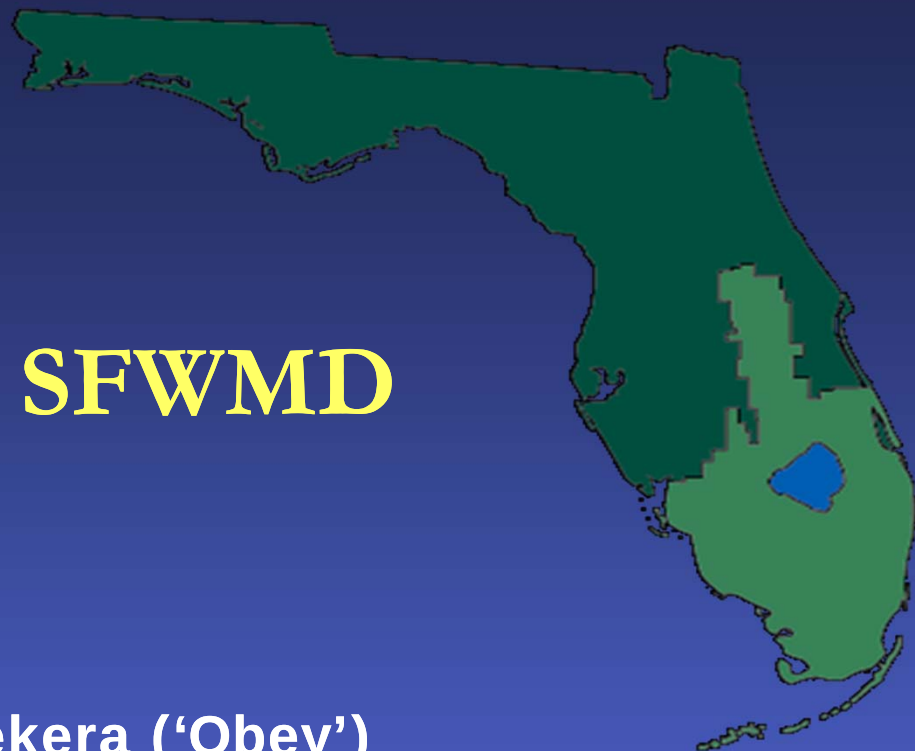


Modeling at SFWMD



Jayantha Obeysekera ('Obey')
Akin Owosina

Hydrologic & Environmental Systems Modeling
South Florida Water Management District
West Palm Beach, Florida

SFWMD Mission

Balance &
Improve

Flood Control

Water Supply

Natural Systems

Water Quality

Why

Manage Drought & Floods

Provide Water Supply

Protect & Restore
Ecosystems

Prepare for Emergencies

How

Land Management

Science, Planning,
Engineering, & Construction

Operation & Maintenance

Regulation

Water Supply Development

Where

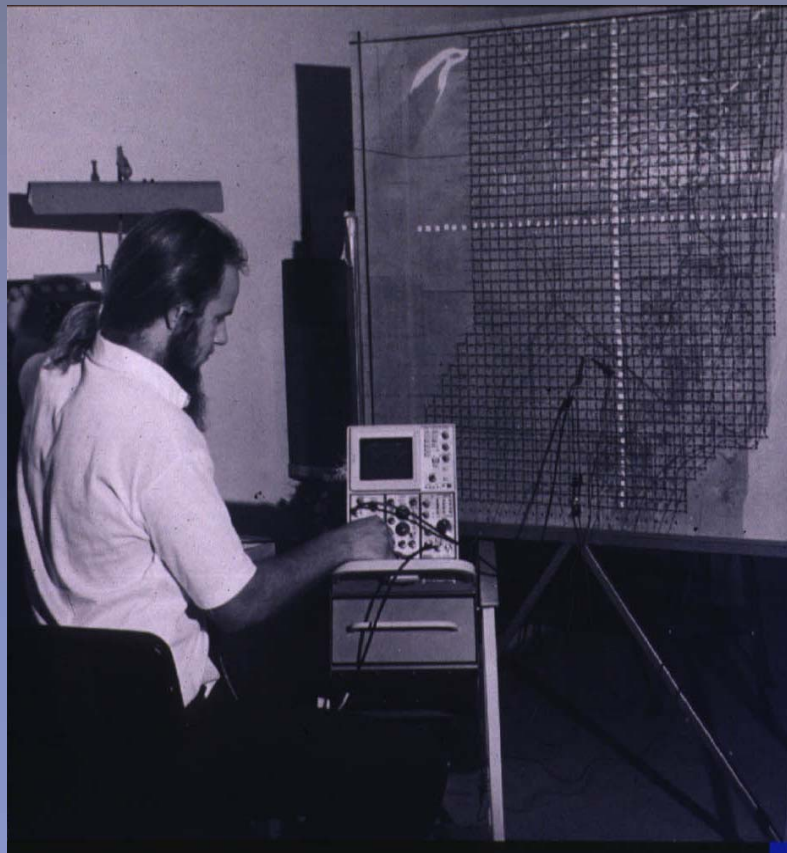
Coastal Watersheds & Estuaries

Everglades

Kissimmee

Lake Okeechobee

Decade of the 70s



Analog Model

- Electric Analog Model
 - Simulated water levels and flows in coastal region
- Upgraded Regional Routing Model to include daily time step
- Initial development of SFWMM (2x2)- a regional-scale computer simulation model

An aerial photograph showing a wide river flowing through a landscape. On the left, there is a large, dense area of green wetlands with a complex, winding network of smaller waterways. On the right, the river is bordered by a straight, light-colored strip, possibly a levee or a road, followed by more open, green fields. In the distance, a dam or bridge structure is visible across the river. The sky is overcast with grey clouds.

Decade of the 90s

Physical Modeling - Real system

sfwmd.gov

An aerial photograph of a large-scale physical model of a river and wetland system, housed within a massive rectangular tank. The model features a complex network of channels, meanders, and islands. The left side of the model is covered in green material, representing vegetation, while the right side is a flat, greyish-brown surface. Numerous small white sticks or pins are placed across the model, likely to represent specific data points or structural elements. The tank's interior walls and structural supports are visible around the perimeter of the model.

Decade of the 90s

Physical Model at U.C. Berkeley

sfwmd.gov



Success!



Kissimmee River circa 1960



How modeling is organized

- Centralized Model Development using a standardized methodology (CMMi)
- Centralized Regional Modeling
- Decentralized sub-regional modeling using some level of oversight
- Standard procedure for modeling intake
- Emergency Modeling Team (activated during major storm events)

Areas Where Modeling is Used

- Planning (Flood Control, Water Supply, Water Quality Protection, Ecosystem Protection and Restoration)
- Regulation (Permitting)
- System Operations & Maintenance (Operational Planning, Tropical Storms)
- Water Resources Evaluation (Data collection & monitoring)

Process Improvements: Implementation

Quality

- Requirements definition
- Modeling Intake Process
- Project Management (Charters, PMP, Schedule Tracking)

- Peer Review (Internal & External)
- Documentation
- QA/QC
- Library of Models

CAPABILITY

MATURITY

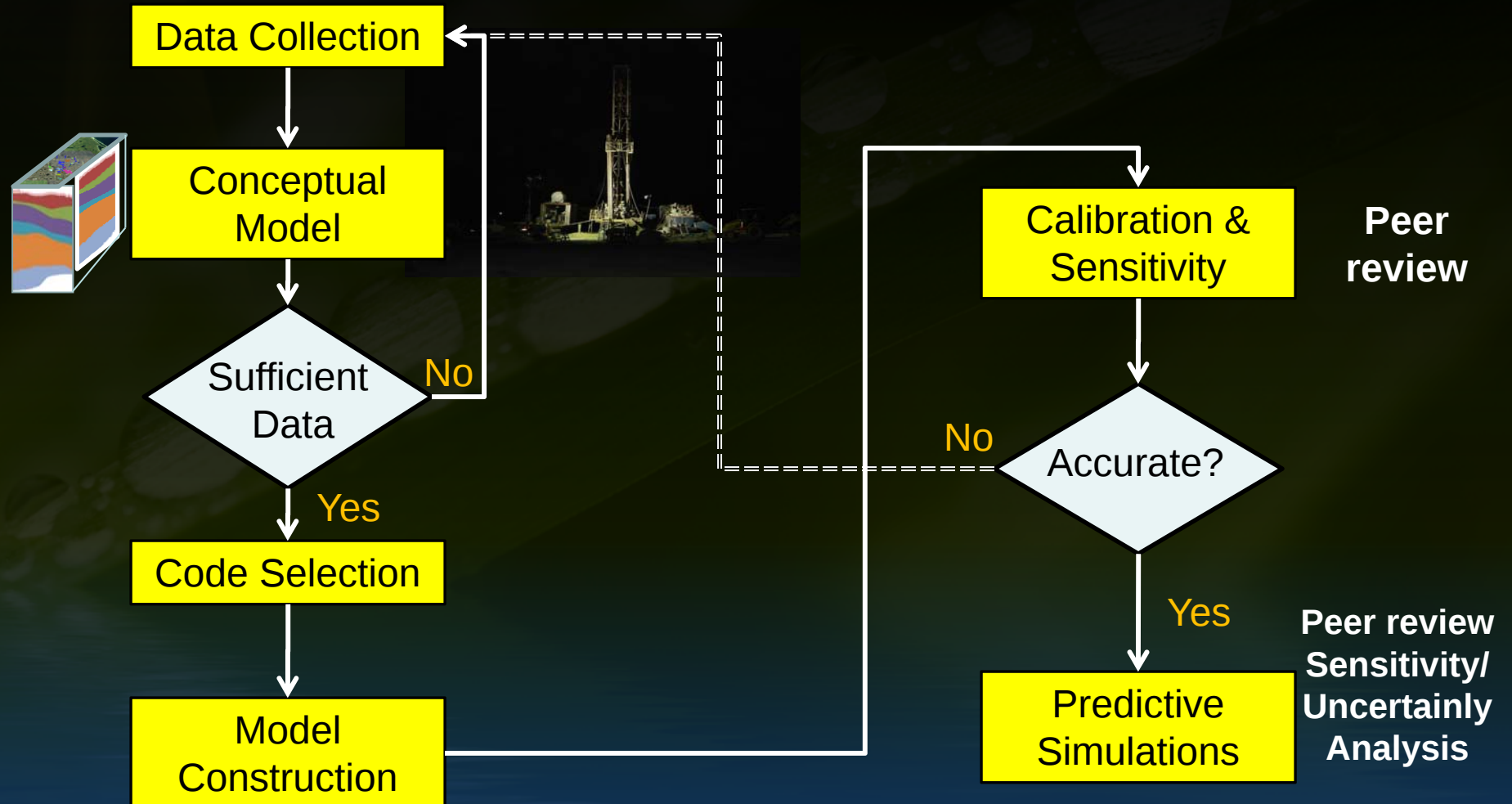
MODEL

(CMMi)

Credibility

Predictability

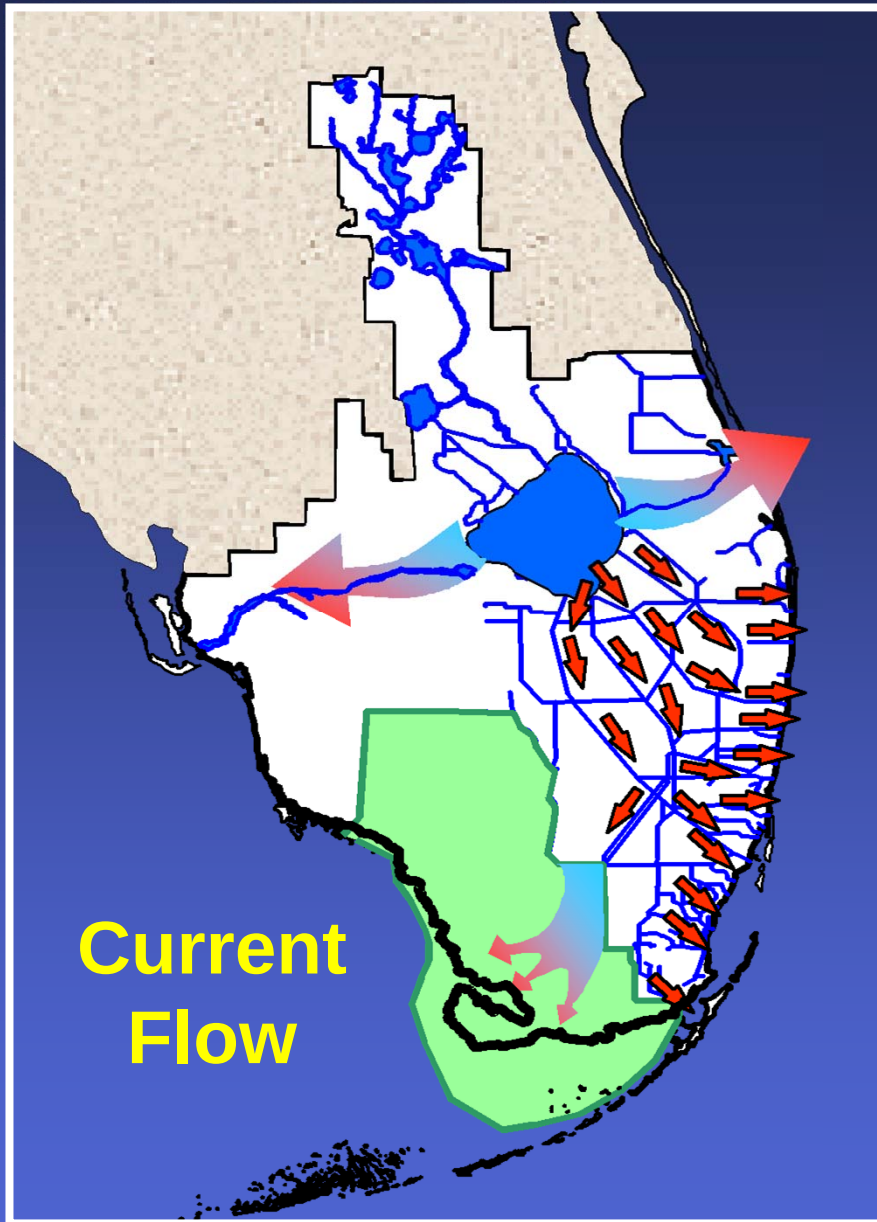
Modeling Process (ASTM) American Standards



Restoration of the Everglades

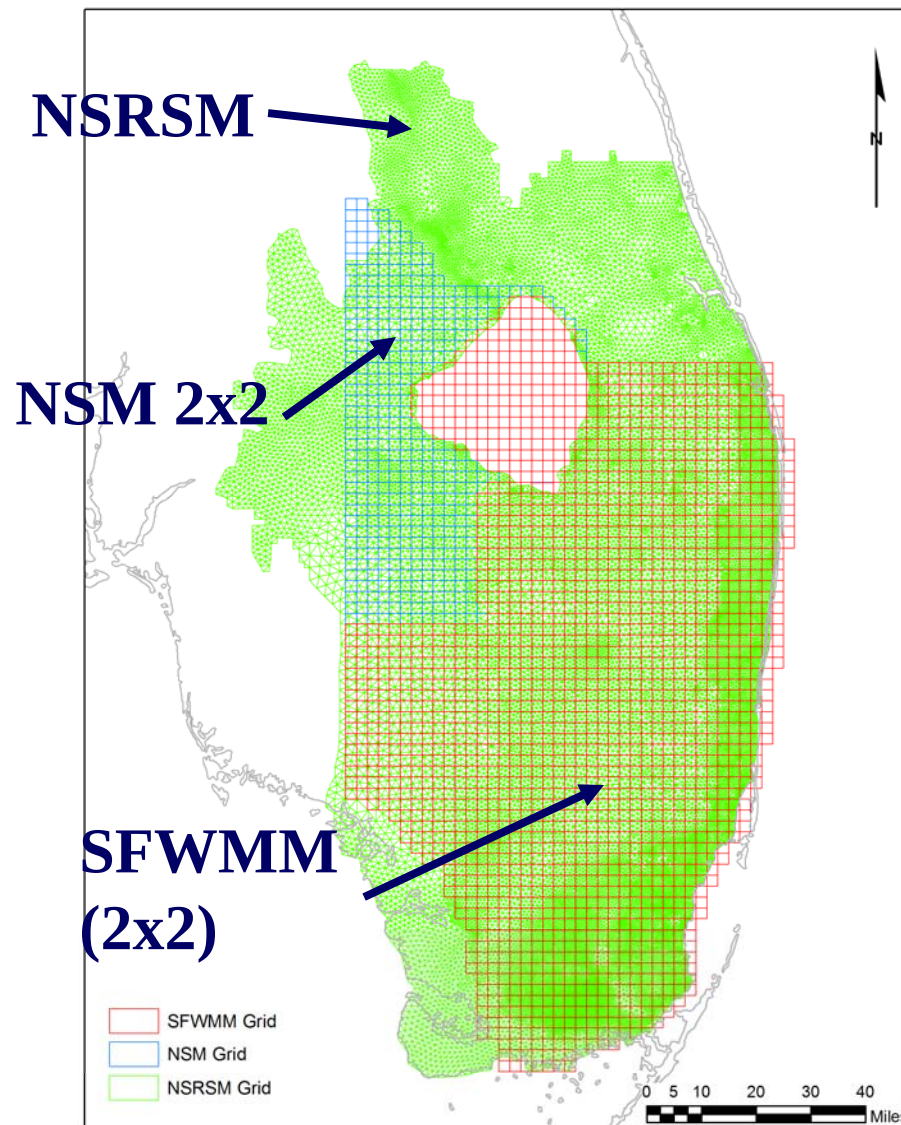
An Ecosystem in Trouble ...

WHY ?

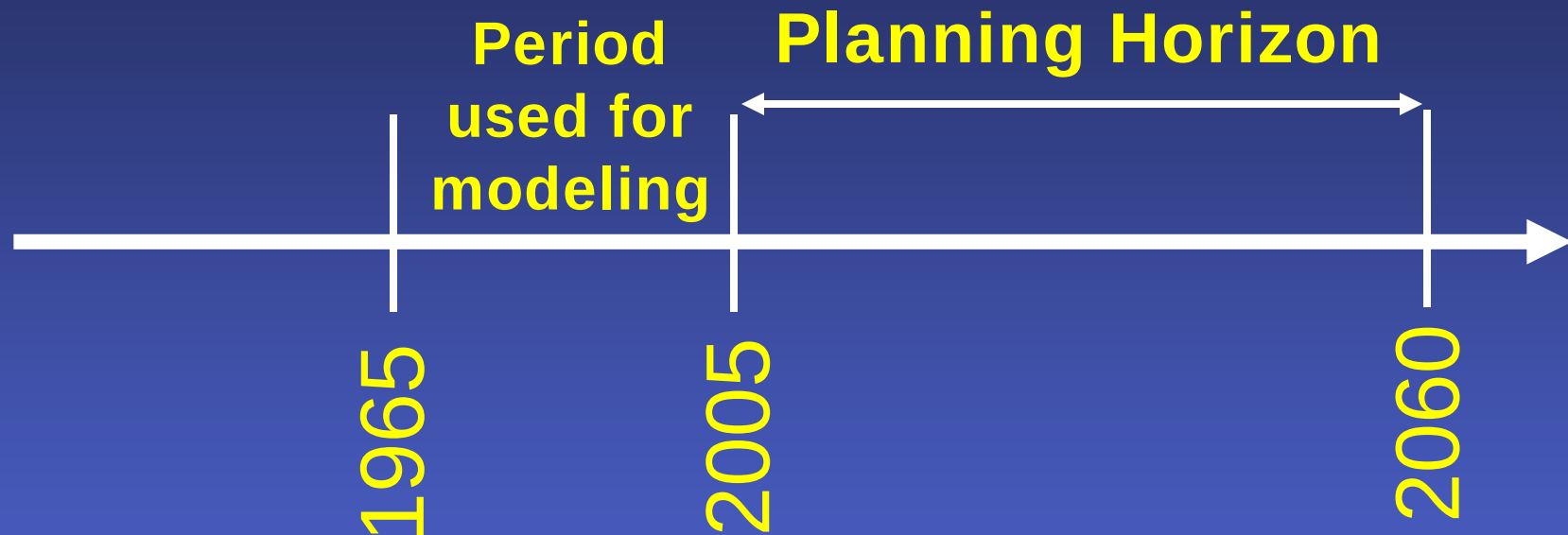


$$\begin{array}{r|l} Q & Q \\ \hline T & P \end{array}$$

Regional Model Meshes

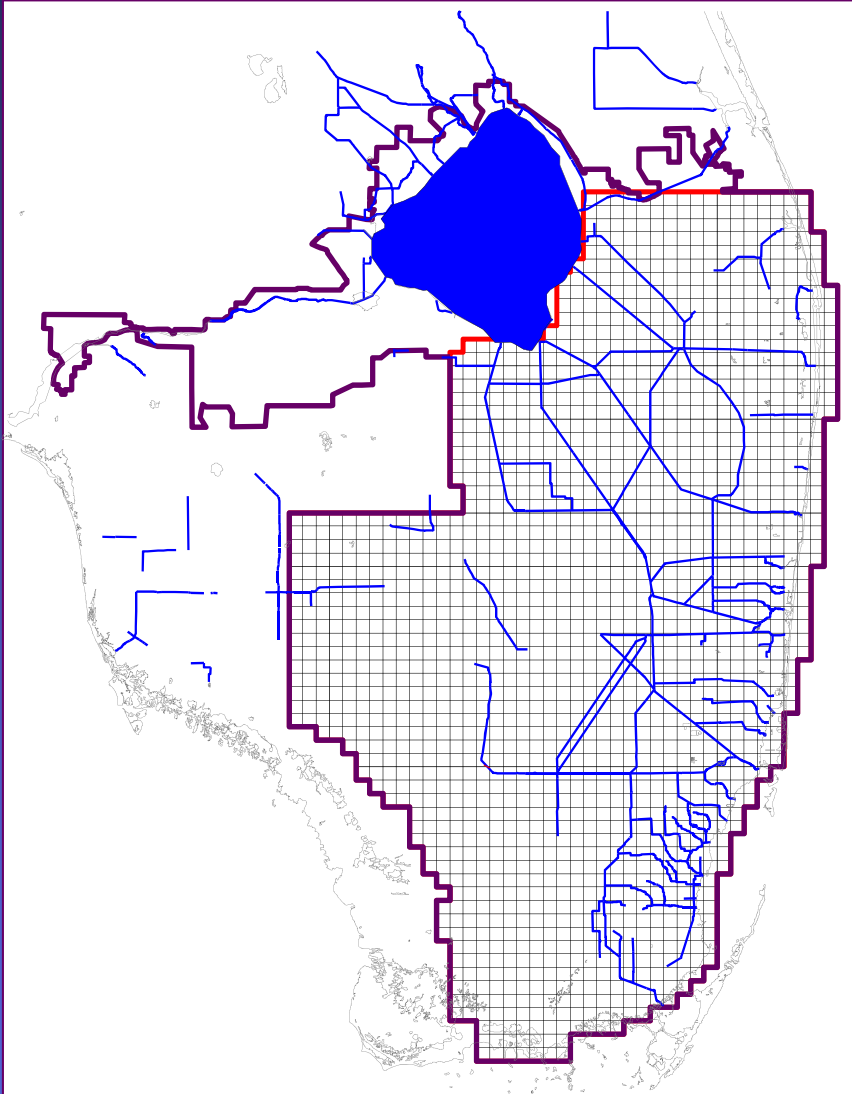


CERP Plan Evaluation



Assumption: 1965-2000 period used for modeling is representative of the climate expected during the future planning horizon

South Florida Water Management Model (SFWMM)

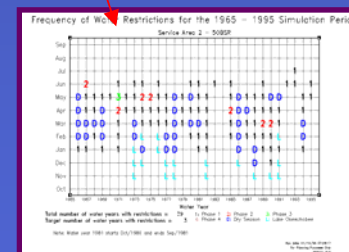
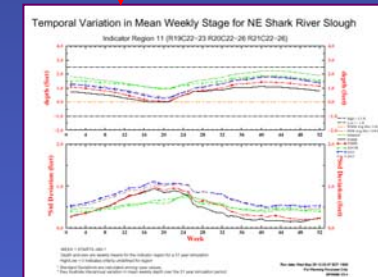
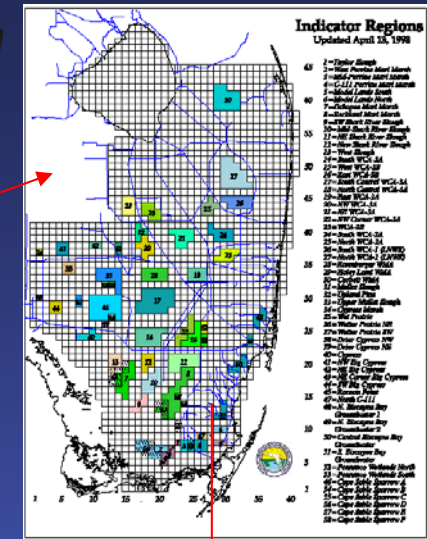
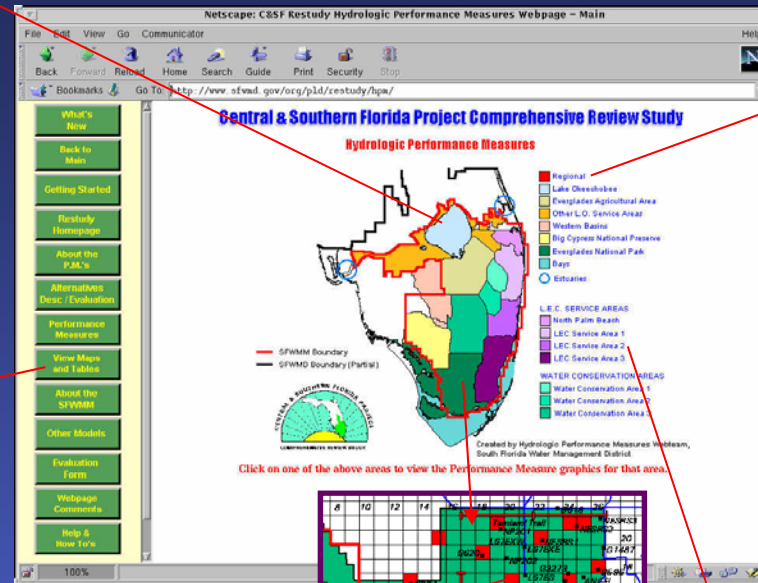
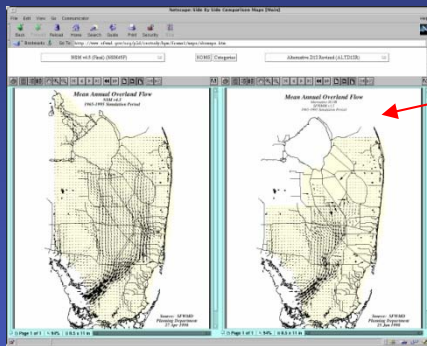
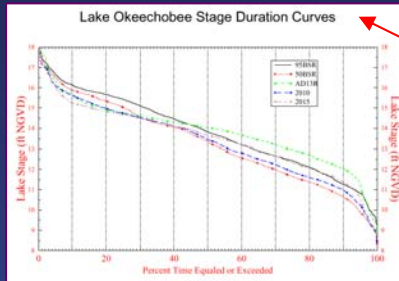


- Integrated surface water groundwater model
- Regional-scale 3.2 x 3.2 km, daily time step
- Major components of hydrologic cycle
- Overland and groundwater flow
- Canal and levee seepage
- Operations of C&SF system
- Water shortage policies
- Extensive performance measures
- Provides input and boundary conditions for other models

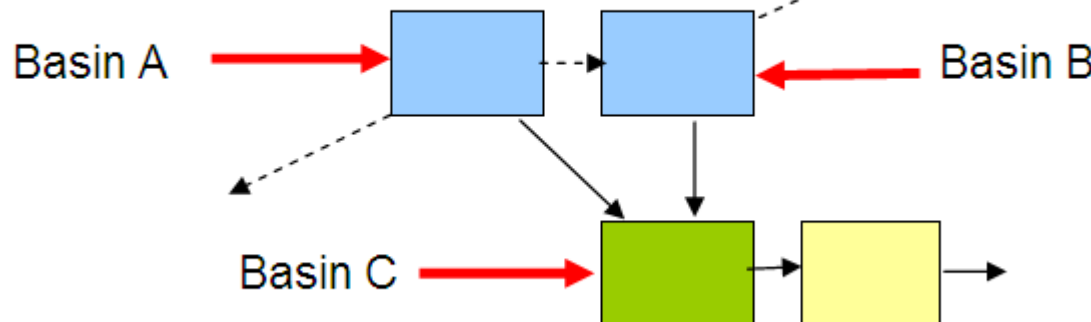
www.sfwmd.gov/org/pld/hsm/models

Hydrologic Performance Measures

www.sfwmd.gov/org/pld/restudy/hpm



Dynamic Model for Stormwater Treatment Areas



Next Generation Regional Tool: Regional Simulation Model

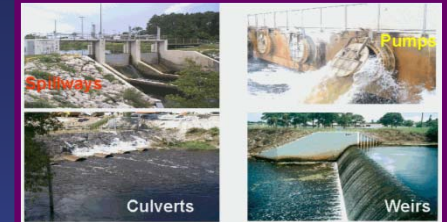
RSM Engines



HSE

RSM

MSE

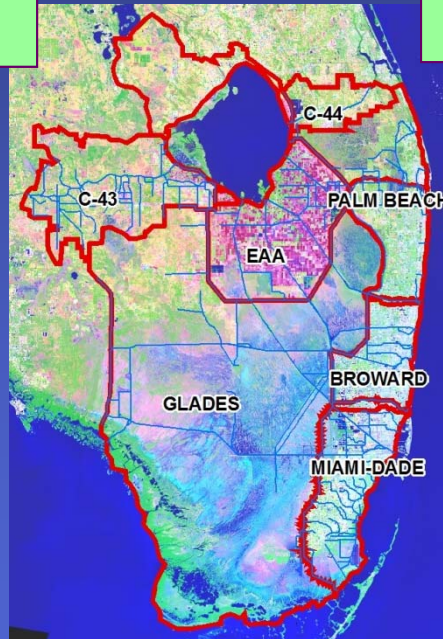


South Florida Regional Simulation Model

SFRSM

Hydrologic Simulation
Engine (HSE)

- Model physical setup
- Simulate hydrologic processes
- Overland flow
- Groundwater flow
- Canal network
- Calibration/validation of model parameters
- Use observed structure flows

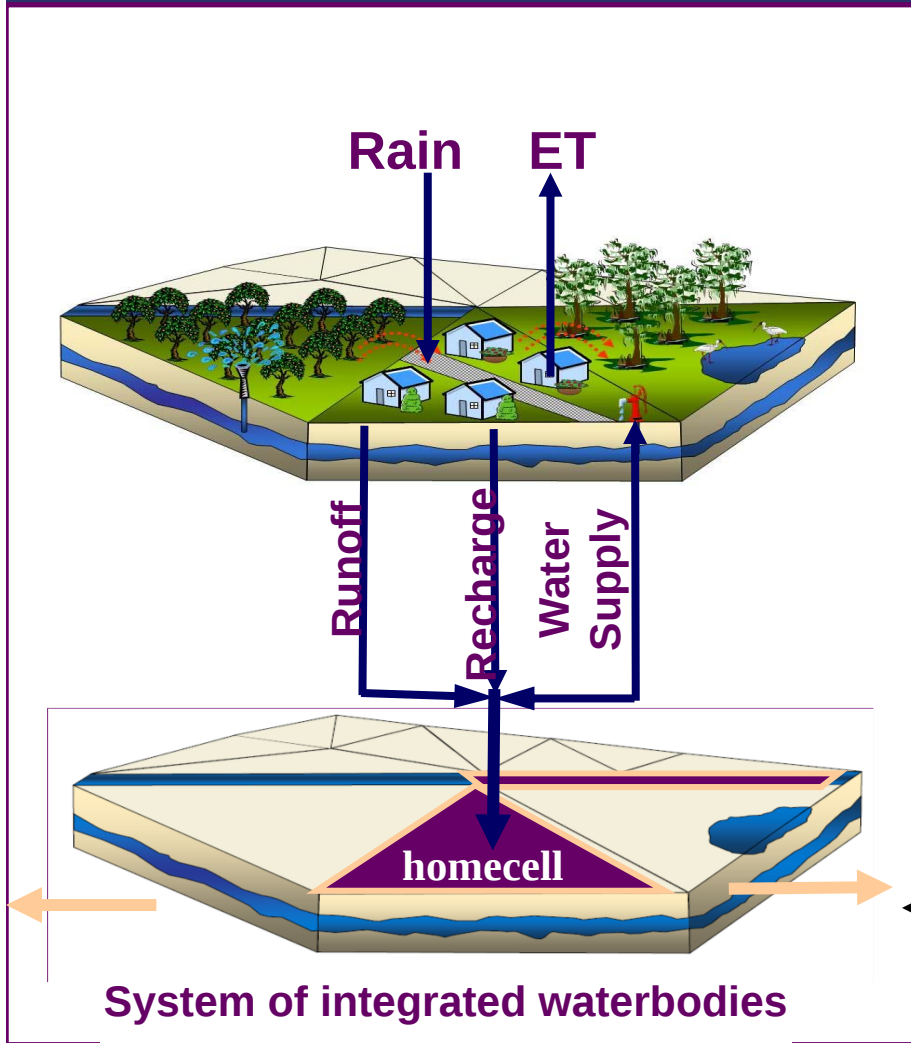


Management Simulation
Engine (MSE)

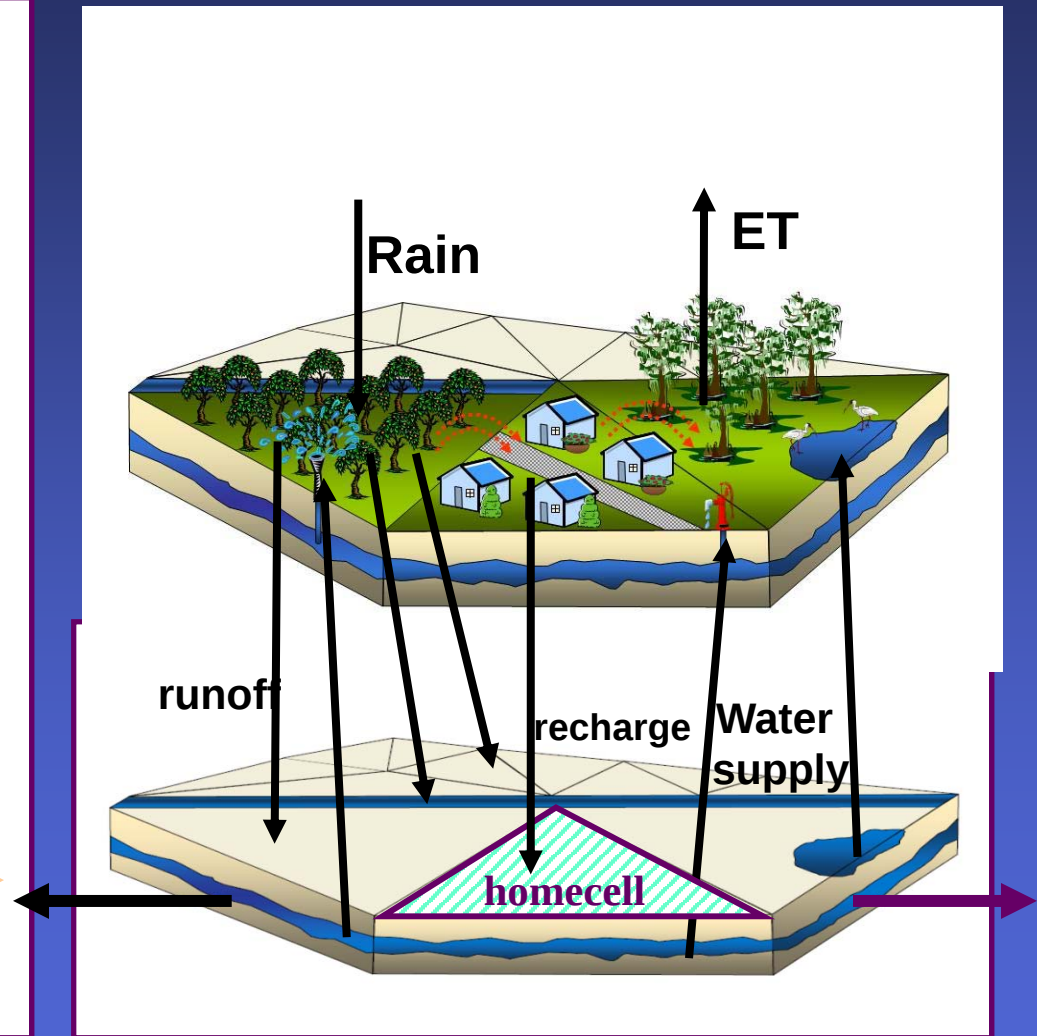
- Simulate structure operations
- Implementation of operational rules
- Flood control rules
- Water supply policies
- Maintain minimum flows & levels
- Regional operational coordination

Hydrologic Process Modules

Simple landscape

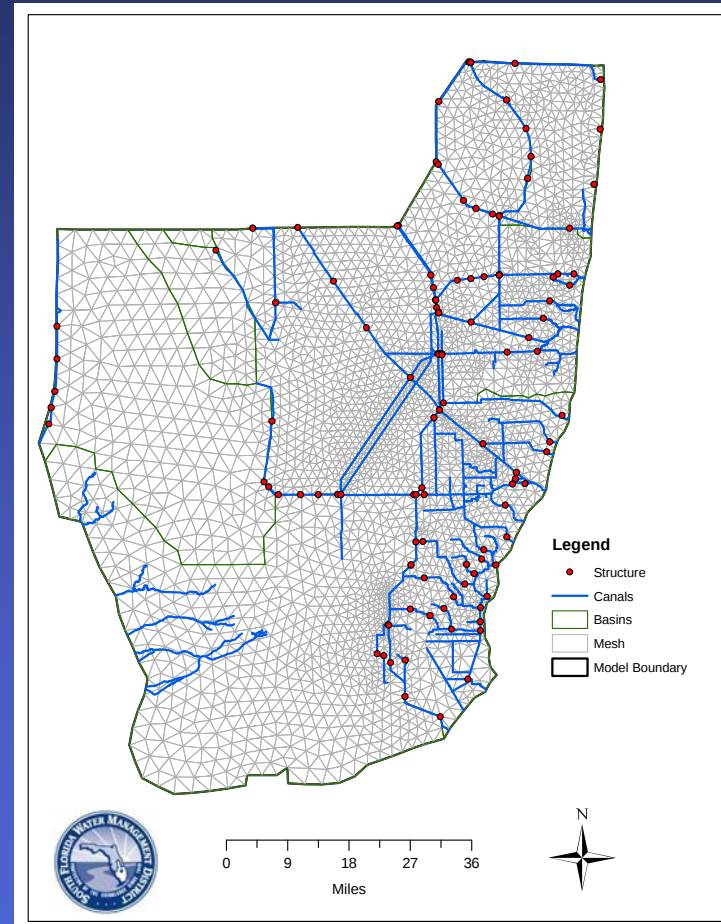


Complex landscape

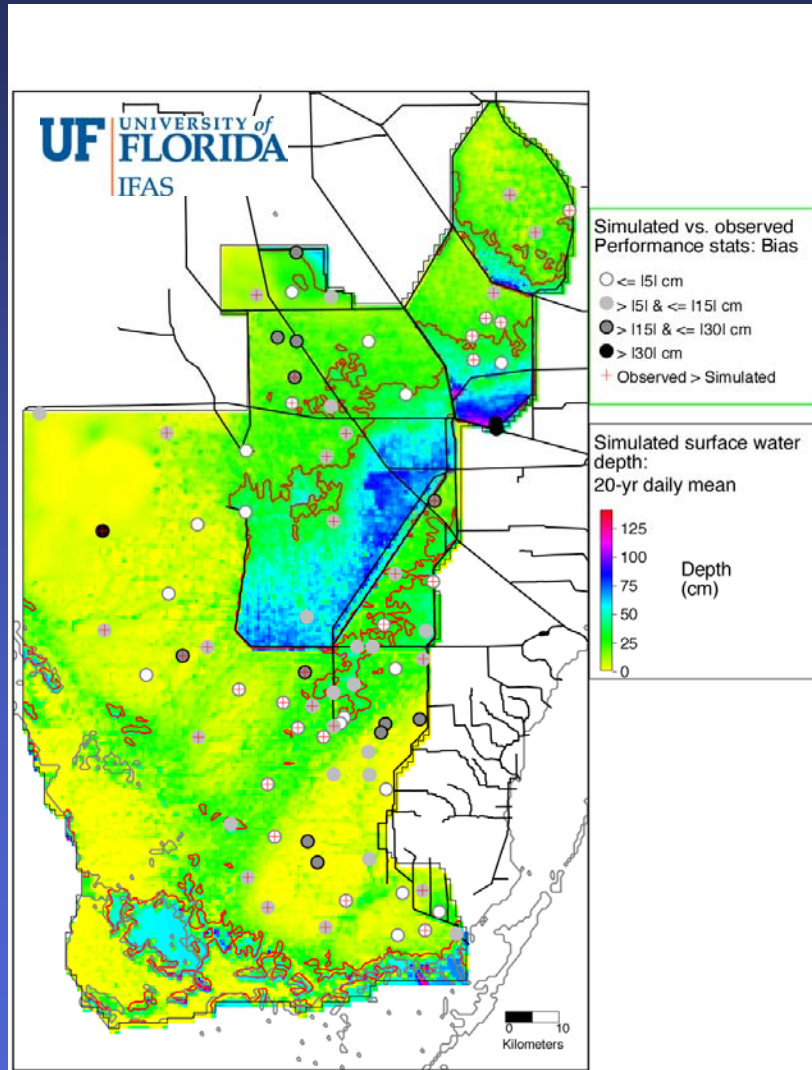


Numerical Mesh

- **5,794** triangular cells
- Mean & standard deviation of mesh cell sizes: **1.01 mi²** & **0.74 mi²**
- Mesh cell size range: **0.05 mi²** to **3.92 mi²**
- **WCA-3B** has the finest resolution; **BCNP** has the coarsest resolution
- **WCA-3A** has a total of **984** cells
- Average cell size in **WCA-3A** is **0.79 mi²**; standard deviation is **0.24 mi²**



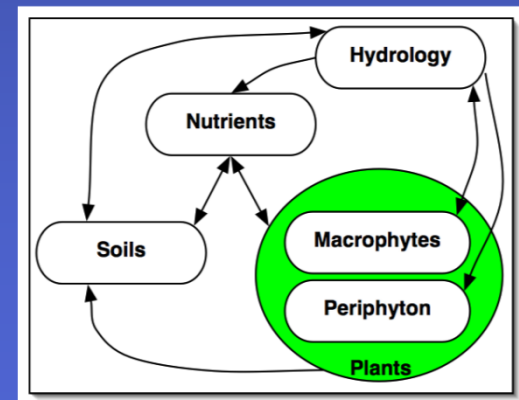
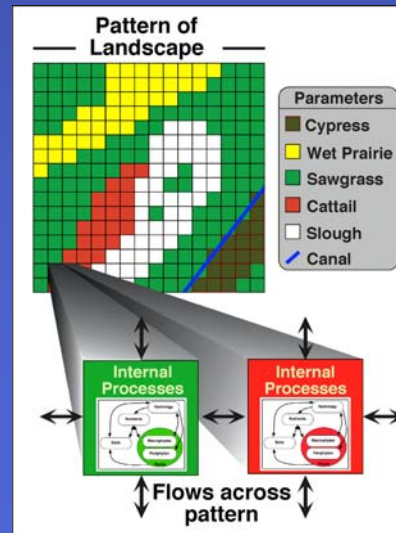
EVERGLADES LANDSCAPE MODEL



- Integrate hydrology, biology and nutrient cycling in spatially explicit simulation

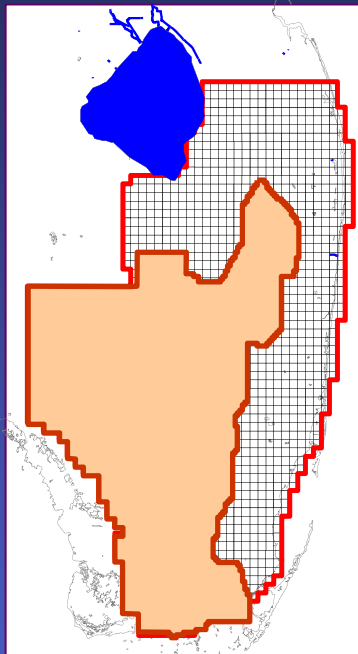
- Understand ecosystem dynamics at regional scale

- Develop predictions of landscape response to altered water & nutrient management



Across Trophic Level System Simulation

<http://www.atlss.org/>



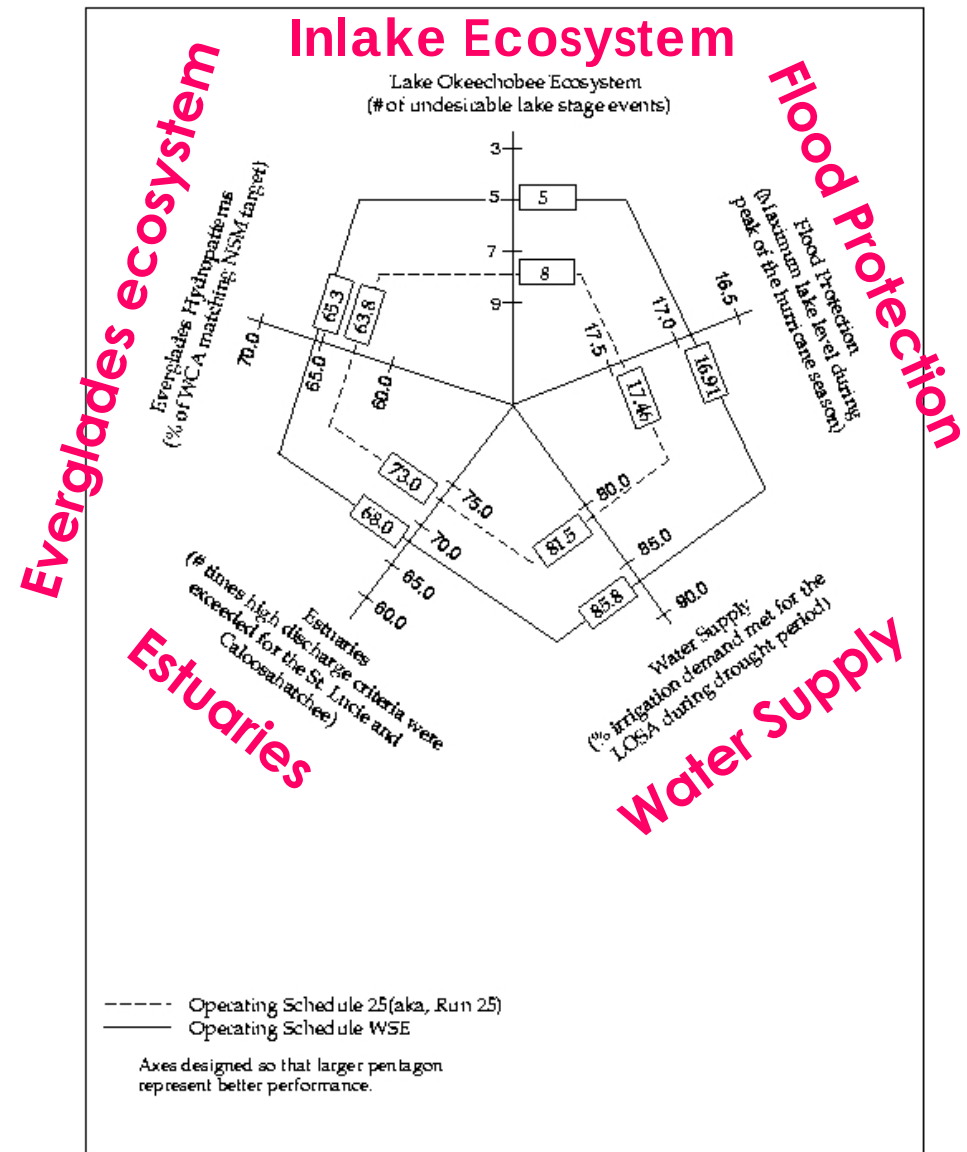
- Integrated system of biotic models
- 500 x 500 m resolution or finer
- Use hydrologic output from SFWMM
- Processes include:
 - lower trophic level, e.g. periphyton or zooplankton
 - fish and macroinvertebrates
 - individual species models, e.g. Cape Sable seaside sparrow, wood storks, American alligators, Florida panther
- Goal is to understand how biotic communities are affected by different hydrologic regimes

Operational Planning

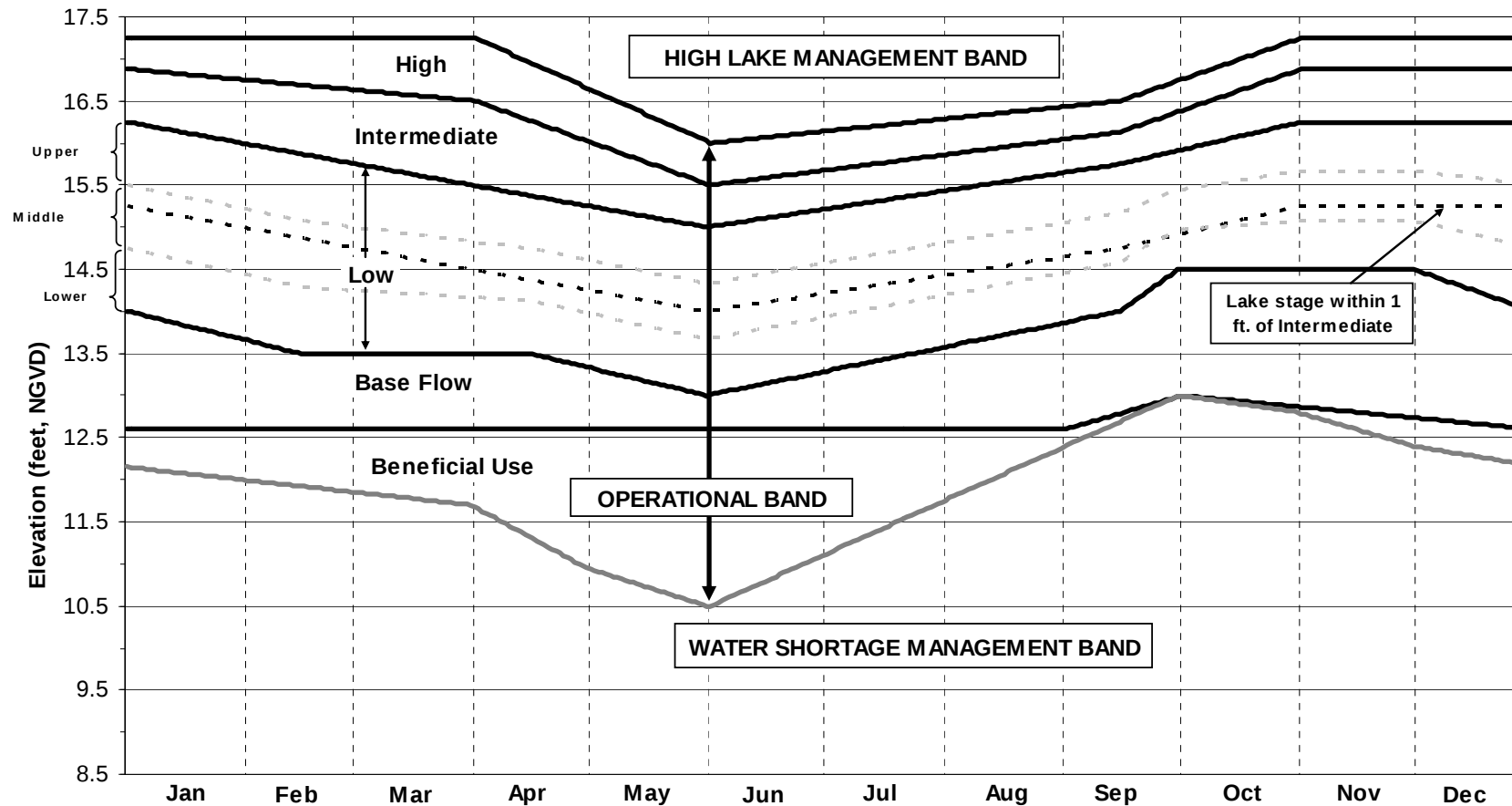
Development of Operating Rules for Lake Okeechobee

Multiobjective Tradeoff Analysis

Figure 6. Multi-Objective Trade-Off Analysis



Lake Okeechobee Management Zones



NOTES:

High Lake Management Band: Outlet canals may be maintained above their optimum water management elevations.

Operational Band: Outlet canals should be maintained within their optimum water management elevations.

Water Shortage Management Band: Outlet canals may be maintained below optimum water management elevations.

CENTRAL AND SOUTHERN FLORIDA PROJECT

2008 LAKE OKEECHOBEE
INTERIM REGULATION SCHEDULE
PART B

DATED: March 2008
DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

Figure 7-2

WSE Regulation Schedule

Operational Elements

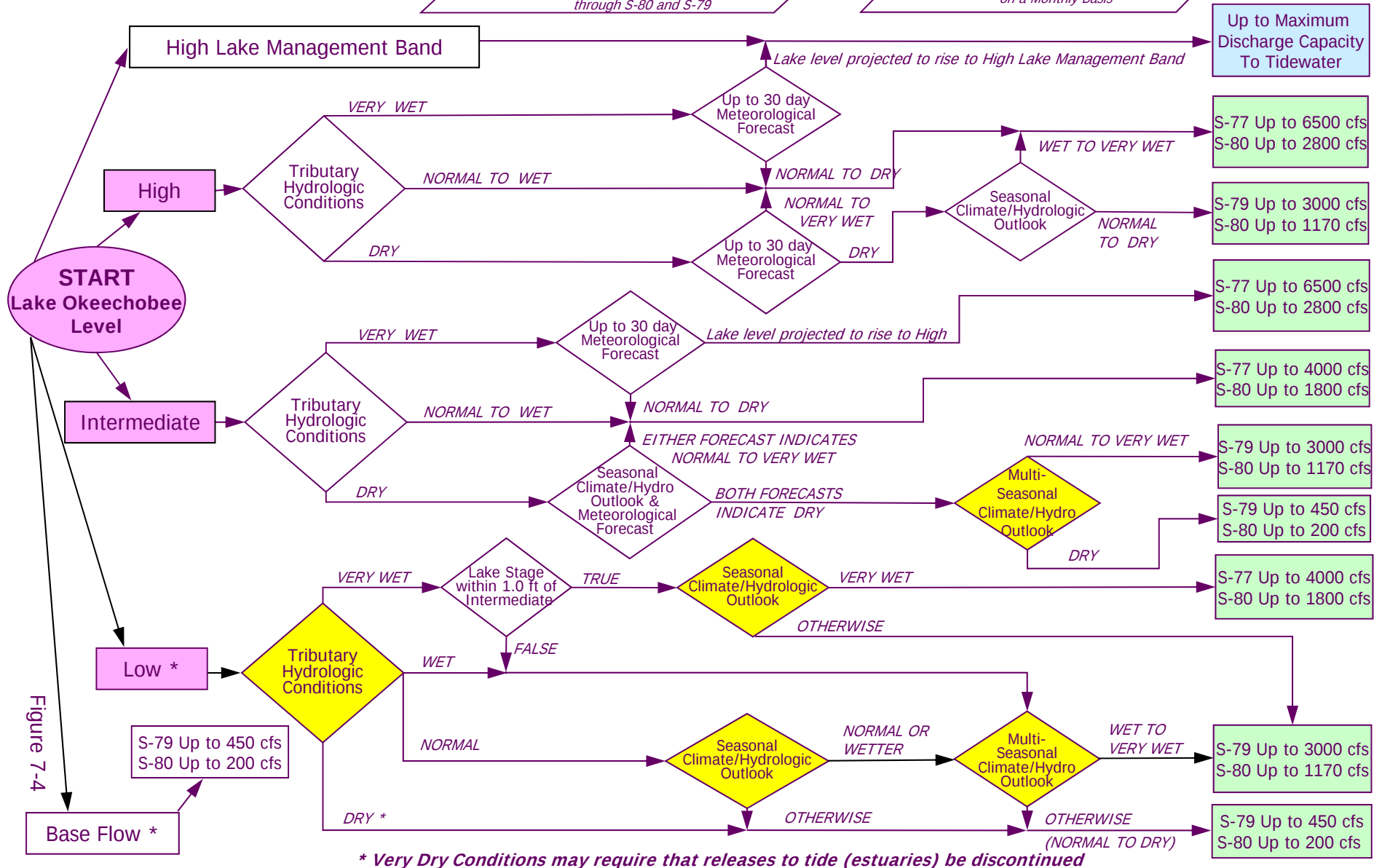
- Lake Okeechobee Water Level
- Tributary Hydrologic Conditions
 - 30 Day Net Rainfall
 - Average Kissimmee River inflow
- Lake Okeechobee Net Inflow Outlook
 - Seasonal Outlook (6 month)
 - Multi-seasonal Outlook (up to 12 months)

2008 LORS

Note: This operational guidance provides essential supplementary information to be used in conjunction with other supporting documentation including text within the Water Control Plan.

*When conducting Base Flow releases,
flows can be distributed East and West
up to 650 cfs as needed
to minimize impacts or provide benefits
through S-80 and S-79*

Apply Meteorological Forecasts on a Weekly Basis; apply Seasonal and Multi-Seasonal Climate/Hydrologic Outlooks on a Monthly Basis



Lake Okeechobee SFWMM April 2012 Position Analysis

Percentiles PA_V5

