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

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M3ENP-MIKE MARSH MODEL OF ENP

Developers:
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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
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
POTENTIAL BENEFITS

- 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

Reservoir

Conclusions
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

Differences in surface water level

Curtain wall - 2-mile vs no wall

Δ = 2825 acre-ft

Wet season
(June to November)

Δ = 2296 acre-ft

Dry season
(December to May)
Curtain wall - 5-mile vs no wall
Differences in surface water level

\( \Delta = 8694 \text{ acre-ft} \)
Wet season (June to November)

\( \Delta = 8666 \text{ acre-ft} \)
Dry season (December to May)
Differences in surface water level

Wet season (June to November): Δ = 5878 acre-ft
Dry season (December to May): Δ = 6422 acre-ft

Curtain wall - 5-mile vs 2-mile 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.