

**Enhanced Water Quality Monitoring and Modeling Program for the
A.R.M. Loxahatchee National Wildlife Refuge
Quarterly Update Report – December 2014**

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Overview

This update is a summary of activities since the previous status report of September 2014 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; USFWS 2013; USFWS 2014).

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/dbhydroplsqli/show_dbkey_info.main_page. Data for June 2006-December 2014 are posted on the Technical Oversight Committee's web site at <http://www.sfwmd.gov/toc/>. This report includes information from samples collected through December 2014.

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 (October – December 2014)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 37 stations in October, 37 in November, and 36 in December 2014 (**Table 1**).

Total phosphorus data available to date for January 2014 through December 2014 are presented in **Table 1**. Maps of stations where samples were collected for the months from for October through December 2014 are presented in **Figures 2-4**.

Conductivity sonde deployment information for January 2014 through December 2014 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.
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- 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.
- USFWS. (2013) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 9th Annual Report – June 2013. LOXA13-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.
- USFWS (2014) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 10th Annual Report for calendar year 2013 – June 2014. LOXA14-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.

Table 1. Total phosphorus data (ppb) available for January 2014 – December 2014 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
LOXA101	13	14	14	-	-	-	17	17	24	13	11	12
LOXA102	7	9	-	-	-	-	-	10	10	8	7	7
LOXA103	7	11	3	-	-	-	-	8	10	8	6	6
LOXA105	14	15	22	-	-	-	17	15	20	15	8	10
LOXA106	11	9	5	-	-	-	-	9	9	12	7	7
LOXA107	5	7	-	-	-	-	-	8	11	10	6	-
LOXA108	9	6	-	-	-	-	-	5	10	7	6	7
LOXA109	11	9	7	3	-	-	9	8	10	5	4	6
LOXA110	8	5	3	-	-	-	6	7	11	4	4	6
LOXA111	6	5	2	3	-	-	7	8	11	11	3	5
LOXA112	8	5	5	U	-	-	6	6	10	7	5	6
LOXA113	6	4	6	4	-	-	5	7	7	8	3	5
LOXA114	7	6	4	U	-	-	6	9	8	10	4	8
LOXA117	13	17	8	5	-	-	16	15	20	19	11	14
LOXA118	8	10	5	U	8	-	7	7	10	10	3	5
LOXA119	7	6	5	3	U	77	8	9	9	4	4	5
LOXA120	7	6	4	3	U	-	5	5	8	5	5	5
LOXA122	13	15	11	8	-	-	11	13	18	14	10	16
LOXA124	20	23	14	-	-	-	9	17	13	17	13	10
LOXA126	7	7	5	38	-	-	6	6	9	9	4	6
LOXA127	7	5	3	6	-	-	7	6	9	6	3	5
LOXA128	6	5	3	5	-	-	5	6	9	12	5	6
LOXA130	11	17	5	2	-	-	10	14	15	14	9	10
LOXA131	U	3	9	U	-	-	9	7	13	7	2	5
LOXA133	13	21	8	-	-	-	23	30	28	20	20	13
LOXA134	7	9	4	-	-	-	11	14	10	14	9	12
LOXA136	16	19	13	32	-	-	15	28	27	25	14	9
LOXA137	8	11	4	-	-	-	14	13	16	12	9	7
LOXA138	5	3	3	-	-	-	9	8	10	7	U	7
LOXA139	-	3	6	-	-	-	10	9	8	8	5	7
LOXA140	13	5	5	-	-	-	12	15	25	10	11	9
LOXA141	16	11	11	5	U	-	10	11	14	10	3	8
MAX	20	23	22	38	8	77	23	30	28	25	20	16
MIN	5	3	2	2	8	77	5	5	7	4	2	5

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 1 cont.

b) Canal stations

Canal Station	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
LOXA104	28	38	25	17	14	31	23	21	20	19	21	16
LOXA115	22	36	-	11	U	22	26	20	20	19	21	17
LOXA129	39	45	28	42	34	33	39	26	25	22	23	15
LOXA132	45	41	30	30	24	29	39	26	26	25	24	12
LOXA135	47	38	33	34	25	31	24	24	24	30	21	15
MAX	47	45	33	42	34	33	39	26	26	30	24	17
MIN	22	36	25	11	14	22	23	20	20	19	21	12

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. January 2014 – December 2014 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. Stations labeled DECOM were decommissioned.

Site ID	2014											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LOXA 104	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 105		X		X		X		X		X		X
LOXA 106		X		X		X		X		X		X
LOXA 107		X		X		X		X		X		X
LOXA 108		X		X		X		X		X		X
LOXA 111	DECOM-->											
LOXA 112	DECOM-->											
LOXA 113	DECOM-->											
LOXA 114	DECOM-->											
LOXA 115	X	X	X	X	X	X	X	X	X	X	X	
LOXA 116		X	X	X	X			X		X		X
LOXA 117		X		X		X		X		X		X
LOXA 118		X		X		X		X		X		X
LOXA 119		X		X		X		X		X		X
LOXA 120		X		X		X		X		X		X
LOXA 126	DECOM-->											
LOXA 127	DECOM-->											
LOXA 128	DECOM-->											
LOXA 129	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 130		X		X		X		X		X		X
LOXA 131		X		X		X		X		X		X
LOXA 132	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 133		X		X		X			X	X		X
LOXA 135		X	X	X	X	X	X	X	X	X	X	
LOXA 136		X		X		X		X		X		X
LOXA 137		X		X		X		X		X		X
LOXA 138		X		X		X		X		X		X
LOXA 139		X		X		X		X		X		X
LOXA 142		X	X	X	X	X	X	X	X	X	X	X
LOXA 143		X	X	X	X		X		X		X	X
LOXA 144		X	X	X	X		X		X		X	X
LOXA 145		X	X	X	X		X		X		X	X
LOXA 146		X	X	X	X		X		X		X	X
LOXA 147	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 148		X	X	X	X		X		X		X	X
LOXA 149		X		X	X		X		X		X	X
LOXA 150		X		X	X		X		X		X	X
LOXA 151		X	X	X	X		X	X	X	X	X	X
LOXA 152		X	X	X	X		X	X	X	X	X	X
LOXA 153		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		X
LOX06	DECOM-->											
LOX07	DECOM-->											
LOX08	DECOM-->											
LOX09	DECOM-->											
LOX10	DECOM-->											
LOX15		X	X		X		X		X	X	X	X

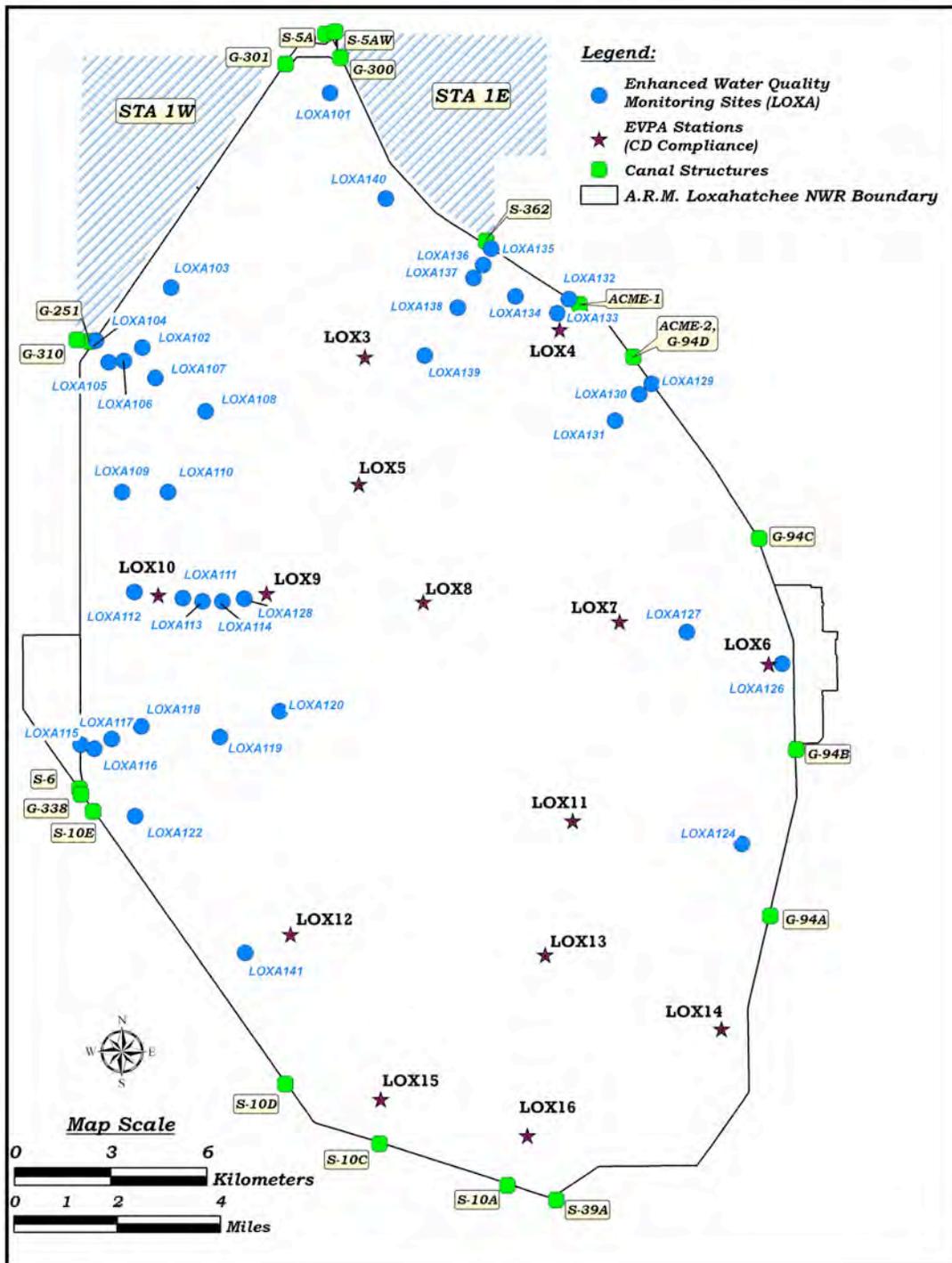


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

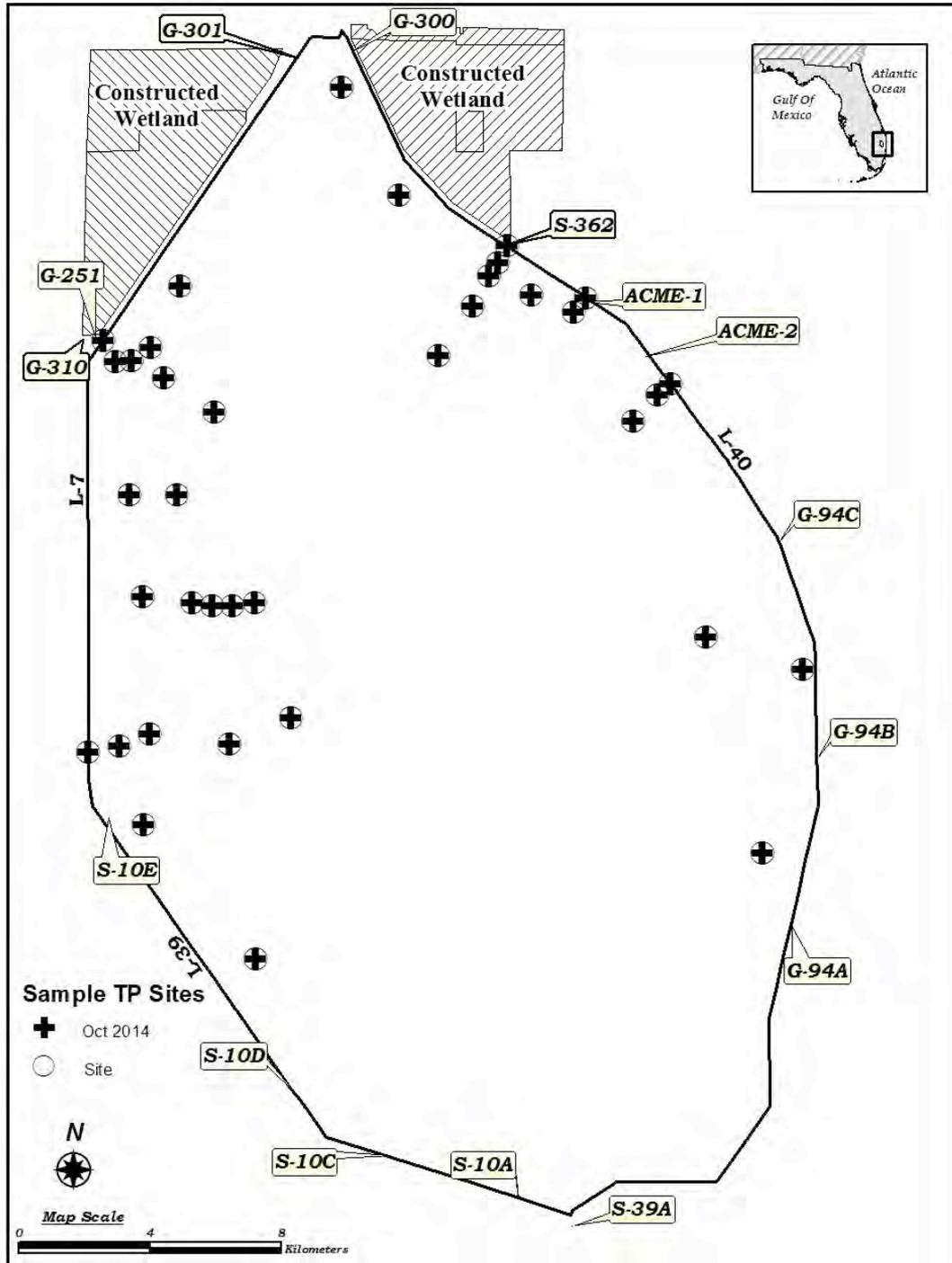


Figure 2. October 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

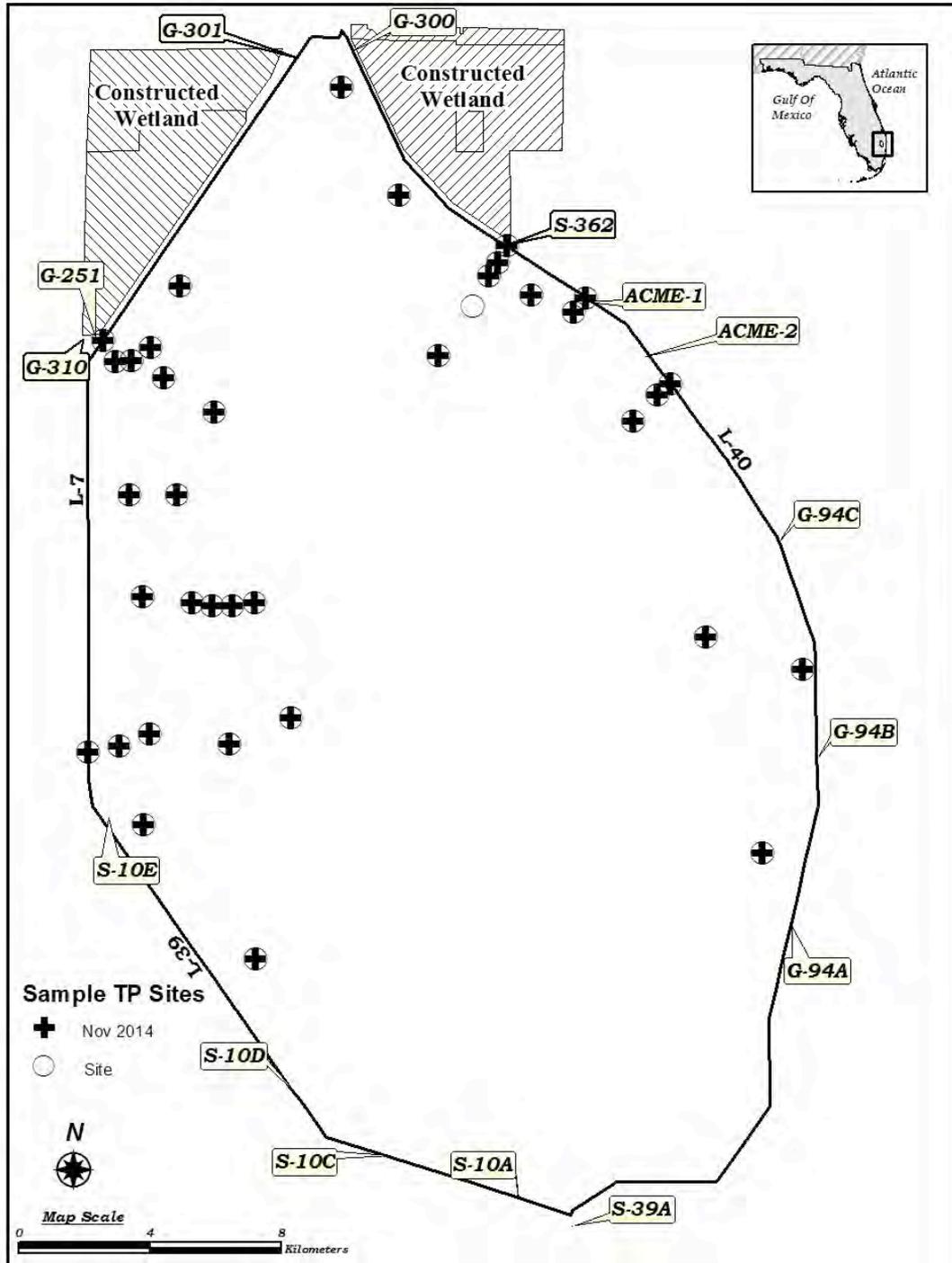


Figure 3. November 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

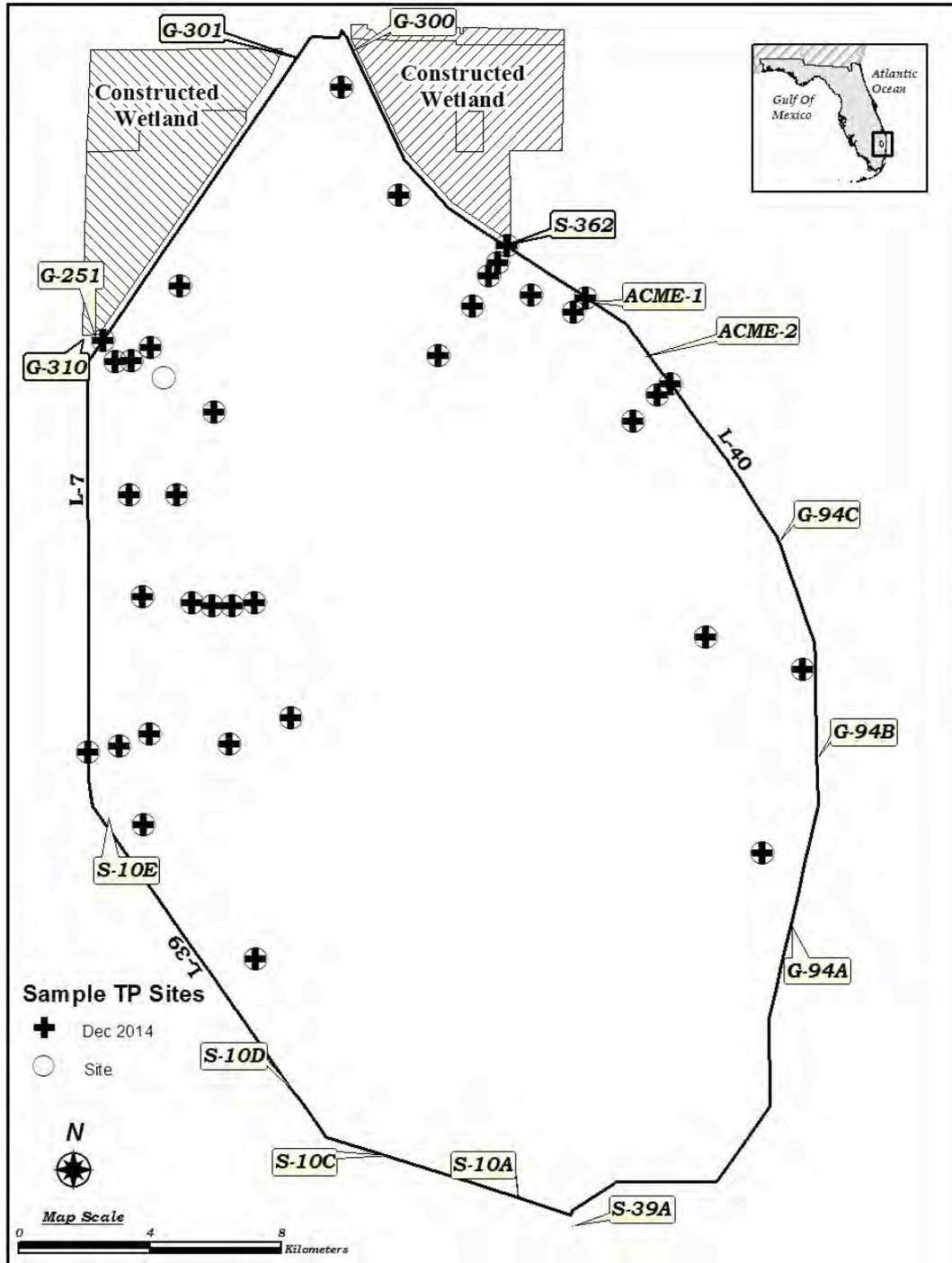


Figure 4. December 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.