

Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – September 2005

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Overview

This update is a summary of activities since the previous status report of April 2005 (Harwell et al. 2005) on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program focuses on providing information for use in ecological management of the Refuge (Brandt et al. 2004; Harwell et al. 2005).

The Refuge's monitoring component of this program 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.

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

C. Modeling of the Refuge

- 1. Develop a water quality/hydraulic model for the Refuge with a phosphorus cycling component.*
- 2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*
- 3. Develop and track a simple phosphorus mass-balance model for the Refuge.*

Additionally, data from the enhanced water quality monitoring network have been used by FDEP in developing their draft Marsh Monitoring Network (Strawman Everglades P-criterion monitoring networks; 17 August 2005 workshop). It is anticipated that as the FDEP network is refined, data from the Refuge's enhanced monitoring program will continue to be of value.

Monitoring Update

Sampling of the enhanced water quality monitoring network (shown in Figure 1) occurred at 7 stations in March 2005, 17 stations in April 2005, 22 stations in May 2005, 38 stations in June 2005, and 24 stations in July 2005 (Table 1; Figures 2-6). Final data

for monthly samples continue to be publicly posted on DBHYDRO by the SFWMD (<http://www.sfwmd.gov/org/ema/dbhydro/index.html>).

Total phosphorus data are presented in Table 1.

Conductivity sonde deployment information for 2005 is presented in Table 2.

Modeling Update

Model development (contract with University of Louisiana – Lafayette) continues. A draft model selection report and a draft model data report are currently being finalized. Concurrent with the completion of the model selection report will be the finalization of the first report from the modeling external technical review panel (contract with Tennessee Technological University).

Results from the first canal sediment survey effort (contract with University of Florida-IFAS) have been reviewed. The first canal water quality survey component is anticipated in the next quarter.

Other Updates

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

Differentially-corrected GPS coordinates of this enhanced network is presently underway, with a complete set of updated coordinates to be available by October 2005.

Data analysis continues as an ongoing process. The Work Plan (Brandt et al. 2004) identifies several potential approaches for refining the network if there are appropriate technical underpinnings for doing so. We are presently examining the potential to eliminate unnecessary or redundant parameters from the monthly monitoring. A draft report for examining parameter elimination has been completed, and a draft report examining potential station reduction is in development. Ultimately, any refinement of the enhanced monitoring network needs to have a sound technical basis before proceeding.

The next steps for this program continue to focus on data collection and analysis and continuing forward with model development.

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.
- Harwell, M. Surratt, D., Waldon, M., Walker, B., Brandt, L. (2005) A.R.M. Loxahatchee National Wildlife Refuge Enhanced Water Quality Monitoring and Modeling Interim Report. April, 2005. 106 pp.

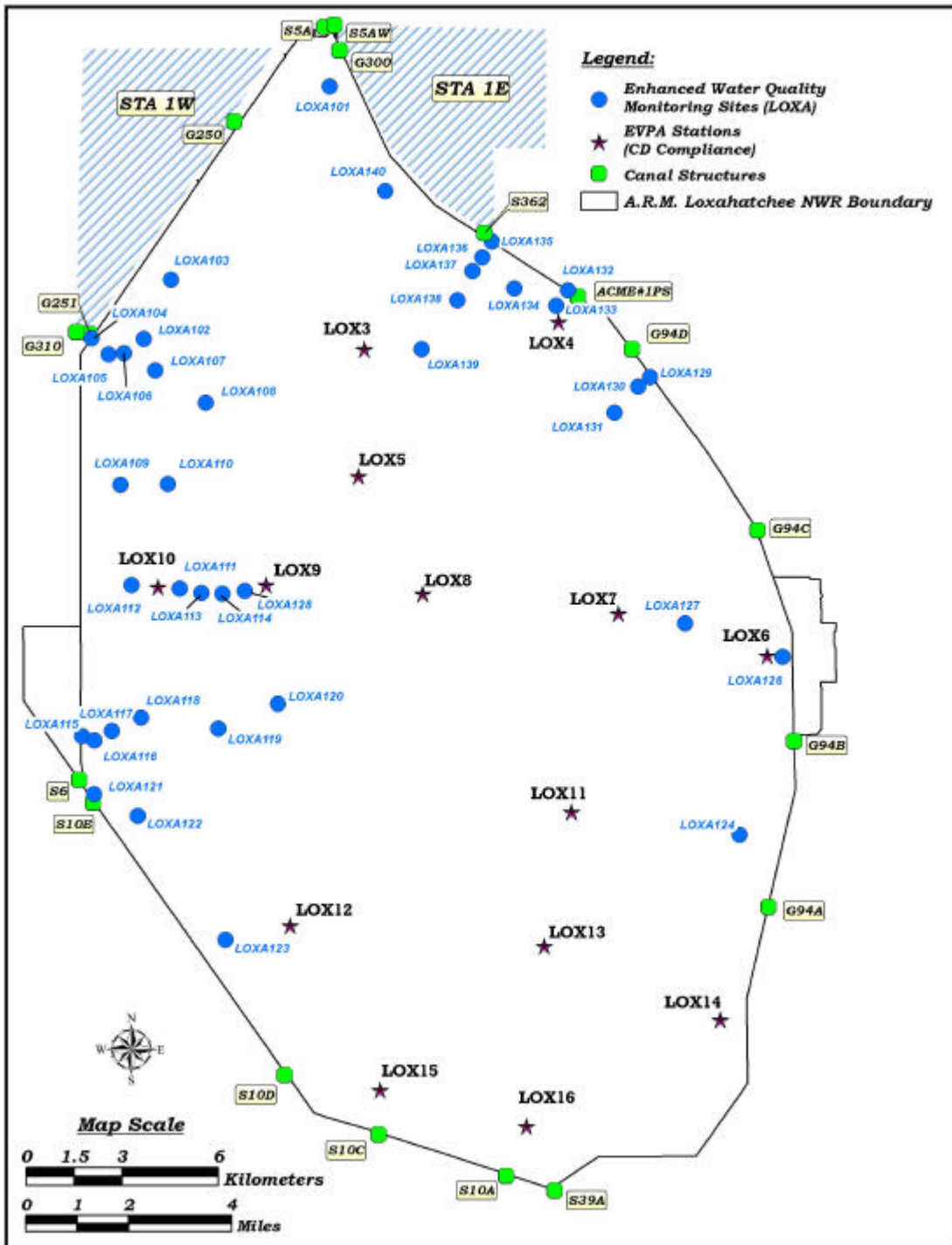


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

Table 1. Total phosphorus data (ppb) 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 Stations	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05
LOXA101				22	53	18	14	11	11		25		58	
LOXA102				15	15	10	12	11			9		16	
LOXA103				19	12	9	12	15	42		16		21	
LOXA105				58	232	25	23	17	23				41	
LOXA106				14	48	11	7	10	14				21	
LOXA107			16	10	9	7	12						23	
LOXA108			17	10	12	8	6						28	12
LOXA109			22	14	8	10	8	9	8			18	13	5
LOXA110			15	9	7	11	17	24					18	
LOXA111			8	9	9	6	13	22	12				19	
LOXA112				15	13	8	9	10	12			18	15	
LOXA113	14		10	7	8	7	8	9	17				13	5
LOXA114	33	18	13	8	9	6	10	15					25	6
LOXA116			74	47	199	38	67	47	32			53	60	19
LOXA117			19	22	15	13	18	8	12			16	35	
LOXA118	18		6	8	6	6	9	6	6			16	17	6
LOXA119	19	10	8	6	6	9	13	12	5	44		52	32	5
LOXA120	16		8	7	6	8	9	12	7			102	34	4
LOXA121			80		136	32	179	91	117					
LOXA122			17	14	10	11	10	9	12	16		29	14	
LOXA123			25	14	8	14	14	9	9	18		36	17	7
LOXA124				69	151	15	15	9	15		106	300	24	13
LOXA126			33	11	8	9	6	7	10		10	59	26	6
LOXA127			27	15	6	8	9	6	7		12	31	10	6
LOXA128			16	10	7	8	21	11					29	7

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Marsh Stations	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05
LOXA130				52	212	19	11	15	16		28	25	63	17
LOXA131				10	10	5	6	6	7		14	6	12	
LOXA133				177	322	65	98	265			44		155	
LOXA134				23	216	24	26	34	16		35	57	69	12
LOXA136				91	238	64	40	154	77		30		72	
LOXA137				28	57	23	14	12	31	17	21	49	53	11
LOXA138				14	10	10	18	12	10		8	26	19	8
LOXA139				13	8	13	14						18	9
LOXA140				30	31	13	13	12	26		13		41	16
MAX	33	18	80	177	322	65	179	265	117	44	106	300	155	19
MIN	14	10	6	6	6	5	6	6	5	16	8	6	10	4

b) Canal stations

Canal Stations	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05
LOXA104	40	23	22	210	237	98	93	93	100	92		62	195	77
LOXA115	55	26	29	181	200	73	53	51	100	94		47	129	64
LOXA129	82	80	76	246	499	66	58	60	81		68	222	258	95
LOXA132	86	77	64	256	574	76	60	61	88		75	117	286	78
LOXA135	81	95	53	257	649	96	84	66	79	115	68	99	216	66
Max	86	95	76	257	649	98	93	93	100	115	75	222	286	95
Min	40	23	22	181	200	66	53	51	79	92	68	47	129	64

Table 2. 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	Description	2004												2005						
		March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July		
LOXA104	NW Transect 0 (canal)				X	X	X	X	X	X		X	X	X	X	X	X	X		
LOXA105	NW Transect 0.5										X	X	X	X	X	X	X	X		
LOXA106	NW Transect 1										X	X	X	X	X	X	X	X		
LOXA107	NW Transect 2										X	X	X	X	X	X	X	X		
LOXA108	NW Transect 4	X									X	X	X	X	X	X	X	X		
LOXA111																X		X		
LOXA112											X	X	X	X	X			X		
LOXA113											X	X	X	X	X			X		
LOXA114																				
LOXA115	SW Transect 0 (canal)	X	X	X	X				X	X	X	X	X	X	X	X	X	X		
LOXA116	SW Transect 0.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA117	SW Transect 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA118	SW Transect 2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA119	SW Transect 4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA120	SW Transect- X5											X	X	X	X	X	X	X		
LOXA126											X	X	X	X	X	X	X	X		
LOXA127											X	X	X	X	X	X		X		
LOXA128																				
LOXA129	NE Transect S 0 (canal)				X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA130	NE Transect S										X	X	X	X	X	X	X	X		
LOXA131	NE Transect S										X	X	X	X	X	X	X	X		
LOXA132	NE Transect N 0 (canal)				X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA133	NE Transect N				X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA134	NE Transect N																			
LOXA135	NE Transect STA1E 0 (canal)	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA136	NE Transect STA1E 0.5	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X		
LOXA137	NE Transect STA1E 1	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
LOXA138	NE Transect STA1E 2	X	X		X	X	X	X	X		X	X	X	X	X					
LOXA139	NE Transect STA1E 4	X	X		X	X			X	X	X	X	X	X	X	X	X	X		

Table 2 cont.

Site ID	Description	Month																
		2004					2005											
		March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July
LOX4	EVPA site/refuge gauge				X	X				X	X	X	X	X	X	X	X	X
LOX6	EVPA site										X	X	X	X	X	X	X	
LOX7	EVPA site										X	X	X	X	X	X		X
LOX8	EVPA site											X	X	X	X	X		
LOX9	EVPA site											X	X	X	X	X	X	
LOX10	EVPA site										X	X	X	X	X	X		X

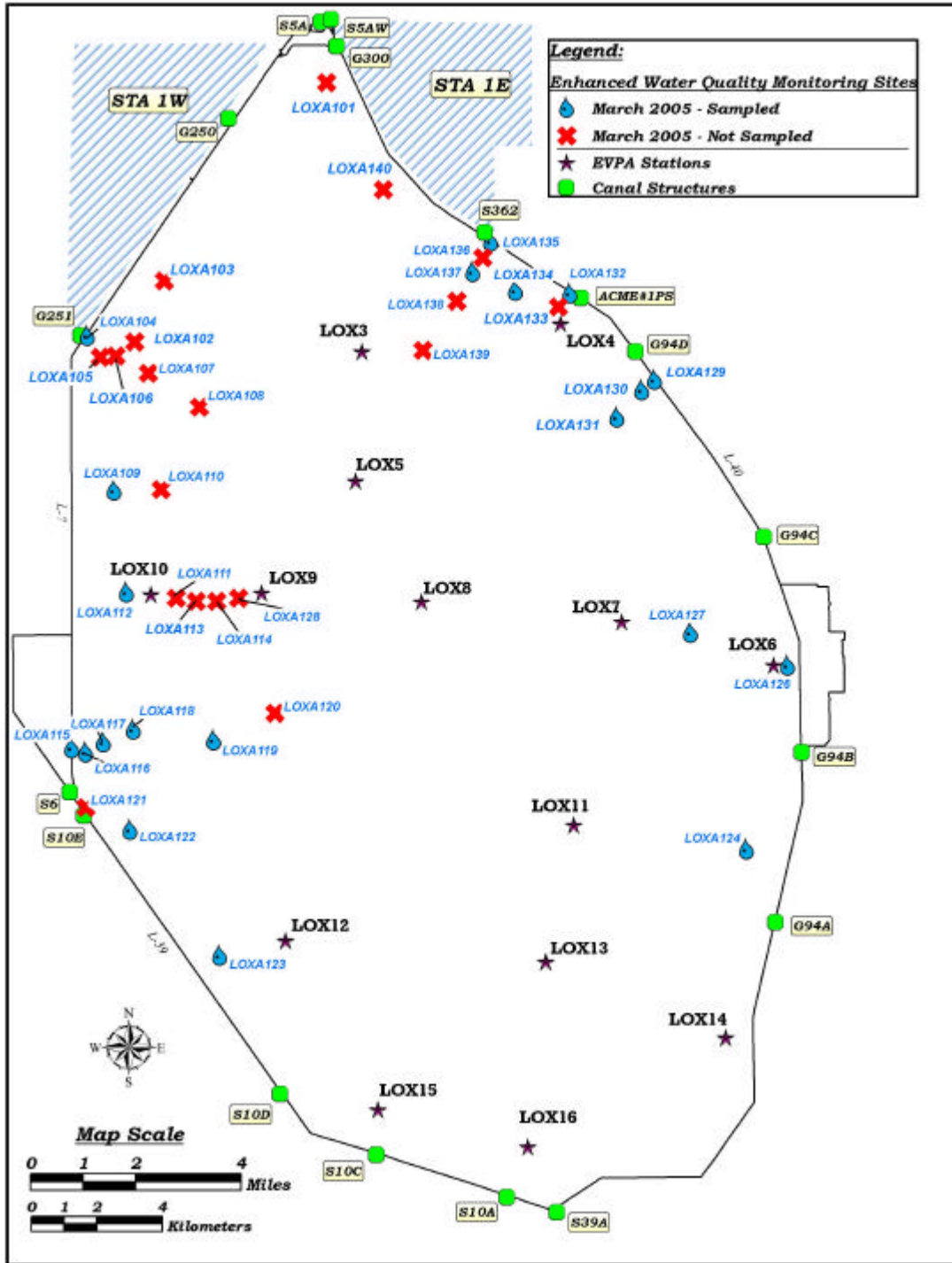


Figure 2. March 2005 map of the Enhanced Water Quality Monitoring network stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

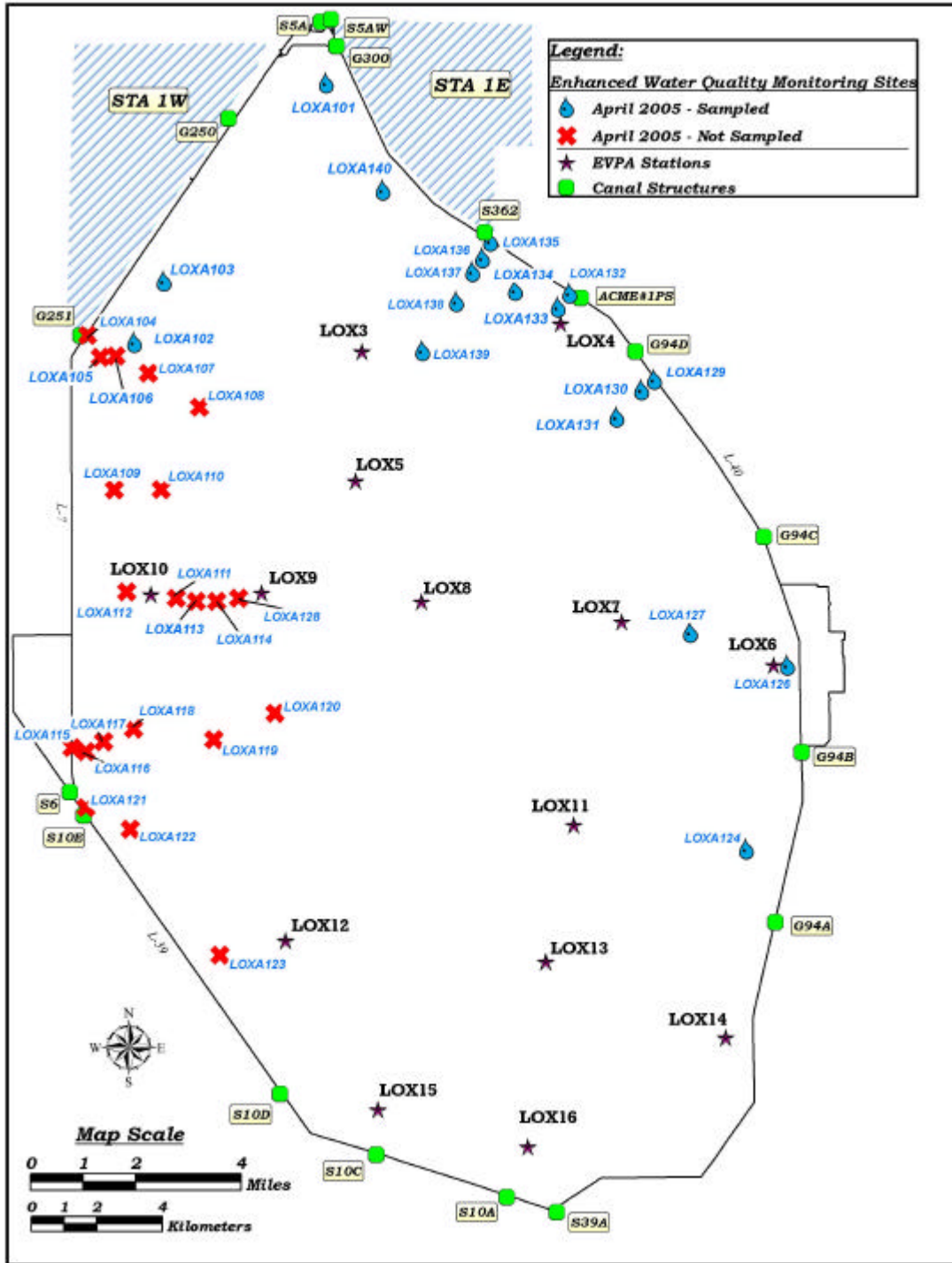


Figure 3. April 2005 map of the Enhanced Water Quality Monitoring network stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

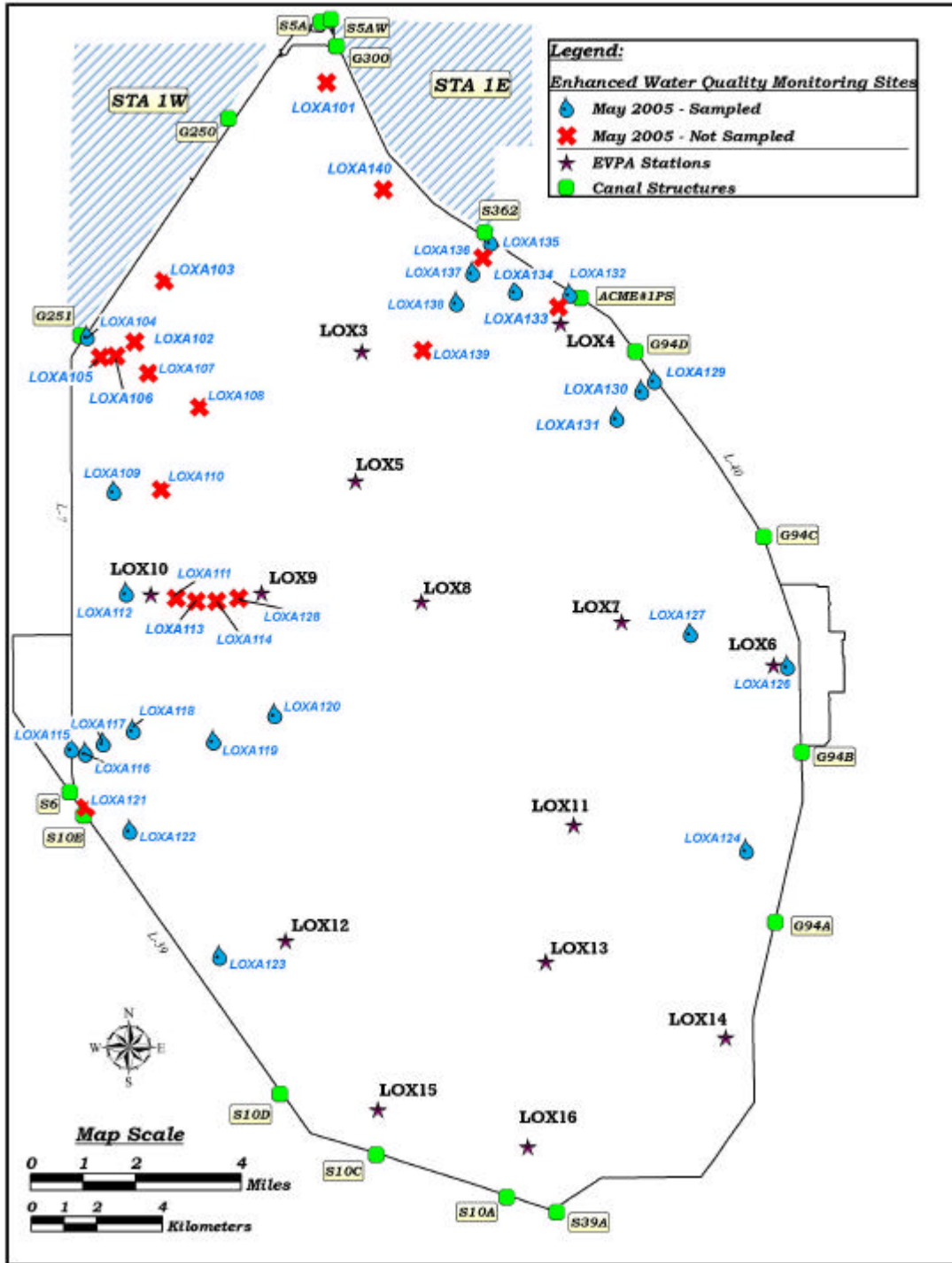


Figure 4. May 2005 map of the Enhanced Water Quality Monitoring network stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

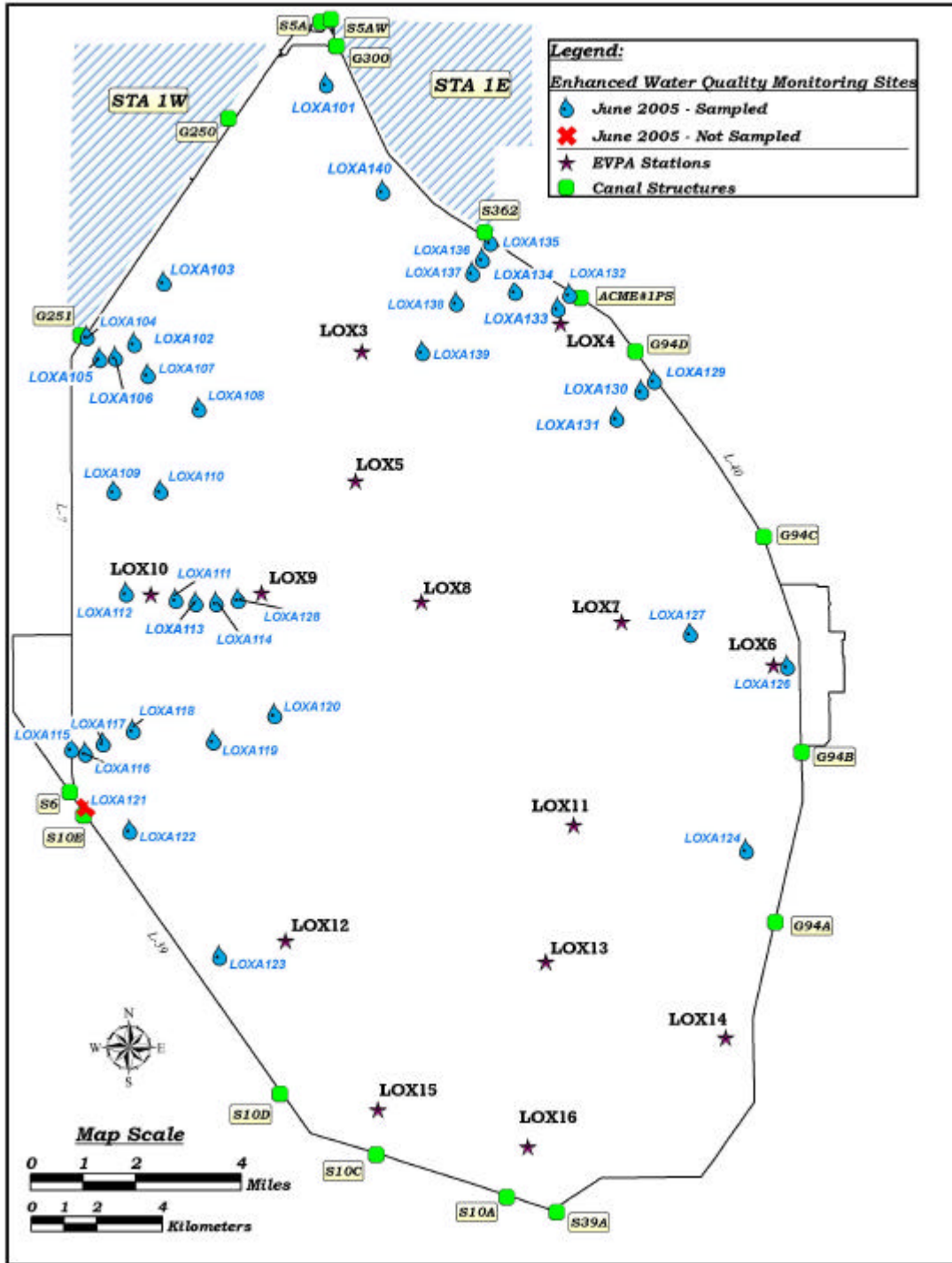


Figure 5. June 2005 map of the Enhanced Water Quality Monitoring network stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

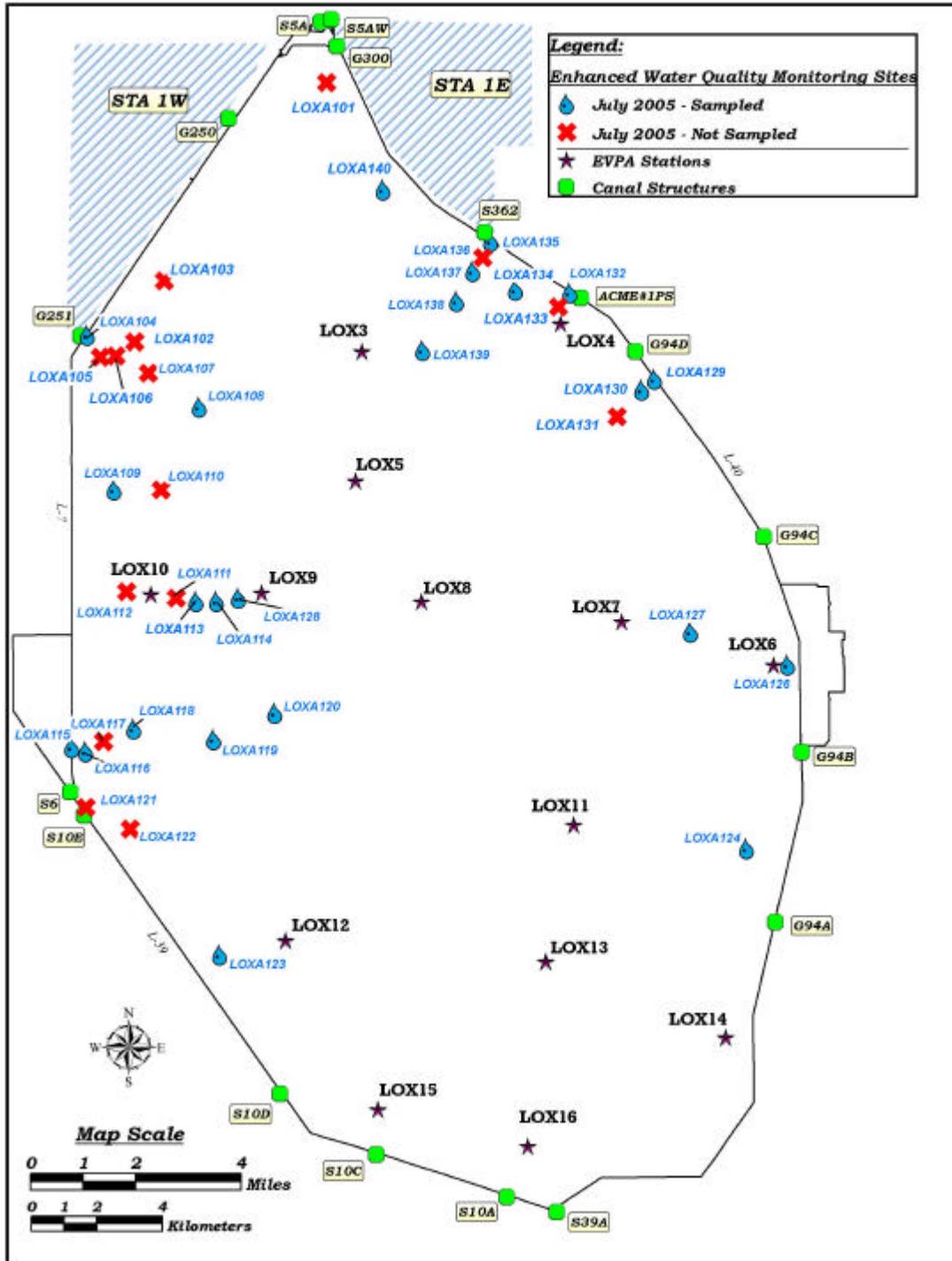


Figure 6. July 2005 map of the Enhanced Water Quality Monitoring network stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.