Application of a Hydrologic Model (LECSR-NP) to Determine Interim Restoration Benefits for the Northwest Fork of the Loxahatchee River

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Presentation Overview

- Loxahatchee River Watershed
  - Adverse alterations have led to lack of freshwater flow for this National Wild and Scenic River

- Recovery and restoration projects

- LECSR-NP Model overview & application

~ 25-35 cfs at Lainhart Dam
Loxahatchee River Watershed
Loxahatchee River Watershed
Recovery and Restoration Goals

- **Minimum flows and levels (MFL)**
  - Exceedance: Lainhart Dam < 35 cfs for more than 20 consecutive days
  - Violation: when an exceedance occurs more than once in a six year period

- **Restoration targets**
  - Dry season: Lainhart Dam > 70 cfs
  - Wet season: Lainhart Dam > 110 cfs
Recovery and Restoration Projects for Modeling

- **Loxahatchee River Replacement Project**
  - Meet minimum flows and levels (MFL) criteria
  - Partial dry season restoration flow

- **Loxahatchee River Watershed Restoration Project (LRWRP)**
  - Full restoration flows and hydrologic improvements within the watershed
  - Salinity wedge downstream of River mile 7.5
CERP Proposed Storage and Flow way Improvements (Tentatively Selected Plan)

- Flow way #1
- Flow way #2
- Flow way #3
- Moss property restoration
- L-8 Reservoir
- Repurposed as Flow Equalization Basin
- LWL Restoration
LECSR-NP Model Overview

- MODFLOW-based (Harbaugh et al. 2000) groundwater model with several SFWMD add-on packages to simulate additional hydrologic functionality
  - Wetland systems
  - Barriers to flow
  - Reservoirs and canals
  - Water diversions
  - Water restrictions
  - Evapotranspiration (ET), recharge, runoff and soil water balance
<table>
<thead>
<tr>
<th>SFWMD Package</th>
<th>Description</th>
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<tbody>
<tr>
<td>Wetland (WTL)</td>
<td>Simulates overland flow and barriers to flow (Restrepo et al. 1998)</td>
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<tr>
<td>Reinjection Drainflow (RDF)</td>
<td>Redirects water to another location (Jones 1999)</td>
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<tr>
<td>Diversion (DIV)</td>
<td>Simulates water control structures (Restrepo et al. 1998)</td>
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<tr>
<td>Trigger (TRG)</td>
<td>Simulates wellfield withdrawal cutbacks (Randall 1992)</td>
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<tr>
<td>Utility Generation (UGEN)</td>
<td>Links static data with time series data (Restrepo et al. 2003)</td>
</tr>
<tr>
<td>Multibud (BUD)</td>
<td>Outputs water budgets (Ecology and Environment, Inc. 2004)</td>
</tr>
</tbody>
</table>
Use modified Agricultural Field Scale Irrigation Requirements Simulation Model (AFSIRS) (Smajstrla 1990)

- Based on land use, soil, rainfall, ET, pervious/impervious areas
- Runoff computed with Soil Conservation Service Curve Number method and attenuated with hydrologic routing procedure

Watershed surface runoff, groundwater recharge, ET, irrigation demands
LECSR-NP Model Overview

- Project area hydrology

- Discretization
  - 704-ft grid cell size and three layers
  - Daily stress periods

- Calibration
  - 1986-2005
  - Flows at key monitoring stations
  - Surface water and groundwater levels
LECSR-NP Surface Water and Groundwater Interaction

- **Mass balance approach**
  - MODFLOW cell-based
  - Main component is the groundwater flow
  - Overland flow simulated with WTL Package

- **Canal drainage and recharge**
  - Transfer of water using DIV or RDF Package
  - Water control structures - source & sink areas
  - Based on pumpage capacity & control levels
LECSR-NP Model Application

- Assisted in identifying the replacement project and determining interim benefits
  - CERP model applications were updated with state modeling assumptions

- Formulated for existing (without project) and future (with project) conditions
  - Period of simulation: 1965-2005
  - Model results were applied to evaluation criteria for state goals
7,200 to 18,000 ac-ft
In-basin storage
Direct route to River

6,960 ac-ft
Additional conveyance

<15,000 ac-ft
Utility demand
Polishing/Advanced Treatment

3,700 ac-ft
Operational changes and agreements
Potential impact to snail kites

2,900 ac-ft
Significant seepage
Simulated C18 Environmental Deliveries

Average Flow (cfs) - 1965-2005

Storage (ac-ft) and Option

- 0 Base
- 2900 Apoxee
- 3125 GWP
- 7200 Mecca
- 6960 Moss
- <15000 C51 Res
- 18000 Mecca
- 7200 Mecca

Model Performance

- MFL Exceedances
- Dry Season Restoration Target (% Met)
Mecca Farms Acquired
Moving Forward

- Additional model refinements post-Replacement Project
  - Water availability evaluation
  - Updating model calibration through 2014

- Additional model refinements pre-CERP
  - Expanding model to include all NWF tributaries
  - One model to evaluate all NWFLR flows for consistency for planning process
Questions