

**Enhanced Water Quality Monitoring and Modeling Program for the
A.R.M. Loxahatchee National Wildlife Refuge
Quarterly Update Report – September 2012**

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Overview

This update is a summary of activities since the previous status report of June 2012 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b; USFWS 2009; USFWS 2010a, b; USFWS 2012a; USFWS 2012b).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

B. Enhancing Monitoring of the Refuge

Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-September 2012 are posted on the Technical Oversight Committee's web site at <http://www.sfwmd.gov/toc/>. This report includes information from samples collected through September 2012.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (July – September 2012)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 31 stations in July, 35 in August, and 37 in September 2012 (**Table 1**).

Total phosphorus data available to date for October 2011 through September 2012 are presented in **Table 1**. Maps of stations where samples were collected for the months from July through September 2012 are presented in **Figures 2-4**.

Conductivity sonde deployment information for October 2011 through September 2012 is presented in **Table 2**.

Next Steps

The next steps for this program include additional efforts on the Annual Report, and additional model development and application.

References

- Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.
- USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.
- USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.
- USFWS. (2009) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 4th Annual Report – July 2009. LOXA09-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 106 pp.
- USFWS. (2010a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 5th Annual Report – September 2010. LOXA08-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 43 pp.
- USFWS. (2010b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 6th Annual Report – October 2010. LOXA09-011, U.S. Fish and Wildlife Service, Boynton Beach, FL. 42 pp.
- USFWS. (2012a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 7th Annual Report – February 2012. LOXA12-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 115 pp.
- USFWS. (2012b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 8th Annual Report – October 2012. LOXA12-004, U.S. Fish and Wildlife Service, Boynton Beach, FL. 68 pp.

Table 1. Total phosphorus data (ppb) available for October 2011 – September 2012 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
LOXA101	18	15	13	11	13	13	-	14	-	8	6	108
LOXA102	14	13	8	11	-	-	-	-	-	-	-	12
LOXA103	9	12	11	8	-	-	-	13	-	-	8	10
LOXA105	32	20	17	13	15	24	-	21	18	-	14	79
LOXA106	19	14	12	10	9	-	-	11	9	-	8	17
LOXA107	-	8	7	-	-	-	-	-	-	-	-	11
LOXA108	7	6	5	4	7	-	-	8	5	6	4	12
LOXA109	17	13	9	8	9	9	8	11	9	7	5	12
LOXA110	7	6	6	7	7	6	-	8	8	6	5	10
LOXA111	8	9	8	6	7	9	-	10	8	6	4	5
LOXA112	11	12	10	7	7	5	8	7	8	6	6	10
LOXA113	7	7	8	6	6	9	-	8	7	7	4	6
LOXA114	8	7	8	7	5	9	-	10	7	5	4	8
LOXA117	27	20	17	9	14	18	17	17	14	11	13	12
LOXA118	18	13	11	7	8	8	8	8	6	5	7	6
LOXA119	10	9	7	6	8	10	10	8	7	9	7	8
LOXA120	11	8	6	4	6	8	8	7	5	22	5	4
LOXA122	20	17	13	9	9	12	11	11	9	8	11	9
LOXA124	18	8	8	13	8	8	13	13	10	10	14	31
LOXA126	10	23	9	8	6	6	7	10	7	5	7	6
LOXA127	8	4	6	3	6	6	6	7	7	4	8	6
LOXA128	8	7	6	5	7	8	-	8	5	6	5	5
LOXA130	15	11	13	9	8	6	13	14	8	7	9	13
LOXA131	7	7	8	5	6	3	-	10	10	11	7	8
LOXA133	30	23	24	10	12	-	-	27	15	-	18	23
LOXA134	13	10	11	9	8	9	-	15	10	9	8	9
LOXA136	32	18	16	12	12	15	17	21	13	12	12	20
LOXA137	17	18	14	12	10	15	-	18	12	8	9	22
LOXA138	5	11	8	6	6	7	-	14	-	6	4	6
LOXA139	5	6	5	4	-	-	-	14	6	6	4	10
LOXA140	13	14	11	10	7	-	-	13	8	7	5	14
LOXA141	14	20	19	10	15	12	10	13	6	14	13	7
MAX	32	23	24	13	15	24	17	27	18	22	18	108
MIN	5	4	5	3	5	3	6	7	5	4	4	4

Table 1 cont.

b) Canal stations

Canal Station	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
LOXA104	22	25	22	17	27	28	22	29	19	20	19	59
LOXA115	29	21	19	16	19	17	19	23	25	3	21	46
LOXA129	18	17	28	21	25	32	27	25	47	39	20	48
LOXA132	16	19	16	19	28	32	29	26	50	43	16	44
LOXA135	17	24	15	28	27	23	26	32	42	25	12	45
MAX	29	25	28	28	28	32	29	32	50	43	21	59
MIN	16	17	15	16	19	17	19	23	19	3	12	44

Table 2. October 2011 – September 2012 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

Site ID	2011			2012								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
LOXA104	X	X		X	X	X	X	X	X	X	X	
LOXA105	X		X		X		X		X		X	
LOXA106	X		X		X		X		X		X	
LOXA107			X		X		X		X		X	
LOXA108		X	X		X		X		X		X	
LOXA111		X		X		X		X		X		X
LOXA112		X		X		X		X		X		X
LOXA113		X		X		X		X		X		X
LOXA114		X		X		X		X		X		X
LOXA115	X	X		X	X	X	X	X	X	X	X	
LOXA116	X	X		X		X		X		X		X
LOXA117	X	X		X		X		X		X		X
LOXA118	X			X		X		X		X		X
LOXA119	X	X		X		X		X		X		X
LOXA120	X	X		X		X		X		X		X
LOXA126		X		X		X		X		X		X
LOXA127		X		X		X		X		X		X
LOXA128		X		X		X		X				X
LOXA129	X	X		X	X	X	X	X	X	X	X	
LOXA130			X		X		X		X		X	
LOXA131			X		X		X		X		X	
LOXA132	X	X		X	X	X	X	X	X	X	X	
LOXA133			X		X		X		X		X	
LOXA135	X	X		X	X	X	X	X	X	X	X	
LOXA136			X		X		X		X		X	
LOXA137			X		X		X		X		X	
LOXA138			X		X		X		X		X	
LOXA139			X		X		X		X		X	
LOXA142	X		X	X	X		X	X		X	X	
LOXA143	X			X		X		X		X	X	
LOXA144	X			X		X		X		X	X	
LOXA145	X			X		X		X		X	X	
LOXA146	X			X		X		X		X	X	
LOXA147			X	X	X		X	X		X	X	
LOXA148		X		X		X		X		X	X	
LOXA149		X		X		X		X		X	X	
LOXA150		X		X		X		X		X		X
LOXA151	X	X		X	X	X	X	X	X	X	X	
LOXA152	X	X		X	X	X	X	X	X	X	X	
LOXA153	X	X		X	X	X	X	X	X	X	X	
I-8C	X	X	X	X	X	X	X	X	X	X	X	X
LOX04			X		X		X		X		X	
LOX06		X		X		X		X		X		X
LOX07		X		X		X		X		X		X
LOX08		X		X		X		X		X		X
LOX09		X		X		X		X		X		X
LOX10		X		X		X		X		X		X
LOX15		X	X			X		X		X	X	

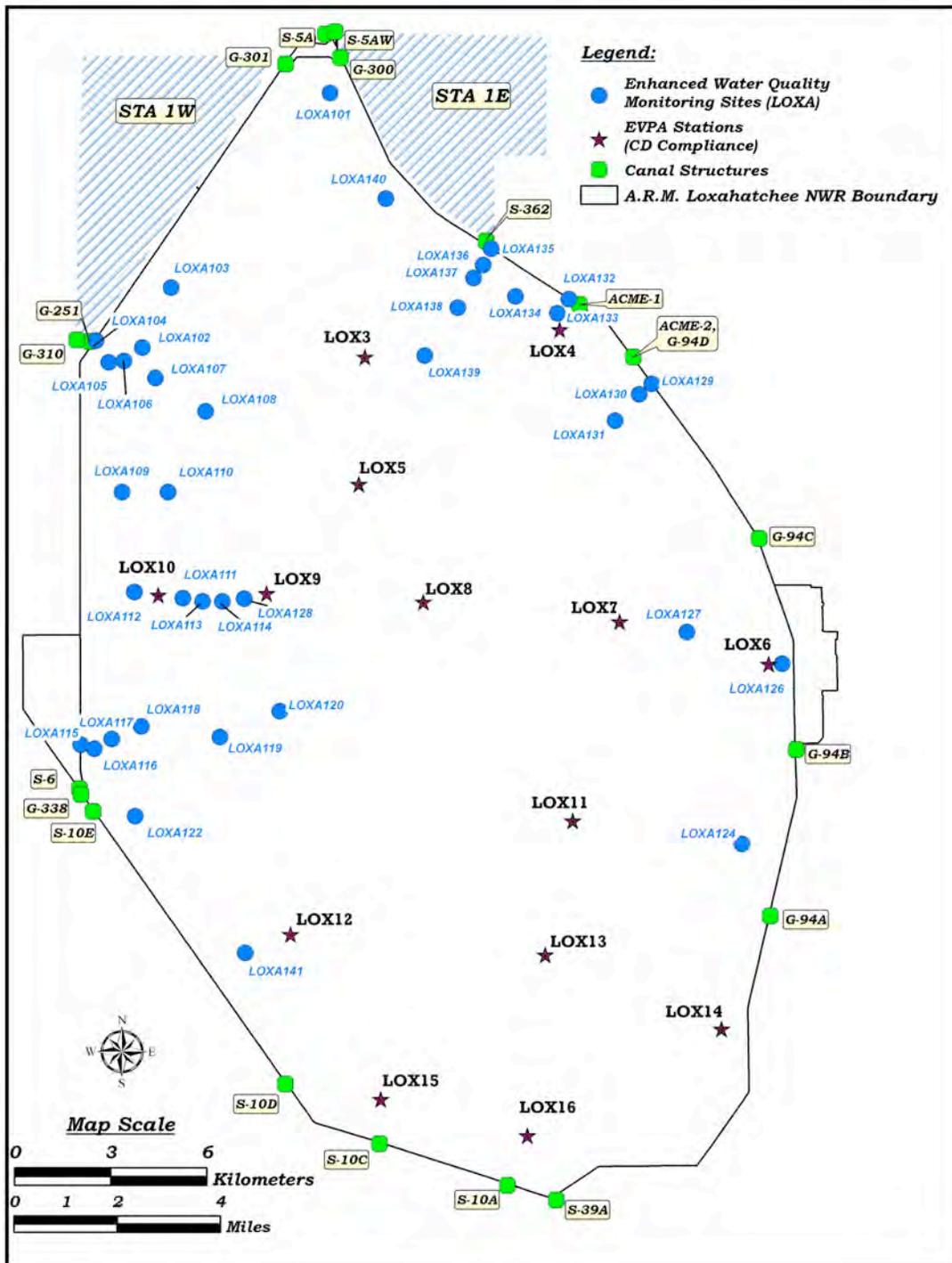


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

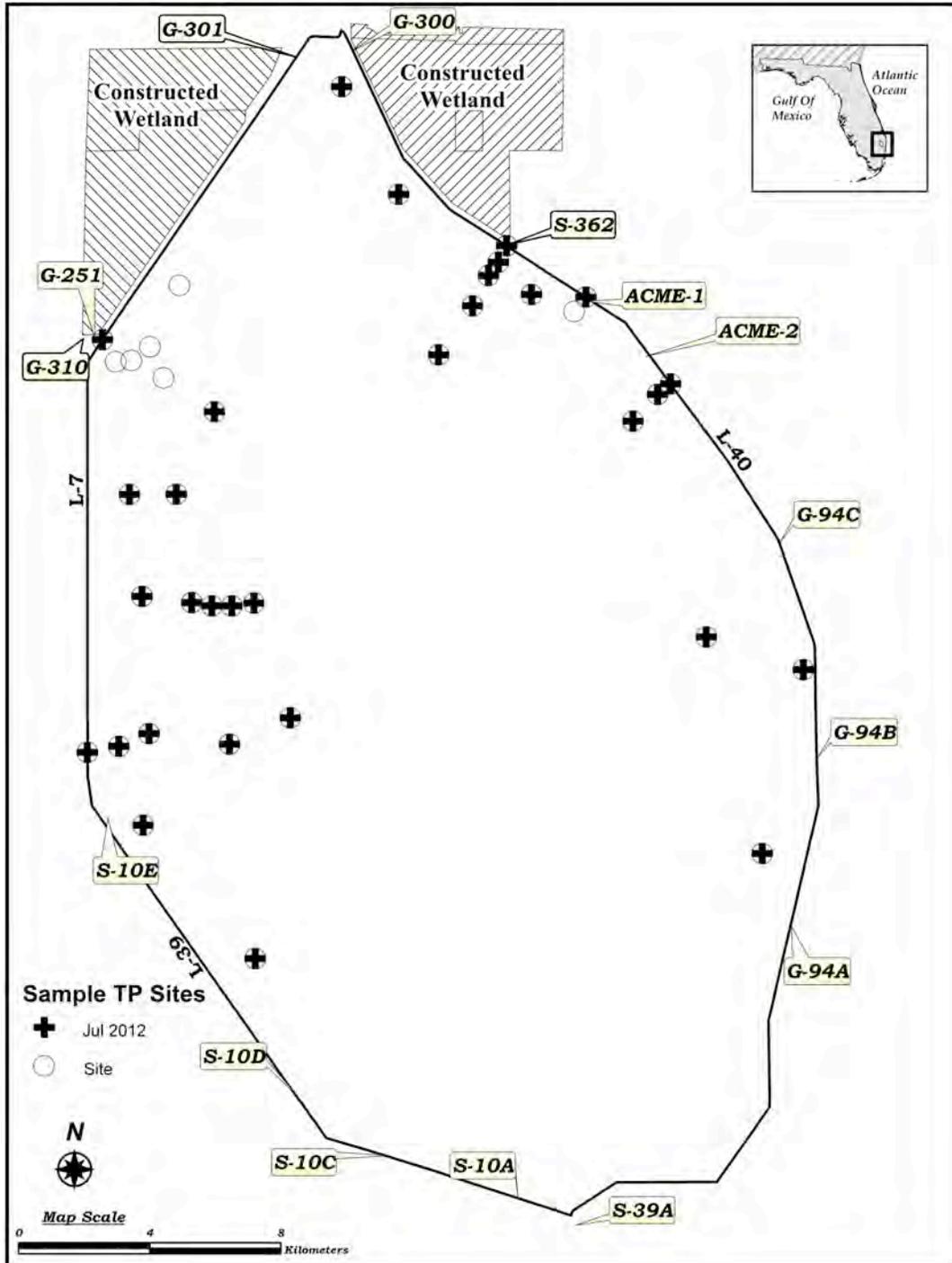


Figure 2. July 2012 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

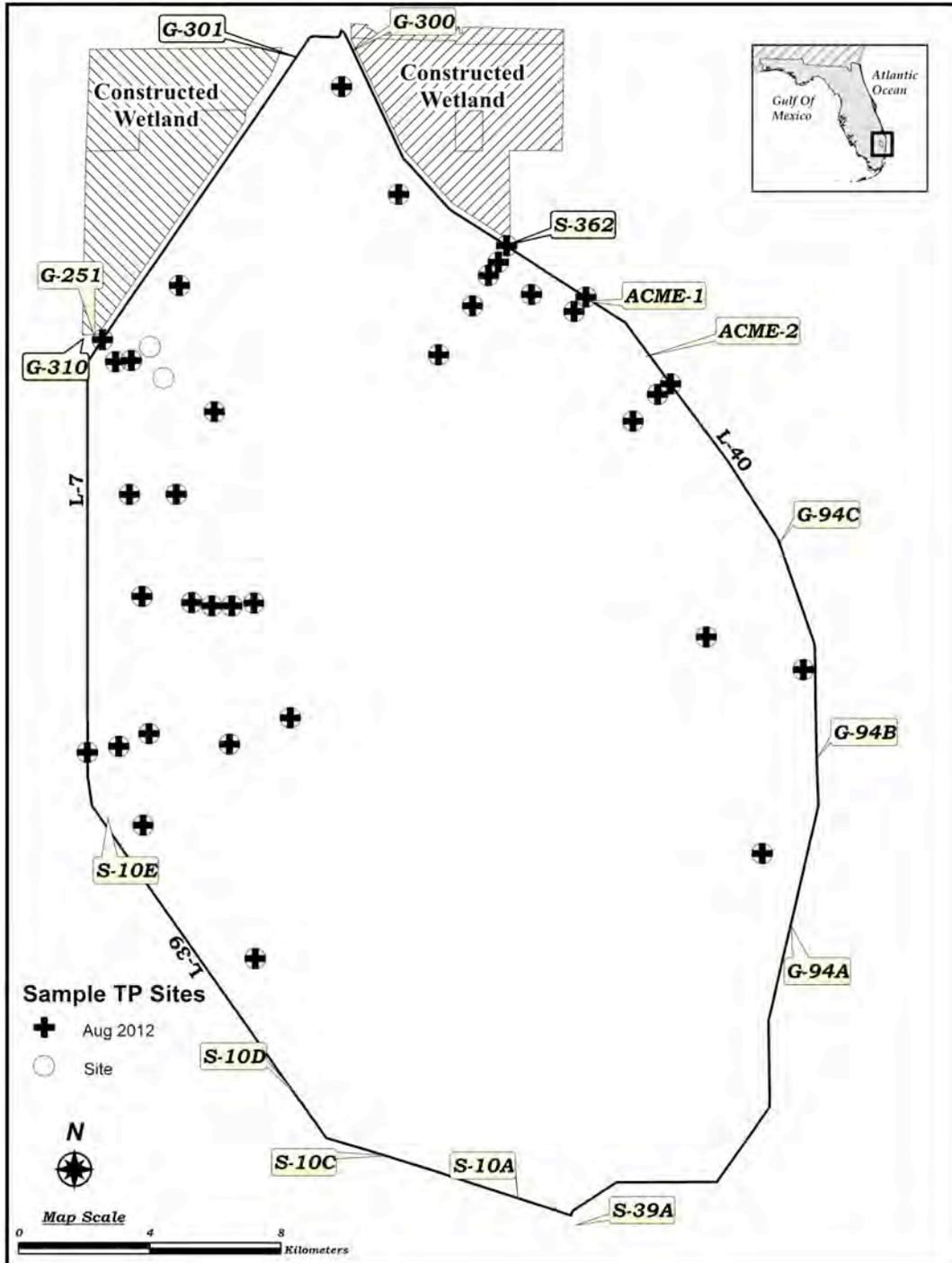


Figure 3. August 2012 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

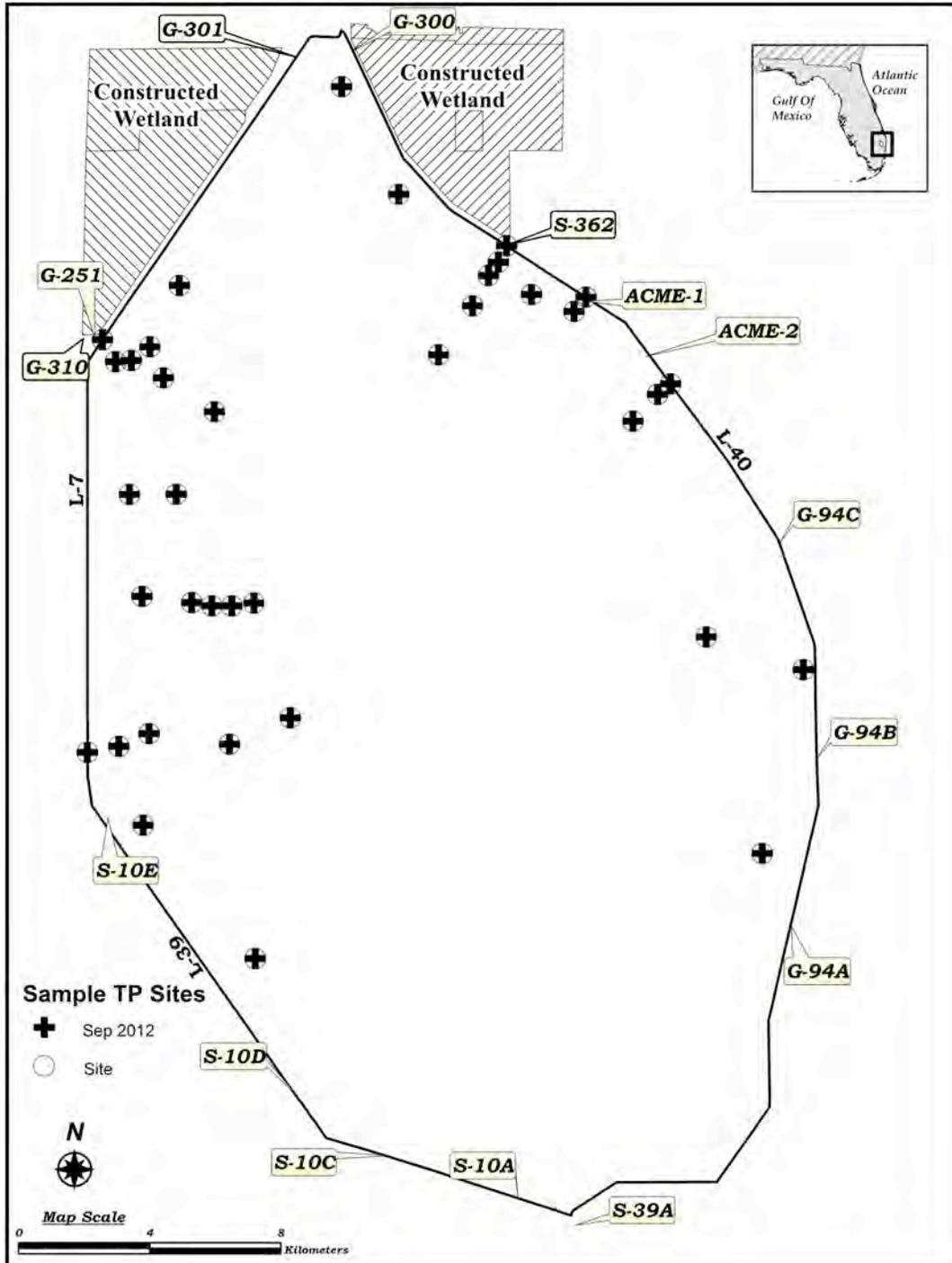


Figure 4. September 2012 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.