



# *Design of Stormwater Treatment Area Enhancements*

**Gary Goforth, P.E., Ph.D.  
Chief Consulting Engineer**

**South Florida Water Management District**



- **Background**
- **Vegetation conversion**
- **Compartmentalization**
- **Operation refinements**
- **Expansion**
- **Future Plans**



- **Stormwater treatment areas (STAs) and agricultural Best Management Practices in the Everglades Ag Area have exceeded expectations (50 ppb)**
- **However, improved STA performance is required to achieve phosphorus criterion (10 ppb) in the Everglades**
- **STA optimization focused on vegetation, operations and compartmentalization**



# STA Vegetation



**Emergent Vegetation - optimal performance: 15-20 ppb**



**Submerged Aquatic Vegetation (SAV) optimal performance: 10-15 ppb**



**Periphyton-based Stormwater Treatment Area (PSTA): optimal performance 10-15 ppb**



# STA-3/4 Vegetation Conversion

***Transplanting SAV from STA-2 Cell 3  
into STA-3/4 Cell 2B***





# STA-3/4 Vegetation Conversion





# STA-3/4 Vegetation Conversion





# STA-3/4 Vegetation Conversion







# STA-3/4 Vegetation Conversion





# STA-3/4 Vegetation Conversion





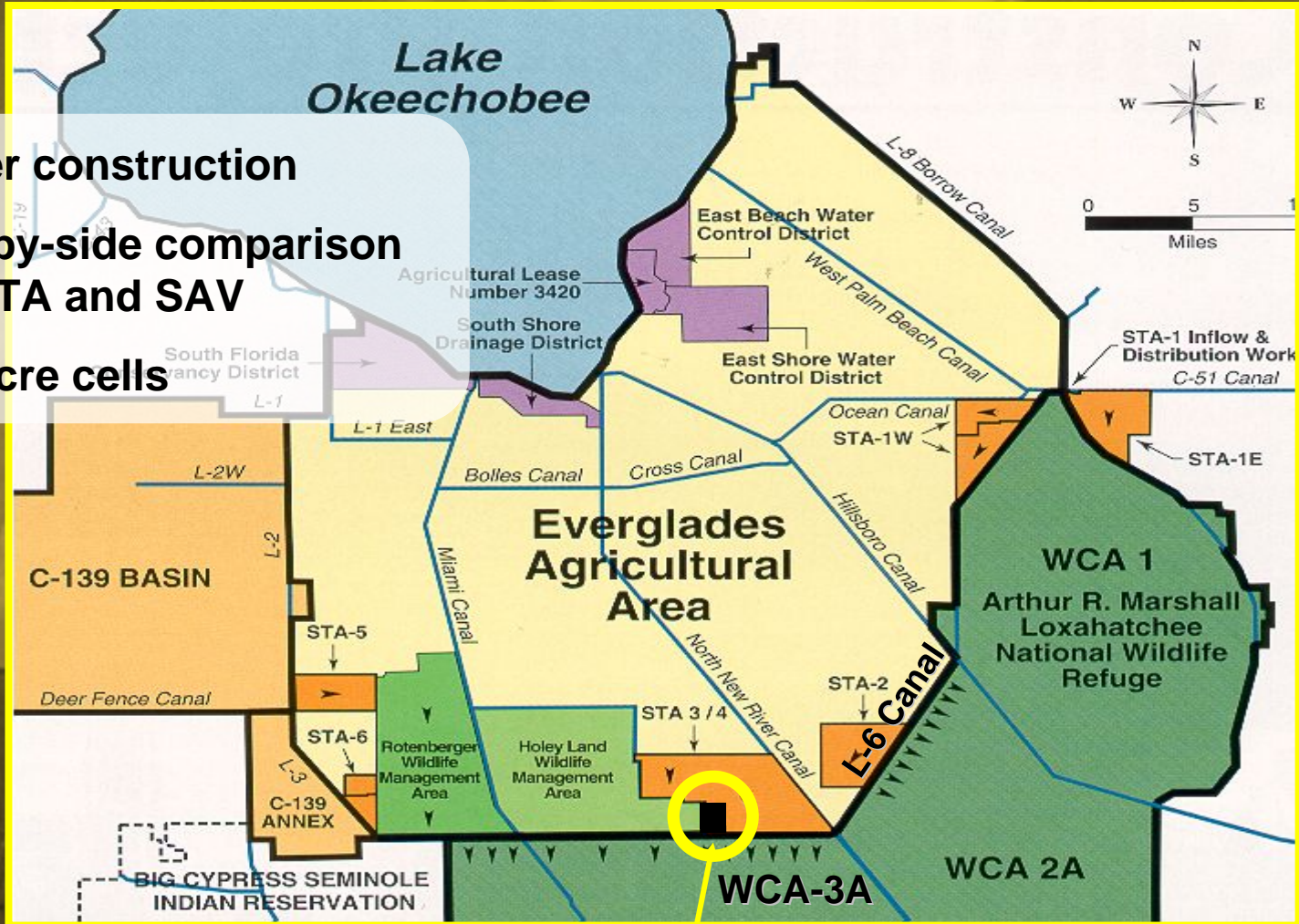
# STA-3/4 Vegetation Conversion





# STA-3/4 PSTA Demonstration Project

- Under construction
- Side-by-side comparison of PSTA and SAV
- 100-acre cells



**PSTA PROJECT LOCATION**



# *PSTA Demonstration Project – Pre-construction*





# STA-3/4 PSTA Demonstration Project



- **Start-up to begin in January**
- **Designed to receive full-scale flows and loads**
- **Modular design for replication in other cells**



## *Compartmentalization*

- **Importance of effective hydraulics in treatment wetlands**
  - **Less hydraulic short-circuiting leads to greater contact area, which in turn yields improved nutrient removal**
- **Alternatives**
  - **Traditional levee/structures**
  - **Limerock berm**



# Limerock Berm Demonstration Project



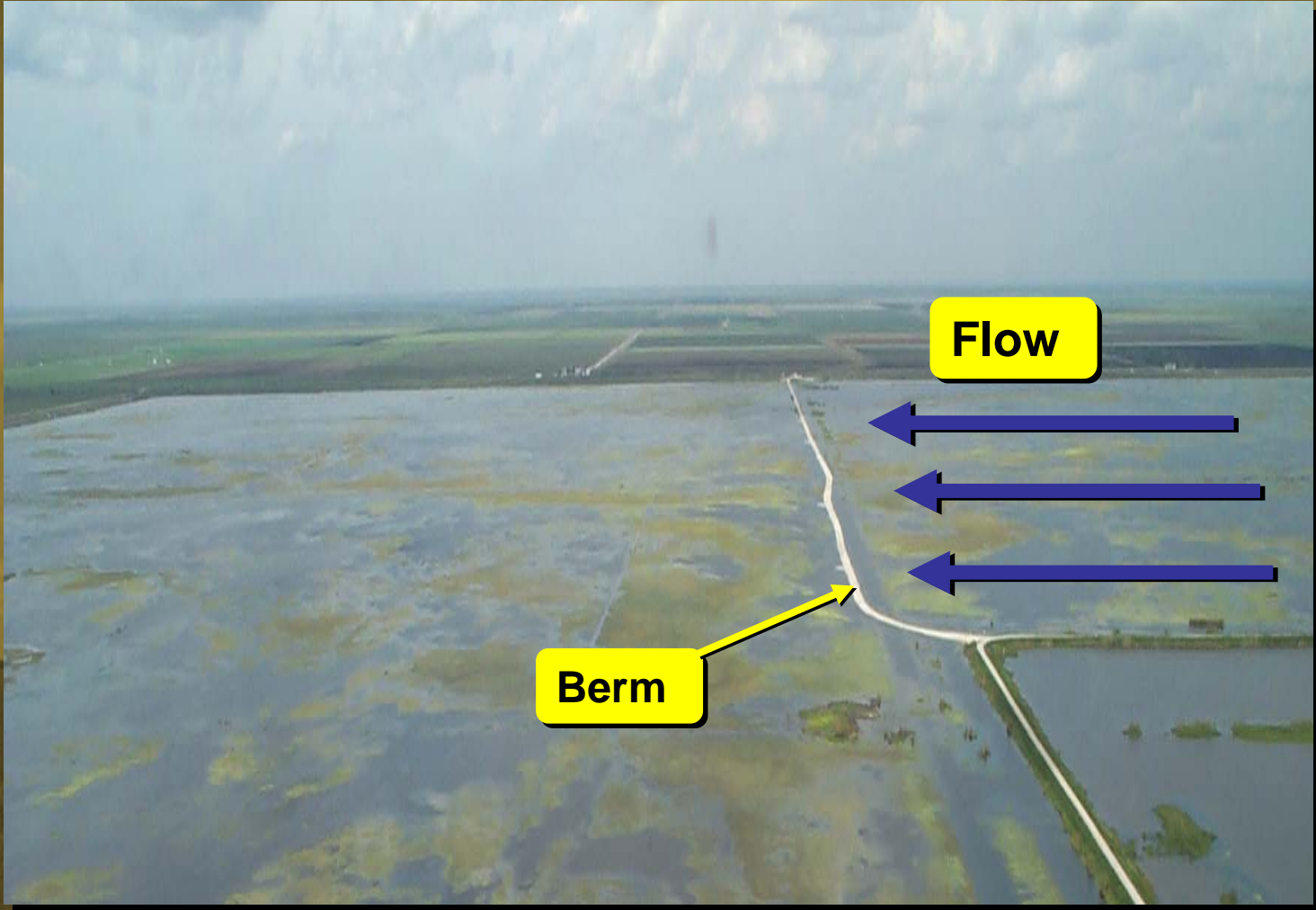
Rock ranged from  
 $\frac{3}{4}$  - 2 inches in diameter

Funding provided by USEPA  
S. 319 Grant via FDEP





# Limerock Berm



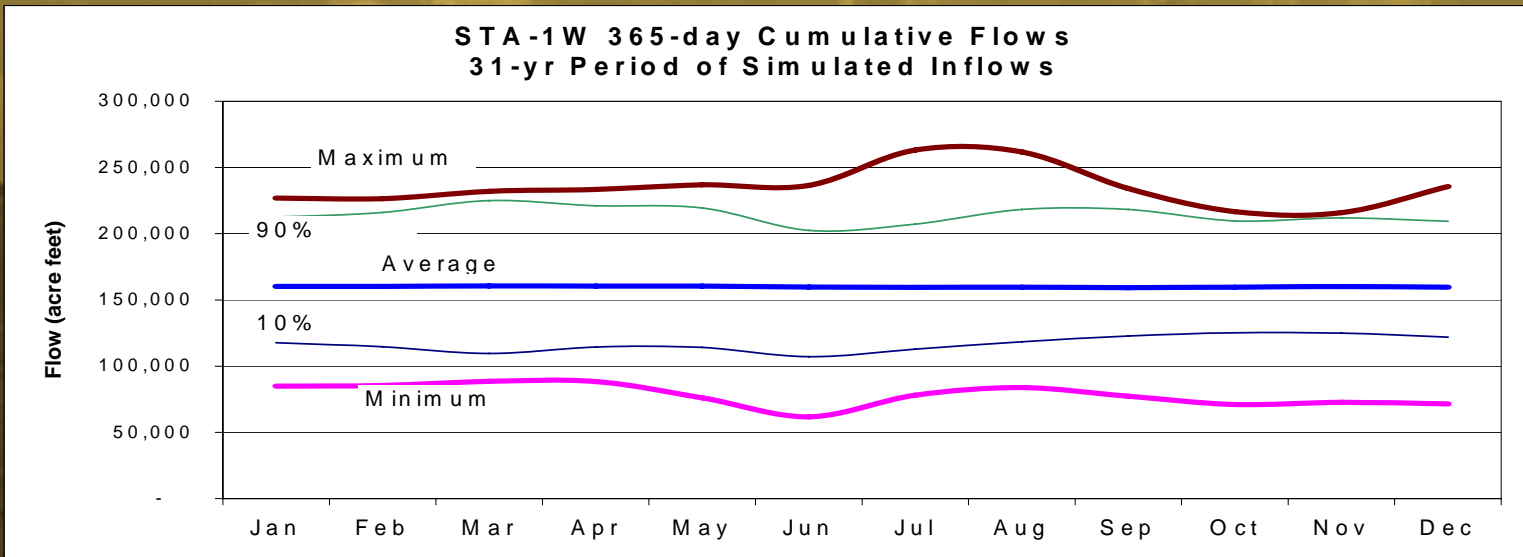
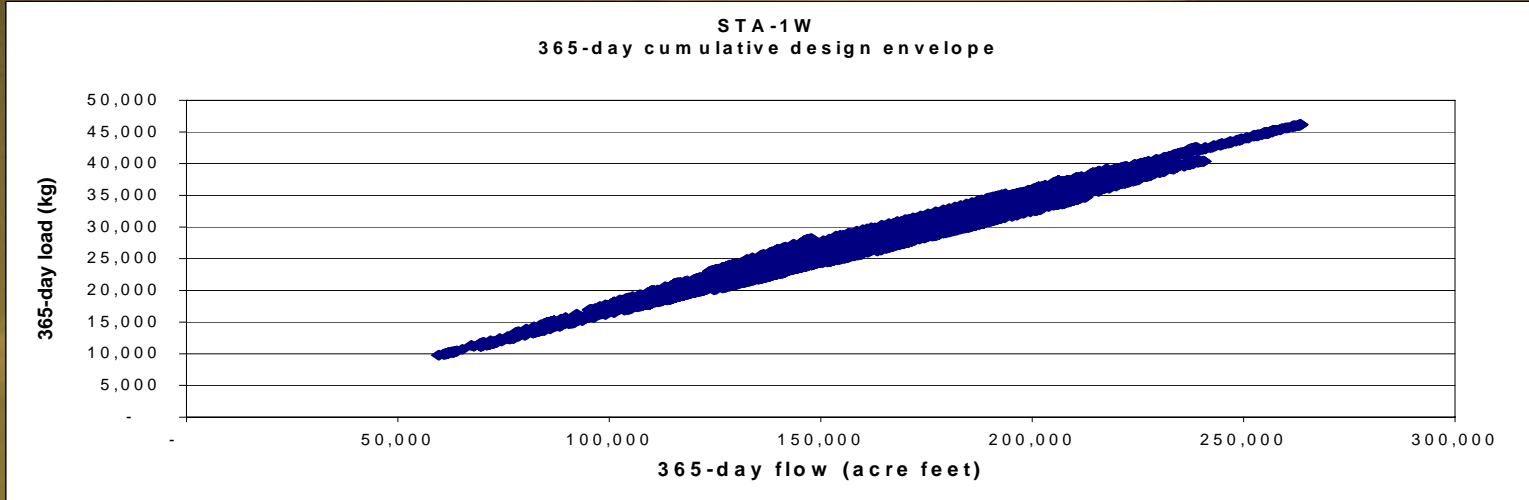


## *Operation Refinements*

- **Operating depths**
  - Emergent vegetation: 1.25 ft
  - SAV: 1.5 ft
- **Balancing flows and loads among cells**
- **Operational envelope – flows and loads**

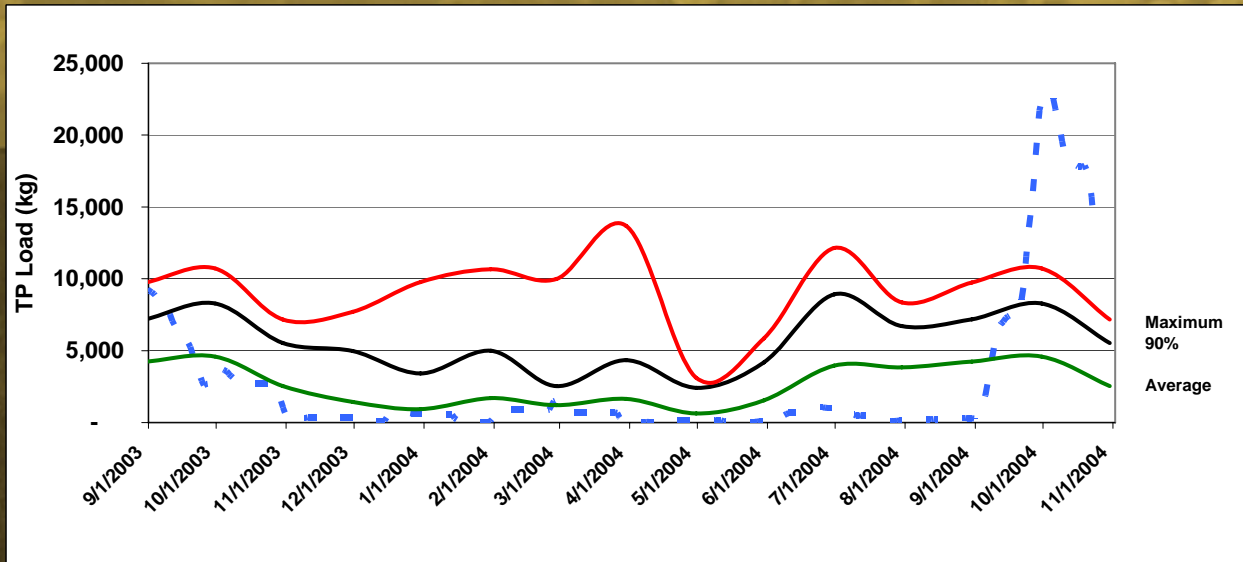
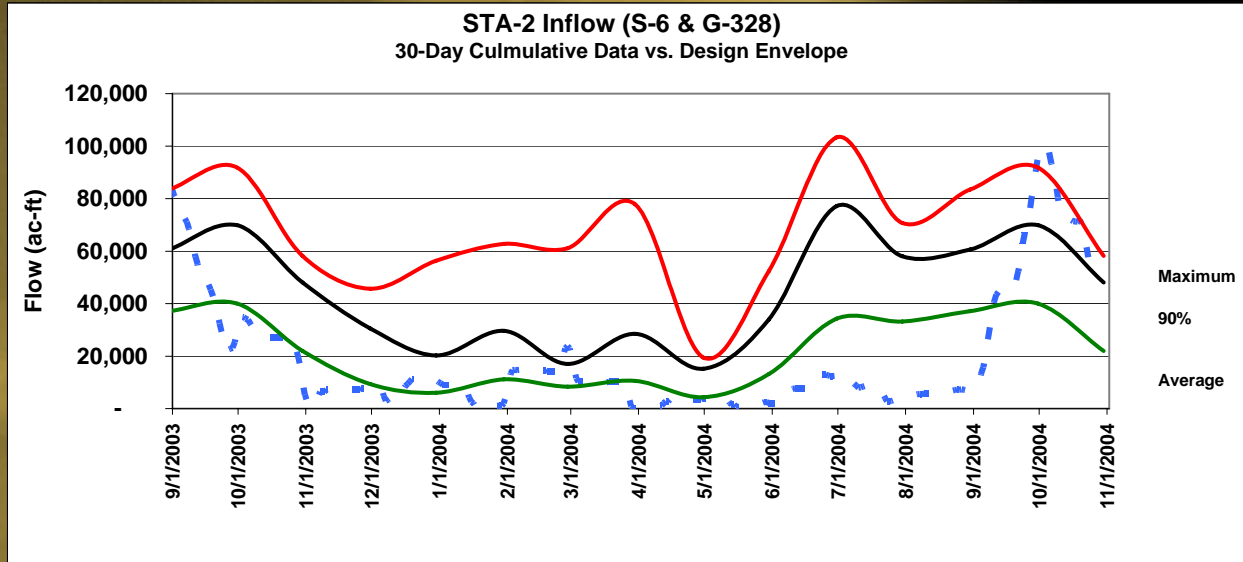


# STA Operational Envelope





# STA-2: Actual vs. Design

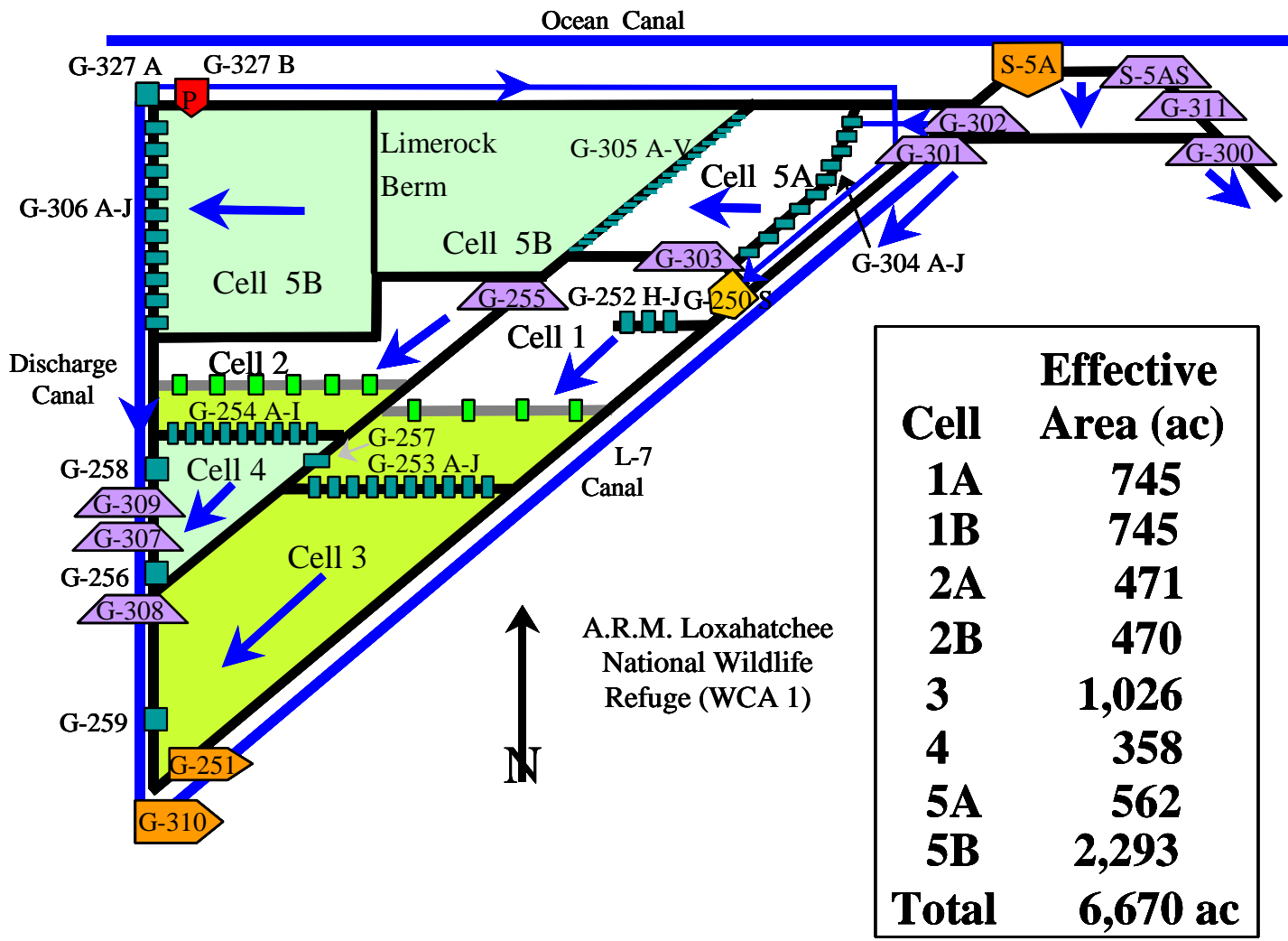






# STA-1W Enhancements:

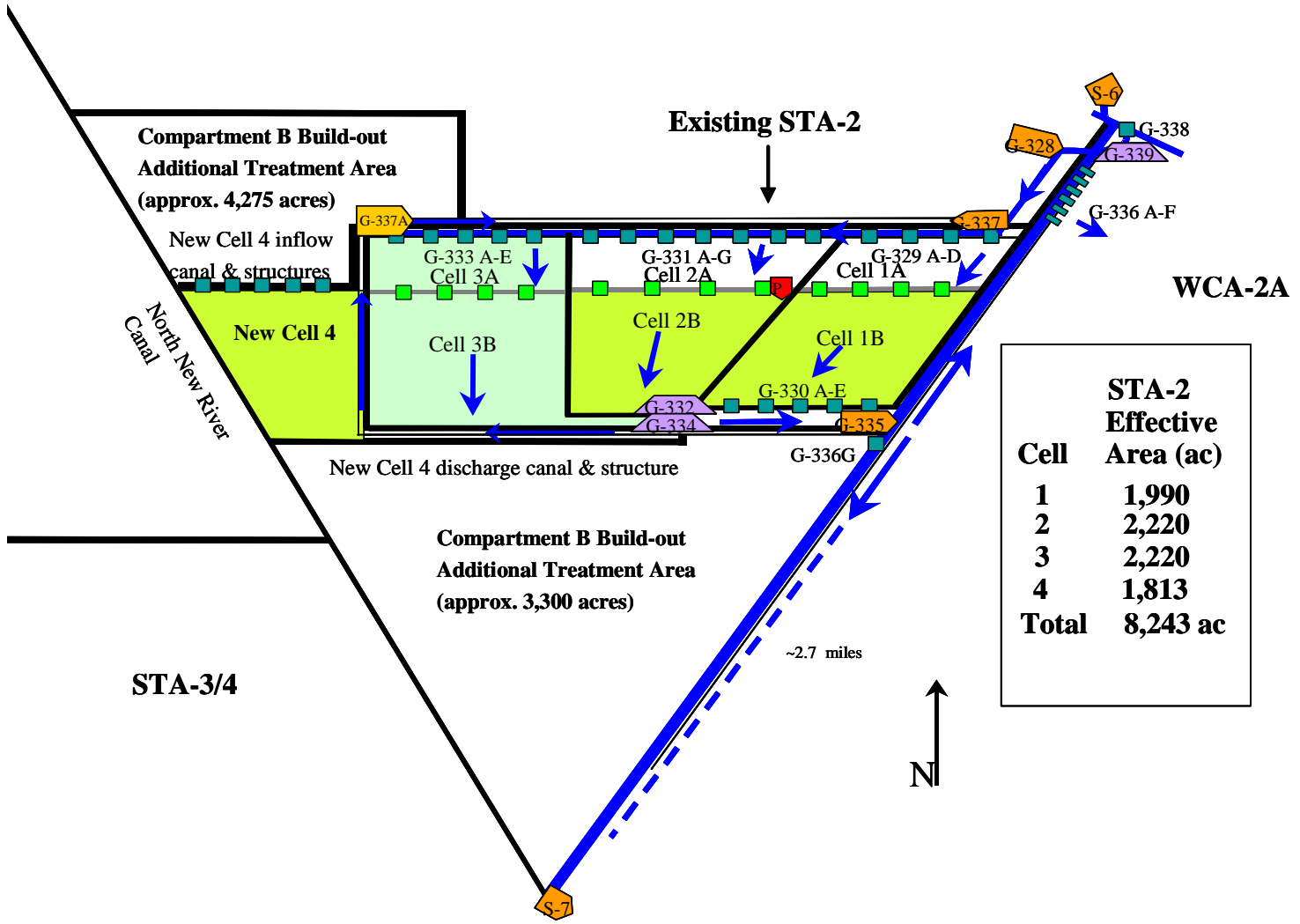
## Compartmentalization, Vegetation Conversion and Operational Refinement



A.R.M. Loxahatchee National Wildlife Refuge (WCA 1)



# STA-2 Enhancements: Compartmentalization, Vegetation Conversion and Expansion



Cell	Effective Area (ac)
1	1,990
2	2,220
3	2,220
4	1,813
<b>Total</b>	<b>8,243 ac</b>

**Compartment B Build-out  
Additional Treatment Area  
(approx. 4,275 acres)**

New Cell 4 inflow canal & structures

New Cell 4

North New River Canal

New Cell 4 discharge canal & structure

**Compartment B Build-out  
Additional Treatment Area  
(approx. 3,300 acres)**

STA-3/4

Existing STA-2

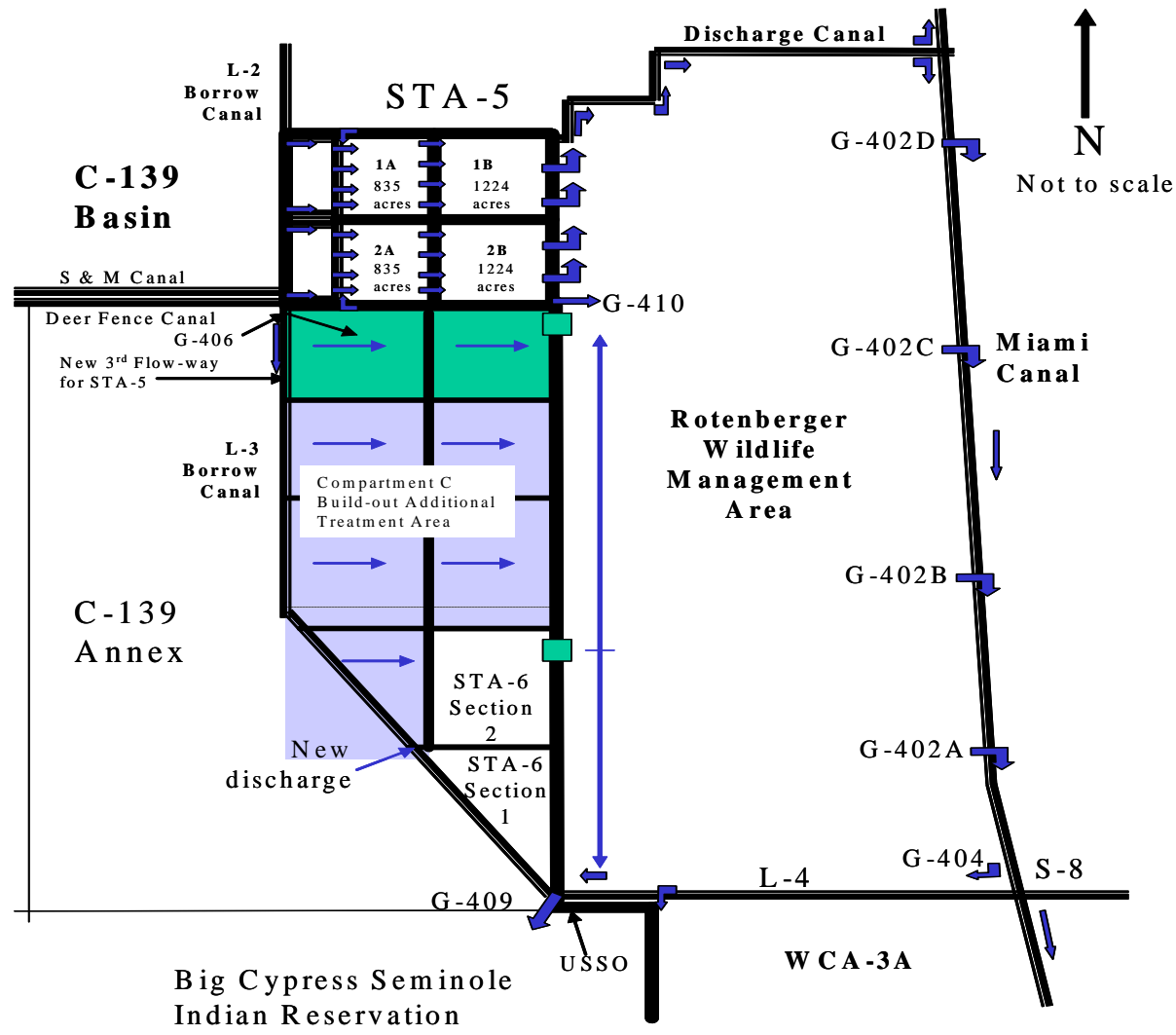
WCA-2A

~2.7 miles





# STA-5 & STA-6 Enhancements: Compartmentalization, Vegetation Conversion and Expansion







# Improved Performance Projections

<b>STA</b>	<b>Before Enhancements</b>	<b>After Enhancements</b>
STA-1E	38 ppb – flow-weighted mean 34 ppb – geomean	15-24 (fwm) 10-11 (geomean)
STA-1W	24-30 (24-26)	14-22 (10-13)
STA-2	33-37 (33-35)	17-28 (10-14)
STA-3/4	36 (36)	14-21 (10-15)
STA-5	45-50 (32-34)	20-30 (10-13)
STA-6	28 (20)	17-24 (10-13)

Inflow volumes and loads have been greater than assumed – updating our inflow data sets and STA performance projections



## *Future Plans*

- **Updating inflow data sets**
- **Use of 2nd generation design model (DMSTA) calibrated with full-scale STA performance**
- **Balancing loads among STAs**
- **Integrating with CERP projects**



# *Design of Stormwater Treatment Area Enhancements*

**Gary Goforth, P.E., Ph.D.  
Chief Consulting Engineer**

**South Florida Water Management District**