

# Northern Everglades Hydrology and Water Quality Issues

Mike Waldon, PhD, PE  
Senior Hydrologist



**U.S. Fish & Wildlife Service**

**Arthur R. Marshall**

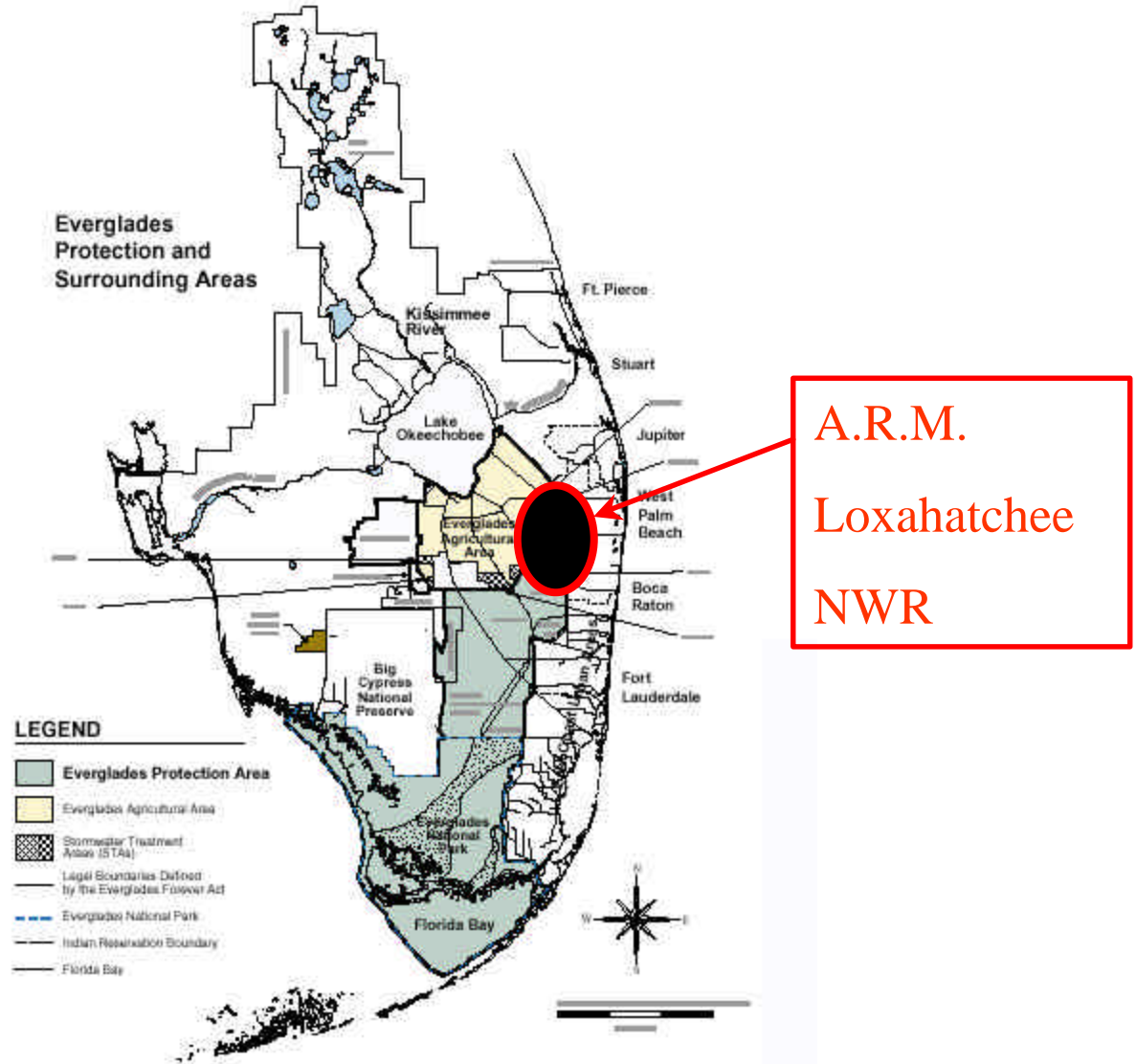
**Loxahatchee National Wildlife Refuge**

# Tree Islands, Sloughs, Wet Prairie



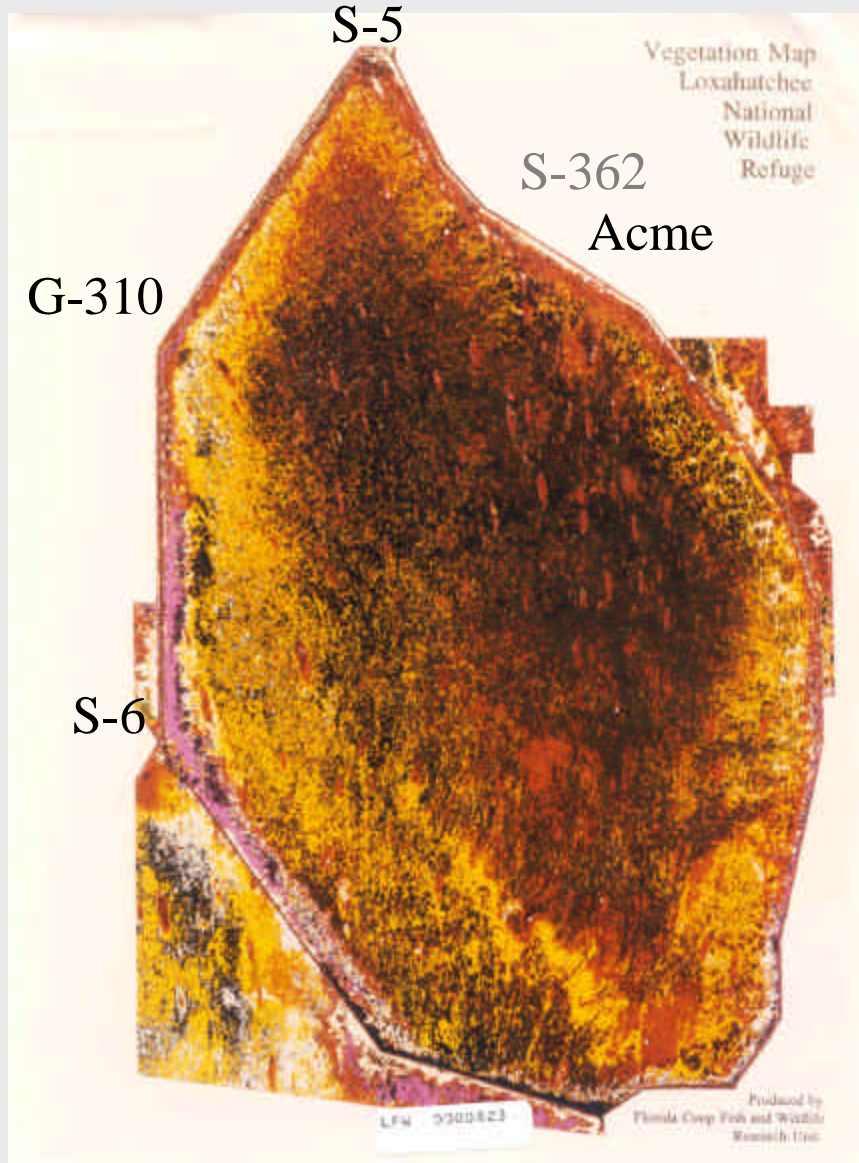
*USFWS Photo by S.D. Jewell*

# South Florida and the “Everglades Protection Area”



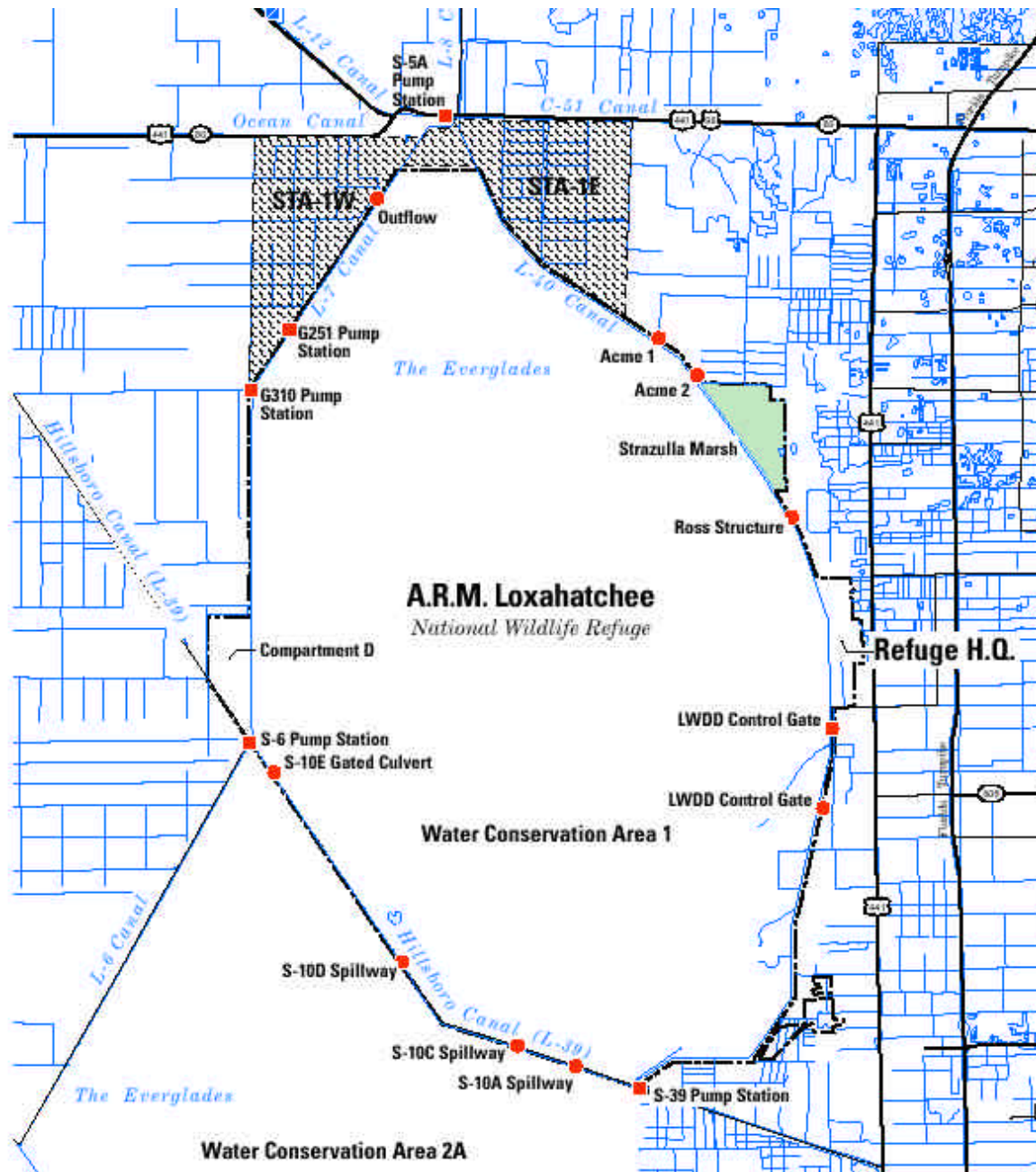
Source: 2001 Everglades Consolidated Report, South Florida Water Management District

# Vegetation Map (Richardson et al. 1990)



## Legend for Classified Vegetation Map

1. High density sawgrass (948 Acres, .7%)
2. Sawgrass with invasion of cattail (2124 Acres, 1.5%)
3. Sawgrass (18132 Acres, 13.0%)
4. Brush/sawgrass (21915 Acres, 15.7%)
5. Peripheral tree island (2387 Acres, 1.7%)
6. Wet prairie (46544 Acres, 33.4%)
7. Core tree island (867 Acres, .6%)
8. Brush (4771 Acres, 3.42%)
9. Sparse wet prairie (9934 Acres, 7.1%)
10. Cattail close to canal (1746 Acres, 1.3%)
11. Open water (282 Acres, .2%)
12. Slough / very sparse wet prairie (272 Acres, .2%)
13. Willow / brush (1160 Acres, .8%)
14. Brush/tree island (16467 Acres, 11.8%)
15. Sawgrass / brush (2548 Acres, 1.8%)
16. Higher elevation sawgrass (6214 Acres, 4.46%)
17. Willow (1167 Acres, .8%)
18. Cattail (1856 Acres 1.33)

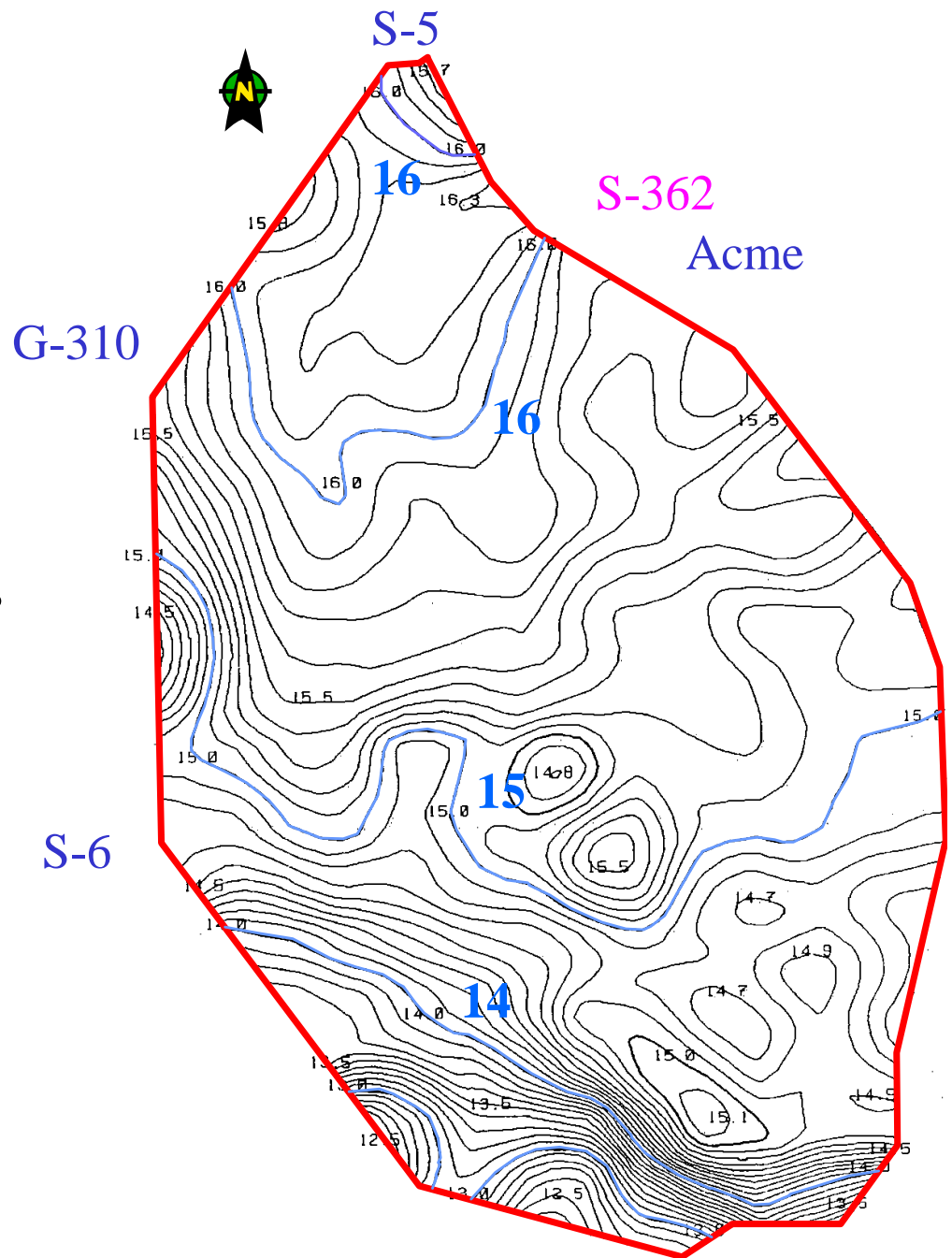


Source: A.R.M Loxahatchee National Wildlife Refuge Comprehensive Conservation Plan

# Contour plot

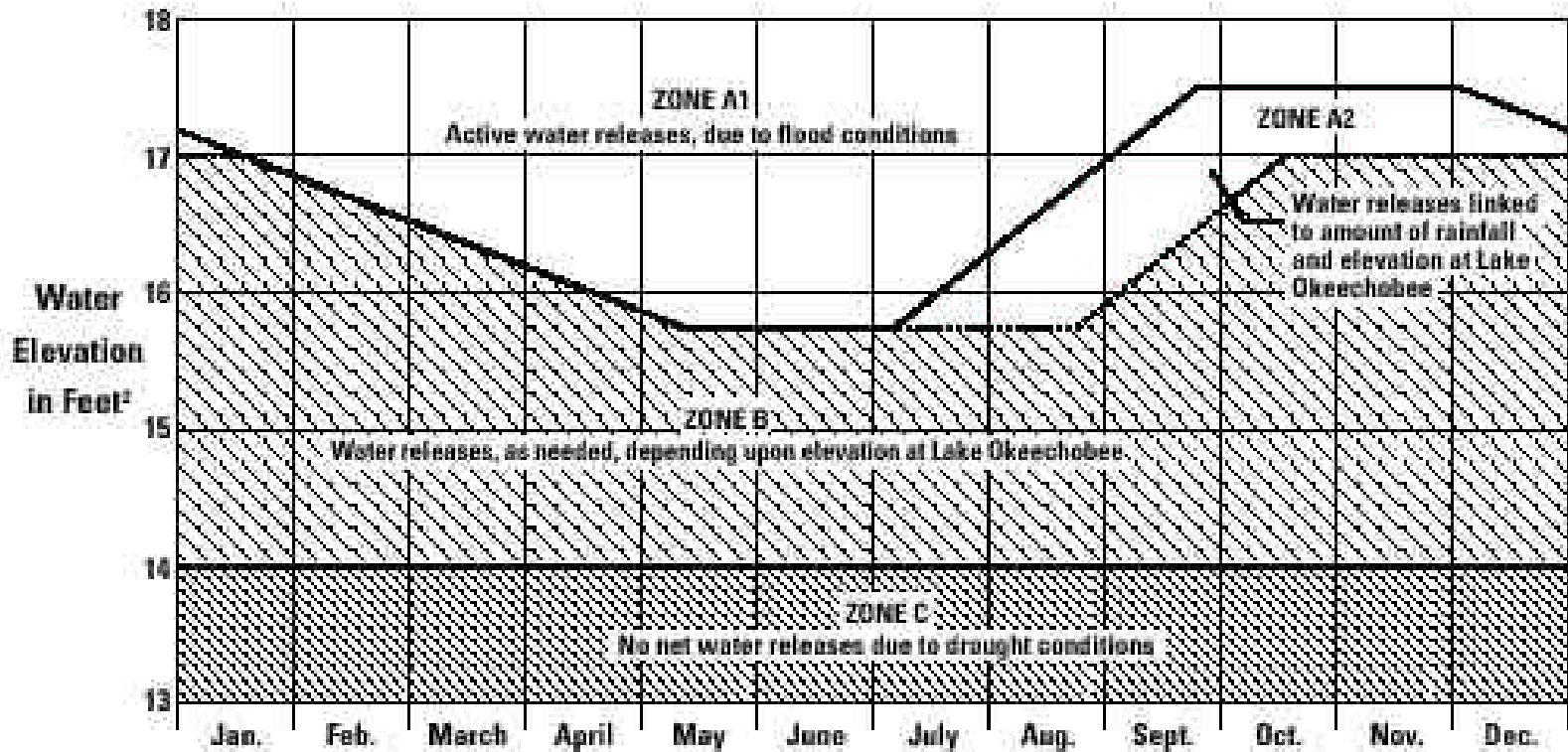
0.1 foot contour intervals

(Richardson, et al., 1990)



Modified from Richardson et al. (1990)

# Water Regulation Schedule



## Present routine water quality monitoring

- 14 compliance stations – Lox 3 thru 16
- Inflow and outflow structures – related to permits and settlement agreement
- Research transects – 11 stations, 2 in L-7 Canal
- No monitoring near inflows in impacted zone

## Present routine stage monitoring

- Interior – 5 USGS sites, other staff gages
- Canal – 1 USGS site, structure head/tail water

# Perimeter Canal & Levee



Access is by Airboat or  
Helicopter



# Airboat Sampling



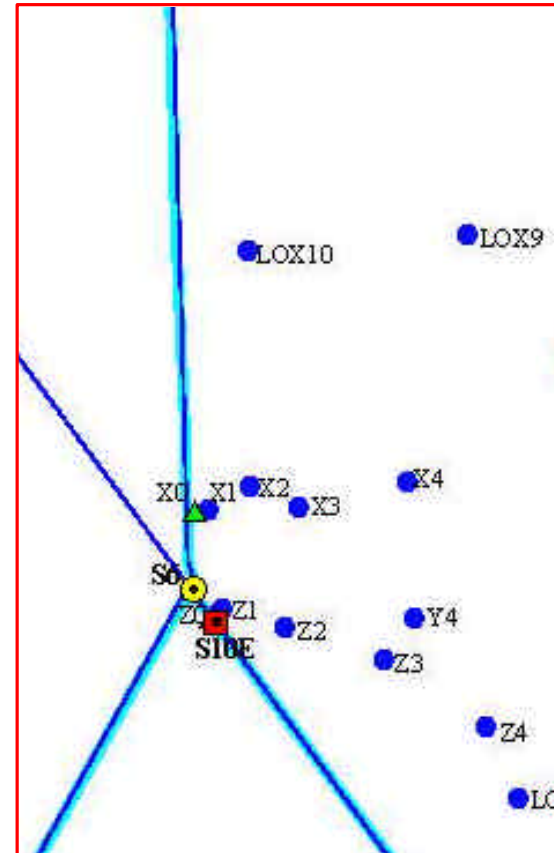
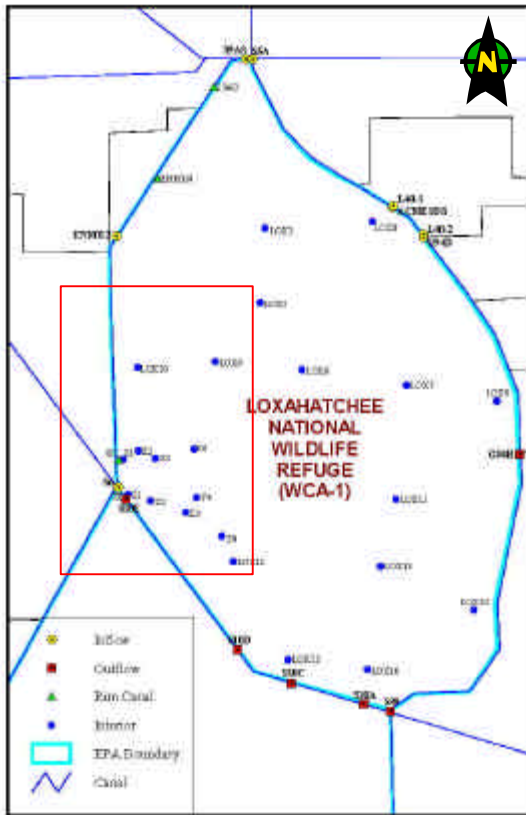
# Interior Marsh



# Stage monitoring site



# A.R.M. Loxahatchee National Wildlife Refuge



# Estimated Concentrations

Inflow=median canal cond>932; Unimpacted=median sites-4 cond<228.85

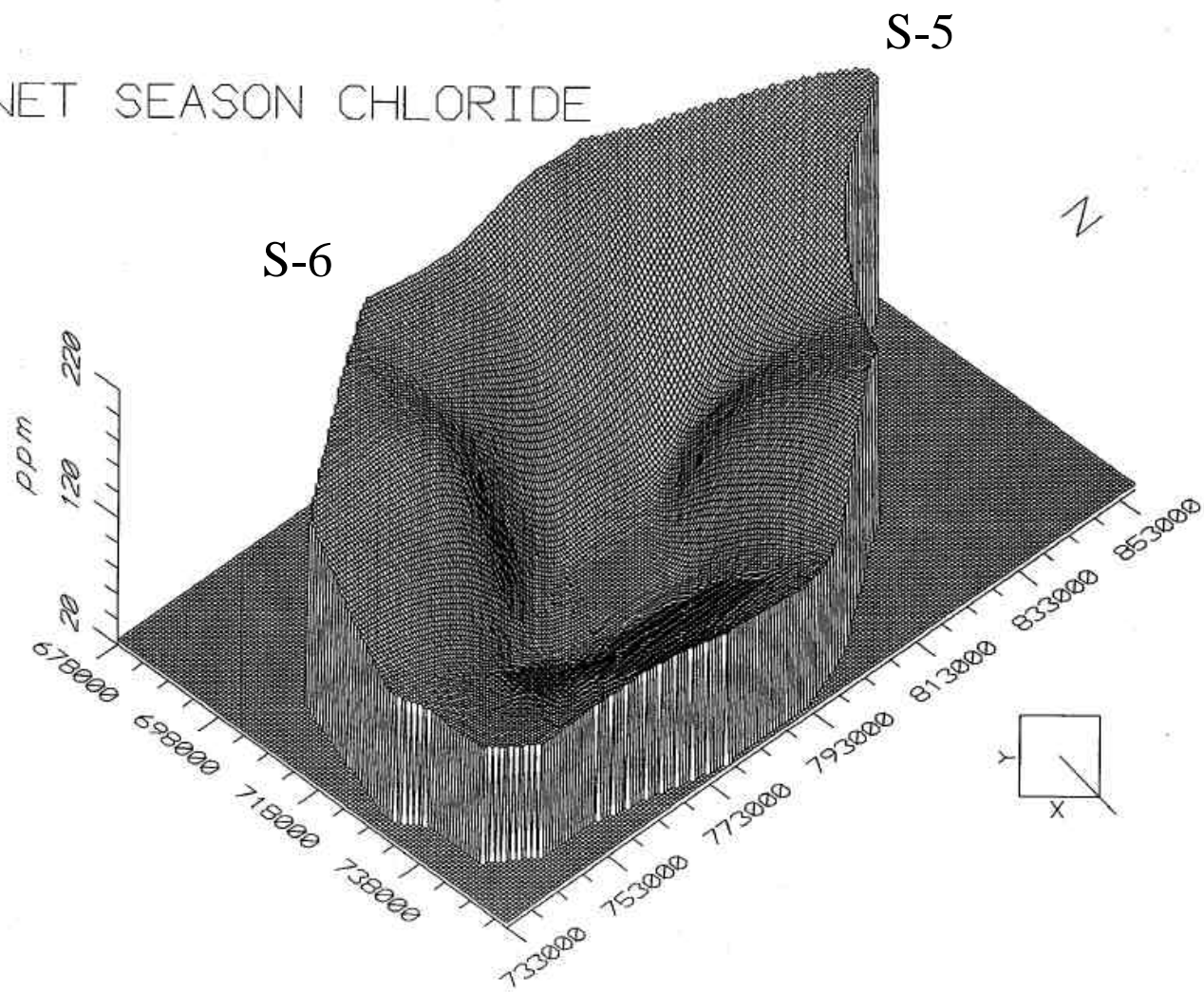
<b>SITE</b>		<b>Inflow</b>	<b>Unimpacted</b>
Conductivity	uS/cm	1101	147
Alkalinity	mg/L	283	37
Chloride (filtered)	mg/L	155.0	22.2
Calcium (filtered)	mg/L	89.1	11.0
Sodium (filtered)	mg/L	106.8	15.5
Silica (filtered)	mg/L	21.5	5.4
Sulfate (filtered)	mg/L	61.5	1.02
Total P	mg/L	0.052	0.008
Total N	mg/L	2.71	0.98
TN/TP (mass)		53	130

# Characterization of water quality parameters

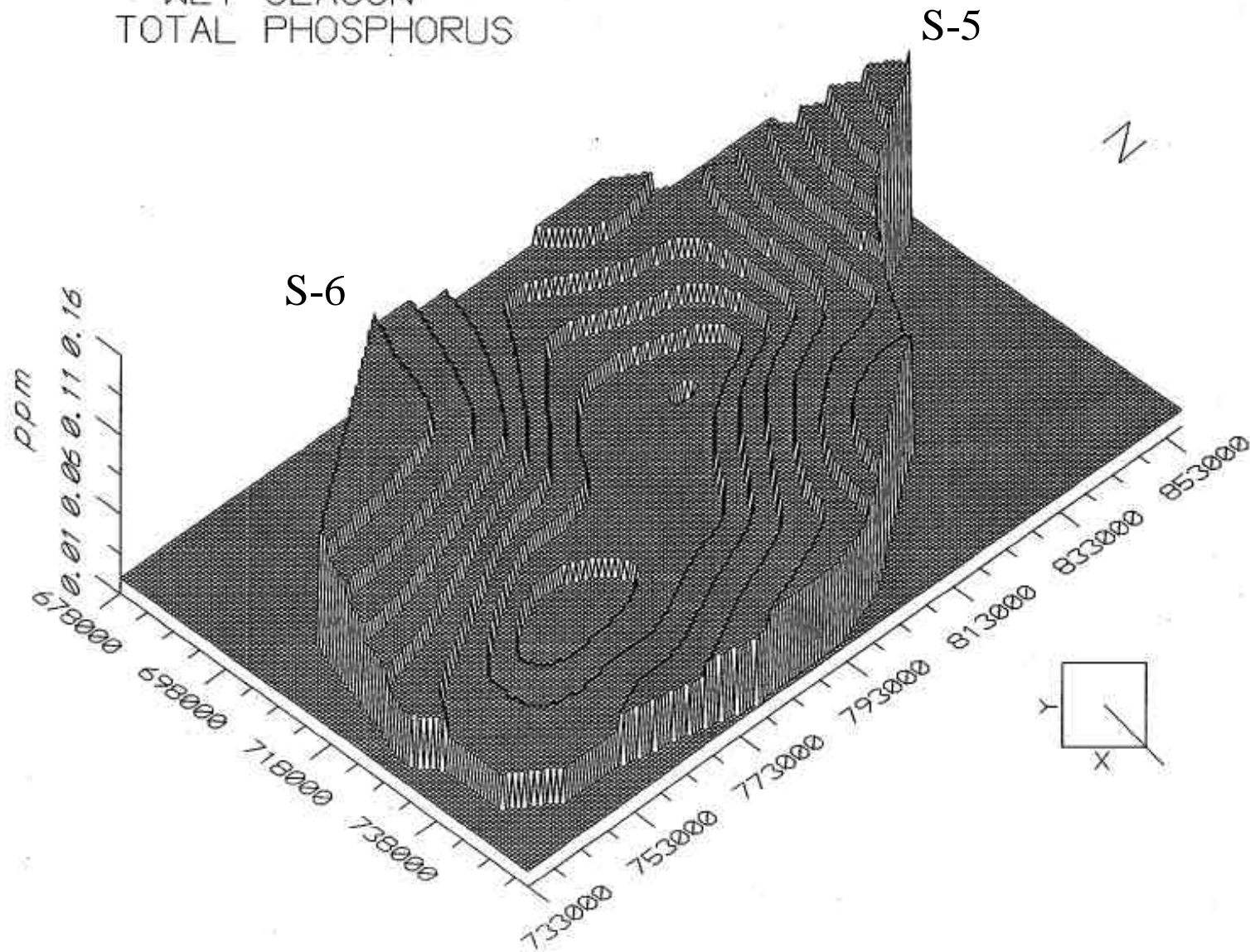
<u>Parameter</u>	<u>Canal</u>	<u>Interior</u>
Sodium	C	C
Calcium	+	-
Sulfate	C	-
Potassium	+	C
Silica	+/-	+/-
Algal Growth Potential	+	-
Total Nitrogen	C	-
Total Phosphorus	+	-

**Conservative = C, source = +, sink = -**

# WET SEASON CHLORIDE



WET SEASON  
TOTAL PHOSPHORUS



# Concerns: Interior Marsh

- Altered hydroperiod/pattern
- Altered flow patterns
- Eutrophication
- Intrusion of high P canal water
- Intrusion of high TDS canal water



*Boat-tailed grackle*  
*USFWS Photo by Evelyn McGraw*

## Need for an alternative approach:

- Dilution from mixing in WCA-1 confounds interpretation of concentration data
- Mixing-plot uses a conservative constituent to estimate the degree that dilution causes reduced concentration
- The mixing-plot provides a graphical means to qualitatively class constituents as conservative, having a source, or having a sink

# Questions?



*USFWS Photo by S.D. Jewell*