Appendix 5-1: Annual Permit Report for the Loxahatchee River Watershed Restoration Project, G-160 and G-161 Components

Permit Report (January 1, 2012–December 31, 2012)
Permit Numbers: EI 50-0128848 and EI 50-0244327

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SUMMARY

Based on Florida Department of Environmental Protection (FDEP) permit reporting guidelines, **Table 1** lists key permit-related information associated with this report. **Table 2** lists attachments included with this report. **Tables A-1** and **A-2** in Attachment A list the specific pages, tables, and graphs, and attachments where project status and annual reporting requirements are addressed. This annual report satisfies the reporting requirements specified in the latest modified permit.

Table 1. Key permit-related information.

Project Name	G-160 / G-161
Permit Number	EI 50-0128848 and EI 50-0244327
Issue and Expiration Dates Permit #: EI 50-0128848 Permit #: EI 50-0244327	 Issued: 3/7/2003; Expires: N/A (in Operation Phase) Issued: 5/15/2006; Expires: N/A (in Operation Phase)
Project Phase	Operation
Permit Specific Condition Requiring Annual Report	10
Relevant Period of Record	January 1, 2012–December 31, 2012
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Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Water Quality Data
C	Hydrologic Data
D	Loxahatchee Slough Restoration and G-160 Monitoring Plan, Fourth Post-Operational Field Based Vegetation Monitoring Report
E	After-Action Report from the City of West Palm Beach

INTRODUCTION

Environmental Resource Permits EI 50-0128848 and No. EI 50-0244327 issued by the Florida Department of Environmental Protection (FDEP) to the South Florida Water Management District (District or SFWMD) authorized the District to construct and operate the C-18 Canal Control Structure (G-160) Project and the G-161 Water Control Structure Phase II Project. Modified Specific Conditions 7 and 10, respectively, require the District to submit an annual report within 75 days of the end of each year of operation. The reporting period for this report is Calendar Year 2012 (January 1, 2012–December 31, 2012). Because both structures are able to be operated concurrently and are designed to restore a more natural hydroperiod to the Loxahatchee Slough while increasing the flows to the Northwest Fork (NW Fork) of the Loxahatchee River, the two reports are unified into this single document. This G-160/G-161 Projects Annual Report presents the results of the permit-mandated monitoring for the G-160 and G-161 structures during Operation Year 2012 (January 1, 2012–December 31, 2012).

The G-160 structure allows stages in the C-18 canal to be increased in accordance with specific hydraulic conditions and zones to meet the recommended target stages within the Loxahatchee Slough that are necessary to maintain the ecological integrity of the slough vegetative communities. The Loxahatchee Slough is a historical tributary component to the Loxahatchee River, providing important base and wet season flows. When supplemental water is available from the CERP project, G-160 will allow the maintenance of a permanent water pool in the Loxahatchee Slough, between 15.5 and 17.5 feet National Geodetic Vertical Datum (ft NGVD of 1929), with maximum water levels up to 17.8 ft NGVD for rainfall driven conditions. The structure is to be effectively operated so that during rainfall events, when stages upstream of the G-160 structure rise to elevation 16.8 ft NGVD, the structure is opened to allow the stages to recede and is closed once they reach an elevation of 16.2 ft NGVD. Gradual reduction of the stage upstream of G-160 should occur through the dry season to compensate for gradual drawdown of the slough to 15.5 ft NGVD toward the end May.

The G-161 structure allows water to be released from the Grassy Waters Preserve (GWP) under Northlake Boulevard into a constructed flow-way through the triangle formed by the area to the west of the intersection of Northlake Boulevard and Beeline Highway (SR 710). The water flows northward to a culvert that discharges under Beeline Highway to the C-18 Canal upstream of G-160.

The Environmental Resource Permit issued by the FDEP to the co-permittees, the District and Palm Beach County, for the construction and operation of the G-160 structure requires hydrologic and vegetation monitoring (vegetation monitoring is only required in the Loxahatchee Slough). The G-161 structure Environmental Resource Permit (ERP) issued by the FDEP to the co-permittees, the District and City of West Palm Beach requires water quality, stage, and flow monitoring, as well as an expansion of the G-160 vegetation monitoring program into areas potentially impacted by the operation of the G-161 Project. Collectively, this report focuses on the monitoring outlined in the 5-Year Operation Monitoring Plan (Plan) for the G-161 Water Control Structure Phase (G-161 Project) to implement Specific Condition 9 (I)–(IV) of permit EI 50-0244327. The G-160 vegetation monitoring report, prepared separately by the Palm Beach County Department of Environmental Resources Management, is also included with this report as **Attachment D**.

The purpose of the G-161 monitoring program is to evaluate the results of the G-161 Project in achieving the desired objectives of restoring a more natural hydroperiod and flow to downstream wetlands, sloughs, ponds, floodplains, and rivers, without impacting water quality relative to baseline conditions. It is also anticipated that restoring a more natural timing, magnitude, duration, and frequency of flow in the downstream flowing waters will also restore a

more natural salinity gradient in the downstream system, with associated benefits for estuarine and marine flora and fauna. However, contribution of the G-161 Project to the restoration of natural hydroperiod to this system, individually or together with the related G-160 Project, is constrained by regional water availability. Operating schedules may still be controlled or influenced by other local government regulations or permits. Full benefits of the G-160 and G-161 structures are not anticipated to be realized until regional water is available in amounts adequate to provide restorative flows to the NW Fork of Loxahatchee River.

To the extent practicable and appropriate, the G-161 Project monitoring program is carried out in coordination with the adjacent G-160 Project using the same methods, procedures, and reporting format. This is intended to ensure comparability of results and continuity of data interpretation, while avoiding duplicative efforts.

Specifically, the Monitoring Plan provides for the following:

1. Continuous water level monitoring during operations at locations upstream and downstream of the G-161 structure via stage gauges with telemetry to support the calculation of the flow rate through the G-161 structure
2. Expansion of the wet and dry season ground-level vegetation monitoring in Loxahatchee Slough under the G-160 ERP into the wetland areas of interest to evaluate the effect of project-related hydrological changes on the vegetation community
3. Upland, wetland, and aquatic wildlife observations incidental to ground-level vegetation monitoring
4. Monthly water quality monitoring during periods of flow via grab sampling upstream of the G-161 structure and the Control 2 Pump Station to evaluate the status of and trends in post-operational water quality relative to pre-operational baseline

The permit requires monitoring in areas that are expected to have an altered or enhanced hydroperiod as a result of regular operation of the G-161 structure. The District has monitored stage and flow per G-161 ERP Specific Condition 9(I) and monthly water quality monitoring per 9(IV) on the few occasions over the last four years when water was flowing through the G-161 structure. However, the general lack of availability of regional water has precluded regular operation of the G-161 structure. Consequently, the co-permittees have been unable to monitor interior stages per 9(II), or vegetation per 9(III), and it was not possible to associate long-term changes in water stage, flow, or quality or vegetation in potentially impacted areas. Altered or enhanced hydroperiods have not been realized. In 2012, the L-8 Reservoir was identified as a key component in the Restoration Strategies Regional Water Quality Plan, to be used as a Flow Equalization Basin (FEB) for the eastern flow path to improve water quality discharged to the Everglades Protection Area. Prior to the completion of the eastern flow path projects, water deliveries are expected to be available from the reservoir to the Loxahatchee River, however alternative storage sites will need to be identified to provide a more permanent source of regional water. Until alternative storage sites are identified and able to consistently deliver water from the regional system to maintain hydroperiod depths and durations as well as provide restorative flows to the river, it is unlikely that significant vegetative changes or changes in wildlife usage will be realized.

MONITORING STATION LOCATIONS

Table 3 summarizes the locations of the water quality and flow monitoring sites used in this report. **Figure 1** shows the monitoring locations in the GWP and Loxahatchee Slough areas. This figure also shows the natural areas to be restored by the operation of these structures in conjunction with the availability of regional water of sufficient quantity and quality to provide for restorative flows. Other relevant structures and environmental features include the G-92 culvert, S-46 spillway, water catchment area (GWP), Loxahatchee Slough, NW Fork of the Loxahatchee River, and Loxahatchee Estuary.

Table 3. G-160/161 monitoring station locations and coordinates.

Station ID	Station Location	Coordinates	
		Latitude	Longitude
G-161	Northlake Boulevard West of SR-710 Outflow for GWP	264836.386	800923.390
G-160	C-18 Canal Loxahatchee Slough	265245.8	801035.6
S-46	Coastal Structure on the C-18 Canal	265603.203	800830.147
L8.M CNL	City of West Palm Beach Control 2 Pump Station on M-Canal	264519.710	802044.450

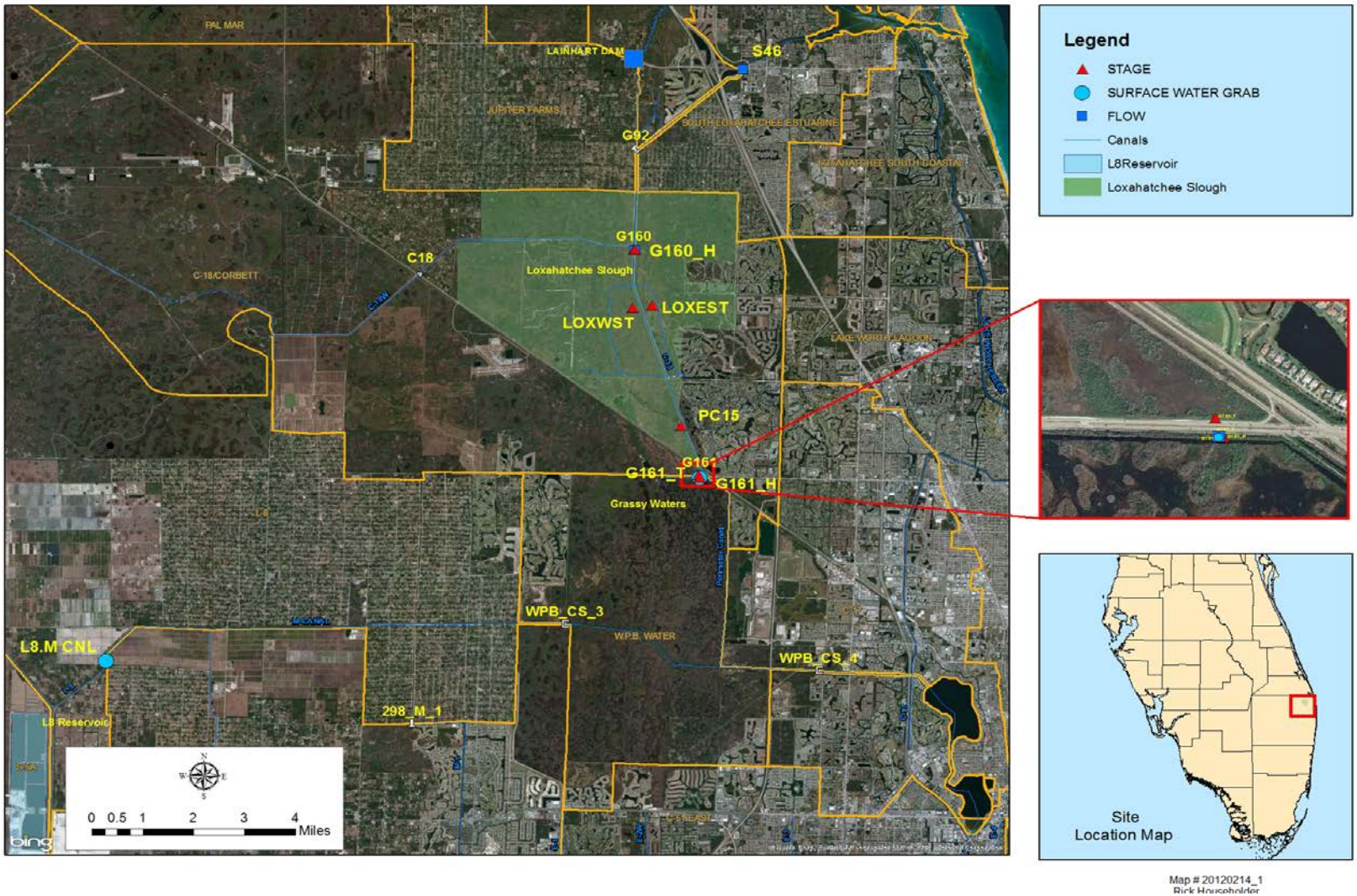


Figure 1. Location of G-160/161 monitoring sites.

2012 OPERATION OF G-160, G-161, AND S-46

In 2009, the FDEP directed the SFWMD to begin incrementally raising the G-160 structure in compliance with the interim operating plan that was component to the permit. The SFWMD responded by indicating that the G-160 headwater would be increased to 16.5 ft NGVD at the beginning of the 2009 wet season. The District also agreed to install and monitor seepage wells adjacent to the communities for a period of two years following the increase in stage to determine if seepage concerns were valid. The representative agencies (SFWMD, Northern Palm Beach County Improvement District, Southern Indian River Water Control District, and City of Palm Beach Gardens) met over several months in late 2009 to determine the location and number of wells to be installed. As a result, fourteen groundwater monitoring wells were installed (six shallow/deep pairs at strategic locations near community boundaries north of PGA Boulevard and two individual shallow wells in Palm Beach Gardens adjacent to GWP) (see **Figure 2**) between January and March 2010. Data collection began in April 2010, and was completed in March 2013. Analysis of the full data set is underway, and will be incorporated into a draft report to be submitted after a formal review in late September 2013.

The flashboard riser elevations for the project culverts on the east and west sides of the C-18 canal are currently set at 16.9 ft NGVD. In late 2010, slough elevations were at or slightly below the target. Although there were opportunities to lower the boards early in the 2010–2011 dry season to provide supplemental dry season flows to the NW Fork, this would have accelerated the slough drydown and further compromised the slough hydroperiod for the duration of the dry season. Any potential future changes to the operational protocol in the absence of adequate regional water needs to consider maintaining slough levels within the target hydroperiod to the greatest extent possible.

The City of West Palm Beach routinely monitors apple snail (*Pomacea* sp.) populations; however, because of the lack of regional water availability, which has resulted in inconsistent and irregular operation of the G-161 structure, vegetation plot data were not collected by the city during this reporting period because vegetation changes are not expected until full operation of the system. However, a formal request to suspend the monitoring has not been submitted to date. In the future, the SFWMD proposes that landscape-level monitoring should offset the need for localized vegetation monitoring. Aerial photography was collected in early 2011, and a landscape level of analysis was conducted that can be used as a baseline for future operation.

During the 2012 dry season (November 2011–May 2012), the District experienced below average rainfall (15.95, 8.74, and 13.82 inches) at each of the three rainfall recorders in the area (SIRG, C18W_R, and S46_R, respectively). The dry season period of record rainfall average for these three sites is 14.66 inches. From April 5 through May 13, 2012, supplemental flows were discharged through G-161 to aid in meeting minimum flows and levels (MFL) criteria for the NW Fork of the Loxahatchee River. An average of 23 cfs was discharged through G-161. Without this supplemental water, flows at Lainhart would have been less than 35 cfs for a period of 40 days, which would have resulted in an MFL exceedance, as shown in **Figure 5**. This is the first year the MFL has been met since an MFL was established for the Loxahatchee River.

Stages at G-161 and G-160 and associated sloughs are shown in **Figures 3a** and **3b**. Flows through G-161, G-160, S-46, and at Lainhart Dam are shown in **Figures 4** and **5**. Average, minimum, and maximum flows are presented in **Table 4**. The average daily dry season flow over Lainhart Dam was 75 cfs; the average for the wet season was 159 cfs. Relevant data are included in **Attachment C**. Water quality samples were collected at G-161 and the City of West Palm Beach Control 2 Pump Station in association with the structure operation to comply with Specific Condition 9(IV) of the G-161 ERP, which requires collection and analysis of water quality samples monthly during periods of flow for the following parameters: temperature, dissolved

oxygen, specific conductance, pH, and turbidity in the field using electro-physicochemical methods; and total suspended solids, ammonia, total Kjeldahl nitrogen, total nitrogen, orthophosphorus, total phosphorus, nitrite-nitrate, chlorides, calcium, and sulfate using a National Environmental Laboratory Accreditation Conference-certified laboratory and quantitative analytical methods that have been approved by the FDEP for this purpose (**Attachment B**).

Figure 2. Groundwater monitoring wells near G-160/161.

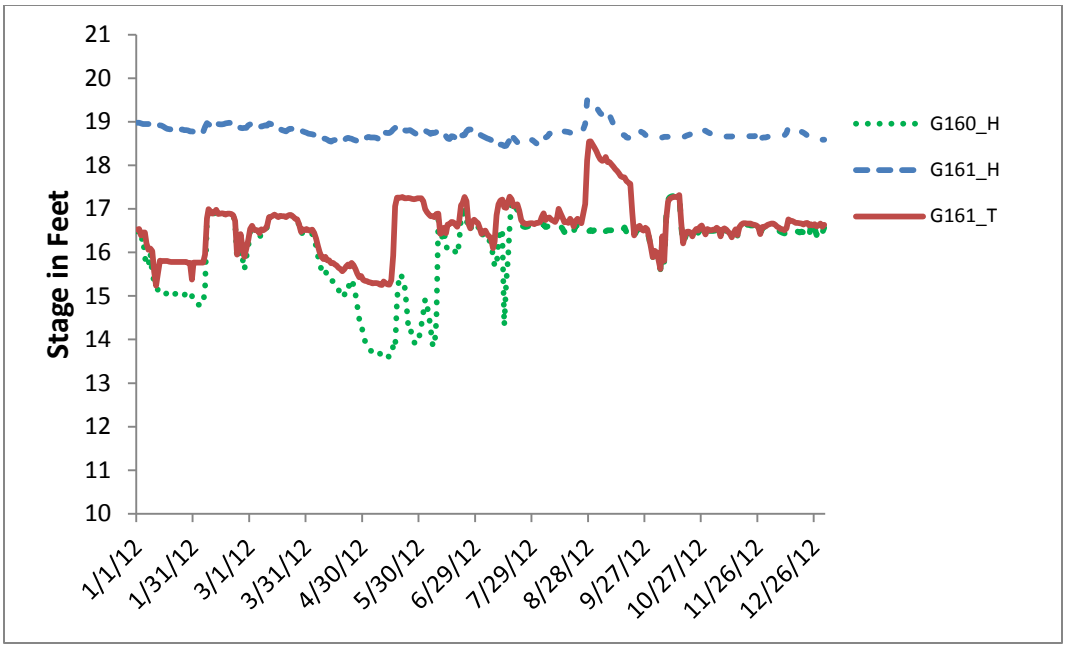


Figure 3a. 2012 daily stages at G160_H and G161.

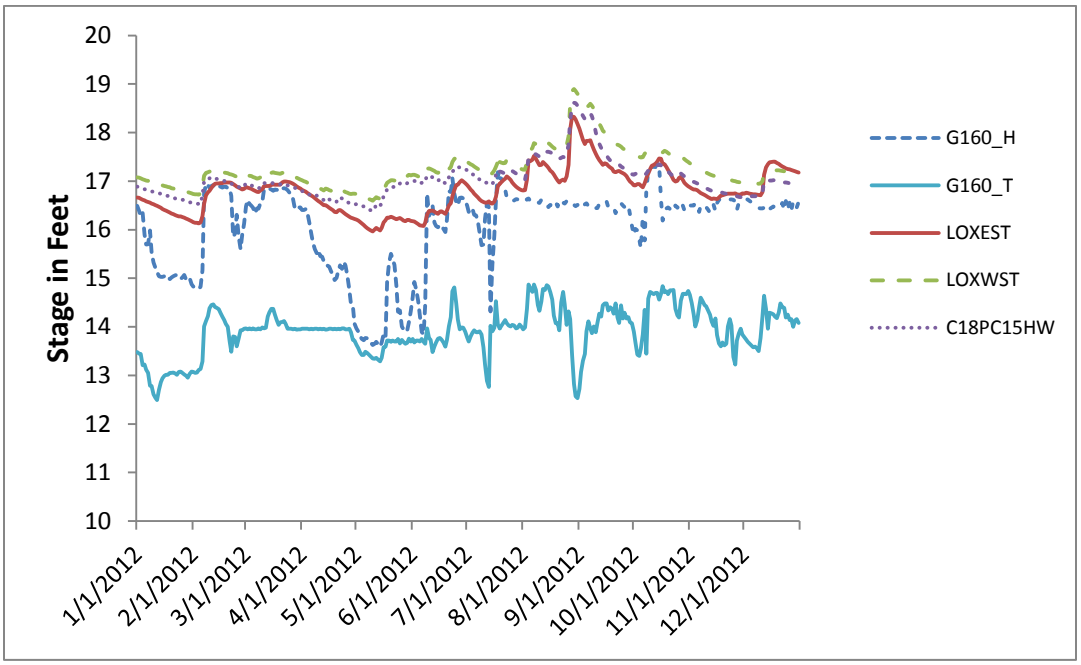


Figure 3b. 2012 daily stages at G-160, LOXEST, LOXWST, and C18PC15HW.

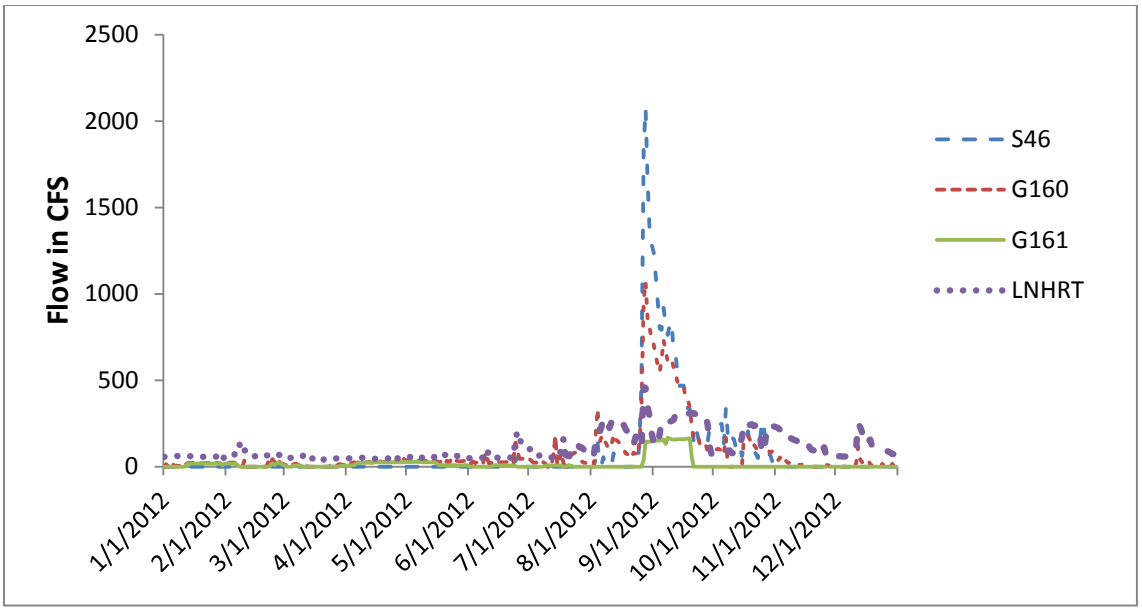


Figure 4. 2012 daily flows at S-46, G-160, G-161, and Lainhart Dam.

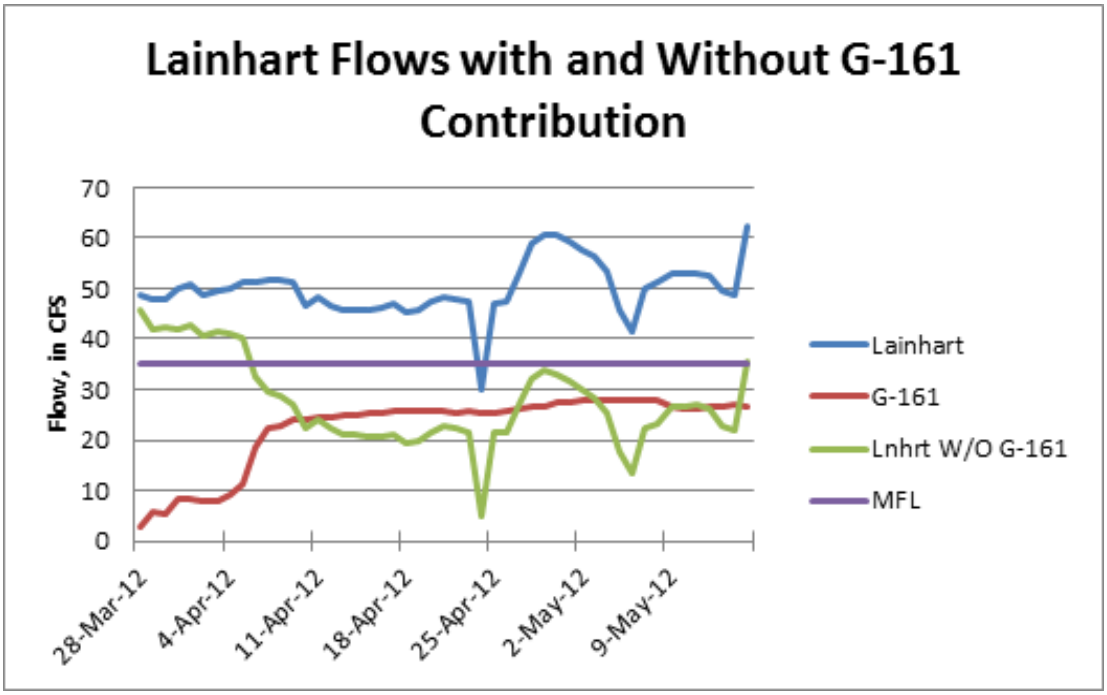


Figure 5. Lainhart dam flows with and without G-161 contribution during 2012.

Table 4. Monthly flow data in cfs for 2012.
Rows shaded in gray (June–October) indicate the wet season.

Month	G-161			G-160			S-46			LNHRT			CWPB2		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
JAN	11.54	0	19.41	15.98	0	25.09	0	0	0	58.74	32.31	63.85	117.03	0	150.26
FEB	7.9	0	23.51	14.84	0	46.47	0	0	0.06	73.74	53.39	133.89	81.9	0	149.64
MAR	1.89	0	8.25	6.89	0	17.88	0.02	0	0.38	50.84	35.26	74.03	94.55	0	148.59
APR	22.28	8.06	27.36	27.41	18.25	49.92	0	0	0.04	48.9	30.08	60.71	139.6	72.32	148.16
MAY	17.93	8.37	28	32.69	19.22	43.95	0	0	0	60.84	41.38	81.63	76.61	0	154.02
JUN	3.51	0	9.81	37.4	18.32	139.36	2.27	0	54.44	75.34	46.75	201.46	0	0	0
JUL	2.88	0	8.84	35.46	0	177.63	0	0	0.13	80.82	46.15	159.3	14.35	0	148.82
AUG	20.13	0	147.23	249.61	0	1069.17	298.62	0	2077.4	225.36	54.95	461.08	0.01	0	0.32
SEP	101.13	0	167.9	401.12	88.49	732.57	511.01	111.91	1242.85	257.96	67.39	324.99	0.01	0	0.19
OCT	0	0	0	84.26	0	175.7	147.37	5.38	341.75	156.58	61.06	255.27	32.08	0	147.3
NOV	0	0	0.08	14.92	0	54.28	0.1	0	2.88	127.1	52.72	230.49	120.42	0	144.12
DEC	0	0	0.01	13.76	0	116.2	1.09	0	31.1	104.62	58.37	252.38	75.25	0	145.08

Following coordination with FDEP, the G-161 structure was utilized in August and September 2012 to provide flood control releases in response to elevated water levels from Tropical Storm Isaac. To bring the water back to the target level in the east Loxahatchee Slough, G-160, G-92, and S-46 were opened for flood protection. An after-action report was provided by the City of West Palm Beach to the FDEP on November 1, 2012 (**Attachment E**).

VEGETATION MONITORING

The pre-operational baseline vegetation conditions in the Loxahatchee Slough were defined by the semiannual monitoring conducted in the wet and dry seasons from 2002 to 2007 by Palm Beach County. The annual reports, the Baseline Report, and 5-Year Report have been previously submitted to the FDEP for purposes of defining pre-operational baseline vegetation conditions in the Loxahatchee Slough, taking into account seasonal and annual variability. Concurrently with the increase in stage elevation at the G-160 structure beginning June 1, 2009, Palm Beach County reinitiated the wet and dry season monitoring of vegetation in the Loxahatchee Slough (see **Attachment D**). Since June 2009, when the wet season control elevation of the G-160 was increased from 15.5 ft NGVD to 16.5 ft NGVD, the eastern part of the Loxahatchee Slough Natural Area has become wetter and the oak hammock ridge more saturated. At this time, there do not appear to be any detrimental effects on the oak hammock ridge vegetation due to the wetter conditions. Also, during the 2011 dry season, the rusted-out PC-17 water control structure in the western Loxahatchee Slough was replaced, and backfilling of approximately 14 miles of drainage ditches was completed by Palm Beach County. The western Loxahatchee Slough is storing more water than in the past, although it is difficult to quantify the extent of observed hydrologic improvement directly attributed to C-18 stages.

The data collected by the county during the 2012 wet season monitoring event is shown in **Table 5**. As specified in the FDEP-approved 5-Year Operation Monitoring Plan for the G-161 Project, semiannual vegetation monitoring and apple snail egg cluster observations within the GWP will be initiated when regional water of adequate quantity and quality is available to be delivered through the G-161 structure. This will meet the intent of the monitoring plan to ensure that changes in water quality or quantity brought about by the delivery of regional water through the GWP and G-161 for deliveries to the NW Fork of the Loxahatchee River are not adversely affecting the preferred prey of the endangered snail kite. The most recent Geographic Information Systems (GIS)-based analysis of the vegetation associated with the G-160/G-161 structures was conducted in March and April 2011. These results and analysis were presented in the 2012 South Florida Environmental Report – Volume III, Appendix 5-1.

Table 5. Summary of 2012 wet season survey in the Loxahatchee Slough (Note: data provided by Palm Beach County.)

Station	Vegetative Community Type	Dominant Plant Species	Average Number of Individuals per Quadrat (Sample Standard Deviation=s)	Cover Class (DAUB)[1]	Average Depth of Water at Station (inches)
1	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub 1. *Cephalanthus occidentalis* Canopy No canopy layer	 382 (**s**=96.6) 1 (**s**=1.7) n/a	 3 0.3 n/a	29
2	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub No shrub layer Canopy No canopy layer	 576 (**s**=226.9) n/a n/a	 4 n/a n/a	26.7
3	Swale	Herbaceous 1. *Eleocharis cellulosa* 2. *Fuirena scirpoides* Shrub No shrub layer Canopy No canopy layer	 306 (**s**=58.5) 15 (**s**=19.7) n/a n/a	 2.7 0.7 n/a n/a	26.7
4	Hydric Hammock	Herbaceous 1. *Blechnum serrulatum* 2. *Vitus rotundifolia* Shrub 1. *Psychotria nervosa* 2. *Rapanea punctata* Canopy 1. *Sabal palmetto* 2. *Psychotria nervosa*	 7 (**s**=3.6) 2 (**s**=3.2) 6 (**s**=7.2) 1 (**s**=1.5) 6 (**s**=3.6) 10 (**s**=11.7)	 1 0.7 1 0.7 1.7 1	dry
5	Wet Flatwoods	Herbaceous 1. *Dichanthelium commutatum* 2. *Blechnum serrulatum* Shrub 1. *Rapanea punctata* 2. *Sabal palmetto* Canopy 1. *Rapanea punctata* 2. *Pinus elliottii* var. *densa*	 4 (**s**=6.4) 2 (**s**=4.0) 4 (**s**=7.5) 2 (**s**=2.9) 15 (**s**=14.7) 4 (**s**=3.5)	 0.3 0.3 0.7 0.3 1.3 1.3	1.7

[1] Daubenmire method

WATER QUALITY

The G-161 permit requires that the District collect and analyze water quality at the Control 2 Pump Station (L8.M CNL) and G-161 structure monthly during periods of flow. Water quality results are summarized in **Table 6** and included in **Attachment B**. The only exceedance of state surface water criteria at G-161 was dissolved oxygen (DO). Overall, there is a marked difference in the results between the Control 2 Pump Station and G-161 (which are 15.3 miles apart), with G-161 having much lower concentrations for nearly all the measured parameters (see **Table 6**). The average TP concentration observed at G-161 was 9 parts per billion (ppb), and the average observed at the M-canal was 113 ppb. Nutrient levels observed at the G-161 discharge structure appear low and compare to levels in the interior marsh. DO levels were also low (DO level was 4.2 milligrams per liter [mg/L]), typical of natural conditions in the marsh. Both the turbidity levels and the nutrient levels observed at the M-canal inflow were higher and were comparable to water quality in the L-8 canal, which receives discharges from Lake Okeechobee. This is the main difference between the water quality within GWP and the regional water quality. G-161 and Control 2 Pump do not always operate at the same time. The increase in turbidity at L8.M CNL in January, February, March, and December was due to water being discharged from Lake Okeechobee.

Table 6. Water quality results from G-161 and Control 2 Pump Station (January–December 2012).

Parameter	Number of Observations	Mean ± Standard Deviation	Minimum	Median	Maximum
Station		**G161**			
Water Temperature (°C)	10	24.9 ± 3.9	19.1	26.2	29.3
Dissolved Oxygen (mg/L)	10	4.2 ± 1.8	1.9	4.2	7.7
Specific Conductance (µS/cm)	10	291.3 ± 91.9	141	278	450
Water pH	9	7.0 ± 0.3	6.5	7.0	7.5
Turbidity (NTU)	10	0.9 ± 0.4	0.5	0.8	1.6
Total Suspended Solids (mg/L)	10	<3.0 ± 0.0	<3.0	<3.0	<3.0
Calcium (mg/L)	9	18.2 ± 4.5	12.0	17.5	25.0
Chloride (mg/L)	10	48.1 ± 13.9	24.7	48.3	67.2
Sulfate (mg/L)	9	1.9 ± 1.4	0.4	1.5	4.5
Ammonia (mg/L)	10	0.011 ± 0.006	0.005	0.010	0.025
Nitrate+Nitrite (mg/L)	10	<0.005 ± 0.000	<0.005	<0.005	<0.005
Total Kjeldahl Nitrogen (mg/L)	10	0.94 ± 0.16	0.68	0.95	1.16
Total Nitrogen (mg/L)	10	0.94 ± 0.16	0.68	0.95	1.16
Soluble Reactive Phosphorus (mg/L)	10	<0.002 ± 0.000	<0.002	<0.002	<0.002
Total Phosphorus (mg/L)	10	0.009 ± 0.004	0.005	0.007	0.019
Station		**L8.M CNL**			
Water Temperature (°C)	10	25.8 ± 5.1	19.2	26.7	32.3
Dissolved Oxygen (mg/L)	10	6.9 ± 1.4	4.3	7.0	8.9
Specific Conductance (µS/cm)	10	628.3 ± 171.5	469	529	934
Water pH	10	7.7 ± 0.2	7.5	7.7	8.1
Turbidity (NTU)	9	18.9 ± 17.9	2.6	10.8	47.2
Total Suspended Solids (mg/L)	10	20.0 ± 16.3	3	15.5	48
Calcium (mg/L)	10	58.0 ± 12.3	44.3	54.2	81.9
Chloride (mg/L)	10	82.4 ± 33.4	45.0	62.7	141.0
Sulfate (mg/L)	10	32.2 ± 9.9	14.3	33.4	51.8
Ammonia (mg/L)	10	0.041 ± 0.029	<0.005	0.040	0.084
Nitrate+Nitrite (mg/L)	10	0.176 ± 0.179	<0.005	0.141	0.370
Total Kjeldahl Nitrogen (mg/L)	10	1.35 ± 0.27	1.03	1.30	1.86
Total Nitrogen (mg/L)	10	1.52 ± 0.36	1.03	1.49	1.96
Soluble Reactive Phosphorus (mg/L)	10	0.026 ± 0.028	<0.002	0.027	0.089
Total Phosphorus (mg/L)	10	0.113 ± 0.052	0.030	0.116	0.186

Note:
°C - Degrees Celsius
µS/cm - microsiemens per centimeter
NTU – nephelometric turbidity units
mg/L - milligrams per liter

Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented for the G-160 Project (Environmental Resource Permit: EI 50-0128848) in this report.

Specific Condition	Description	Applicable Phase	Action Taken	Reported in the 2013 SFER in: *(All references are to Volume III, unless noted)*			
				Narrative (page #'s)	Figure	Table	Attachment
1	Authorized Construction	Construction	N/A	3			
2	Interim Operation	Operation	N/A	7			
3	Stage Control Elevations	Operation	Operated as required	7			
4	Continuous Stage Monitoring	Operation	Stage monitoring was conducted as required	3 - 4, 7	1, 3a		C
5	Vegetation Monitoring for Loxahatchee Slough	Operation	Veg. monitoring was conducted as required	3 - 4, 7, 12		5	D
6	Operational Monitoring of S-46 & Annual Operational Evaluation Report	Operation	Report developed and included as part of annual permit report (see specific condition 7, below)	5, 7, 10	3a - 4		
7	Annual Monitoring Reports	Operation	Report developed and submitted on time	2 - 3			
8	Water Reservation/Allocation	Operation	Complied with as required				
9	Construction Best Management Practices: Turbidity & Erosion Control	Construction	N/A				
10	Drawings and Attachments	Operation	N/A	2		2	A - E
11	Compliance with Specific Conditions	Operation	Complied with as required	3, 10			A
12	Compliance with General Conditions	Operation	Complied with as required				

Table A-2. Specific conditions, actions taken, and cross-references presented for the G-161 Project (Environmental Resource Permit: EI 50-0244327) in this report.

Specific Condition	Description	Applicable Phase	Action Taken	Reported in the 2013 SFER in: *(All references are to Volume III, unless noted)*			
				Narrative (page #'s)	Figure	Table	Attachment
1	Authorized Construction	Construction	N/A	3			
2	Authorized Interim Operation	Operation	N/A	7			
3	Construction Limits	Construction	N/A	3			
4	Fencing off Wetlands	Construction	N/A				
5	Construction Best Management Practices: Turbidity & Erosion Control	During Construction	N/A				
6	Turbidity Monitoring	During Construction	N/A	8		6	
7	Turbidity Monitoring Reports	During Construction	N/A				
9	5-Year Operation Monitoring Plan	Operation	Monitoring was conducted as required	3, 12			
9 I	Continuous Water Level Monitoring	Operation	Monitoring was conducted as required	3 - 4	3b		
9 II	Hydrological Monitoring	Operation	Monitoring was conducted as required	3 - 5, 7, 10	3b - 5	4 - 5	C
9 III	Vegetative Monitoring	Operation	Monitoring was conducted as required	3 - 4, 7, 12		5	D
9 IV	Water Quality Monitoring at G-161 and at Control 2 Pump Station	Operation	Monitoring was conducted as required	4, 7, 14	1	6	B
10	Annual Monitoring Reports	Operation	Report developed and submitted on time	2 - 3, 12			
11	Water Reservation/Allocation	Operation	Complied with as required				
12	Drawings and Attachments	Operation	N/A	2		2	A - E
13	Compliance with Specific Conditions	Operation	Complied with as required	3 - 4, 7, 10			A
14	Compliance with General Conditions	Operation	Complied with as required				

Attachment B: Water Quality Data

This project information is required by Specific Condition 7 of the G-160 permit (EI 50-0128848), and Specific Conditions 9 and 10 of the G-161 permit (EI 50-0244327), and is available upon request.

Attachment C: Hydrologic Data

This project information is required by Specific Conditions 4 and 7 of the G-160 permit (EI 50-0128848), and Specific Conditions 9 and 10 of the G-161 permit (EI 50-0244327), and is available upon request.

Attachment D: Loxahatchee Slough Restoration and G-160 Monitoring Plan, Fourth Post-Operational Field-Based Vegetation Monitoring Report

Note: This document, dated February 2013, was prepared by the Palm Beach County Department of Environmental Resources Management for the South Florida Water Management District and the Florida Department of Environmental Protection.

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Fourth Post Operation Field-based Vegetation Monitoring Report

Prepared for:

The South Florida Water Management District

and

The Florida Department of Environmental Protection

February 2013

Prepared by:

Palm Beach County
Department of Environmental Resources Management

Executive Summary

A mutually agreeable arrangement was reached between Palm Beach County‟s Department of Environmental Resources Management (County) and the South Florida Water Management District (SFWMD) with regard to the execution of the Loxahatchee Slough Restoration and G-160 Monitoring Plan (Plan). The Plan requires that the County conduct baseline and post-construction/operation (G-160 Structure) vegetation and hydrological monitoring within the Loxahatchee Slough Natural Area (Slough). The purpose of the monitoring plan is to determine the effectiveness of the first tier improvements completed under the North Palm Beach County Comprehensive Water Management Plan and to provide a measure of success in achieving restoration targets. The results are expected to provide the SFWMD with beneficial information that will allow adjustments to the operation of the G-160 Structure to most effectively meet the Plan‟s objectives. The work includes two approaches to monitoring vegetation, a field-based site-specific component and a GIS-based landscape-level analysis. This report presents the findings from the field-based component of the vegetation surveys and hydrological monitoring data collected during the dry season (between February 1 and March 15) and wet season (between August 1 and September 15) of 2011. It represents the fourth year of post-operation monitoring that will be combined with the landscape-level monitoring summary report prepared by the SFWMD.

The field-based vegetation and hydrological monitoring involves the collection of data from a total of five field stations. At each station, three rectangular nested vegetation quadrats, one staff gauge, and one photopoint were established. Vegetation parameters measured within the quadrats are species composition, density (total/unit area), cover [Daubenmire Cover Class (1-6)], and qualitative descriptions. The staff gauges are used to obtain water elevations relative to sea level (NGVD). The depth of the water within the quadrats is also measured. The photopoints were established to take a composite panoramic photograph of the vegetation at each station from the same location, angle, and perspective during each survey event.

Stations 1-3 are situated in swale communities dominated by spikerush (*Eleocharis cellulosa*) with very little shrub layer and virtually no canopy layer. Station 4 is a mature hydric hammock dominated by wild coffee (*Psychotria nervosa*) and swamp fern (*Blechnum serrulatum*) in the understory, and cabbage palm (*Sabal palmetto*) and laurel oak (*Quercus laurifolia*) in the canopy layer. The herbaceous layer is very sparse and severely damaged (tilled) by feral hogs (*Sus scrofa*). Station 5 is comprised of wet flatwoods where the herbaceous layer is highly variable, the shrub layer is dominated by saw palmetto (*Serenoa repens*) and myrsine (*Rapanea punctata*), and the canopy is dominated by slash pine (*Pinus elliottii* var. *densa*). Surface water is generally not present at Stations 4 and 5 during the wet or dry seasons, however Station 4 was saturated in 2009 and Station 5 had standing water at one of the plots in 2009, 2010 and 2012, and was saturated in 2011.

Panoramic photographs were taken at each of the five stations as well as three additional locations that lie west and east of the hammock to give both quantitative (shrub and herbaceous layer heights) and qualitative representations of the vegetative community types. One change to note is in the photos of Station 4 (Hydric Hammock), there is a surge in shrub vegetation after Sept. 2004. This is attributed to the loss of canopy after the hurricanes of 2004 (Frances and Jeanne) and 2005 (Wilma) that affected Palm Beach County.

Another point of note is that the 2011 dry season was longer and drier than normal which resulted in the water levels reaching seasonal low levels in the month of June. Stations 1-3 ranged 1 to 10 inches of surface water in the 2011 dry season and 10.3 to 21.7 inches in the 2011 wet season. Station 4 was dry during both 2011 monitoring events and Station 5 was dry during the 2011 dry season but the soil was saturated during the 2011 wet season. The wet season monitoring events of 2009, 2010 and 2012 were the only years that Station 5 (Wet Flatwoods) had any measurable standing water. Although station 5 did not have standing water during the 2011 wet season, the soil was saturated. This is notable since dry season conditions extended later into the wet season and there were no tropical storms or large low pressure systems affecting the region.

Since June 2009, when the wet season control elevation of the G-160 was increased from 15.5 ft. NGVD to 16.5 ft. NGVD, the eastern part of the Loxahatchee Slough Natural Area has become wetter and the oak hammock ridge more saturated. At this time, there does not appear to be any detrimental effects on the oak hammock ridge vegetation due to the wetter conditions. Also, during the 2011 dry season, the rusted out PC-17 water control structure in the western Loxahatchee Slough was replaced and the backfilling of approximately 14 miles of drainage ditches was completed. The western Loxahatchee Slough is storing more water than in the past, although how this might affect seasonal high water levels is dependent on the following: the efficacy of the new PC-17 (A and B) structures, effects of the backfilled ditch project, and potential seepage rate changes due to higher water levels along the northern border of the parcel due to the lower control elevation of the west leg of the C-18 Canal. It is difficult to quantify the extent of observed hydrologic improvement which is directly attributed to the C-18 stages.

Introduction

The extant areas of the Loxahatchee Slough are comprised of approximately 16,000 acres of pine flatwoods, swale, wet prairies, hydric hammock, strand swamp, slough, dome swamp, depression marsh, and disturbed areas within the County-owned Hungryland Slough Natural Area (approximately 3,000 acres) and the Loxahatchee Slough Natural Area (approximately 12,836 acres) (Figure 1). The Loxahatchee Slough contains the headwaters of the Loxahatchee River, one of Florida‟s two federally designated Wild and Scenic Rivers. The site is one of the most ecologically diverse tracts of protected land in Palm Beach County, including nine distinct habitat types, the largest oak hammock and swale/slough in the County, and 63 federally or state-listed species of plants and animals (Gann *et al.*, 2001). The hydrology of the Loxahatchee Slough has been severely altered through the construction of drainage canals, flood protection berms, and increased anthropogenic water consumption. Overdrainage and hydroperiod alterations have contributed to the establishment of invasive exotic plant species such as melaleuca (*Melaleuca quinquenervia*), Old-world climbing fern (*Lygodium microphyllum*), and Brazilian pepper (*Schinus terebinthifolius*), which has led to decreases in habitat quality for native flora and fauna.

In 2003, in order to increase water control and restore the historic hydroperiod to the Slough, the G-160 structure was constructed in the C-18 canal immediately south of the intersection with its western leg, the C-18W (Figure 2). The structure will allow water managers operational flexibility for the purposes of water supply, flood protection, and environmental restoration, including hydrologic restoration of the Loxahatchee Slough to provide water to meet the base flow requirements for the Northwest Fork of the Loxahatchee River. From August 10, 2005 until June 1, 2009, the SFWMD operated the gates on the G-160 at 15.5 ft. NGVD during the dry season and 15.0 ft. NGVD during the wet season because of difficulties reaching an agreement between the SFWMD and Northern Palm Beach County Improvement District, the City of Palm Beach Gardens and the South Indian River Water Control District. The 15.0 ft./15.5 ft. NGVD operating schedule that started in 2005 was so low that it had no effect on increasing water elevations within the Loxahatchee Slough. Because the G-160 structure was not operated above 15.5 ft. NGVD, the County ceased monitoring in September 2006.

During the spring of 2009, the Florida Department of Environmental Protection mandated the SFWMD to begin to raise the elevation of the water in the C-18 canal by June 1, 2009 to 16.5 ft. NGVD during the wet season and 15.5 ft. NGVD during the dry season. When the SFWMD began to raise the elevation to 16.5 ft. NGVD in June 2009, the County resumed monitoring by performing the fall, wet season monitoring event. The monitoring plan was developed to assess the effects of the operation of the G-160 water control structure (and subsequent raising of water elevations) on the vegetation communities within the Loxahatchee Slough and to determine if restoration goals are being met. During the 2011 dry season, the rusted out PC-17 water control structure in the western Loxahatchee Slough was replaced with two new structures (PC-17 A and B) and the backfilling of approximately 14 miles of agricultural drainage ditches was completed.

Methods

A total of five permanent vegetation and two hydrological monitoring stations were established in the Loxahatchee Slough Natural Area at pre-determined locations both east and west of the C-18 canal (see Figure 2). The selected locations are representative of major habitat types found within the Loxahatchee Slough, which are anticipated to be affected by the operation of the G-160 structure. At each of these five locations, three nested vegetation quadrats and one photopoint were established. The vegetation plots were positioned within the given community type using random compass directions and distances that were selected from a random numbers table and paced off as described in the SFWMD Save Our Rivers Environmental Monitoring Protocols (Van Horn and Van Horn 1993). The photopoint was positioned centrally between the three vegetation quadrats at each station. The vegetation plots and photopoints are monitored twice a year, once during the wet season (between August 1- September 15) and once during the dry season (between February 1 and March 15).

The vegetation plots are a nested design that includes a small (0.25m x 3m) herbaceous quadrat within a medium sized (1m x 12m) shrub quadrat, which is in turn contained within a larger (3m x 24m) canopy quadrat. The quadrat dimensions were permanently established in the field by installing four foot pieces of rebar (1/2 inch diameter) approximately two feet into the ground and covering them with a five-foot long PVC pipe (3/4 inch diameter) at each quadrat corner. The methods and monitoring definitions of herbaceous, shrub, and canopy are included as Attachment A. Vegetation parameters measured within the quadrats included species composition, density (total/unit area), cover [Daubenmire Cover Class (1-6)], and qualitative descriptions. Within the herbaceous quadrat, each individual plant was counted and recorded by species. An estimate of the vegetative cover (total surface area of the 0.25m x 3m quadrat covered by vegetation) was then recorded by species. This estimate was recorded as a particular Daubenmire Cover Class (1-6), each of which represents a range of percentages of vegetative cover (Attachment B). The qualitative observations (e.g. vigor of plant, overall appearance), and any other relevant observations (e.g., plant alive/dead, no herbaceous layer) were also recorded. Within the shrub quadrat and canopy quadrat, the same parameters were recorded as in the herbaceous quadrat.

Two automatic gauges monitored with telemetry were established by SFWMD at Stations 1 and 2. The readings are used to obtain water elevations relative to sea level (NGVD). The depth of the water within the quadrats was also measured.

The photopoints were established to take a composite panoramic photograph of the vegetation at each station from the same location, angle, and perspective during each survey event. The photopoint was permanently marked in the field with a 4 ft. long piece of rebar (3/4 inch diameter) and covered with a 5 ft. piece of PVC pipe (3/4 inch diameter). The photos were taken at the five photomonitoring stations using the method described in „Photomonitoring Protocol for Palm Beach County Natural Areas“ (Attachment C). A Photomonitoring Record Form for each photostation described the purpose of the photopoint, location, direction of photos, and other information important for future monitoring events. Three additional photopoints were established outside of the vegetation plots to capture potential changes west (photopoint 6) and east (photopoints 7and 8) of the hammock.

Data

Tables 1 and 2 summarize the results of the vegetation monitoring quadrats during the dry and wet season surveys conducted in March 2012 and September 2012. For more detailed information about vegetation structure and composition, the individual station quadrat data sheets for the 2012 surveys are included in Attachment B. The panoramic photos in Attachment D compare stations (1-5) from 2003 and 2006 (baseline events) to the fourth post operational monitoring event in 2012. Attachment D also includes three additional photopoints (6, 7 and 8) that compare the pine density in 2002 to 2012.Attachment E includes water level data, rainfall data and stage data from 2006-2012. The monitoring locations for all of the hydrological data are shown in Figure 3. Attachment F includes a summary of the vegetation data collected from 2006-2012.

Table 1: Summary of G-160 Vegetation Monitoring During Dry Season 2012

Monitoring Station	Vegetative Community Type	Dominant Plant Species	Average Number of Individuals per Quadrat (Sample Standard Deviation=*s*)	Cover Class (DAUB)	Average Depth of Water at Station (in inches)
1	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub 1. *Cephalanthus occidentalis* Canopy No canopy layer	 326 (***s***=97.8) 1 (***s***=1.7) n/a	 2.7 0.3 n/a	16.3
2	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub No shrub layer Canopy No canopy layer	 374 (***s***=91.3) n/a n/a	 3 n/a n/a	18.2
3	Swale	Herbaceous 1. *Eleocharis cellulosa* 2. *Fuirena scirpoides* Shrub 1. *Cephalanthus occidentalis* Canopy No canopy layer	 261 (***s***=51.7) 9 (***s***=14.2) 1 (***s***=1.2) n/a	 2.3 0.7 0.3 n/a	14.3
4	Hydric Hammock	Herbaceous 1. *Blechnum serrulatum* 2. *Vitus rotundifolia* Shrub 1. *Psychotria nervosa* 2. *Rapanea punctata* Canopy 1. *Sabal palmetto* 2. *Psychotria nervosa*	 4 (***s***=1.2) 3 (***s***=3.1) 5 (***s***=6.1) 1 (***s***=1.5) 6 (***s***=3.8) 8 (***s***=10.6)	 1 0.7 0.7 0.7 1.7 1	Dry
5	Wet Flatwoods	Herbaceous 1. *Ludwigia repens* 2. *Dichanthelium commutatum* Shrub 1. *Rapanea punctata* 2. *Sabal palmetto* Canopy 1. *Rapanea punctata* 2. *Pinus elliottii* var. *densa*	 5 (***s***=9.2) 5 (***s***=8.1) 4 (***s***=6.9) 2 (***s***=2.9) 17 (***s***=18.3) 4 (***s***=3.5)	 0.3 0.3 0.7 0.3 1.3 1.3	Moist

Table 2: Summary of G-160 Vegetation Monitoring During Wet Season 2012

Monitoring Station	Vegetative Community Type	Dominant Plant Species	Average Number of Individuals per Quadrat (Sample Standard Deviation=*s*)	Cover Class (DAUB)	Average Depth of Water at Station (in inches)
1	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub 1. *Cephalanthus occidentalis* Canopy No canopy layer	 382 (*s*=96.6) 1 (*s*=1.7) n/a	 3 0.3 n/a	29
2	Swale	Herbaceous 1. *Eleocharis cellulosa* Shrub No shrub layer Canopy No canopy layer	 576 (*s*=226.9) n/a n/a	 4 n/a n/a	26.7
3	Swale	Herbaceous 1. *Eleocharis cellulosa* 2. *Fuirena scirpoides* Shrub No shrub layer Canopy No canopy layer	 306 (*s*=58.5) 15 (*s*=19.7) n/a n/a	 2.7 0.7 n/a n/a	26.7
4	Hydric Hammock	Herbaceous 1. *Blechnum serrulatum* 2. *Vitus rotundifolia* Shrub 1. *Psychotria nervosa* 2. *Rapanea punctata* Canopy 1. *Sabal palmetto* 2. *Psychotria nervosa*	 7 (*s*=3.6) 2 (*s*=3.2) 6 (*s*=7.2) 1 (*s*=1.5) 6 (*s*=3.6) 10 (*s*=11.7)	 1 0.7 1 0.7 1.7 1	dry
5	Wet Flatwoods	Herbaceous 1. *Dichanthelium commutatum* 2. *Blechnum serrulatum* Shrub 1. *Rapanea punctata* 2. *Sabal palmetto* Canopy 1. *Rapanea punctata* 2. *Pinus elliottii* var. *densa*	 4 (*s*=6.4) 2 (*s*=4.0) 4 (*s*=7.5) 2 (*s*=2.9) 15 (*s*=14.7) 4 (*s*=3.5)	 0.3 0.3 0.7 0.3 1.3 1.3	1.7

Discussion of Findings

In Tables 1 and 2, the data from each of the three vegetation quadrats at each of the five vegetation monitoring stations were averaged by herbaceous layer, shrub layer, and canopy layer. The detailed data sheets in Attachment B reflect the species composition and structure of each of the three layers within the specific nested quadrats. Only the two species with the dominant vegetation cover percentage in each of the five stations were included. The data in this report represents the fourth collection of post operation data. For comparison purposes, the 2006 data was used as the final baseline. Attachment F includes a summary of all of the vegetation monitoring events.

Stations 1-3 (Swale) are dominated by *Eleocharis cellulosa*, but had some minor changes in the herbaceous layer and the shrub layer. *Rhynchospora tracyi* disappeared from the herbacecous layer in Station 1 in 2009 and Station 2 in 2012, and was replaced by *Furiena scirpoides* in Station 3 in 2010. In 2009, *Hypericum fasiculatum* disappeared from the shrub layer in Station 2 and *Cephalanthus occidentalis* disappeared from the shrub layer in Station 3. In Station 4, *Blechnum serrulatum* continues to dominate the herbaceous layer, while the shrub layer had *Rapanea punctata* and *Psychotria nervosa*, and the canopy layer had *Sabal palmetto* and *Psychotria nervosa*. Most of the changes in the herbaceous layers of Stations 4 and 5 can be attributed to the hog rooting in those plots. Station 5 was consistent with *Rapanea punctata* in the shrub and canopy layers. The 2006 Baseline conditions will continue to be compared with post-operation data in future reports.

The panoramic photographs taken at each of the photopoints give both quantitative (shrub and herbaceous layer heights) and qualitative representations of the vegetative community types described above (Attachment D). One change to note is in the photos of Station 4 (Hydric Hammock), there is a surge in shrub vegetation after September 2004. This is attributed to the loss of canopy after the hurricanes of 2004 (Frances and Jeanne) and 2005 (Wilma) that affected Palm Beach County. Photopoint 6 shows the early stages of pine and wax myrtle mortality. These species would have moved into the wetlands during periods of lower water levels and are expected to be drowned out as water depths and/or hydroperiod increase.

Another point of note is that the 2011 dry season was longer and drier than normal which resulted in the water levels reaching seasonal low levels in the month of June. Stations 1-3 averaged 5 inches of surface water in the 2011 dry season and 16 inches in the 2011 wet season. Station 4 was dry during both 2011 monitoring events and Station 5 was dry during the 2011 dry season but the soil was saturated during the 2011 wet season. The wet season monitoring events of 2009 and 2010 were the only years that Station 5 (Wet Flatwoods) had any measurable standing water. Although station 5 did not have standing water during the 2011 wet season, the soil was saturated. This is notable since dry season conditions extended later into the wet season and there were no tropical storms or large low pressure systems affecting the region that year. Surface water is generally not present at Stations 4 and 5 during the wet or dry seasons, however Station 4 was saturated during the 2009 wet season and Station 5 had standing water at one of the plots during the 2009 and 2010 wet seasons and was saturated during the 2011 wet season. The saturated soil may be attributed to the operation of the G-160. While the dry season was drier and longer than normal in 2011, the hydroperiod fluctuated naturally and the area was able to maintain surface water elevations at levels high enough to keep soils saturated. At this time, there does not appear to be any detrimental effects to the oak hammock ridge vegetation due to the wetter conditions.

During the period from 2006 to 2008, most of the deteriorated C-18 project culverts (9 through 15) were

replaced, which were contributing to overdraining the Loxahatchee Slough. The G-160 began effectively controlling water levels behind it in June of 2009, when the wet season control elevation was raised to 16.5‟ NGVD (from the 15.0‟ NGVD elevation in 2005). Since June of 2009, the area has experienced an extreme wet 2009-2010 dry season, an awfully dry 2011 wet season, and the exceptional amount of rainfall (up to 20” in a week) from Tropical Storm Isaac in August 2012. Also in 2011, approximately 14 miles of drainage ditches were backfilled in the western portion of the property, and the rusted out PC-17 culverts were replaced. The ineffective PC-17 culverts prior to their repair, made some of the western portion of the site controlled at the 14.8‟ NGVD wet season elevation of the C-18 West leg. This allowed a significant amount of „back door‟ drainage prior to 2011. Based on the water elevation data post 2009 (Figures E-2 and E-4), the portion of the Loxahatchee Slough on the east side of the C-18 Canal (LOXEST) is tracking closer in elevation to the western portion of the site (LOXWST), which is a good sign that our restoration goals will be met.

Following Tropical Storm Issac in August 2012, staff observed record high water levels as water flowed from the west to the east through wetlands and sloughs through the newly installed culverts in the restoration area. Staff observed over two feet of water in the hammock islands in the central part of the slough with the project culvert‟s levels at 18‟ NGVD. Also, PGA Blvd was flooded and one lane had to be temporarily closed. The high water levels caused a blowout just north of PC-9. South Indian River Water Control District contacted SFWMD and requested that the boards be temporarily removed to drop water levels enough to make the necessary repairs. Since the extremely high water levels were temporary, there appears to be no damage to the hammock vegetation. However, staff believes that maintaining a control elevation above 16.5‟ NGVD could have detrimental effects to the oak hammock vegetation during extreme high water periods.

The western Loxahatchee Slough is storing more water than in the past, although how this might affect seasonal high water levels is dependent on the following: the efficacy of the new PC-17 (A and B) structures, effects of the backfilled ditch project, and potential seepage rate changes due to higher water levels along the northern border of the parcel due to the lower control elevation of the west leg of the C-18 Canal. It is difficult to determine the effects of the G-160 on the water levels in the Loxahatchee Slough, particularly the larger western portion of the site, due to these changes within this area and the erratic weather patterns during the period since the control elevation of it was raised.

Literature Cited

Gann, G., K. Bradley and S. Woodmansee. 2002. Habitats in South Florida. The Institute for Regional Conservation. Miami, Florida.

Van Horn, M. and K. Van Horn . 1993. „Save Our Rivers‟ Environmental Monitoring Protocols. South Florida Water Management District. West Palm Beach, Florida.

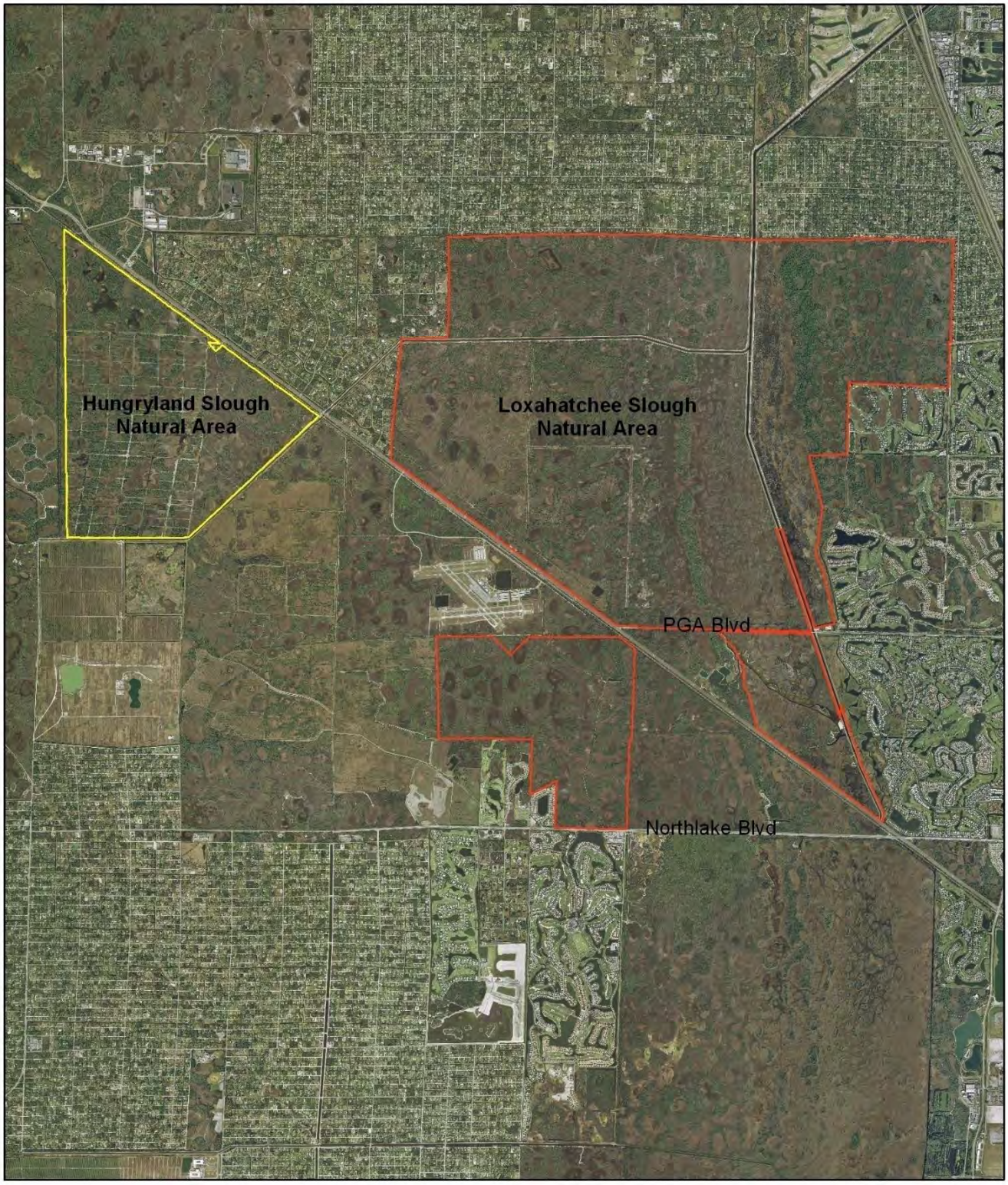


Figure 1: Hungryland Slough and Loxahatchee Slough Natural Areas Location Map

N

0 0.5 1 2 3 4 Miles

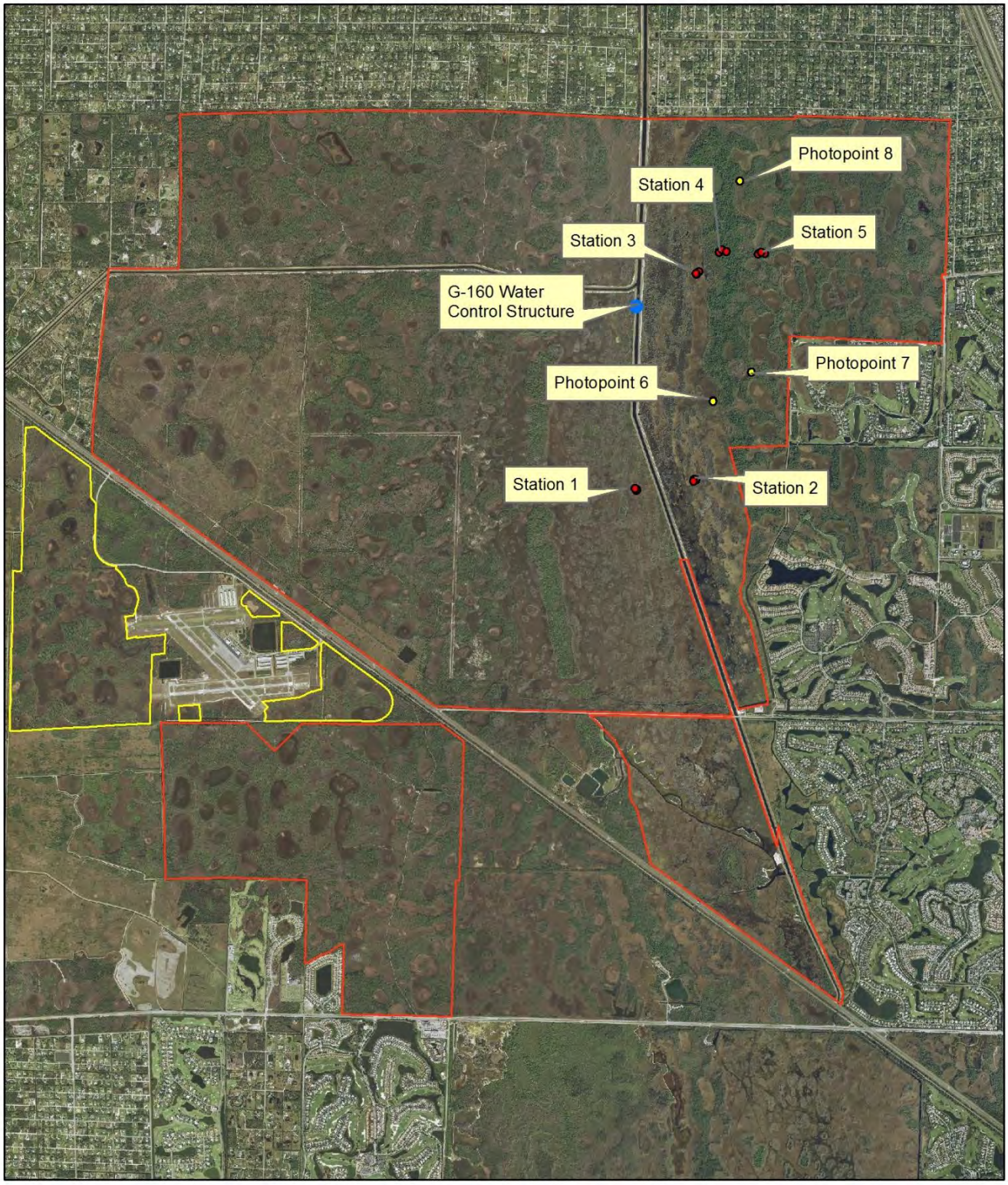


Figure 2: G-160 Vegetation Monitoring Stations in the Loxahatchee Slough Natural Area

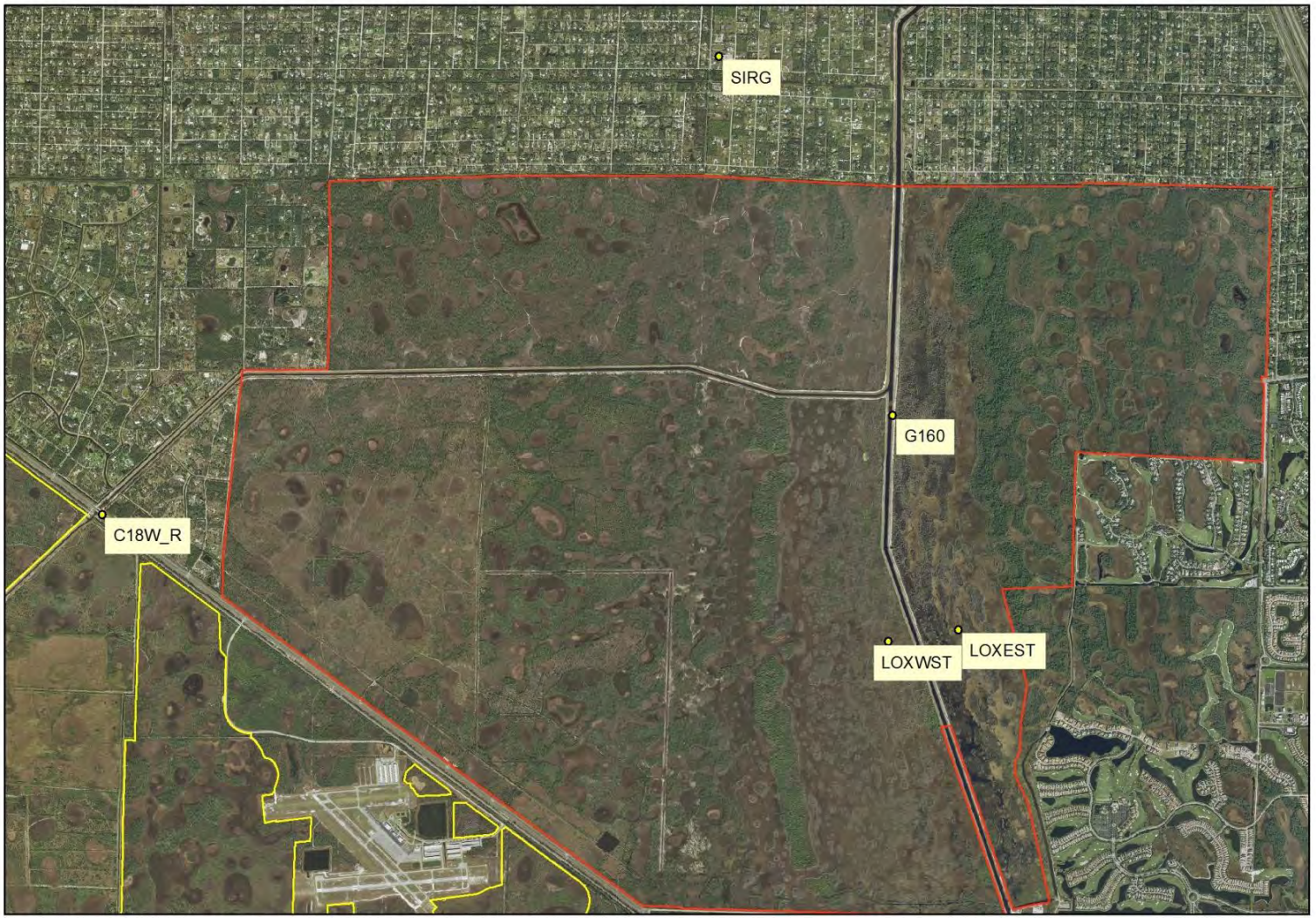


Figure 3: Hydrological Monitoring Stations in the Vicinity and Within the Loxahatchee Slough Natural Area

ATTACHMENT A

Definitions for G-160 Vegetation Monitoring Stations at the Loxahatchee Slough Natural Area

Herbaceous layer = any *non-woody* plants, *excluding* seedlings of woody species that are presently non-woody (e.g. *Sabal palmetto*, *Hypericum* spp.), but *including* vines (e.g. *Vitis* spp., *Toxicodendron radicans).* Only count plants with at least half of their roots *within* the plot.

Shrub layer = any *woody* plant above the ground and *less* than, or equal to, 2.5 meters (8.2 feet) tall, excluding vines (which will *only* be recognized in the herbaceous plot canopy cover). Count *all Hypericum* spp. and *all* seedlings of potentially woody species in this plot. Shrub canopy cover class will be determined using trees rooted *both* inside *and* outside the plot.

Canopy layer = any *woody* plant greater than 2.5 meters tall, excluding vines. Only count the number of trees with more than half their root system within the plot. *Do not* count *seedlings* of canopy species; these will be counted within the shrub layer plot. Canopy cover class will be determined using trees rooted *both* inside *and* outside the plot.

Note: Always use the *first three letters* of both the genus and species names in the **Species** column on the Veg. Plot Data Sheets.

ATTACHMENT B

Vegetation Quadrat Data Sheets
For the Loxahatchee Slough Natural Area

March & September 2012

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 1, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, David Witmer

Date: 3 / 6 / 12

Station #: 1 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around the herbaceous plots to delineate their perimeters

Depth of water in plots: **17" (A), 16" (B), 16" (C)** Staff Gauge Reading: **17.02 ft NGVD** (SFWMD gauge)

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A **Herbaceous Plot (0.25x3 meters)**			
Ele cel	236	2	
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B **Herbaceous Plot (0.25x3 meters)**			
Ele cel	430	3	

Shrub Plot (1x12 meters)			
Cep occ	3	1	stressed
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	312	3	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 2, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, David Witmer

Date: 3 / 6 / 12

Station #: 2 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Depth of water in plots: **18" (A), 19" (B), 17.5" (C)** Staff Gauge Reading: **16.84 ft NGVD** (SFWMD gauge)

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A **Herbaceous Plot (0.25x3 meters)**			
Ele cel	300	2	
Shrub Plot (1x12 meters)			
Seedlings of shrub or canopy species within plot			
Tax dis	0	0	not found
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B **Herbaceous Plot (0.25x3 meters)**			
Ele cel	346	3	

Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	476	4	
Shrub Plot (1x12 meters)			
			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 3, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, Dave Witmer

Date: 3 / 8 / 12

Station #: 3 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Depth of water in plots: **15" (A), 12" (B), 16" (C)**

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (0.25x3 meters)			
Ele cel	217	2	
Fur sci	25	1	
Shrub Plot (1x12 meters)			
Cep occ	2	1	
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B			
Herbaceous Plot (0.25x3 meters)			
Ele cel	248	2	
Fur sci	1	1	

Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	318	3	
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 4, Hydric Hammock)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, Dave Witmer

Date: 3 / 8 / 12

Station #: 4 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around these plots to permanently delineate the perimeters

Depth of water in plot: **N/A** inches

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (1x3 meters)			
Ble ser	5	1	
Dic com	1	1	
Par qui	1	1	
Tox rad	3	1	
Smi sp	2	1	
Shrub Plot (1x12 meters)			
Phy ame	3	1	
Psy ner	4	1	
Psy sul	2	1	
Seedlings of shrub or canopy species within plot			
Ure lob	53	1	
Psy ner	50	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Sab pal	9	2	
Eug axi	2	1	
Psy ner	4	1	
Fic mic	1	1	
Per bor	1	1	

Mor rub	2	1	
Ile cas	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Mor rub		1	
Sab palm		2	
Chr oli		1	
Que lau		1	
Quadrat B			
Herbaceous Plot			
(1x3 meters)			
Vit rot	6	1	
Ble ser	3	1	
Shrub Plot			
(1x12 meters)			
Psy ner	12	1	
Rap pun	3	1	
Chr ica	1	1	
Sab pal	3	1	
Seedlings of shrub or canopy species within plot			
Sab pal	6	1	
Que lau	8	1	
Ure lob	4	1	
Rap pun	1	1	
Psy ner	100	2	
Canopy Plot			
(3x24 meters)			
Trees *rooted* within plot			
Sab pal	8	2	
Psy ner	20	2	
Per bor	1	1	
Bac hal	1	1	
Chr ica	1	1	
Ace rub	1	1	
Ile cas	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Que lau		2	
Sab pal		1	
Quadrat C			hog damage
Herbaceous Plot			
(1x3 meters)			
Smi sp	2	1	
Ble ser	5	1	
Emi fos	6	1	
Tox rad	2	1	

Vit rot	2	1	
Shrub Plot (1x12 meters)			
Rap pun	1	1	
Ser rep	1	1	
Seedlings of shrub or canopy species within plot			
Ure lob	4	1	
Que lau	2	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Sab pal	2	1	
Que vir	1	1	
Rap pun	7	1	
Que lau	2	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Pin ell var. *den*		1	
Ile cas		1	
Que lau		1	
Sab pal		1	

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 5, Pine Flatwoods)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carrol, Dave Witmer

Date: 3 / 8 / 12

Station #: 5 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around these plots to permanently delineate the perimeters

Depth of water in plots: **moist (A), moist (B), N/A (C)**

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (1x3 meters)			hog damage
Smi sp	1	1	
Ble ser	4	1	
Dic ere	3	1	
Tox rad	2	1	
Vit rot	1	1	
Shrub Plot (1x12 meters)			
Ser rep	3	1	
Ile gla	2	1	
Bac hal	1	1	
Seedlings of shrub or canopy species within plot			
Pin ell var. *den*	1	1	
Ser rep	1	1	
Chr ica	1	1	
Que lau	1	1	
Ile gla	1	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Pin ell var. *den*	1	1	
Sab pal	3	1	
Myr cer	6	1	

Rap pun	3	1	
Ile cas	2	1	
Ser rep	2	1	
Lyo fru	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Sab pal		1	
Quadrat B **Herbaceous Plot** **(1x3 meters)**			
Cla jam	3	1	
Lud rep	16	1	
Rhy sp	2	1	
Ele bal	8	1	
Shrub Plot **(1x12 meters)**			
Seedlings of shrub or canopy species within plot			
Sab pal	1	1	
Pin ell var. *den*	2	1	
Chr ica	2	1	
Que sp	1	1	
Ann gla	1	1	
Canopy Plot **(3x24 meters)**			
Trees *rooted* within plot			
Pin ell var. den	4	1	
Sab pal	3	1	
Rap pun	38	2	
Chr ica	1	1	
Myr cer	2	1	
Ile cas	1	1	
Bac hal	2	1	
Per bor	1	1	
Psy ner	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Myr cer		1	
Sab pal		1	
Pin ell var. den		1	
Quadrat C **Herbaceous Plot** **(1x3 meters)**			
Cas cha	5	1	lots of pine needles

Dic com	14	1	
Shrub Plot (1x12 meters)			
Rap pun	12	2	
Myr cer	1	1	
Sab pal	5	1	
Ile gla	1	1	
Seedlings of shrub or canopy species within plot			
Rap pun	3	1	
Pin ell var. den	2	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Pin ell var. den	8	2	2 dead pine trees not included
Sab pal	7	2	
Rap pun	11	1	
Ile cas	2	1	
Myr cer	2	1	
Per bor	1	1	
Ile gla	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Pin ell var. den		1	
Ile cas		1	

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 1, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, David Witmer, Carrie Black

Date: 9 / 11 / 12

Station #: 1 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around the herbaceous plots to delineate their perimeters

Depth of water in plots: **30" (A), 28" (B), 29" (C)** Staff Gauge Reading: **18.20 ft NGVD** (SFWMD gauge)

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A **Herbaceous Plot (0.25x3 meters)**			
Ele cel	276	2	
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B **Herbaceous Plot (0.25x3 meters)**			
Ele cel	405	3	

Shrub Plot (1x12 meters)			
Cep occ	3	1	stressed
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	465	4	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 2, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, David Witmer, Carrie Black
Date: 9 / 11 / 12
Station #: 2 A, B, C
GPS Location: See attached aerial photo for exact locations Management Unit: n/a
General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Depth of water in plots: **26" (A), 27" (B), 27" (C)** Staff Gauge Reading: **17.51 ft NGVD** (SFWMD gauge)

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A **Herbaceous Plot (0.25x3 meters)**			
Ele cel	517	4	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			
Seedlings of shrub or canopy species within plot			
Tax dis	0	0	not found
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B **Herbaceous Plot (0.25x3 meters)**			
Ele cel	385	3	
Utr sp	--	1	submerged - unable to count

Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	827	5	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			
			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 3, Swale)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, Dave Witmer, Carrie Black

Date: 9 / 11 / 12

Station #: 3 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Depth of water in plots: 2**5" (A), 27" (B), 28" (C)**

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (0.25x3 meters)			
Ele cel	241	2	
Fur sci	37	1	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			
Cep occ	0		not found
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat B			
Herbaceous Plot (0.25x3 meters)			
Ele cel	355	3	
Fur sci	7	1	
Utr sp	--	1	submerged - unable to count

Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Quadrat C			
Herbaceous Plot (0.25x3 meters)			
Ele cel	321	3	
Utr sp	--	1	submerged - unable to count
Shrub Plot (1x12 meters)			no shrub layer
Seedlings of shrub or canopy species within plot			
Canopy Plot (3x24 meters)			no canopy layer
Trees *rooted* within plot			
Trees *not* rooted within plot but whose canopy contributes to canopy cover			

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 4, Hydric Hammock)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carroll, Carrie Black

Date: 9 / 12 / 12

Station #: 4 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around these plots to permanently delineate the perimeters

Depth of water in plot: **N/A** inches

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (1x3 meters)			
Ble ser	8	1	
Dic com	5	1	
Par qui	1	1	
Tox rad	4	1	
Smi sp	1	1	
Cam phy	3	1	
Opl hir	1	1	
Shrub Plot (1x12 meters)			
Psy ner	4	1	
Psy sul	1	1	
Seedlings of shrub or canopy species within plot			
Ure lob	20	1	
Psy ner	50	1	
Sab pal	3	1	
Ace rub	1	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Sab pal	9	2	
Eug axi	2	1	
Psy ner	8	1	
Fic mic	1	1	

Per bor	1	1	
Mor rub	2	1	
Ile cas	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Mor rub		1	
Sab palm		2	
Chr oli		1	
Que lau		1	
Quadrat B			
Herbaceous Plot (1x3 meters)			
Vit rot	6	1	
Ble ser	3	1	
Opl hir	1	1	
Dic sp	4	1	
Shrub Plot (1x12 meters)			
Psy ner	14	2	
Rap pun	3	1	
Chr ica	1	1	
Sab pal	3	1	
Seedlings of shrub or canopy species within plot			
Sab pal	9	1	
Que lau	8	1	
Ure lob	3	1	
Bac hal	6	1	
Psy ner	55	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Sab pal	7	2	
Psy ner	23	2	
Per bor	1	1	
Bac hal	1	1	
Chr ica	1	1	
Ace rub	2	1	
Ile cas	1	1	
Psy sul	1	1	
Rap pun	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Que lau		2	
Sab pal		1	
Quadrat C			hog damage
Herbaceous Plot			

(1x3 meters)			
Smi sp	1	1	
Ble ser	10	1	
Phy ame	1	1	
Tox rad	2	1	
Vit rot	1	1	
Shrub Plot **(1x12 meters)**			
Rap pun	1	1	
Ser rep	1	1	
Que lau	1	1	
Bac hal	1	1	
Cal ame	1	1	
Seedlings of shrub or canopy species within plot			
Ure lob	3	1	
Que lau	2	1	
Canopy Plot **(3x24 meters)**			
Trees *rooted* within plot			
Sab pal	2	1	
Que vir	1	1	a portion of the tree appears dead
Rap pun	7	1	
Que lau	2	1	smaller individual covered with grape vine
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Pin ell var. *den*		1	
Ile cas		1	
Que lau		1	
Sab pal		1	

Loxahatchee Slough Restoration and G-160 Monitoring Plan
Vegetation Quadrat Data Sheet (Station 5, Pine Flatwoods)

Note: See "Rules for Vegetation Monitoring Plots at the Loxahatchee Slough Natural Area" prior to conducting the surveys.

Observer (s): Melissa Tolbert, Harper Carrol, Carrie Black

Date: 9 / 12 / 12

Station #: 5 A, B, C

GPS Location: See attached aerial photo for exact locations Management Unit: n/a

General Comments: Cover Class (DAUB) is determined using the Daubenmire Cover Scale:

Cover Class	Cover (%)
1	0-5
2	6-25
3	26-50
4	51-75
5	76-95
6	96-100

Note: String needs to be placed around these plots to permanently delineate the perimeters

Depth of water in plots: **sat'd (A), 5" (B), sat'd (C)**

Species	# of individuals per quadrat	Cover Class (DAUB)	Comments (alive, dead,etc.)
Quadrat A			
Herbaceous Plot (1x3 meters)			hog damage
Smi sp	1	1	
Ble ser	7	1	
Dic ere	5	1	
Tox rad	2	1	
Vit rot	1	1	
Shrub Plot (1x12 meters)			
Ser rep	3	1	
Ile gla	2	1	
Bac hal	1	1	
Seedlings of shrub or canopy species within plot			
Pin ell var. *den*	1	1	
Ser rep	1	1	
Bac hal	1	1	
Que lau	1	1	
Ure lob	1	1	
Rap pun	1	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Pin ell var. *den*	1	1	
Sab pal	3	1	

Myr cer	6	1	
Rap pun	4	1	
Ile cas	2	1	
Ser rep	2	1	
Lyo fru	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Sab pal		1	
Quadrat B			
Herbaceous Plot (1x3 meters)			
Cla jam	5	1	
Lud rep	2	1	
Shrub Plot (1x12 meters)			
Seedlings of shrub or canopy species within plot			
Chr ica	1	1	
Ann gla	3	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Pin ell var. den	4	1	
Sab pal	3	1	
Rap pun	32	2	
Chr ica	1	1	
Myr cer	2	1	
Ile cas	1	1	
Per bor	1	1	
Psy ner	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Myr cer		1	
Sab pal		1	
Pin ell var. den		1	
Quadrat C			
Herbaceous Plot (1x3 meters)			
Rhy sp	4	1	lots of pine needles
Dic com	11	1	
Shrub Plot (1x12 meters)			
Rap pun	13	2	
Sab pal	5	1	

Chr ica	1	1	
Seedlings of shrub or canopy species within plot			
Rap pun	2	1	
Canopy Plot (3x24 meters)			
Trees *rooted* within plot			
Pin ell var. den	8	2	2 dead pine trees not included
Sab pal	8	2	
Rap pun	10	1	
Ile cas	2	1	
Myr cer	3	1	
Per bor	1	1	
Ile gla	1	1	
Trees *not* rooted within plot but whose canopy contributes to canopy cover			
Pin ell var. den		1	
Ile cas		1	

ATTACHMENT C

Photomonitoring Protocol for Palm Beach County Natural Areas

(Updated 10/7/02)

The following is to be used as a guideline for site managers for establishing photopoints and taking the photographs at each photomonitoring station required per the site management plan. The standards established here are to be treated as minimum requirements. It is assumed here that all photopoints shall always be established in accordance with the appropriate site management plan in addition to the standards set below. Individual site managers may decide additional photopoints are necessary to adequately monitor a particular event (e.g. extreme high water conditions, wildfire, etc.), or more comprehensive photos (e.g. a photo encompassing a 180 degree field of view photo instead of only approximately 110 degrees) are necessary to assess the success of a particular management activity. Note: See the appropriate management plan and the Burn Monitoring Protocol Memo for appropriate timing of photomonitoring events.

Objective:

To obtain a qualitative, long-term visual record of changes in vegetative structure and/or condition over time, including the effects of planned management activities. The visual record can become semi-quantitative with the use of a density board and/or range pole.

Equipment Required for Establishing Photopoints:

- Photopoint monitoring record form (see attachment)
- Aerial photograph of site
- GPS unit
- Measuring tape
- Monument stakes (rebar and PVC)
- Compass
- Camera
- Tripod (must have compass degree increments of at least 45 degrees on camera mount for horizontal movement left and right (our Mangrotto 3030 tripod has this))
- Range pole and/or density board

Methods:

1) Location Selection:

Establish permanent photopoints in areas where planned management activities are anticipated to occur and in areas where natural vegetation succession (of management interest) is expected to occur. Examples of planned management activities include the following:

- prescribed burns
- exotic vegetation removal/herbiciding
- mechanical cutting of vegetation (e.g. Hydro-axe, Brontosaurus, roller-chopping, mowing, logging. etc.)
- construction of public use facilities and/or management roads
- wetland/upland restoration
- volunteer events

- tree plantings
- construction of water control structures on-site
- adjacent property owner activities (construction)

Examples of areas of natural vegetation succession of management interest include the following:

- known listed species populations being outcompeted
- early (e.g. post-wildfire) or late (e.g. fire-suppressed) successional vegetation communities
- new invasions of exotic species
- insect pest (e.g. pine beetles, Mexican bromeliad weevils) or plant disease outbreaks

Site management plans may dictate the number and general locations of photopoints (e.g. one photo point per management unit), but the abovementioned conditions shall be considered in the micrositing of the photopoints.

At a minimum, each* management/burn unit *shall contain at least one photopoint within a vegetation community that is expected to carry fire during a wildfire or prescribed burn.

In addition, if practical, every* vegetation community *on-site shall contain at least one representative photopoint which captures at least one of the abovementioned planned management activities and/or vegetation conditions.

Additional photopoints may be deemed necessary (to be determined by the site manager) in order to appropriately represent the vegetation conditions on site.

2) Establishing the Photopoint:
The location from which the photograph is taken shall be permanently marked by placing rebar in the ground and covering it with a PVC tube. The rebar shall be placed *at least* 2 feet into the ground (or until completely stable) and the PVC covering should stand *at least* 4 feet above the ground (or until it is readily visible). The PVC can be left off if the point is in an area with a significant chance of being vandalized/removed or, the point can be easily encountered in the field in the future by ERM staff. Another rebar shall be placed in the ground at a reference point 15 feet from the photopoint in the direction of the central photo (i.e. one of four cardinal directions N, E, S, or W). This rebar should be *no more than* 3 feet above the ground and covering it with PVC will be optional. Both of these points can then be GPS‟d with the Trimble Backpack unit (or other unit w/ sub-meter accuracy) and their location clearly described on the photopoint monitoring record form. Describing additional reference points (e.g. trees, structures, other unique features) may also make the point easier to re-locate in the future (e.g. photopoint is 28 meters at 114 degrees from 20" d.b.h. slash pine).

3) Taking the photo:
(Note: If the photopoint was established prior to this protocol, evaluate the significance of the difference between the previously taken photos and photos taken according to this protocol before initiating this methodology. If the site manager determines that significant information will be lost by adopting this protocol, continue to take the photos according to the previously written instructions, otherwise, initiate this methodology during the next photo session.)

Take 3 photos to compose a panoramic image of the target vegetation. Each of the 3 photos will be taken at 45 degree intervals (use the degree graduation marks on the tripod to make this alignment). Set the

tripod up so that the camera mount is at 4.5 feet above the ground directly over top of the rebar and at a 90 degree angle to the ground (bring a level if the photopoints are on excessively uneven terrain). In addition, set up the tripod so that the "0" on the dial with the degree graduations (below the camera mount on top of the tripod) is facing the center point of your 3 photo panorama. The center point of the middle photo should be in line with one of four cardinal directions N, E, S, or W (place the compass on top of the camera to assist with this alignment). Holding the bottom tripod handle and progressing from right to left, or left to right, take a photo at "45" degrees (middle dot between "0" and "90"), "0", and end at "45" on the other side from where you started (total of three photos). The range pole or density board shall be placed at the reference point 15 feet from the photopoint and included in the middle photograph. The range pole can be placed directly over top of the rebar.

Note: Always take your photos using the widest angle "zoom" possible (on either camera). Press the "w" on the zoom lever until the image stops zooming out. This will give sufficient overlap between the photos in order to arrange a composite panorama if needed. In addition, always take photos using the 1600x1200 image size (if using the Sony Cybershot, open "Menu" and select "File/Image Size/1600x1200", if using the Nikon, select "Medium" quality) for optimum image clarity and practical storage capacity.

4) Image Storage:
Using Adobe Photoshop Elements, compile the three photos into a panoramic photo and save as a single file (JPEG) with the name of the site, management unit, and photopoint number within the unit (if applicable), and the date it was taken. This file can then be viewed and printed as needed. Save copies of this file to the "Master" photomonitoring CD under the appropriate site folder and year.

In addition, save *each* of the three individual photos taken at each photopoint individually, including the degree angle at which each photo was taken in the name of each file. These will be saved as back-up files of the panoramic mosaic if needed in the future.

ATTACHMENT D

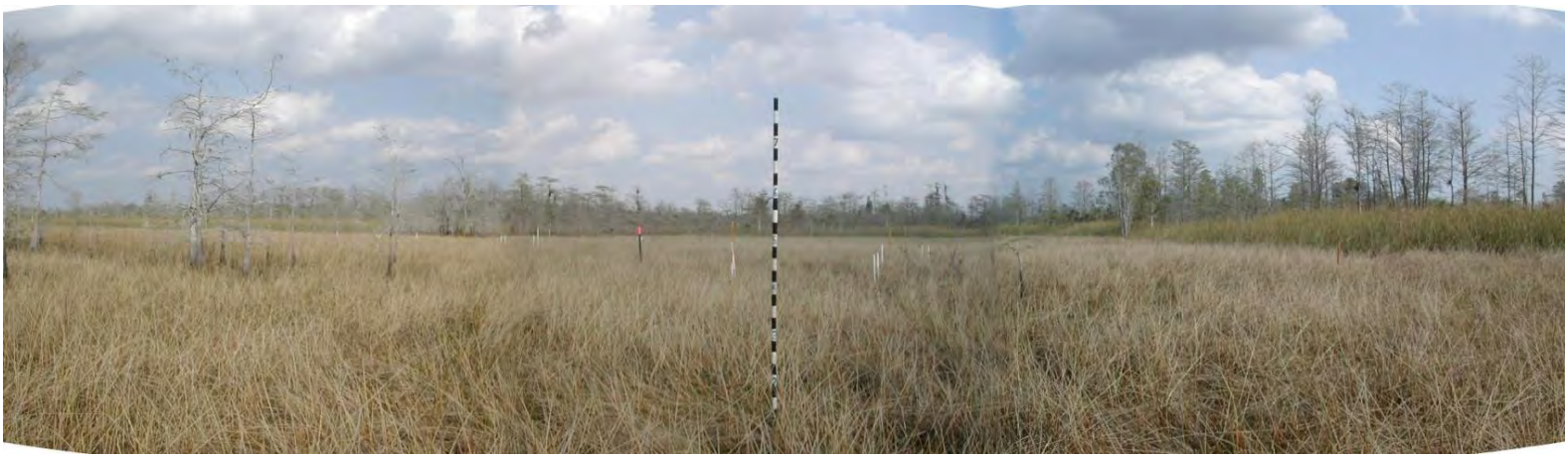
Photomonitoring in the Loxahatchee Slough Natural Area

March and September 2012

ATTACHMENT D - Panoramic Photos

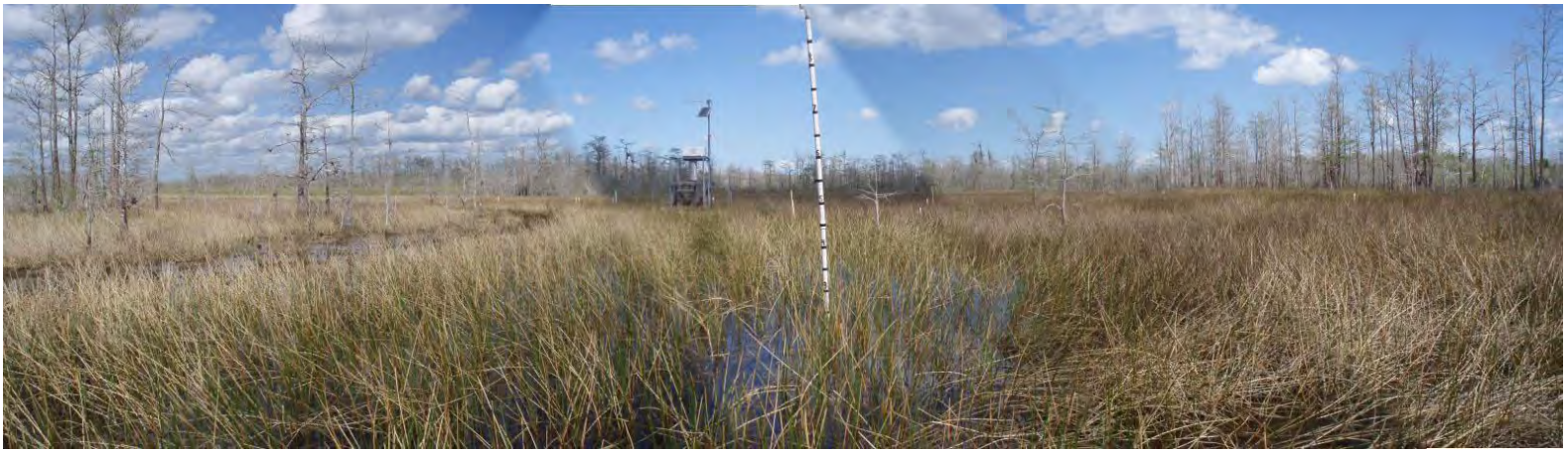
Photostation 1 - Swale

March 2003



March 2006

March 2012



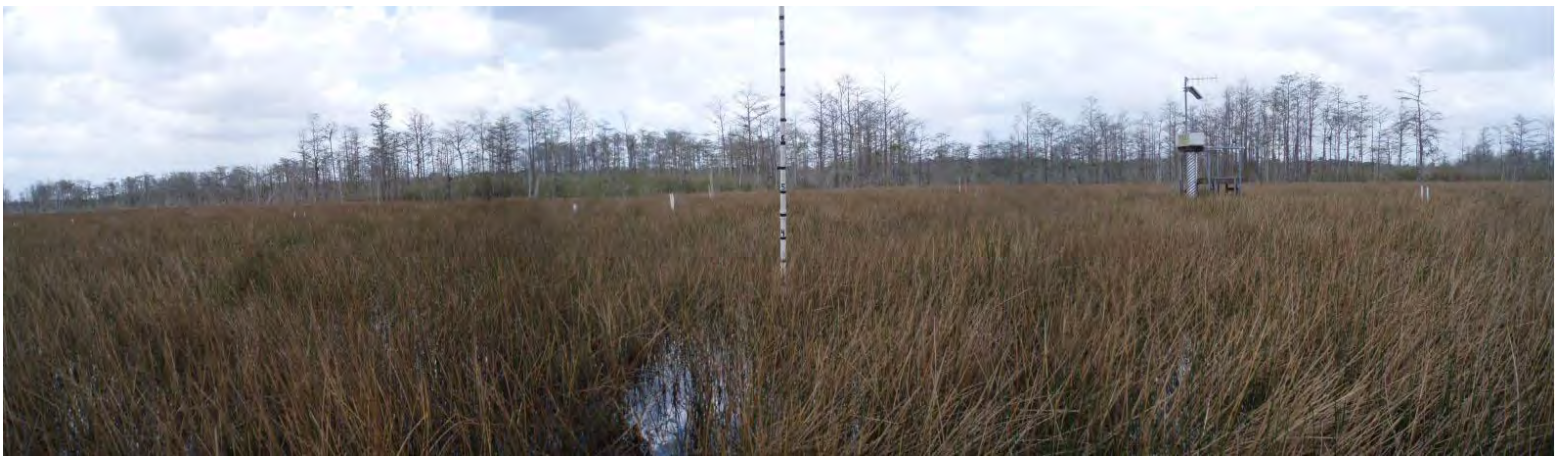
ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 2 - Swale

March 2003

March 2006

March 2012

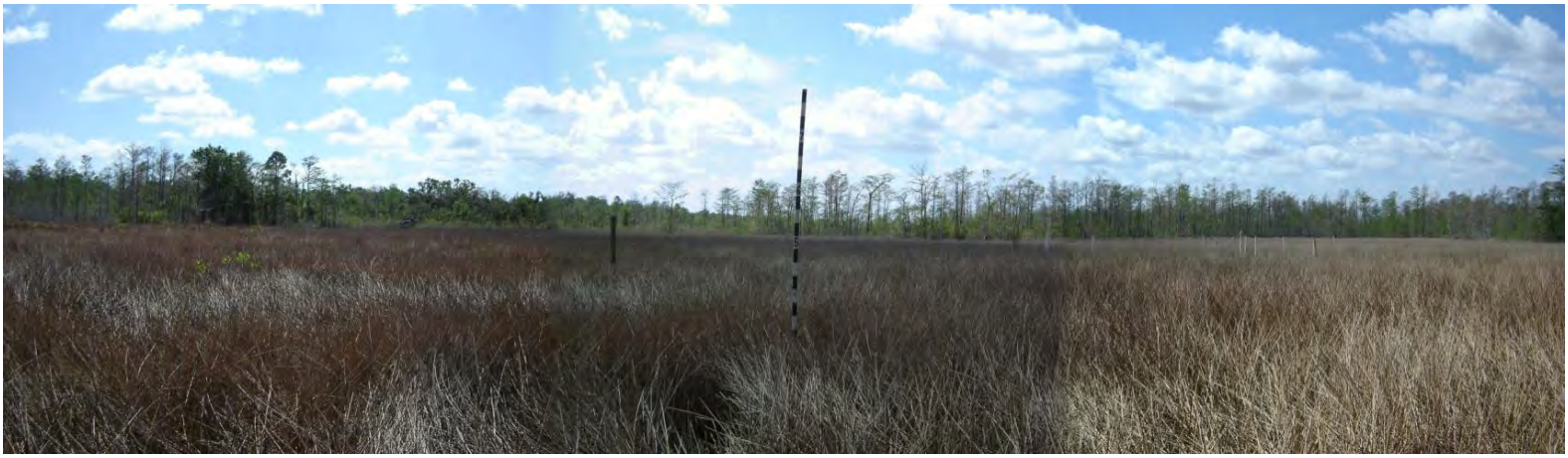


ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 3 - Swale

March 2003

March 2006



March 2012

ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 4 – Hydric Hammock

March 2003

March 2006

March 2012

ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 5 – Wet Flatwoods

March 2003

March 2006

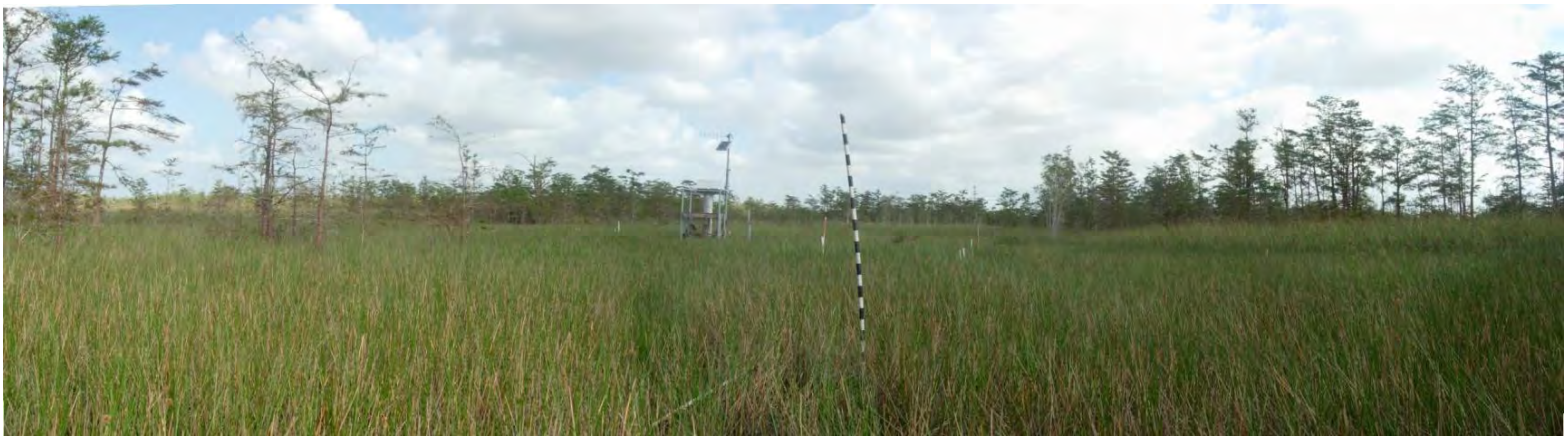
March 2012

ATTACHMENT D - Panoramic Photos

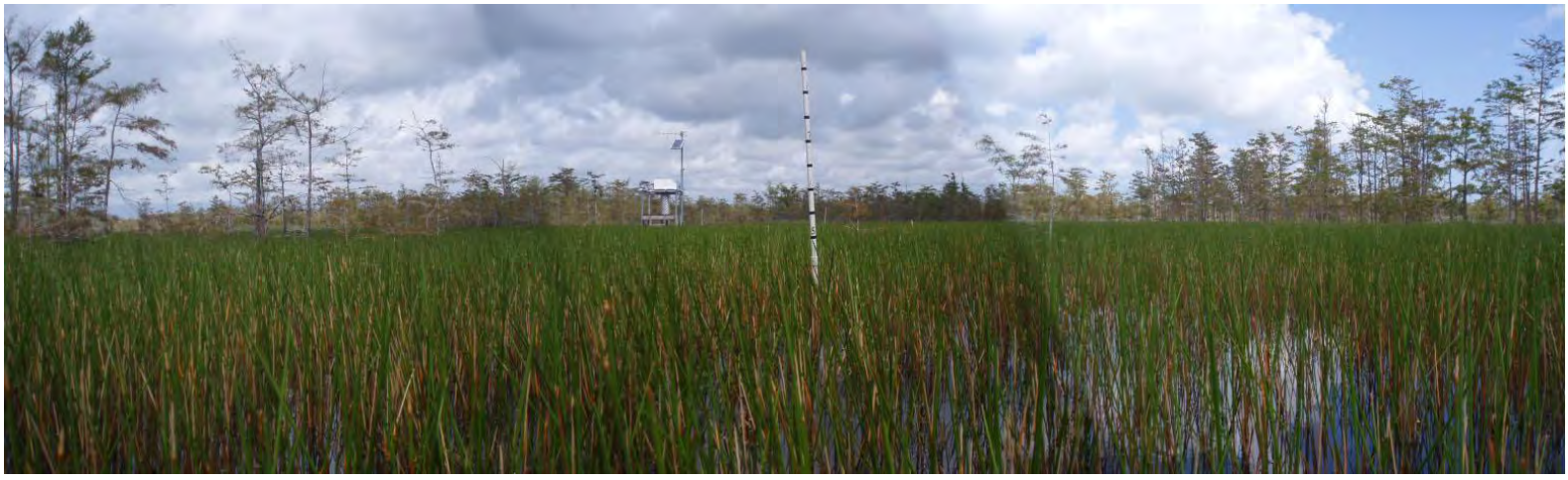
Photostation 1 - Swale

September 2003

September 2006



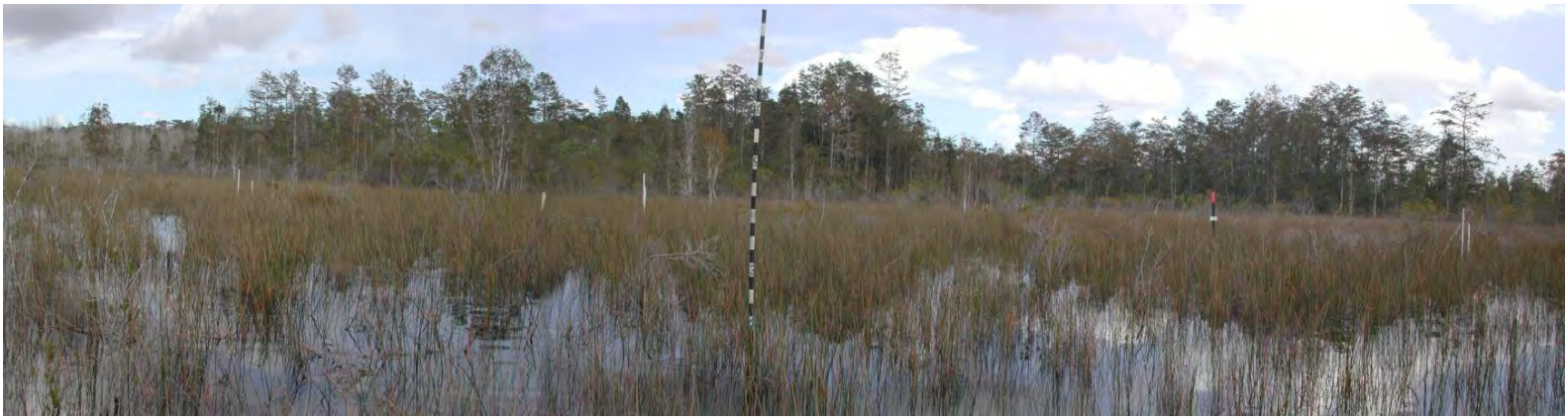
September 2012



ATTACHMENT D - Panoramic Photos (cont'd)

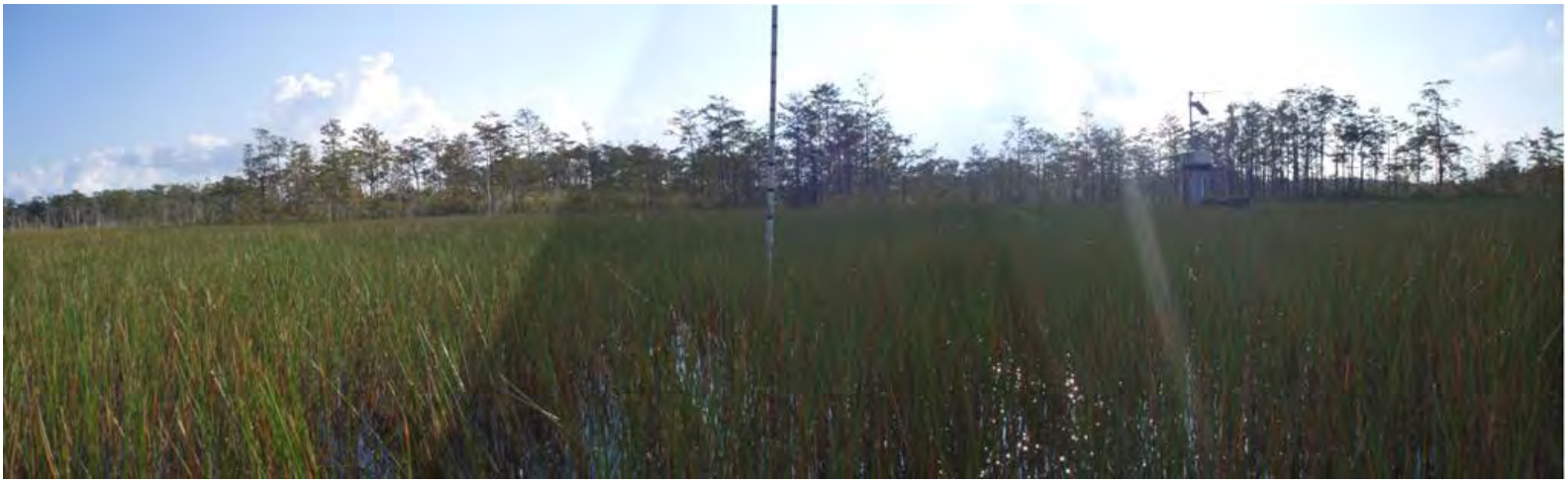
Photostation 2 - Swale

September 2003



September 2006

September 2012



ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 3 - Swale

September 2003

September 2006

September 2012

ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 4 – Hydric Hammock

September 2003

September 2006

September 2012

ATTACHMENT D - Panoramic Photos (cont'd)

Photostation 5 – Wet Flatwoods

September 2003

September 2006

September 2012

Photostation 6 – Pine Invasion

October 2002

September 2010

September 2012

Photostation 7 – Pine Invasion

October 2002

September 2010

September 2012

Photostation 8 – Pine Invasion

October 2002

September 2012

ATTACHMENT E

Water Levels, Rainfall and Stages
In the Loxahatchee Slough Natural Area

2006-2012

Figure E-1: Monthly Rainfall Totals (inches)

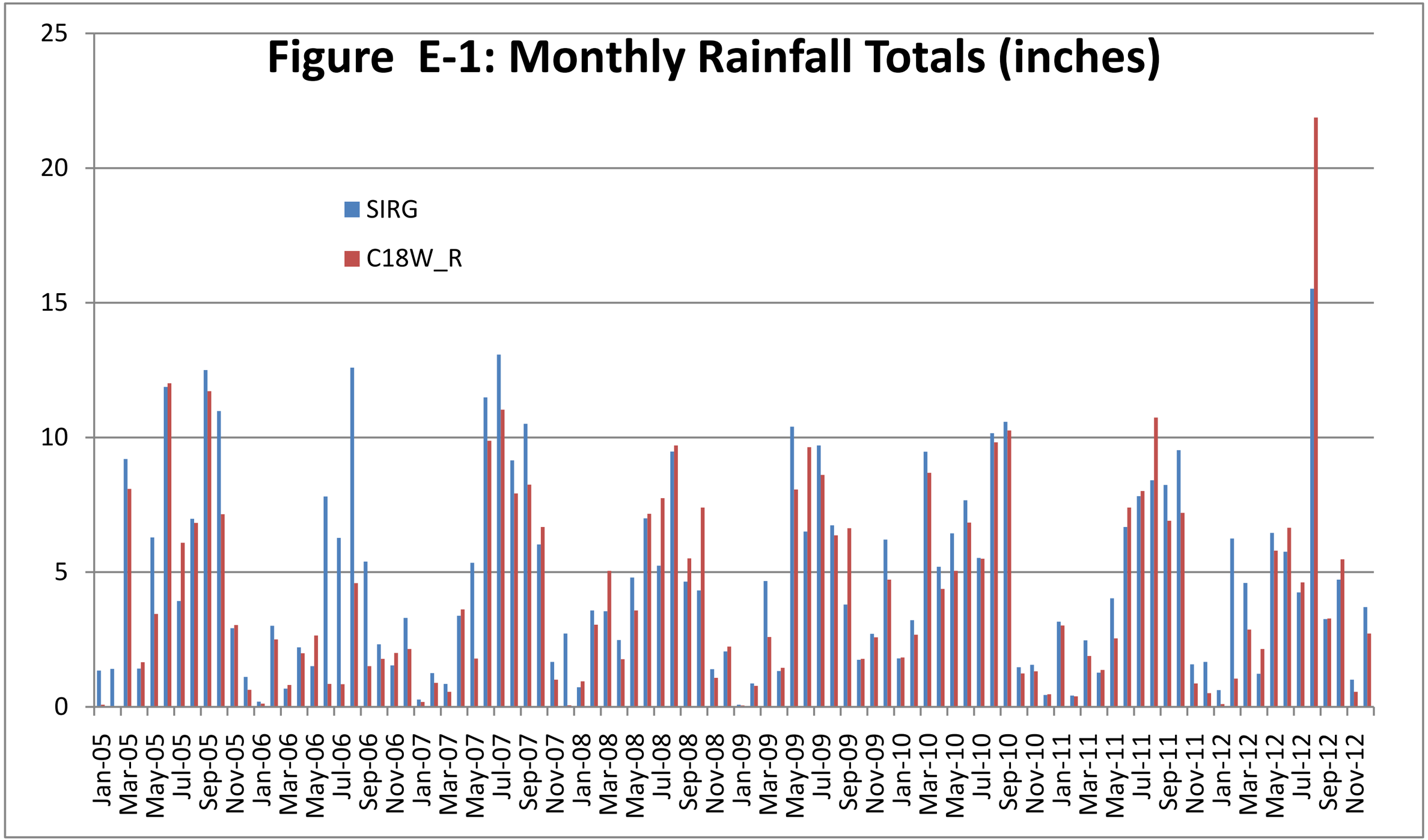


Figure E-2: Water Levels 2005-2012

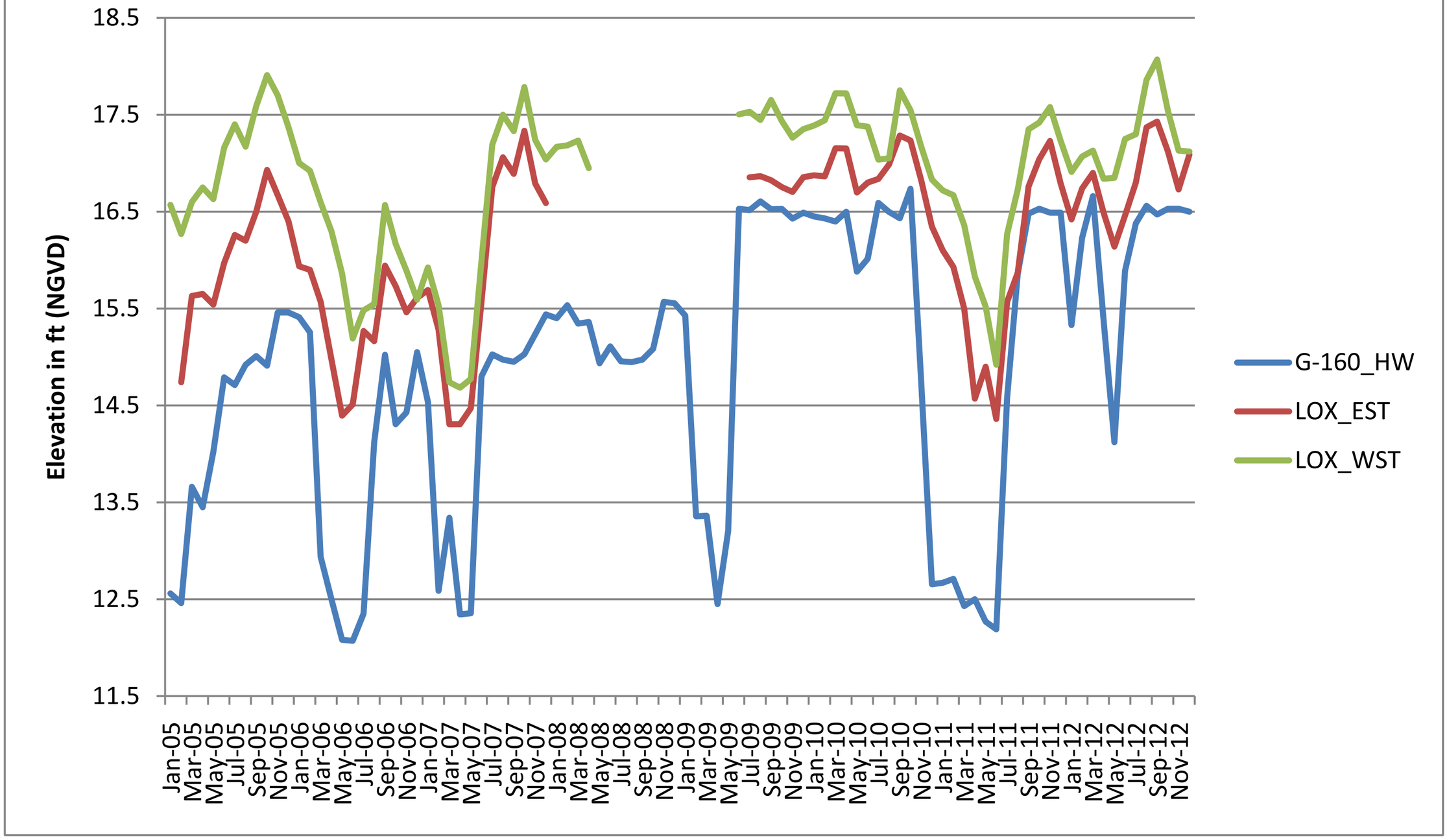


Figure E-3: Water Depths 2006-2012

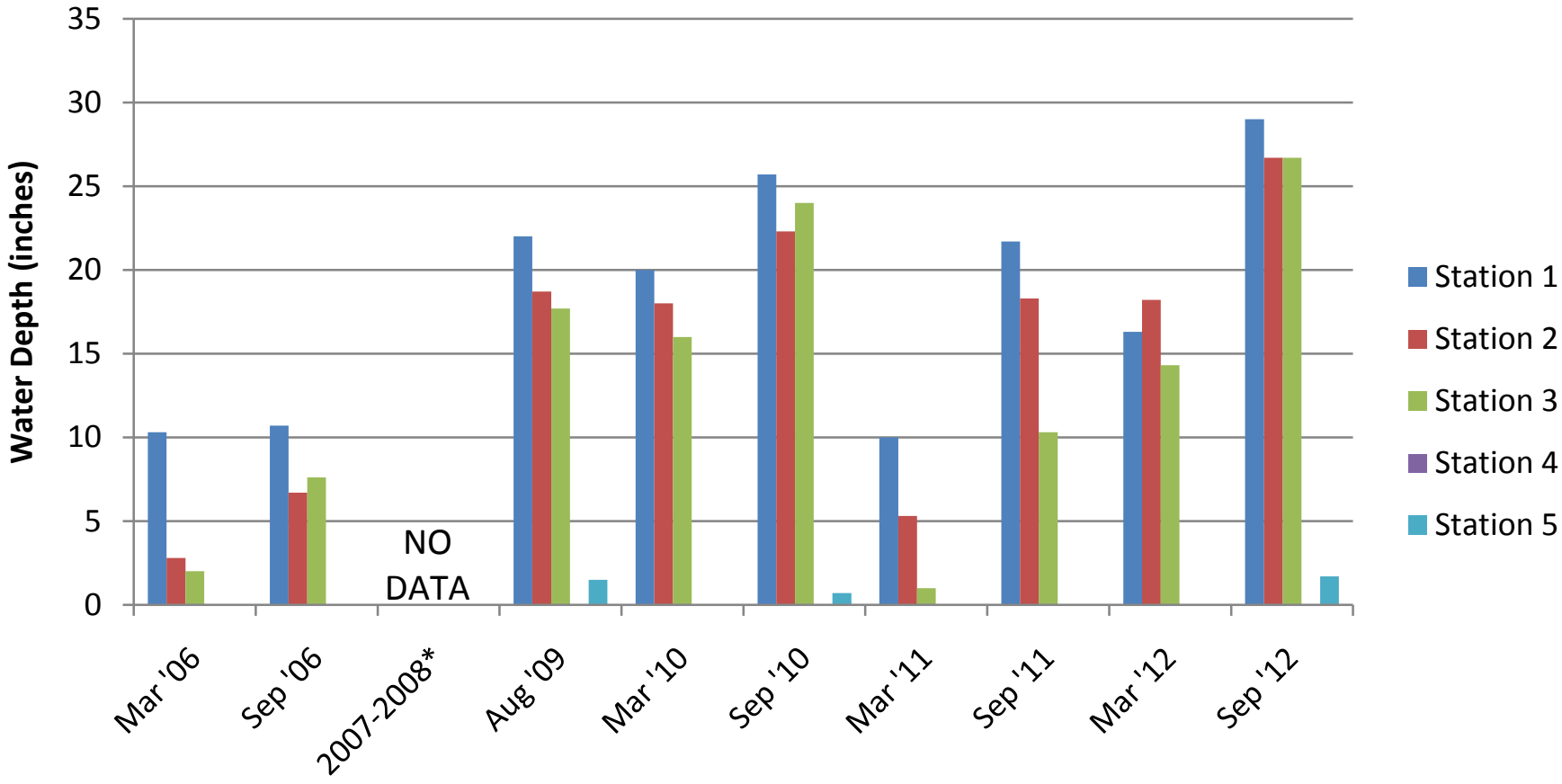
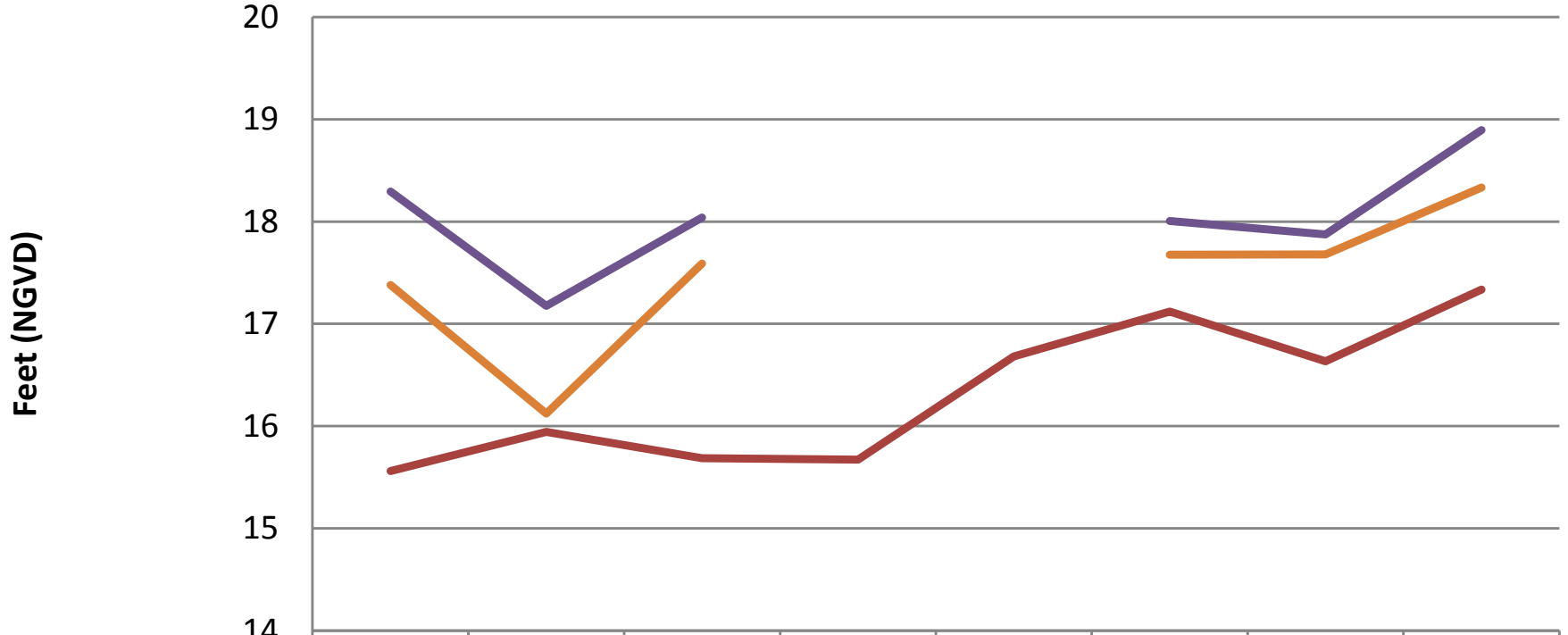


Figure E-4: Maximum Elevations



	2005	2006	2007	2008	2009	2010	2011	2012
G-160 Max	15.559	15.942	15.685	15.673	16.682	17.12	16.634	17.334
LOXWST Max	18.294	17.176	18.04			18.005	17.873	18.895
LOXEST Max	17.38	16.122	17.589			17.677	17.679	18.333

ATTACHMENT F

Summary of Vegetation Data
For the Loxahatchee Slough Natural Area

2006-2012

Vegetation Monitoring: nested plots		Station 1 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 2 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 3 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 4 - Mature Hammock dominated by Psychotria nervosa, Blechnum serrulatum in understory, Quercus laurifolia, sabal palmetto in canopy				Station 5 Pine flatwoods, variable understory, dominated by Pinus elliottii var. densa and Myrsine floridana			
		Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)
BASELINE MONITORING																					
Dry Season - March 2006	Herba-ceous	*Eleocharis cellulosa*	90 (s=50.5)	1.3	10.3	*Eleocharis cellulosa*	62 (s=24.0)	1	2.8	*Eleocharis cellulosa*	60 (s=40.0)	1	2.0	*Blechnum serrulatum*	9 (s=4.4)	1.3	Dry	*Blechnum serralatum*	2 (s=4.0)	0.3	Dry
		Rhynchospora tracyi	8 (s=7.5)	0.7		*Rhynchospora tracyi*	9 (s=4.5)	1		*Rhynchospora tracyi*	18 (s=16.7)	0.7		*Dichanthelium commutatum*	2 (s=1.7)	1		*Dichanthelium erectifolium*	4 (s=6.9)	0.3	
	Shrub					*Melaleuca quinquinervia*	0.7 (s=0.6)	0.7						*Psychotria nervosa*	33 (s=53.2)	1.7		*Rapanea punctata*	8 (s=10.8)	1	
		Cephalanthus occidentalis	1 (s=1.7)	0.3		*Taxodium distichum*	0.3 (s=0.6)	0.3		*Cephalanthus occidentalis*	0.3 (s=0.6)	0.3		*Urena lobata*	50 (s=74.2)	1		*Sabal palmetto*	3 (s=4.6)	0.7	
	Canopy													*Sabal palmetto*	5 (s=2.6)	2		*Sabal palmetto*	5 (s=3.8)	1.3	
		n/a (no canopy)	n/a	n/a		*N/a (no canopy)*	n/a	n/a		*N/a (no canopy)*	n/a	n/a		*Rapanea punctata*	4 (s=6.9)	0.7		*Rapanea punctata*	8 (s=8.4)	1.3	
Wet Season - Sept. 2006	Herba-ceous	*Elecoharis cellulosa*	200 (s=106.2)	1	10.7	*Eleocharis cellulosa*	125 (s=50.7)	1	6.7	*Eleocharis cellulosa*	223 (s=281.2)	1.3	7.6	*Blechnum serrulatum*	10 (s=5.5)	1	Dry	*Dichanthelium commutatum*	4 (s=6.4)	0.3	Dry
		Rhynchospora tracyi	43 (s=35.4)	1		*Rhynchospora tracyi*	72 (s=30.3)	1		*Rhynchospora tracyi*	47 (s=40.8)	0.7		*Erechtites hieraciifolius*	12 (s=20.2)	0.3		*Chamaecrista fasciculata*	5 (s=8.1)	0.3	
	Shrub					*Hypericum fasciculatum*	0.3 (s=0.6)	0.3						*Psychotria nervosa*	52 (s=79.9)	1.7		*Urena lobata*	13 (s=21.9)	0.3	
		Cephalanthus occidentalis	1 (s=1.7)	0.3		*Taxodium distichum*	0.3 (s=0.6)	0.3		*Cephalanthus occidentalis*	0.3 (s=0.6)	0.3		*Urena lobata*	142 (s=99.9)	1.3		*Sabal palmetto*	22 (s=22.5)	1.3	
	Canopy													*Sabal palmetto*	6 (s=2.5)	1.7		*Sabal palmetto*	5 (s=2.0)	1.3	
		n/a (no canopy)	n/a	n/a		*N/a (no canopy)*	n/a	n/a		No canopy	n/a	n/a		*Psychotria nervosa*	2 (s=1.5)	0.7		*Rapanea punctata*	20 (s=23.1)	1.3	
YEAR 1: POST OPERATION MONITORING																					
Wet Season - Sept. 2009	Herba-ceous	*Eleocharis cellulosa*	216 (s=81.5)	1.7	22	*Eleocharis cellulosa*	180 (s= 50.5)	1.3	18.7	*Eleocharis cellulosa*	167 (s=85.6)	1.3	17.7	*Psychotria nervosa*	78 (s=122.9)	0.7	Saturated	*Dichanthelium erectifolium*	4 (s=6.4)	0.3	1.5
						Rhynchospora tracyi	6 (s= 5.5)	0.7		*Rhynchospora tracyi*	21 (s=18.1)	0.7		*Blechnum serrulatum*	4 (s=2.0)	1		*Blechnum serrulatum*	2 (s=4.0)	0.3	
	Shrub					*Taxodium distichum*	0.3 (s=0.6)	0.3						*Psychotria nervosa*	21 (s=28.4)	0.7		*Rapanea punctata*	7 (s=9.8)	1	
		Cephalanthus occidentalis	1 (s=1.7)	0.3						No shrub layer	n/a	n/a		*Urena lobata*	14 (s=20.9)	0.7		*Serenoa repens*	2 (s=2.9)	0.3	
	Canopy													*Sabal palmetto*	5 (s=3.6)	1.7		*Pinus elliottii var. densa*	3 (s=2.5)	1.3	
		n/a (no canopy)	n/a	n/a		N/a (no canopy)	n/a	n/a		No canopy	n/a	n/a		*Rapanea punctata*	3 (s=3.8)	0.7		*Rapanea punctata*	12 (s=13.2)	1.3	
YEAR 2: POST OPERATION MONITORING																					
Dry Season - March 2010	Herba-ceous	*Eleocharis cellulosa*	259 (s=83.2)	1.3	20	*Eleocharis cellulosa*	244 (s=53.2)	1.3	18	*Eleocharis cellulosa*	136 (s=78.1)	1.3	16	*Psychotria nervosa*	9 (s=15.0)	0.3	Dry	*Dichanthelium commutatum*	1 (s=2.3)	0.3	Dry
						Rhynchospora tracyi	3 (s=3.1)	0.7		*Fuirena scirpoides*	18 (s=31.2)	0.3		*Blechnum serrulatum*	7 (s=7.0)	0.7		*Blechnum serrulatum*	3 (s=4.6)	0.3	
	Shrub					*Taxodium distichum*	0.3 (s=0.6)	0.3						*Psychotria nervosa*	17 (s=19.3)	0.7		*Rapanea punctata*	5 (s=5.7)	0.7	
		Cephalanthus occidentalis	1 (s=1.7)	0.3						No shrub layer	n/a	n/a		*Urena lobata*	6 (s=6.7)	0.7		*Serenoa repens*	2 (s=2.9)	0.3	
	Canopy													*Sabal palmetto*	5 (s=4.0)	1.7		*Pinus elliottii var. densa*	4 (s=3.1)	1.3	
		n/a (no canopy)	n/a	n/a		N/a (no canopy)	n/a	n/a		No canopy	n/a	n/a		*Psychotria nervosa*	3 (s=5.8)	0.3		*Rapanea punctata*	12 (s=13.2)	1.3	
Wet Season - Sept. 2010	Herba-ceous	*Eleocharis cellulosa*	198 (s=33.5)	2	25.7	*Eleocharis cellulosa*	294 (s=55.9)	2.3	22.3	*Eleocharis cellulosa*	179 (s=41.8)	2	24	*Psychotria nervosa*	9 (s=15.6)	0.3	Dry	*Dichanthelium commutatum*	10 (s=10.3)	0.7	0.7
						Rhynchospora tracyi	3 (s=3.5)	0.7		*Fuirena scirpoides*	15 (s=18.9)	0.7		*Blechnum serrulatum*	6 (s=6.0)	0.7		*Blechnum serrulatum*	3 (s=4.9)	0.3	
	Shrub					*Taxodium distichum*	0.3 (s=0.6)	0.3						*Psychotria nervosa*	12 (s=13.9)	1		*Rapanea punctata*	4 (s=5.8)	1	
		Cephalanthus occidentalis	1 (s=1.7)	0.3						No shrub layer	n/a	n/a		*Urena lobata*	6 (s=10.4)	0.3		*Serenoa repens*	1 (s=2.3)	0.3	
	Canopy													*Sabal palmetto*	6 (s=3.8)	1.7		*Pinus elliottii var. densa*	4 (s=3.1)	1.3	
		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		*Psychotria nervosa*	4 (s=5.5)	0.7		*Rapanea punctata*	16 (s=17.6)	1.3	

Vegetation Monitoring: nested plots		Station 1 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 2 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 3 (Swale community dominated by Eleocharis cellulosa, little shrub, no canopy				Station 4 - Mature Hammock dominated by Psychotria nervosa, Blechnum serrulatum in understory, Quercus laurifolia, sabal palmetto in canopy				Station 5 Pine flatwoods, variable understory, dominated by Pinus elliottii var. densa and Myrsine floridana			
		Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)	Species Composition	Density (total unit/area)	Cover Class 1-6	Water Depth (inches)
YEAR 3: POST OPERATION MONITORING																					
Dry Season - March 2011	Herba-ceous	*Eleocharis cellulosa*	177 (s=66.2)	1.3	10	*Eleocharis cellulosa*	269 (s=59.1)	2	5.3	*Eleocharis cellulosa*	97 (s=26.4)	1	1	*Blechnum serrulatum*	3 (s=2.3)	0.7	Dry	*Rhynchospora colorata*	4 (s=5.1)	0.7	Dry
										Fuirena scirpoides	17 (s=24.7)	0.7		*Vitus rotundifolia*	2 (s=1.5)	0.7		*Eleocharis baldwinii*	3 (s=5.8)	0.3	
	Shrub	*Cephalanthus occidentalis*	1 (s=1.7)	0.3		*Taxodium distichum*	0.3 (s=0.6)	0.3		No shrub layer	n/a	n/a		*Psychotria nervosa*	4 (s=4.5)	0.7		*Rapanea punctata*	3 (s=4.9)	0.7	
														Rapanea punctata	2 (s=2.1)	0.7		*Serenoa repens*	2 (s=3.5)	0.3	
	Canopy	n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		*Sabal palmetto*	5 (s=4.0)	1.7		*Pinus elliottii var. densa*	4 (s=3.0)	1.3	
														Psychotria nervosa	10 (s=11.2)	1		*Rapanea punctata*	13 (s=13.6)	1.3	
Wet Season - Sept. 2011	Herba-ceous	*Eleocharis cellulosa*	184 (s=74.3)	1.7	21.7	*Eleocharis cellulosa*	227 (s=43.6)	2	18.3	*Eleocharis cellulosa*	260 (s=133.2)	2	10.3	*Blechnum serrulatum*	4 (s=3.5)	0.7	Dry	*Dichanthelium erectifolium*	7 (s=7.0)	0.7	Saturated
						Rhynchospora tracyi	6 (s=5.5)	0.7		*Fuirena scirpoides*	11 (s=19.1)	0.3		*Vitus rotundifolia*	3 (s=4.2)	0.7		*Rhychospora sp.*	2 (s=4.0)	0.3	
	Shrub	*Cephalanthus occidentalis*	1 (s=1.7)	0.3		*Taxodium distichum*	0.3 (s=0.6)	0.3		No shrub layer	n/a	n/a		*Psychotria nervosa*	10 (s=14.6)	1		*Myrica cerifera*	1 (s=0.6)	0.7	
														Rapanea punctata	2 (s=2.1)	0.7		*Rapanea punctata*	4 (s=6.4)	0.3	
	Canopy	n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		*Sabal palmetto*	6 (s=3.8)	1.7		*Pinus elliottii var. densa*	4 (s=3.0)	1.3	
														Psychotria nervosa	5 (s=7.6)	1		*Rapanea punctata*	18 (s=19.5)	1.3	
YEAR 4: POST OPERATION MONITORING																					
Dry Season - March 2012	Herba-ceous	*Eleocharis cellulosa*	326 (s=97.8)	2.7	16.3	*Eleocharis cellulosa*	374 (s=91.3)	3	18.2	*Eleocharis cellulosa*	261 (s=51.7)	1	14.3	*Blechnum serrulatum*	4 (s=1.2)	1	Dry	*Ludwigia repens*	5 (s=9.2)	0.3	Moist
										Fuirena scirpoides	9 (s=14.2)	0.7		*Vitus rotundifolia*	3 (s=3.1)	0.7		*Dichanthelium commutatum*	5 (s=8.1)	0.3	
	Shrub	*Cephalanthus occidentalis*	1 (s=1.7)	0.3		*No shrub layer*	n/a	n/a		*Cephalanthus occidentalis*	1 (s=1.2)	0.3		*Psychotria nervosa*	5 (s=6.1)	0.7		*Rapanea punctata*	4 (s=6.9)	0.7	
														Rapanea punctata	1 (s=1.5)	0.7		*Sabal palmetto*	2 (s=2.9)	0.3	
	Canopy	n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		*Sabal palmetto*	6 (s=3.8)	1.7		*Rapanea punctata*	17 (s=18.3)	1.3	
														Psychotria nervosa	8 (s=10.6)	1		*Pinus elliottii var. densa*	4 (s=3.5)	1.3	
Wet Season - Sept. 2012	Herba-ceous	*Eleocharis cellulosa*	382 (s=96.6)	3	29	*Eleocharis cellulosa*	576 (s=226.9)	4	26.7	*Eleocharis cellulosa*	306 (s=58.5)	2.7	26.7	*Blechnum serrulatum*	7 (s=3.6)	1	Dry	*Dichanthelium commutatum*	4 (s=6.4)	0.3	1.7
										Fuirena scirpoides	15 (s=19.7)	0.7		*Vitus rotundifolia*	2 (s=3.2)	0.7		*Blechnum serrulatum*	2 (s=4.0)	0.3	
	Shrub	*Cephalanthus occidentalis*	1 (s=1.7)	0.3		*No shrub layer*	n/a	n/a		No shrub layer	n/a	n/a		*Psychotria nervosa*	6 (s=7.2)	1		*Rapanea punctata*	4 (s=7.5)	0.7	
														Rapanea punctata	1 (s=1.5)	0.7		*Sabal palmetto*	2 (s=2.9)	0.3	
	Canopy	n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		n/a (no canopy)	n/a	n/a		*Sabal palmetto*	6 (s=3.6)	1.7		*Rapanea punctata*	15 (s=14.7)	1.3	
														Psychotria nervosa	10 (s=11.7)	1		*Pinus elliottii var. densa*	4 (s=3.5)	1.3	

Attachment E: After-Action Report from the City of West Palm Beach

The City of West Palm Beach

"The Capital City of the Palm Beaches"

DEPARTMENT OF PUBLIC UTILITIES
DAVID HANKS
OFFICE OF THE DIRECTOR
P. O. BOX 3366
WEST PALM BEACH, FLORIDA 33402-3366
TEL: 561: 494-1060
FAX: 561: 494-1115

November 1, 2012

Florida Department of Environmental Protection
Attn: Ernie Marks, Environmental Administrator
Office of Ecosystem Projects
Program Coordination and Regulation Program
3900 Commonwealth Boulevard, MS-24
Tallahassee, FL 32399-3000

Subject: Operation of G-161 Structure

Dear Mr. Marks:

The City is very grateful for allowing us to operate the G-161 Structure in a time of high waters and flooding conditions due to Tropical Storm Isaac. Below are the answers to the items the City agreed to as a part of this operational protocol.

1) After Action Report

The circumstances that led to the request for an increase in the flow rate through the G-161 structure were as follows:

a. Between August 25 and August 29 2012, Tropic Storm Isaac deposited +/- 17 inches of rain on portions of Palm Beach County, Florida. This volume of rain caused excessive flood stages in lakes, canals, roadways and properties, particularly in the western communities of Palm Beach County. The Indian Trail Improvement District (ITID) service area and Corbett Wildlife Management Area were especially hard hit. ITID was experiencing flood stages that exceeded some finished floor elevations within their jurisdiction. Normal stormwater management facilities were not providing timely relief of the flooding.

b. ITID made a request of SFWMD for permission to discharge to the City's M Canal, in an effort to provide some flood relief (which SFWMD granted via Order No. 2012-096-DAO); and,

c. The City accepted flow from ITID, but in order to control stages within Grassy Waters Preserve and the M Canal, requested the additional flow rate through the G-161 structure; and,

d. The City made the request of the South Florida Water Management District (SFWMD), which is the operating entity for the G-161 structure, but they advised that the City needed to make the request of the FDEP (Department).

2) ***SFWMD authorization for discharges to their system***
SFWMD was the entity that advised the City to seek permission from the Department for the increased discharge rate through the G-161 Structure (which SFWMD owns/operates); they were fully aware of the request. Since SFWMD operates the structure, they were in fact the entity that was physically responsible for the increased discharge rate into their own system, once approval was received from the Department.

SFWMD authorized the emergency discharges from ITID to the City's M-Canal under the Emergency Authorization issued by Gov. Scott (Executive Order 12-199, declaring a statewide state of emergency as a result of TS Isaac).

3) ***Continued communication between SFWMD and the City during the discharge period***
SFWMD is the operating entity for the G-161 Structure. They are aware at all times of the flow condition at that structure. During extreme water management conditions such as Tropical Storm Isaac, the City sustains on-going communication with SFWMD on multiple systems within its jurisdiction.

4) ***Confirmation that the discharges did not exceed 30 days from date of authorization***
Attached is the DbHydro data for the G-161 structure. It indicates that discharges via the G-161 Structure ceased on September 20, 2012, well within the 30-day period from the authorization date of September 6, 2012.

5) ***Coordination on modification to facility operations to avoid, to the maximum extent practicable, the need for future individual approvals***
The permitted owner and operating entity for the G-161 Structure is the SFWMD. However, at the Department's suggestion, the City met with SFWMD staff on October 31, 2012 to discuss the Department's request for modification(s) that would allow, to the maximum extent practicable, the avoidance of future individual approvals for special operation of the G-161 structure. SFWMD is already having internal discussions about possible modified operation of the structure and plans future coordination with the City on this matter. Staff has indicated that they will contact you to pursue a permit modification on operational protocols with the Department.

Sincerely,
CITY OF WEST PALM BEACH

David Hanks
Director of Public Utilities

cc: Sam Heady, Assistant Utility Director

"An Equal Opportunity Employer"