Use of Surface and Groundwater Models in MFL Development and Implementation

September 25, 2020
Kathleen Coates, PhD
Chief, Resource Evaluation Bureau

Statutory Requirements s.373.042, F.S.

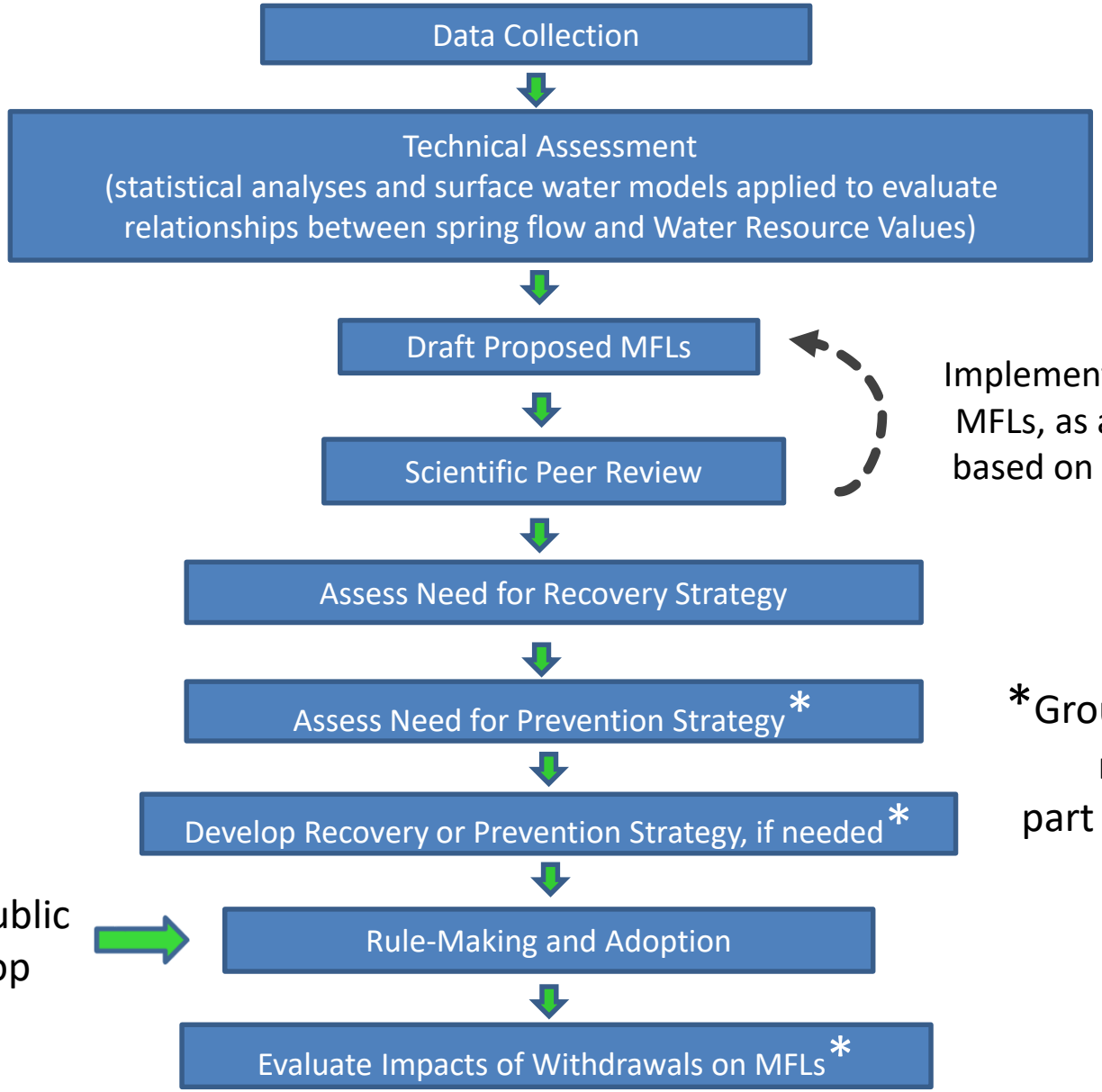
What is an MFL? **Limit at which further withdrawals will cause significant harm** to the water resources or ecology of the area.

Purpose: To protect water resources and associated ecology. Provides information to support water supply planning and water use permitting evaluations.

MFLs Shall Be Established for:

- **1st** magnitude and Outstanding Florida Springs
- **2nd** magnitude springs on state or federal conservation lands
- Other waterbodies: Based on importance of waterbody and potential for significant harm to regional water resources or ecology.

MFL Establishment and Implementation



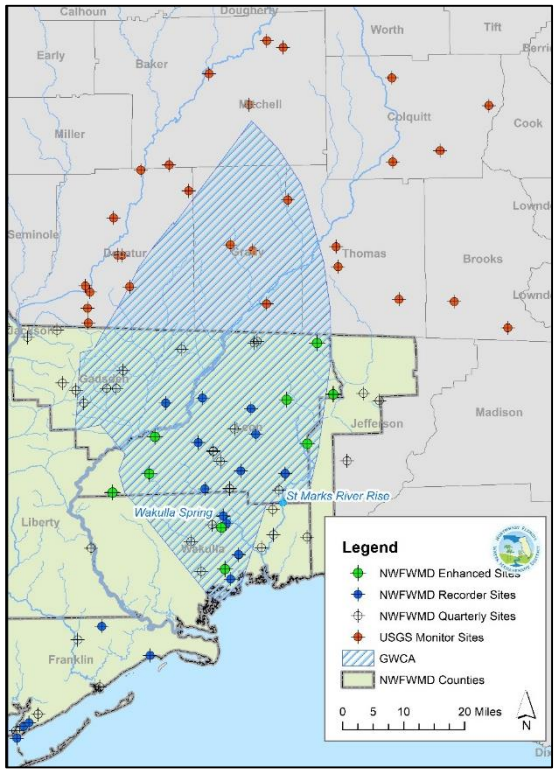
*Groundwater flow modeling part of these steps

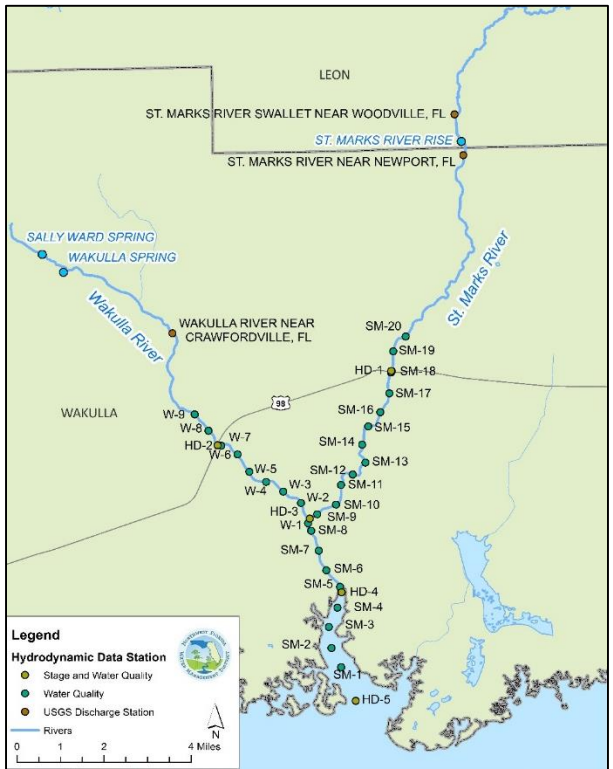
MFL Work Plan

- Florida Statutes requires the establishment of minimum flows (1972)
- District MFL Program created in Fiscal Year 2013-2014
- Work Plan for Wakulla Spring MFL developed in 2014 by consultants to provide options
- Work plan suggested using an “integrated model”
- The District opted to collect data rather than use modeled / estimated spring flows
- Surface water models used to determine the Wakulla Spring minimum flows were calibrated using observed spring flows and river stage

Enhanced Data Collection

- 70 monitoring sites installed or enhanced by the District to support MFL development for Wakulla Spring
- Spring flows, river stage, temperature, salinity, aquifer levels, swallet inflows, water quality, and other data





Florida Administrative Code (FAC) Requirements

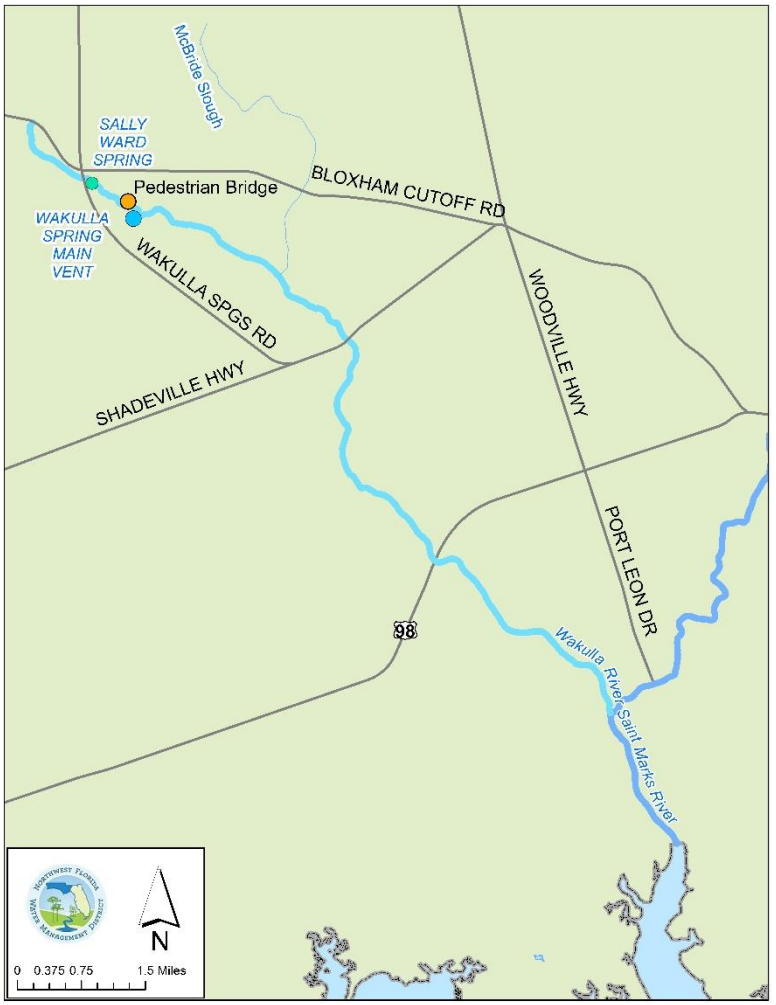
Chapter 62-40.473(1), FAC

1. Natural seasonal fluctuations in water flows or levels,
2. Non-consumptive uses, and
3. Ten water resource values associated with coastal, estuarine, riverine, spring, aquatic, and wetland ecology, including:

   (a) Recreation in and on the water
   (b) Fish and wildlife habitats and the passage of fish
   (c) Estuarine resources
   (d) Transfer of detrital material
   (e) Maintenance of freshwater storage and supply
   (f) Aesthetic and scenic attributes
   (g) Filtration and absorption of nutrients and other pollutants;
   (h) Sediment loads
   (i) Water quality
   (j) Navigation

Water Resource Value Metrics

- Quantified along the spring run
- Multiple metrics across a range of flows
- Recreation metrics
  - Water depth for tour boats
  - Water depth for power boats
  - Water depth for canoeing/kayaking
- Fish and Wildlife habitat metrics
  - Fish passage depth
  - Manatee passage depth
  - Manatee thermal refuge habitat
- Estuarine habitat
- **Surface water models are tools used to quantify relationships between spring flows and metrics**

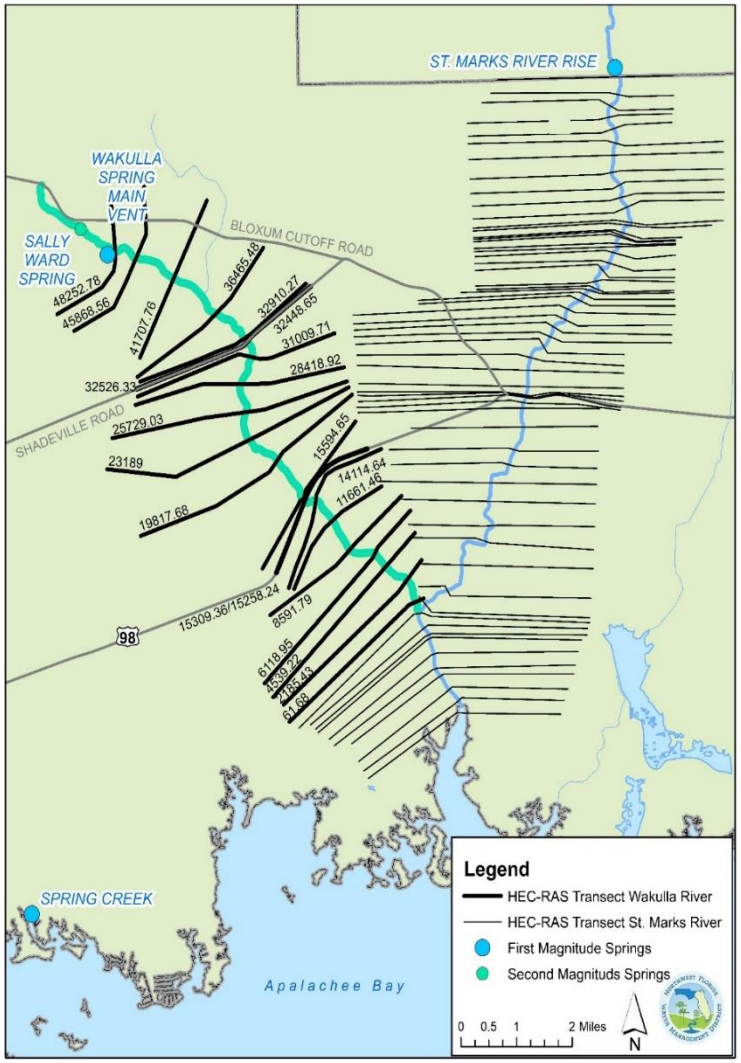


Surface Water Models

- Two types of surface water models
- River hydraulic model ("HEC-RAS" model)
  - Simulates how water levels in the river changes in response to changes in spring flows
- Hydrodynamic models (Environmental Fluid Dynamics Code, "EFDC")
  - Simulate flows, stage, temperature and salinity
  - Incorporate effects of air temperature, wind speed, and other factors
  - Two separate hydrodynamic models
    - Estuarine habitat
    - Manatee thermal refuge

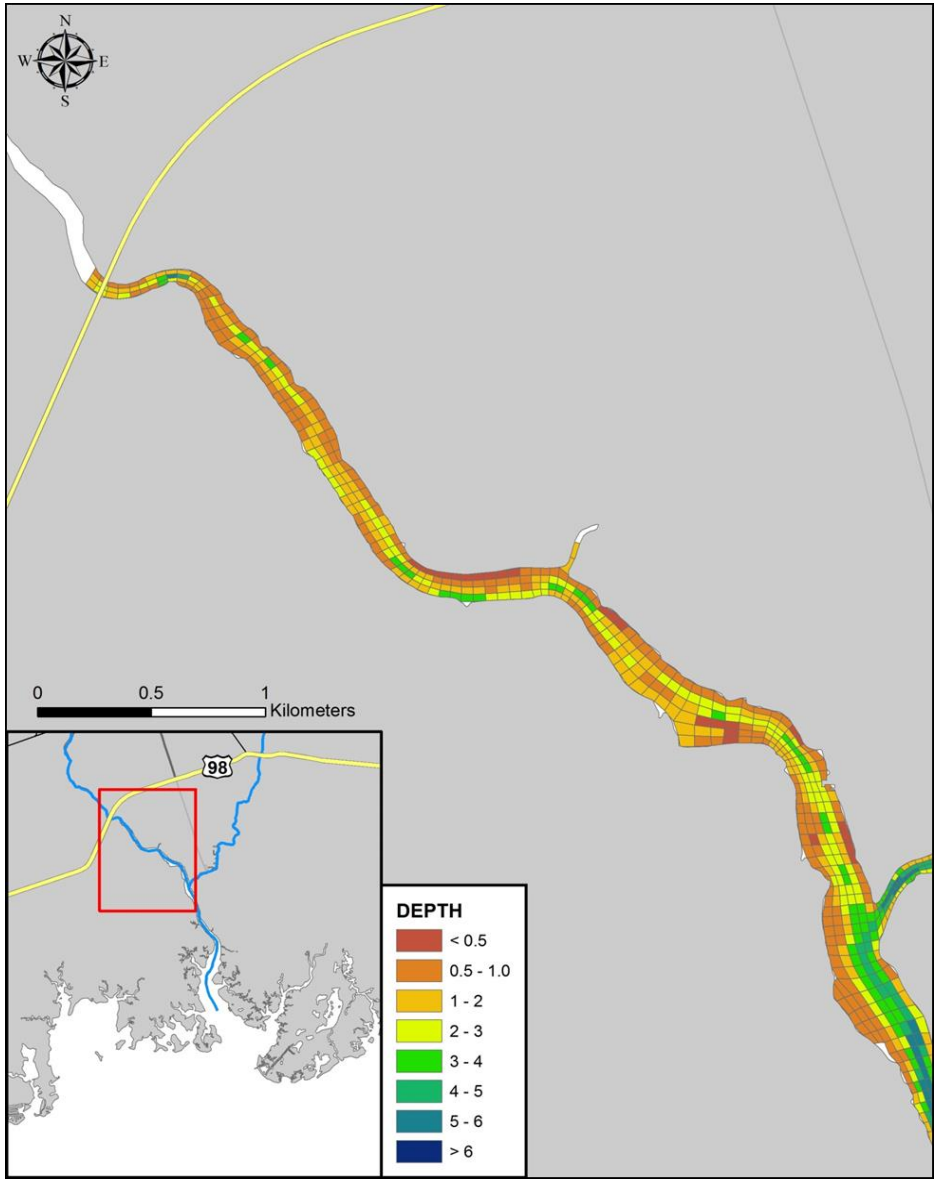
Surface Water Models
Hydraulic Model

- "HEC-RAS"
  - Hydraulic Engineering Centers River Analysis System
- Entire Wakulla and Sally Ward river/spring run system
- Relates spring/river flow and river stage
- Incorporates detailed survey data along the river
- Useful for stage-based metrics
  - Fish, manatee, and boat passage metrics



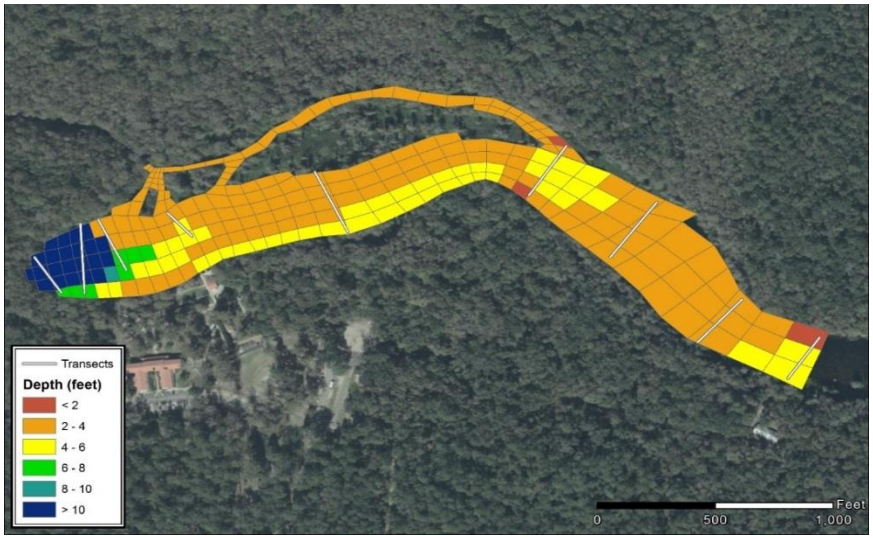
Estuarine Model

- Simulates changes in salinity as a result of changes in spring flow
- U.S. Hwy 98 Bridge to below the confluence with the St. Marks River
- Incorporates air temperature, wind speed, other hydrologic variables
- Habitat metrics include volume, surface area, shoreline length of different oligohaline (low salinity) zones
  - Ex. <0.5 ppt, <1 ppt, etc.



Thermal Model

- Simulates changes in thermal refuge habitat available for manatees
- Spring pool to Wakulla River boat tram
- Winter months
  - November through March
- Volume and/or surface area of water greater than 3.8 ft in depth for more than:
  - 20°C for 3 continuous days
  - 15°C for 4 continuous hours



Groundwater Models

- Groundwater flow models are not used to represent complex hydrodynamic processes or simulate how river stage or temperature change in response to changes in spring flow.

Eastern District Model

- Regional scale model that simulates the effect of withdrawals on spring flows and aquifer levels
- Applied within the context of MFLs to evaluate the need for and development of a prevention strategy
- Groundwater models can also be used after an MFL is established to estimate the effects of withdrawals