

To: Representatives of the Technical Oversight Committee  
Nick Aumen, Everglades National Park  
Mike Waldon, A.R.M. Loxahatchee National Wildlife Refuge  
Paul DuBow, Jacksonville District, Army Corps of Engineers  
Garth Redfield, South Florida Water Management District

From: Matt Harwell and Laura Brandt, A.R.M. Loxahatchee National Wildlife Refuge

Date: 29 November 2004

Re: Quarterly Update on Enhanced Water Quality Monitoring and Modeling Program  
for the A.R.M. Loxahatchee National Wildlife Refuge

This update is a summary of activities from the previous three months (September – November 2004) on the implementation of the Refuge’s Enhanced Water Quality Monitoring and Modeling Program. A project overview of this effort is provided in Attachment 1.

The Principals (17 December 2003) requested implementation of the eight recommendations of the TOC (24 July 2003). The Refuge’s Enhanced Water Quality Monitoring and Modeling Program addresses four of these recommendations. Specifically:

***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.*

An expanded water quality monitoring network (a combination of transects and individual sites) has been designed and established (Fig. 1). With the rise in water levels, complete sampling of the network occurred in September, October, and November (Figs. 2-4). This provides us a full quarter of data to begin preliminary analysis and interpretation. The results of these analyses will be presented at future TOC meetings. Final data for monthly samples continue to be publicly posted on DBHYDRO by the SFWMD.

The monitoring transects are also being equipped with water conductivity data loggers to collect conductivity and temperature data. This information can then be used to understand and refine operations, when possible, to minimize canal water intrusion into the interior marsh. Four of these transects have been instrumented and, in cooperation with the USGS, we plan to deploy additional instruments within the next few months. Conductivity sonde deployment information for 2004 is presented in Table 1.

In September, three hurricanes passed through the region: Hurricane Frances (September 4), remnants of Hurricane Ivan (September 20-21), and Hurricane Jeanne (September 25). The Refuge’s Enhanced Water Quality Monitoring sampling occurred 14-16 September

and 4-7 October. We hope to utilize information from our water quality monitoring network to gain insights from these storms.

### ***C. Modeling of the Refuge***

- 1. Develop a water quality / hydraulic model for the Refuge with a phosphorus cycling component.*
- 3. Develop and track a simple phosphorus mass-balance for the Refuge.*

A contract has been established with Dr. Ehab Meselhe (University of Louisiana – Lafayette) for the development of these modeling tools for the Refuge. The first phase of this effort involves a model selection process.

#### Current Status:

- Dr. Meselhe made initial visit to Refuge
- Model selection process in progress
- This phase of the project set to be completed January 2005

Separately, a contract has been established with Dr. Vince Neary (Tennessee Technological University) to establish an external technical panel to provide review of the model selection process and the development of the modeling tool(s) over time.

#### Current Status:

- Technical Panel members identified.
- Initial panel meeting targeted for January 2005.

### ***C. Modeling of the Refuge***

- 2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*

A canal monitoring contract has been established with Dr. Samira Daroub (UF – IFAS) to conduct canal hydrographic surveys and synoptic water quality surveys.

#### Current Status:

- Survey protocols and plans are currently being developed.
- The sediment survey component will begin by end of CY 04.
- The canal water quality survey component will begin in early CY 05.

Finally, below is a brief list of some of the next steps that are critical for the implementation of this project:

- Complete personnel actions necessary to complete the project. Upcoming hires include a water quality technician and a water quality ecologist.
- Develop database management approach for data from the project
- Refine information presentation approaches
- Ongoing data analysis
- The monitoring program will be presented at the 1<sup>st</sup> Nat. Conf. on Ecosystem Restoration in Orlando (Dec. 5-9<sup>th</sup>)

## Attachment 1:

### Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge

#### **Project Overview**

In FY 04, a \$1 million Congressional appropriation was specifically targeted to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) for development of an enhanced water quality monitoring network and to develop hydrodynamic and water quality modeling tools. The appropriation is intended, in part, to improve the scientific understanding of water quality issues in the Refuge and provide information that can be incorporated into water management decisions to better protect of Refuge resources.

A work plan was developed by Refuge staff outlining studies in four areas: (1) increased monthly water quality sampling sites; (2) monitoring of canal water intrusion using surface water conductivity transects into the interior marsh; (3) characterization of sediment and water quality in the perimeter canals of the Refuge; and, (4) development of hydrodynamic and water quality modeling. These four areas are consistent with long-term goals identified in the Refuge's 15 year Comprehensive Conservation Plan and recommendations made by the Technical Oversight Committee for addressing exceedances observed in interim phosphorus levels within the Refuge ([http://www.sfwmd.gov/org/ema/toc/archives\\_mtgs.html#2004](http://www.sfwmd.gov/org/ema/toc/archives_mtgs.html#2004)). The plan was provided to State, other Federal, and Tribal partners for review and comment in February 2004, and was subsequently improved based on constructive comments received. The plan is available at: [http://www.sfwmd.gov/org/ema/toc/archives/docs/refuge\\_final\\_work\\_plan\\_2004-2006.pdf](http://www.sfwmd.gov/org/ema/toc/archives/docs/refuge_final_work_plan_2004-2006.pdf).

The Refuge's existing water quality monitoring network (used for Federal Consent Decree compliance [EVPA]; Fig. 1) is estimated to cover approximately 60% of the Refuge, leaving 40% of the marsh uncharacterized, predominantly in the outer, impacted regions of the marsh. The additional monthly sampling as part of the enhanced water quality monitoring program focuses on these uncharacterized areas (Fig. 1). This information can then be used to refine operations, when possible, to minimize canal water intrusion into the interior marsh. Sampling for the enhanced water quality monitoring program is designed to be as similar as possible as the compliance monitoring program (e.g., same collection protocols, collection staff, laboratory analyses by SFWMD, data QA/QC, data availability, etc.).

The goal of the modeling exercise is to provide support for Refuge management decisions and planning related to water control operations, water supply, and water quality and provide a foundation for future ecological studies. The model will be maintained to support future management decisions, model development, and monitoring planning. Preliminary modeling is anticipated to be available in FY 06, with completed model(s) available for management decision support in early FY 07.

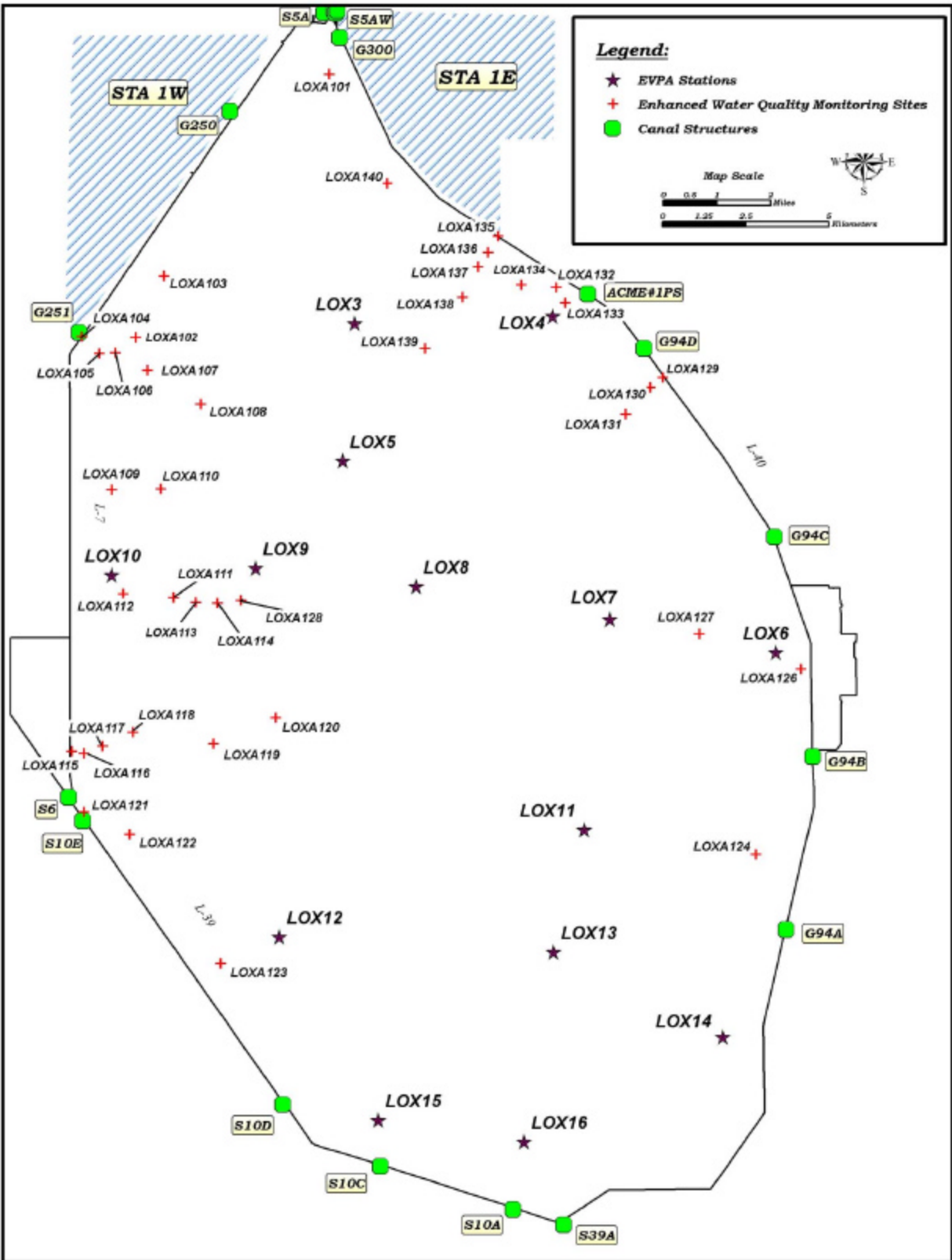


Figure 1: Map of A.R.M. Loxahatchee National Wildlife Refuge showing location of the existing Federal Consent Decree compliance monitoring network (EVPA stations; ★) and the new, enhanced water quality monitoring program stations (+).

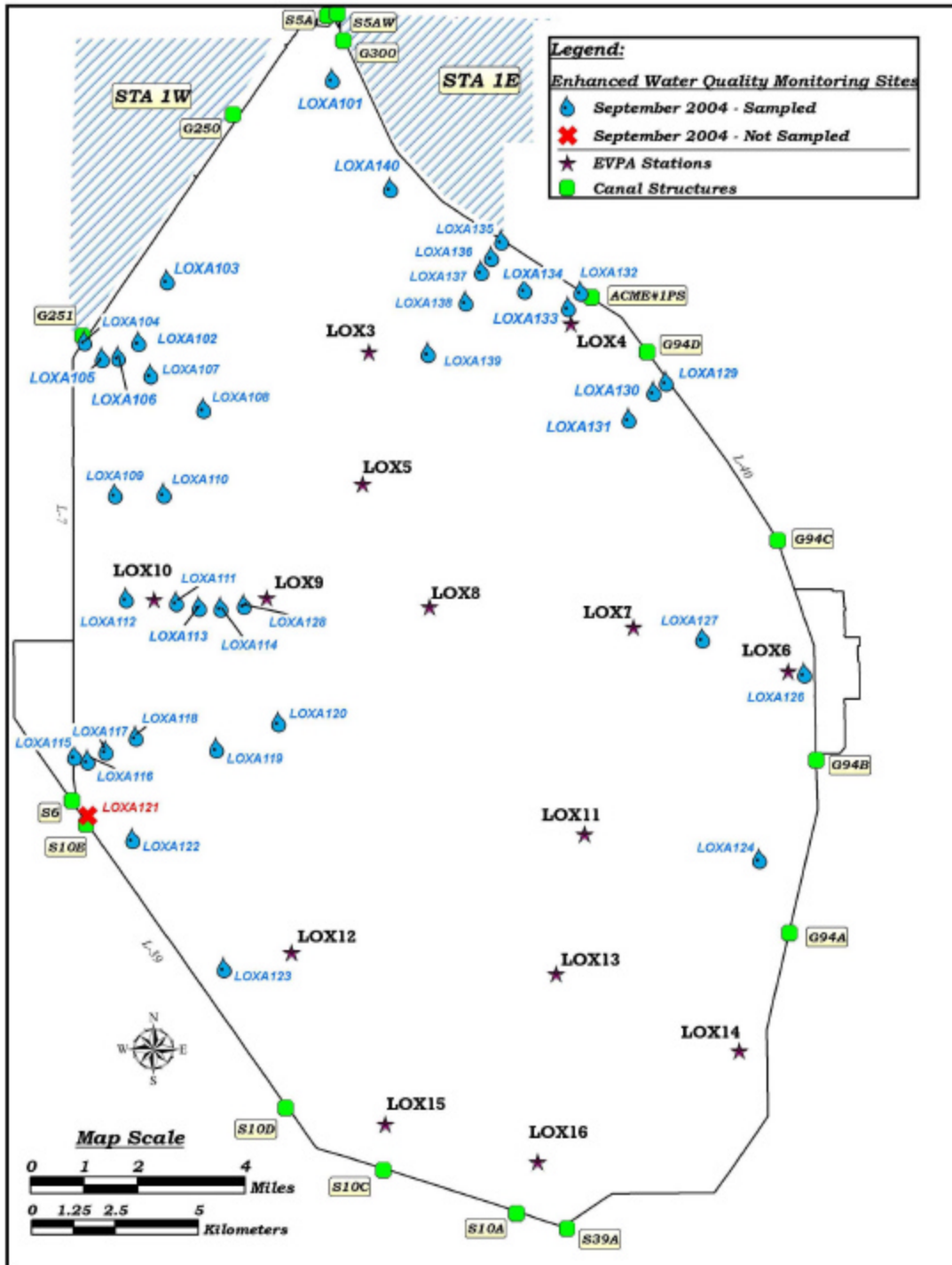


Figure 2: September 2004 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.

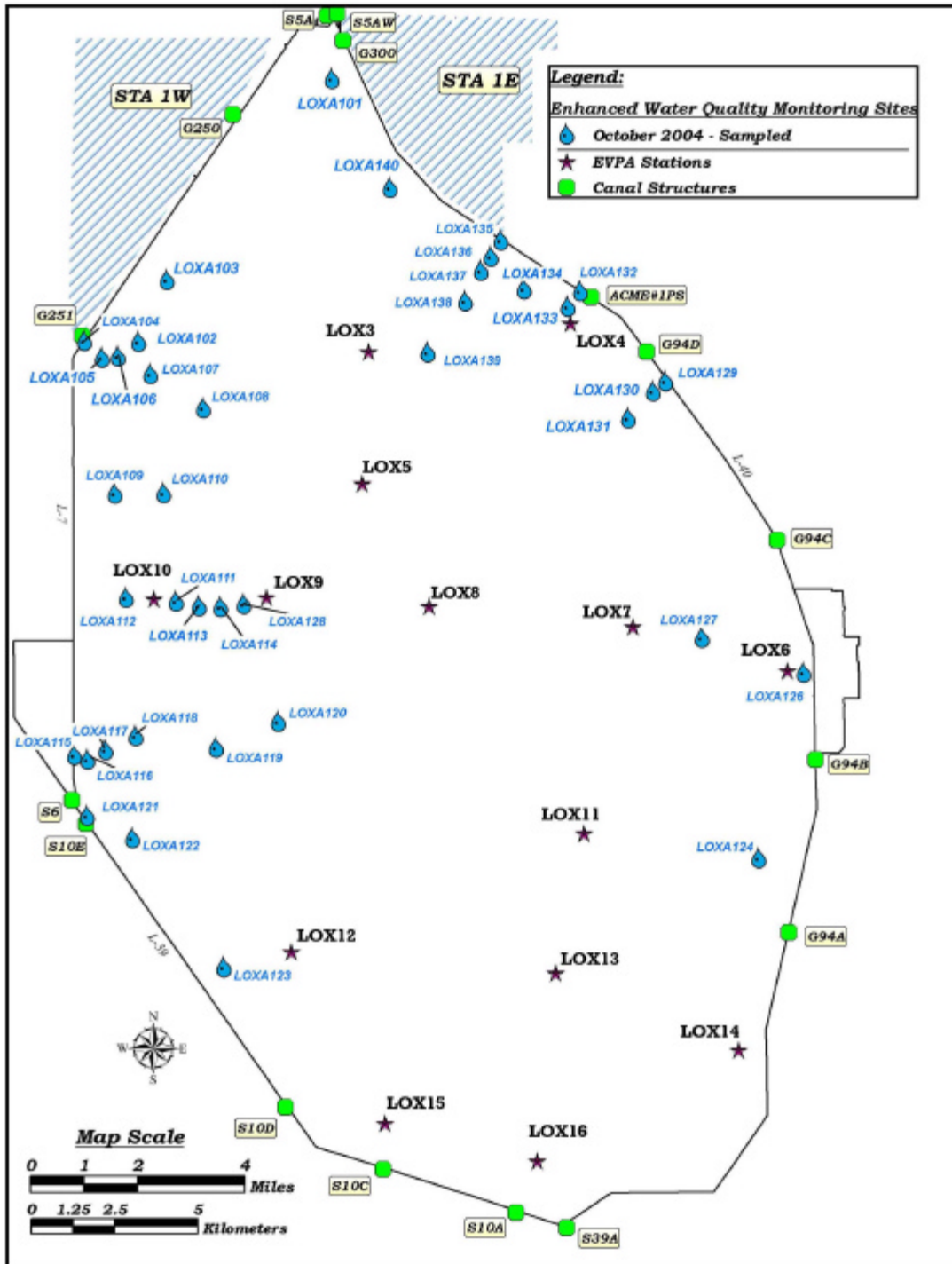


Figure 3: October 2004 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.

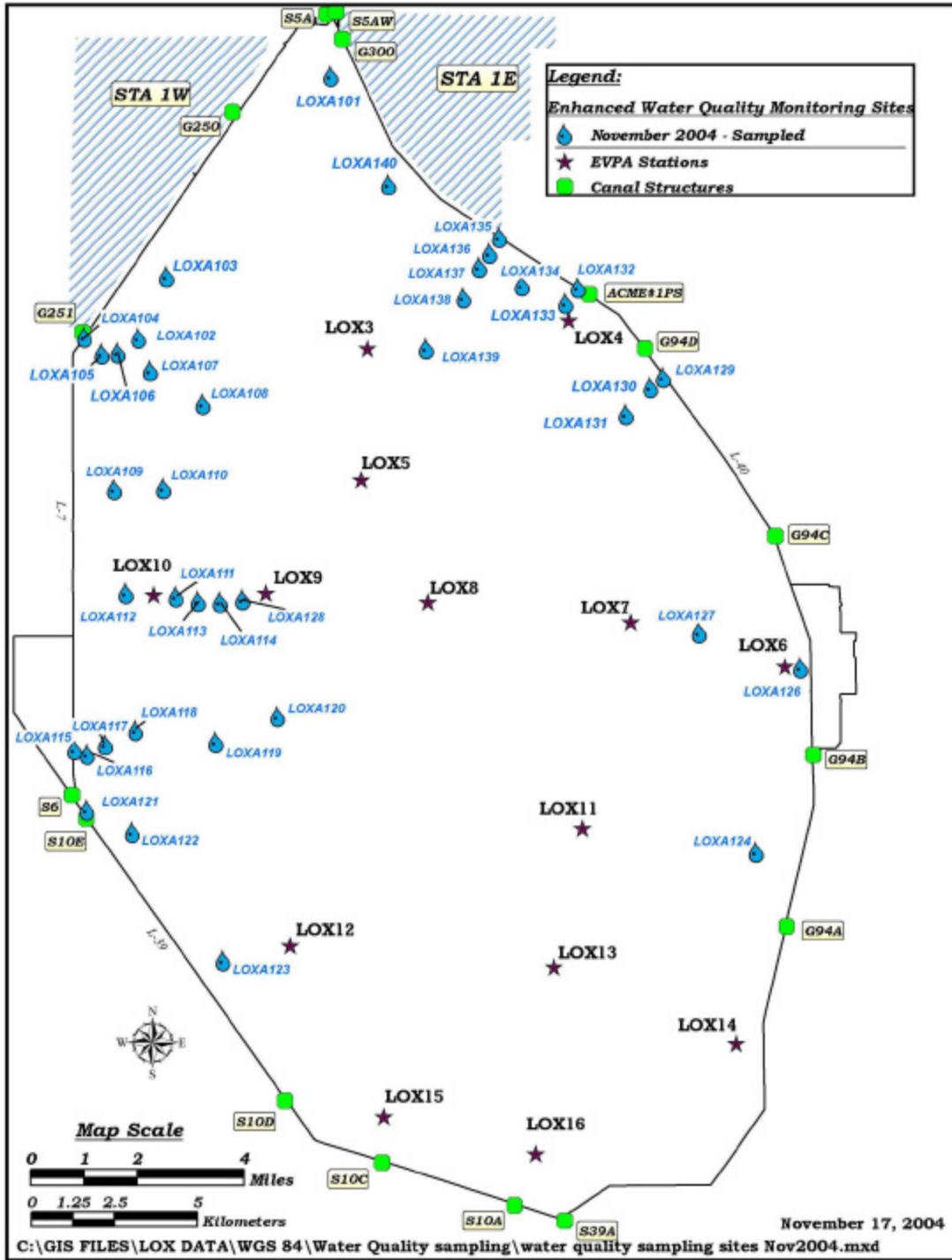


Figure 4: November 2004 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.

Table 1: Conductivity sonde deployment information for 2004 (as of November 2004).

Site	Description	Month									
		March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
LOXA104	NW Transect 0 (canal)				X	X	X	X	X	D	
LOXA105	NW Transect 0.5										
LOXA106	NW Transect 1										
LOXA107	NW Transect 2										
LOXA108	NW Transect 4	X									
LOXA111											
LOXA112											
LOXA113											
LOXA114											
LOXA115	SW Transect 0 (canal)	X	X	X	X				X	D	
LOXA116	SW Transect 0.5	X	X	X	X	X	X	X	X	D	
LOXA117	SW Transect 1	X	X	X	X	X	X	X	X	D	
LOXA118	SW Transect 2	X	X	X	X	X	X	X	X	D	
LOXA119	SW Transect 4	X	X	X	X	X	X	X	X	D	
LOXA120	SW Transect- X5										
LOXA126											
LOXA127											
LOXA128											
LOXA129	NE Transect S 0 (canal)				X	X	X	X	X	D	
LOXA130	NE Transect S										
LOXA131	NE Transect S										
LOXA132	NE Transect N 0 (canal)				X	X	X	X	X	D	
LOXA133	NE Transect N				X	X	X	X	X	D	
LOXA134	NE Transect N										
LOXA135	NE Transect STA1E 0 (canal)	X	X		X	X	X	X	X	D	
LOXA136	NE Transect STA1E 0.5	X	X		X	X	X		X	D	
LOXA137	NE Transect STA1E 1	X	X		X	X	X	X	X	D	
LOXA138	NE Transect STA1E 2	X	X		X	X	X	X	X	D	
LOXA139	NE Transect STA1E 4	X	X		X	X			X	D	
LOX4	EVPA site/refuge gauge				X	X				D	

X = Sonde was deployed and data was recorded successfully for all or part of this month

D = Sonde is currently deployed