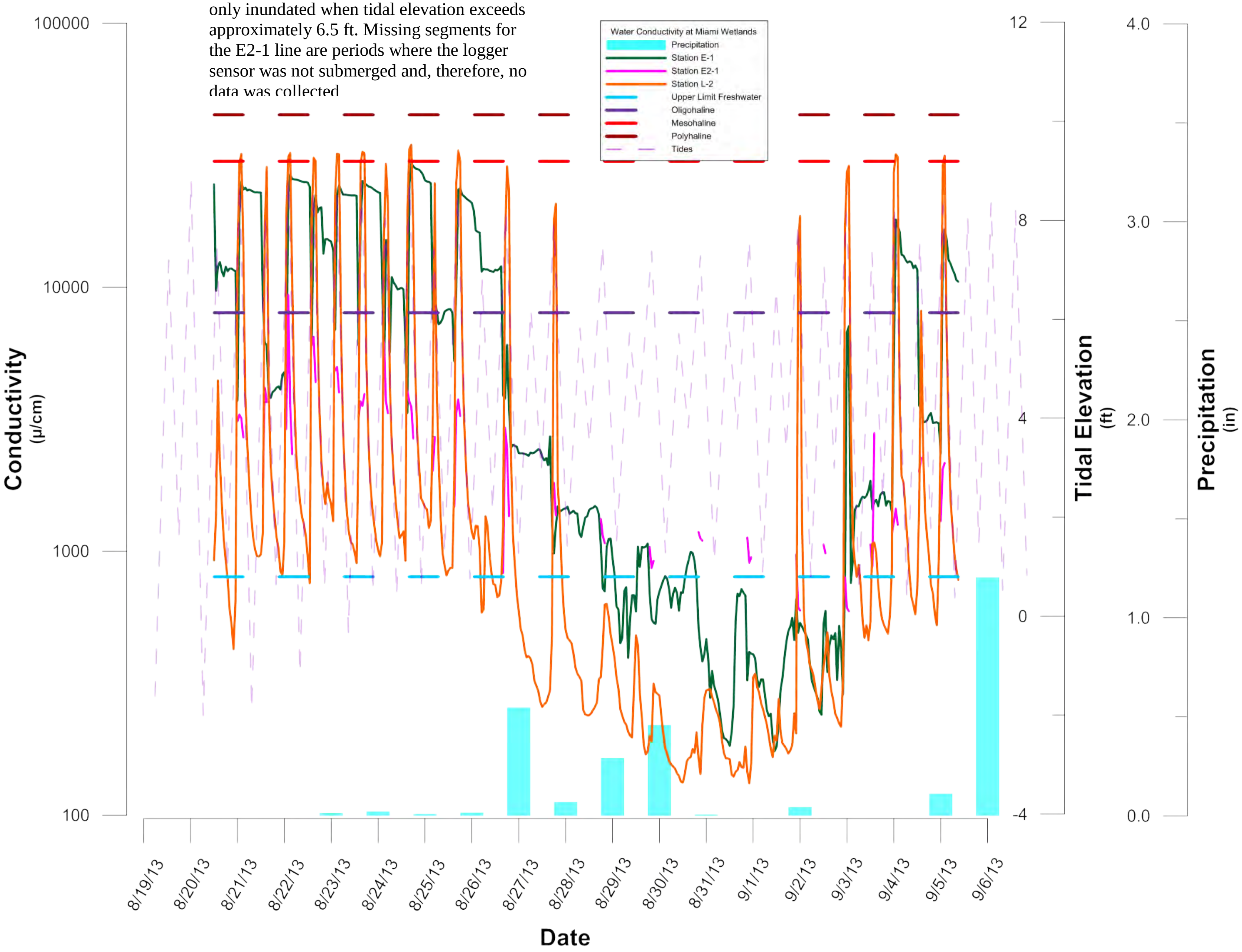


Figure 9. Continued



Note: Upper portions of the E channels are only inundated when tidal elevation exceeds approximately 6.5 ft. Missing segments for the E2-1 line are periods where the logger sensor was not submerged and, therefore, no data was collected

Figure 9. Continued

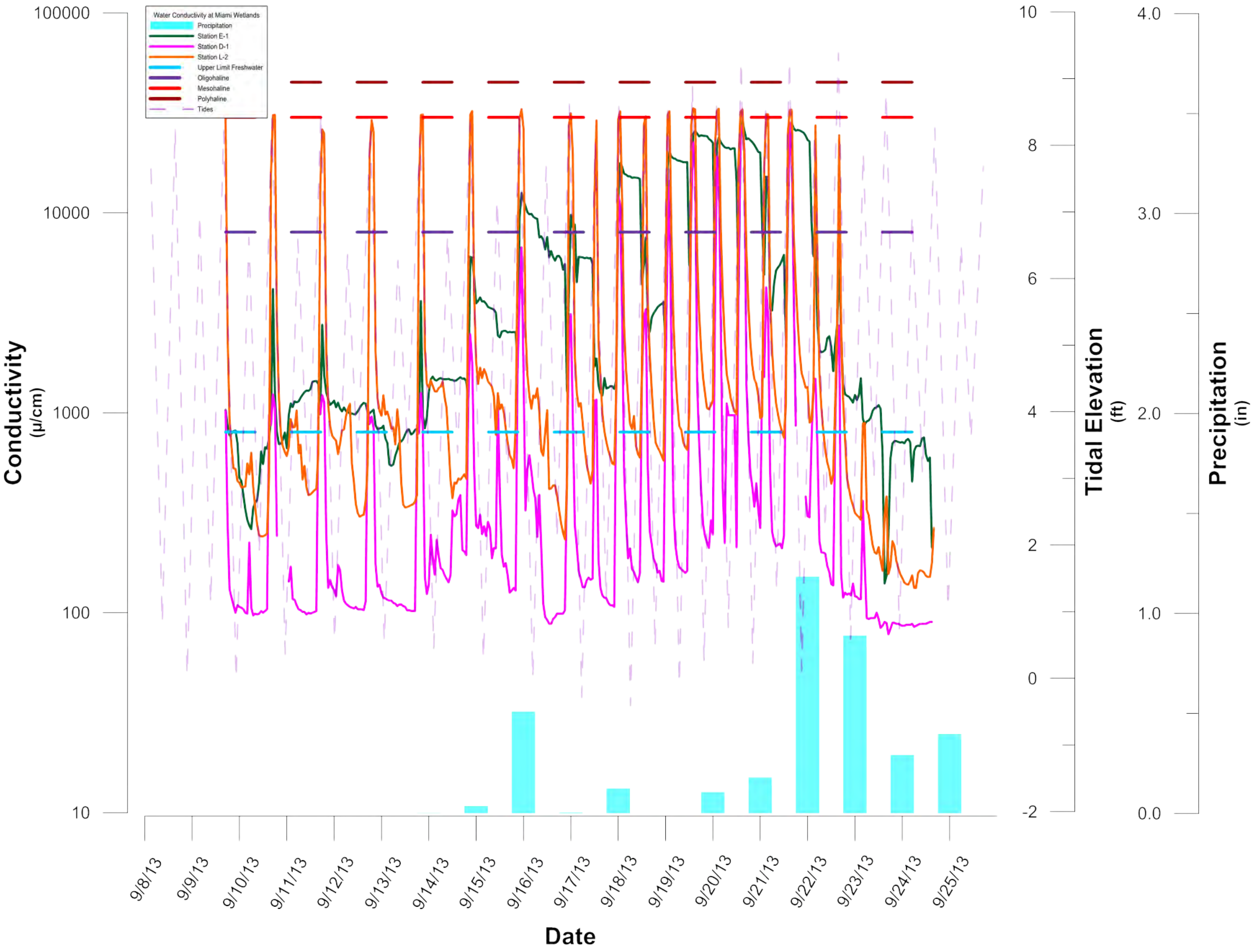


Figure 9. Continued