

Recent Progress in the MIKE Marsh Model (M3ENP) of Everglades National Park

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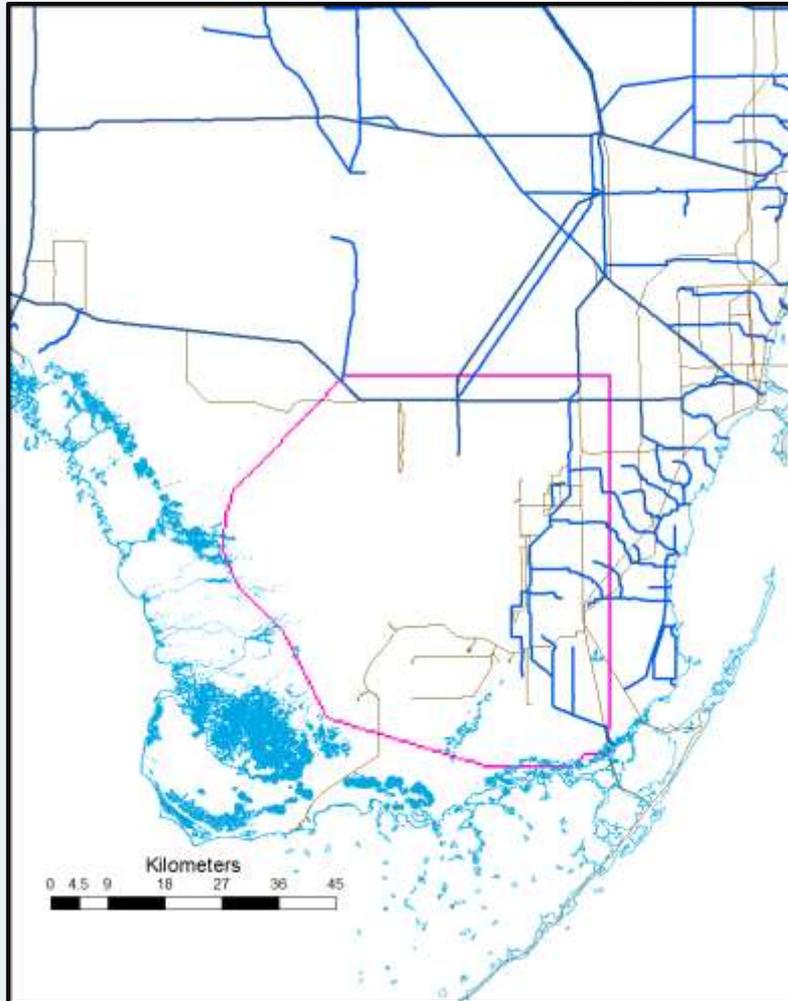
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M3ENP-MIKE MARSH MODEL OF ENP



Developers:

- Robert Fennema, Georgio Tachiev, Amy Cook, Kiren Bahm

Funding

- NPS – CESI and Others

Commercial Software

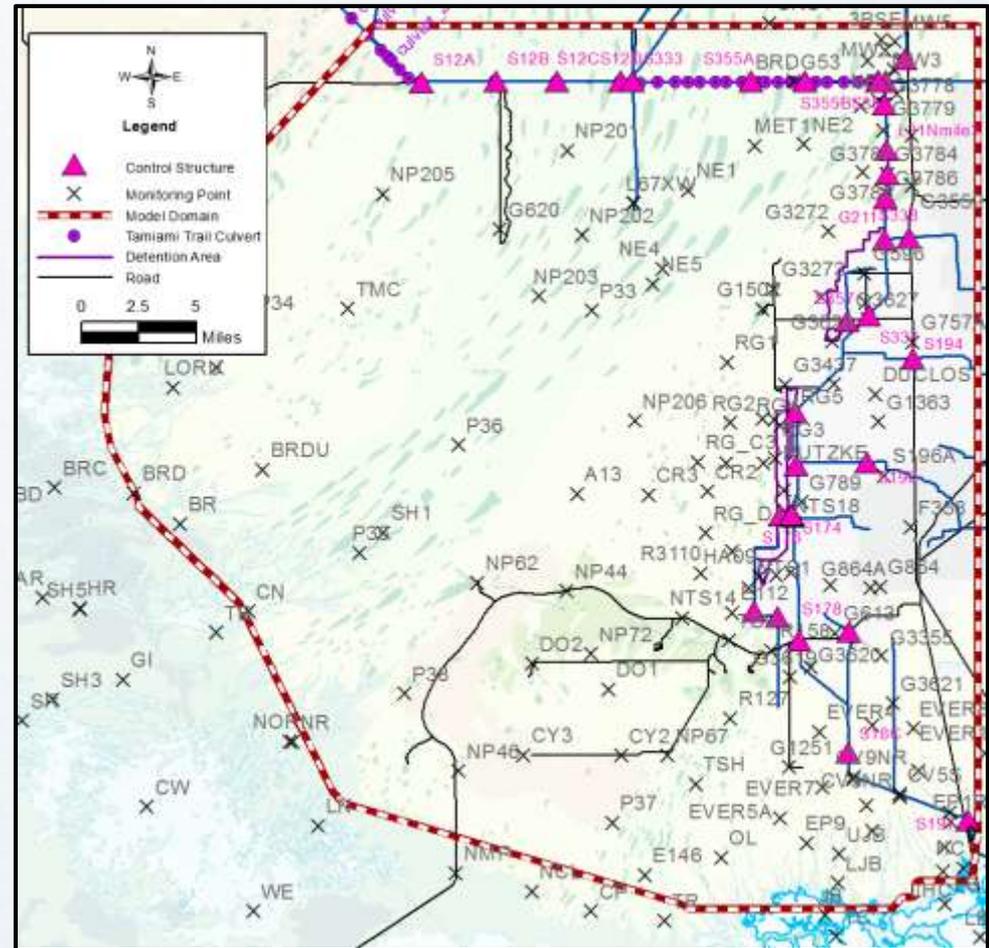
- MIKE SHE
- MIKE 11

M3ENP-MIKE MARSH MODEL OF ENP

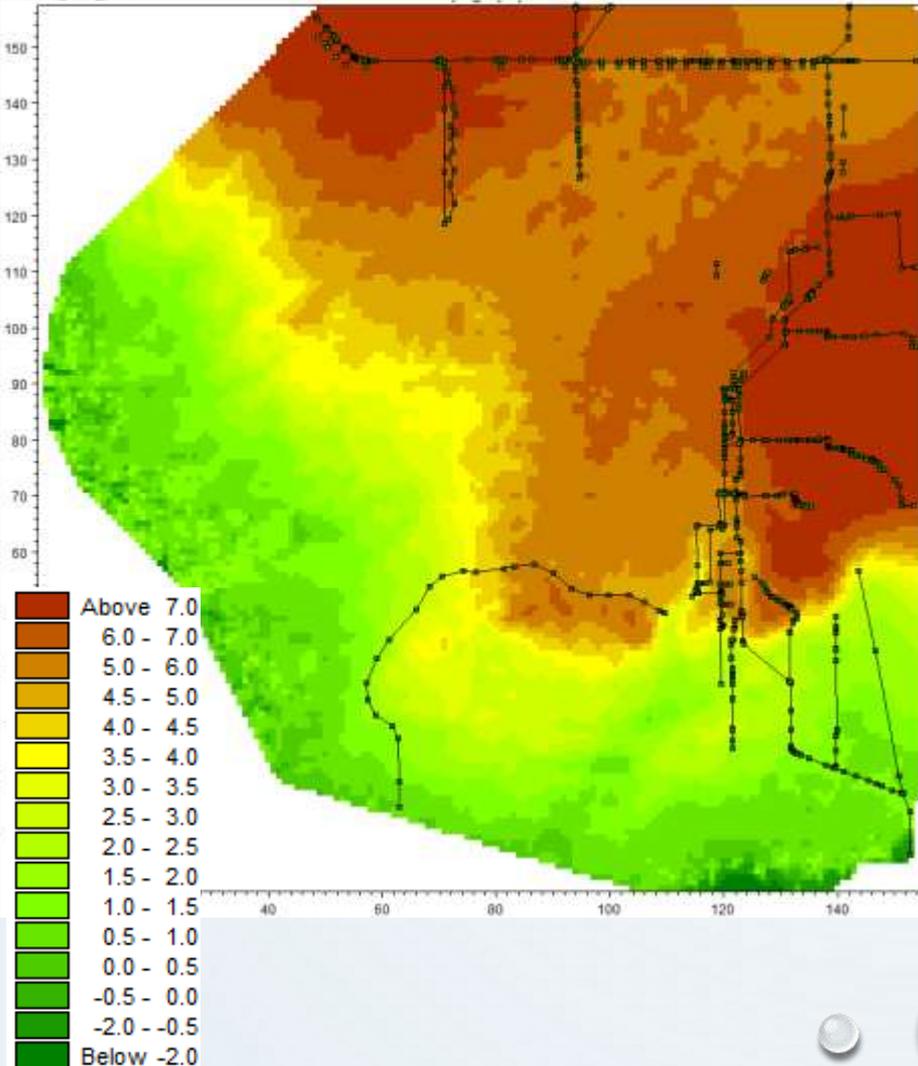
- MIKE SHE (MSHE) – 3D Saturated And Unsaturated Groundwater, 2D Overland/Sheet Flow, and 1D Unsaturated Zone Flow (Vertical)
 - Domain selection and discretization
 - Domain parameters (subsurface hydrology), vegetation, soil, overland flow, rainfall, ET, Manning's number, detention storage, imperviousness
 - Boundary conditions (rainfall, evapotranspiration, groundwater)
- MIKE 11 (M11) – 1D flow model
 - Canals, cross sections, Manning's number, structure and structure operations
 - Boundary conditions (stage and flow)

M3ENP-MIKE MARSH MODEL OF ENP

- Simulation Period
 - 1987-2010
- 1226 Square Mile Domain
- 120 Miles Of Canals
- Structures:
 - Tamiami Trail Culverts
 - Gates (Full Ops)
 - Pump Stations (Full Ops)
 - Stormwater Detention Areas



M3ENP-MIKE MARSH MODEL OF ENP



- Square Finite Difference Grid (400m discretization)
- Key Parameters: Hydraulic Conductivity, Manning n, Canal Seepage, Structure Operations
- 350 Observation Points
- Computes: Canal Water Levels, Flows, Seepage
- Spatial Plots: Flow Velocities, Water Depth

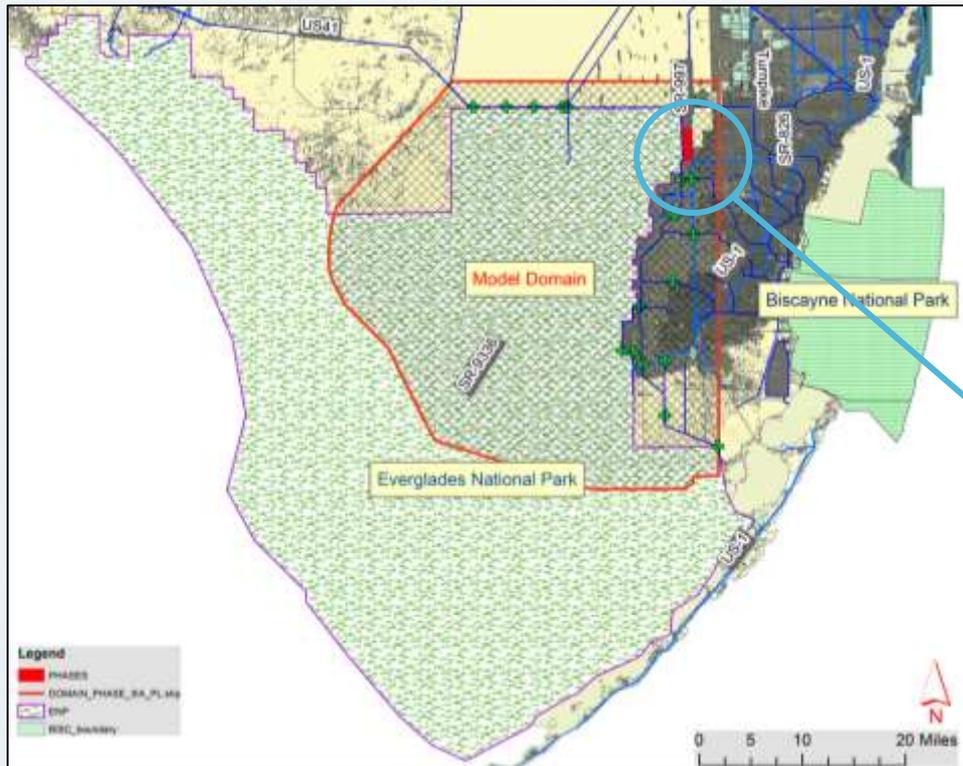
APPLICATIONS OF M3ENP

1. Feasibility Study for Proposed Biscayne Bay Ecosystem Restoration Reservoir
2. Effects of a Curtain Wall Adjacent to L31-N Canal

The image features a light blue background with several realistic water droplets of various sizes scattered in the corners. The droplets have highlights and shadows, giving them a three-dimensional appearance. The word "Reservoir" is centered in a large, bold, black sans-serif font.

Reservoir

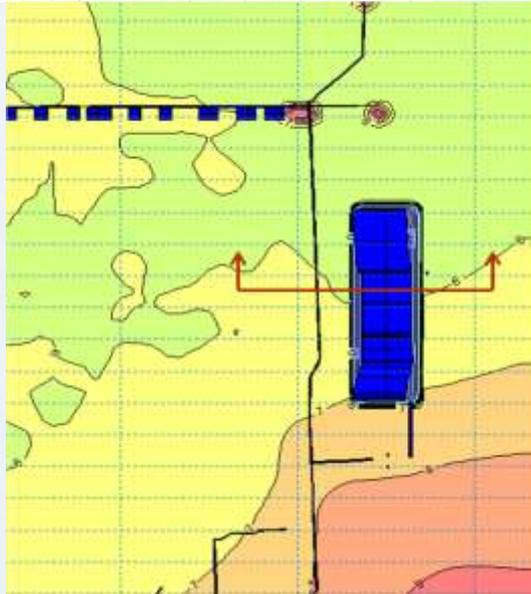
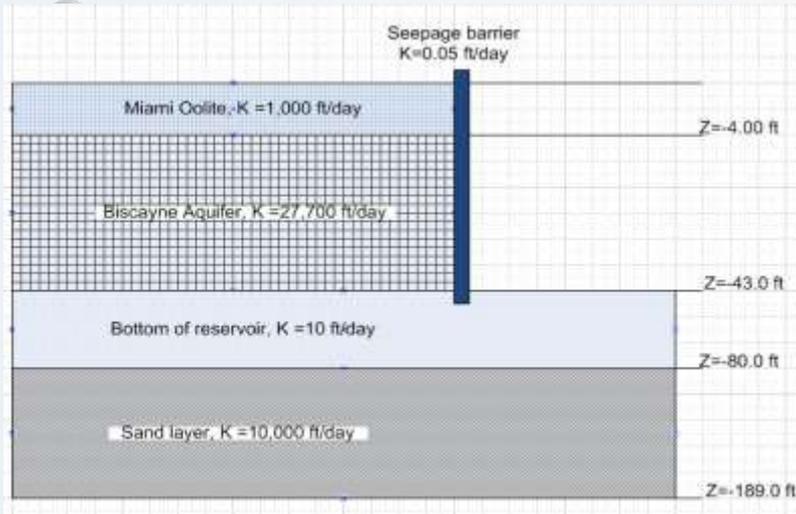
RESERVOIR



- Adjacent to L31N, south of C-4
- 638 acres – 1800 acres



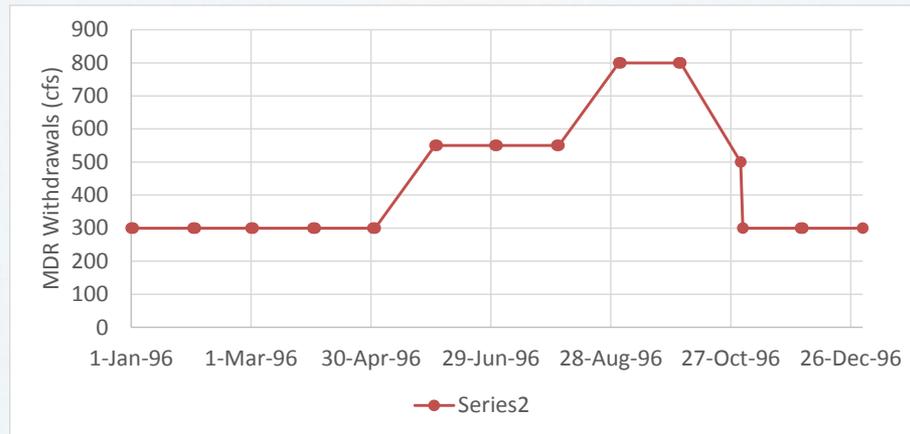
Reservoir



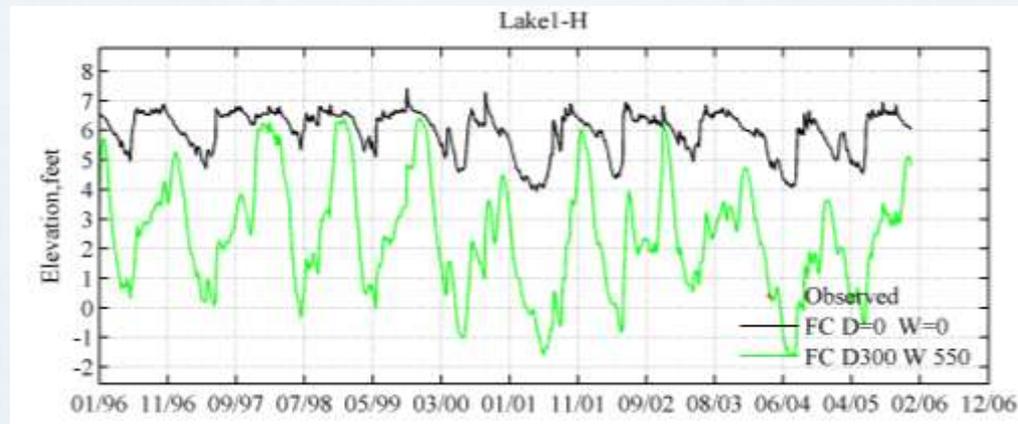
- Drawdown, volumes, seepage rates, and potential withdrawals
- Up to 800 cfs are possible and will keep the levels at -25 Ft elevation (NGVD29)

Reservoir

Simulated Withdrawal



Resulting Water Levels With Proposed Pumping Vs. No Pumping



Reservoir

BISCAYNE BAY ECOSYSTEM RESTORATION RESERVOIR

HYDROLOGIC MODELING OF PROPOSED BISCAYNE BAY ECOSYSTEM RESTORATION RESERVOIR

Project Number: 104-107-1000-0001. For more details, visit: www.floridawater.com. For more information, visit: www.floridawater.com.

Biscayne Bay Problem Statement

Flood control, development and growing demand for fresh water have reduced the natural flow of fresh water into the Biscayne Bay ecosystem, leading to hypereutrophic conditions in the Bay.

Restoration has been required to reverse the decline of the Biscayne Bay ecosystem. Key components of the restoration include: (1) increasing the natural flow of fresh water into the Bay; (2) increasing the natural flow of fresh water into the Bay; (3) increasing the natural flow of fresh water into the Bay.

Solution Objectives

1. Analyze an existing hydrologic model of the Biscayne Bay watershed to determine the natural flow of fresh water into the Bay.
2. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
3. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
4. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.

Solution: In-Ground Reservoir

The Biscayne Bay Ecosystem Restoration (BBER) will be completed using the existing in-ground reservoir and a new reservoir. The new reservoir will be located in the Biscayne Bay watershed and will be used to store fresh water for use in the Biscayne Bay watershed.

Numerical Model

- Existing model used to determine natural flow of fresh water into the Bay.
- Model used to determine the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
- Model used to determine the impact of the proposed reservoir on the natural flow of fresh water into the Bay.

Delivery Options

1. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
2. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
3. Evaluate the impact of the proposed reservoir on the natural flow of fresh water into the Bay.

Reservoir Performance Results

- Existing model used to determine natural flow of fresh water into the Bay.
- Model used to determine the impact of the proposed reservoir on the natural flow of fresh water into the Bay.
- Model used to determine the impact of the proposed reservoir on the natural flow of fresh water into the Bay.

Hydrologic Modeling Conclusions

- The natural flow of fresh water into the Bay is significantly reduced by the proposed reservoir.
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Biscayne Bay Additional Water Needs

- Average annual water demand for Biscayne Bay is approximately 1.5 billion gallons per year.
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Reservoir Water Budget and Projected Deliveries to Biscayne Bay

Water Budget and Projected Deliveries to Biscayne Bay

Conclusions

- Capture Excess Water From L-31N During the Wet Season to Improve Year-Round Flows to The Biscayne National Park
- Regional Water Supply
- Wellfield Recharge
- Stormwater Management

The image features a light blue background with several realistic water droplets of various sizes scattered in the corners. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text 'Curtain Wall' is centered in a bold, black, sans-serif font.

Curtain Wall

Curtain Wall

Effects on the hydrology in NE Shark River Slough

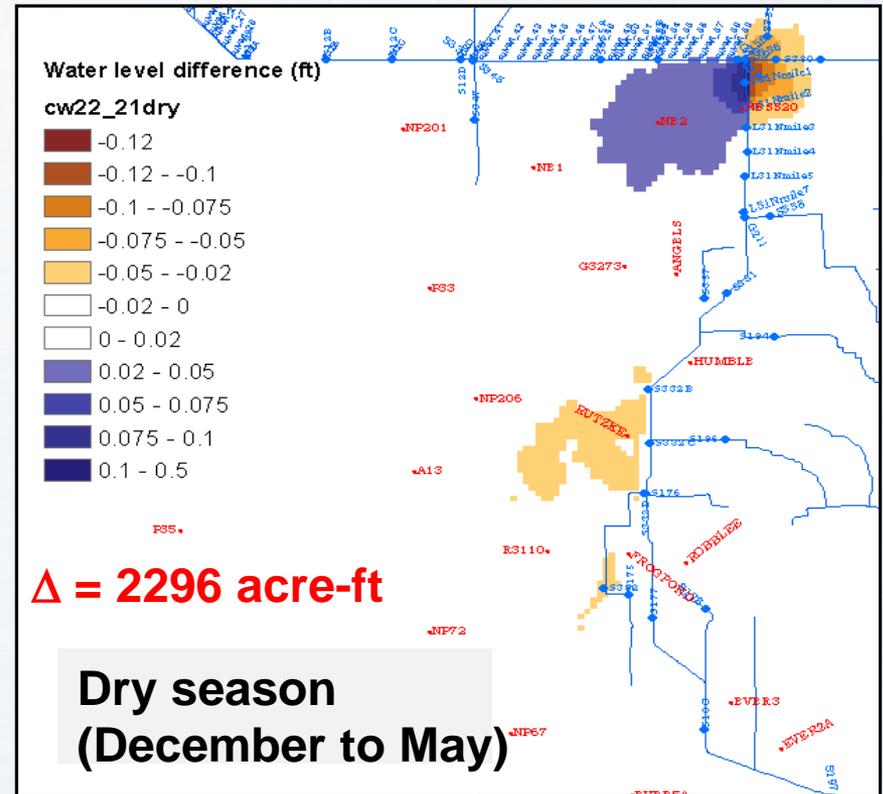
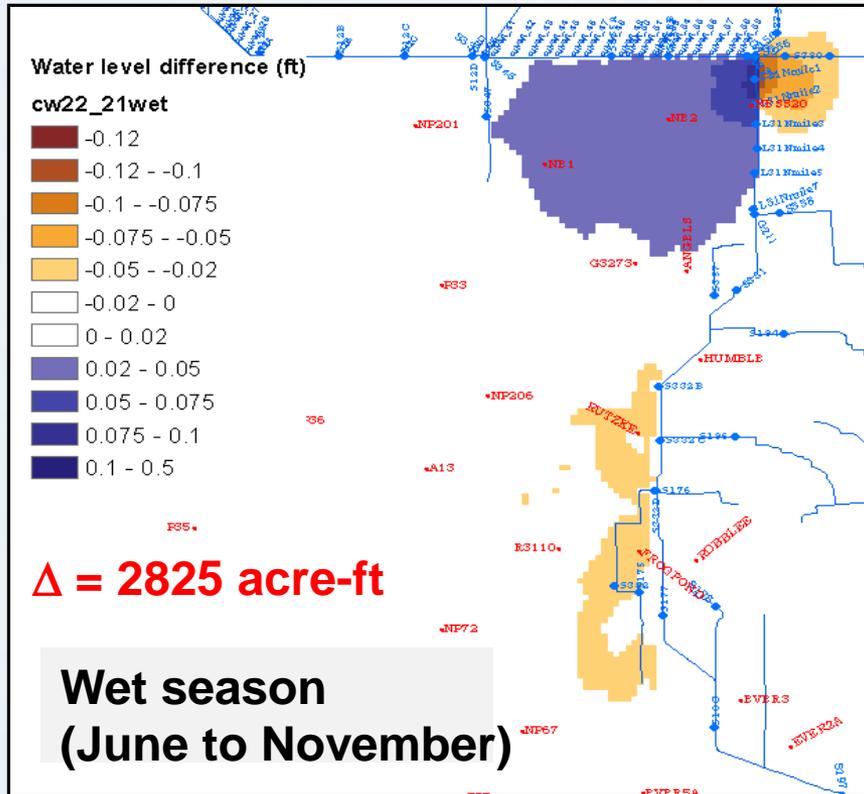
Three Models:

'v21' – No curtain wall implemented

'v22' – Same as 'v21' but with a 2-mi long curtain wall added along L31N

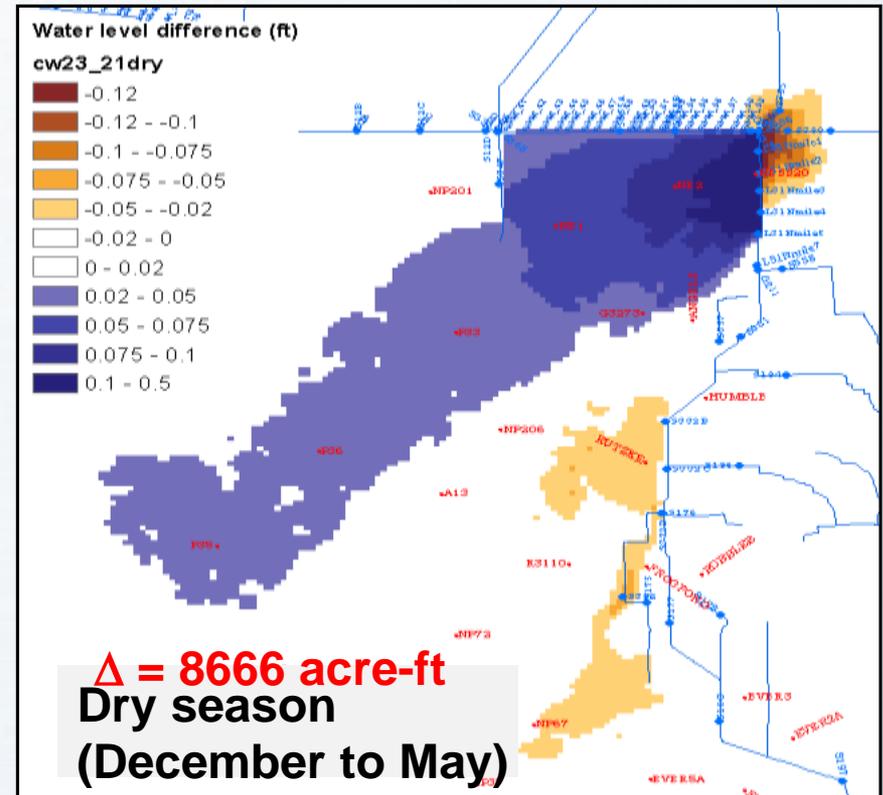
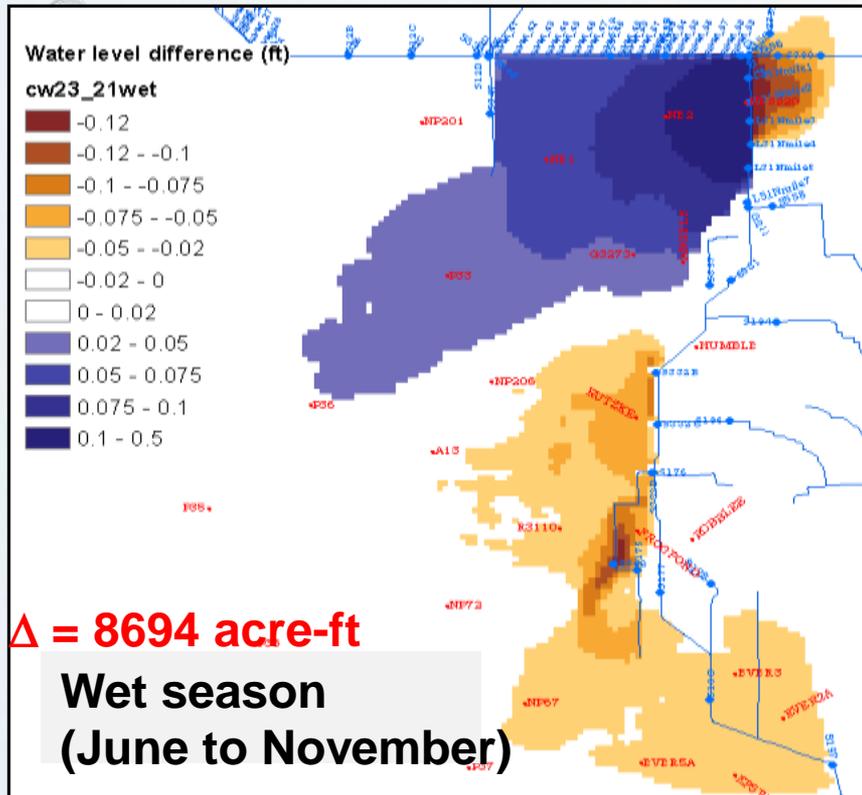
'v23' – Same as 'v21' but with a 5-mi long curtain wall added along L31N

Curtain Wall



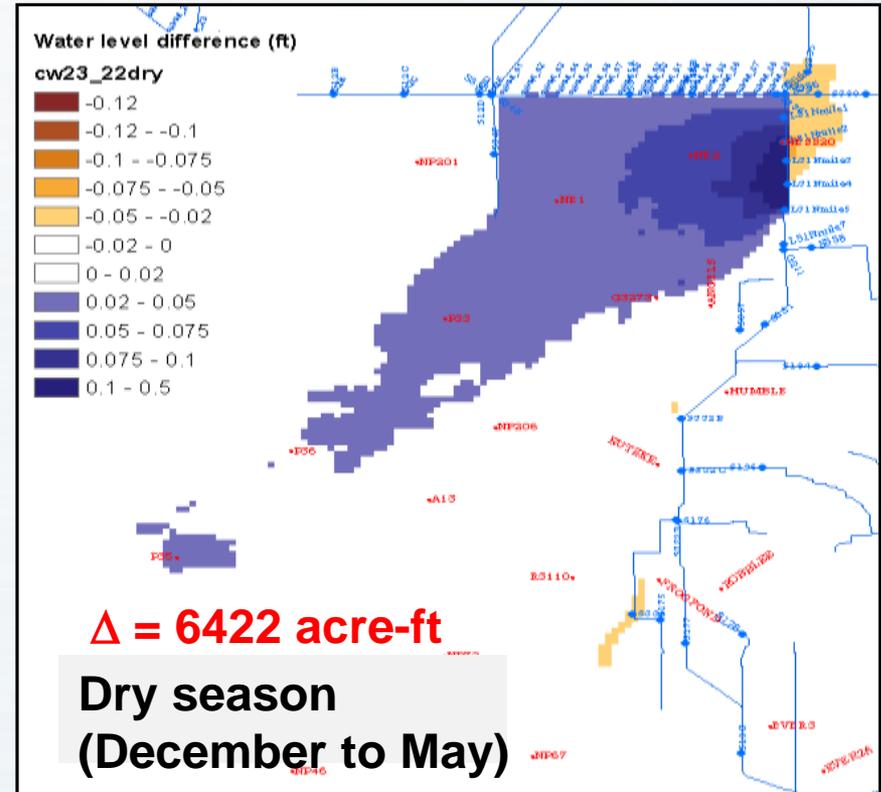
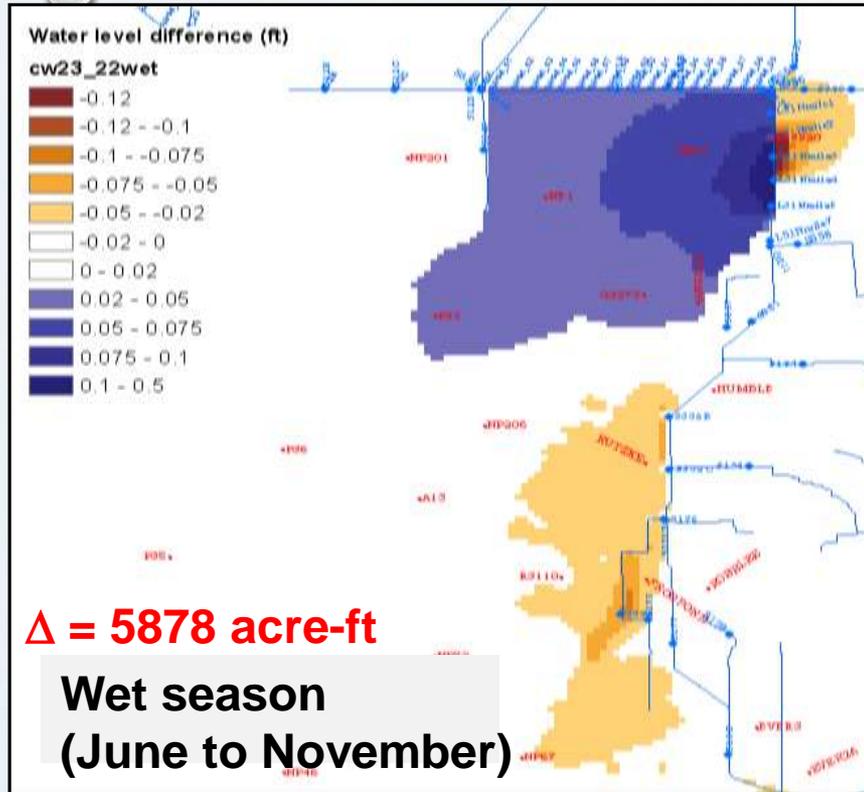
Curtain wall - 2-mile vs no wall
Differences in surface water level

Curtain Wall



Curtain wall - 5-mile vs no wall
Differences in surface water level

Curtain Wall



Curtain wall - 5-mile vs 2-mile wall
Differences in surface water level

Curtain Wall

What are the potential benefits of a curtain wall?

- Increased Surface Water Storage
 - Averaged during 2000-2010 for dry (Jan-May, Dec) and wet (Jun-Nov) season periods. Summed across entire model domain, but main effect is in NE Shark Slough.
- Potential Reduction of Flow from West to East
 - North to South transect.
 - Several transects were tested including:
 - a) 5-mile transect parallel and adjacent to the 5-mi curtain wall, and
 - b) 7+ mi transect that extends ~ 0.5 mi south of G211.

FUTURE APPLICATIONS

- Cape Sable Seaside Sparrows
- Water Quality Analysis
- Quantification Of Canal Seepage
- Evaluation of Tamiami Trail Bridge Construction
- Stormwater Detention Area Effectiveness

THANK YOU!

Do you like my
chickee?

I do, I do like your chickee!
...and what a lovely hat.

