Rule Development Workshop for Kissimmee Water Reservations

April 17, 2020

Welcome

Photo: Kissimmee River

Workshop Agenda

- Welcome
- Water reservation process
- Recap of past rule development workshops
- Kissimmee River Restoration Project and underpinnings for Water Reservation (3 presentations)
- Overview of technical document
- Changes to draft Water Reservation rule and permitting criteria
- UK-OPS modeling and evaluation tool
- Public comment
- Next steps

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Water Reservation Process

Toni Edwards
Applied Sciences Bureau

Photo: Kissimmee River

Water Reservations

Authority: Section 373.223(4), F.S.

Functions and Considerations

- Reserve water for the protection of fish and wildlife or public health and safety
- Prevent use of reserved water by consumptive users
- Required for CERP projects by WRDA 2000
- May be used as part of an MFL recovery or prevention strategy

Osprey (*Pandion haliaetus)* with bass (*Micropterus* sp.) on Merritt's Mill Pond. Source: http://nykography.weebly.com

Water Reservations Do Not…

- Prevent use of unreserved water or water allocated under consumptive use permits
- Establish an operating regime
- Drought-proof the natural system
- Ensure wildlife proliferation

Lake Okeechobee under drought conditions
Source: SFWMD

American Alligator (*Alligator mississipiensis)*
Source: http://www.photodrom.com

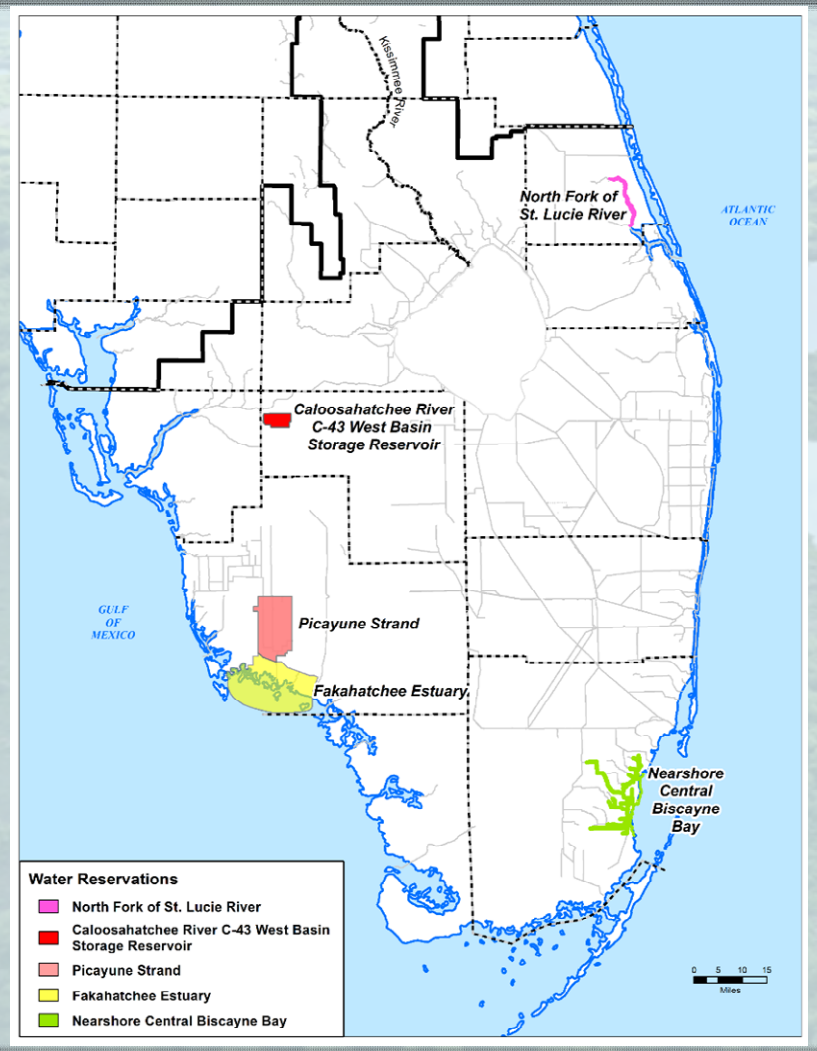
S-67 water control structure (replaced G-85 structure)
Source: SFWMD

Water Reservations

Defining Water to be Reserved

- Identify the “reservation waterbody”
- Characterize the hydrology of the waterbody
- Identify fish and wildlife species to be protected
- Establish linkages between hydrology and species
- Define and quantify the water needed to protect the identified species

Water Reservations Adopted in SFWMD



- Fakahatchee Estuary (2009)
- Picayune Strand (2009)
- North Fork of the St. Lucie River (2010)
- Nearshore Central Biscayne Bay (2013)
- Caloosahatchee River C-43 West Basin Storage Reservoir (2014)

Cover 172,074 acres Districtwide

Kissimmee River and Chain of Lakes Water Reservations

Chapter 40E-10, F.A.C.

For the Protection of Fish and Wildlife

Nationally recognized largemouth bass fishery

Largemouth Bass (*Micropterus salmoides*)
Source: Engbretson Underwater Photography
https://www.underwaterfishphotos.com

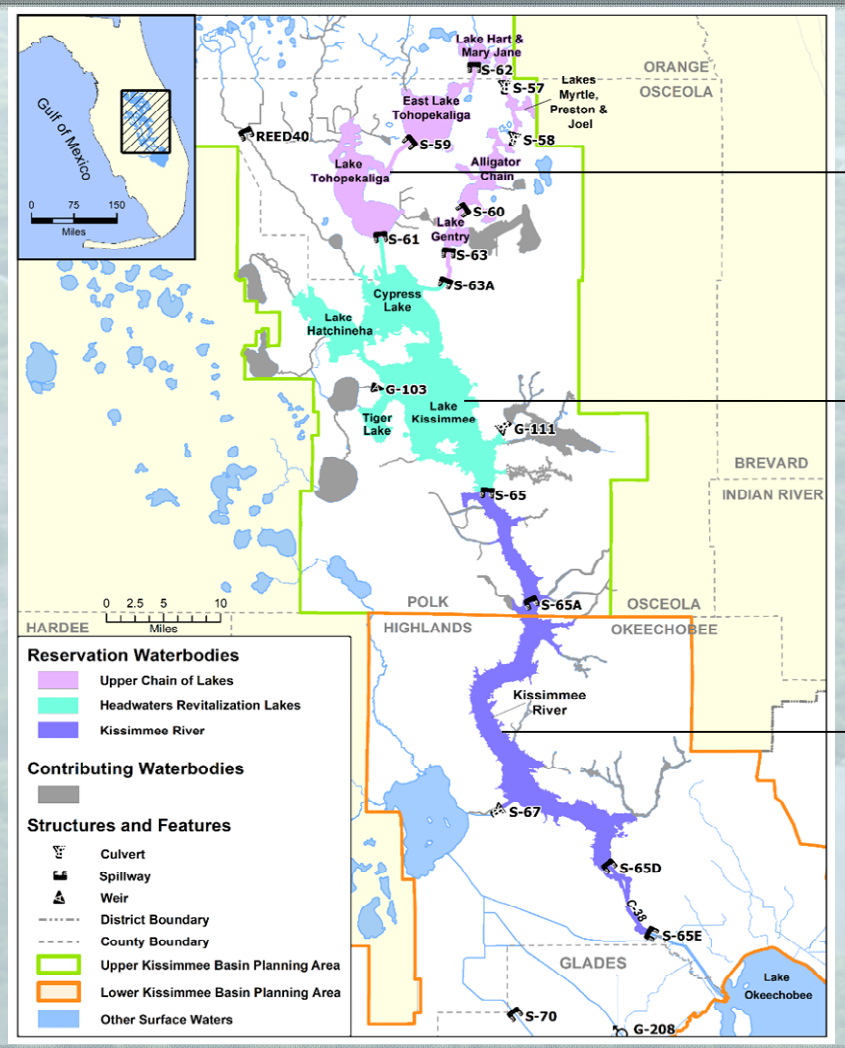
Wood stork and snail kite nesting colonies

Snail Kite (*Rostrhamus sociabilis*)
Source: https://de.wikipedia.org

One of the largest concentrations of nesting bald eagles in the U.S.

Bald Eagle (*Haliaeetus leucocephalus)*
Source: Audubon.org

Kissimmee River and Chain of Lakes Reservation Waterbodies



Upper Chain of Lakes
Lakes Hart-Mary Jane, Lakes Myrtle-Preston-Joel, Alligator Chain of Lakes, Lake Gentry, Lake Tohopekaliga, East Lake Tohopekaliga, and associated canals

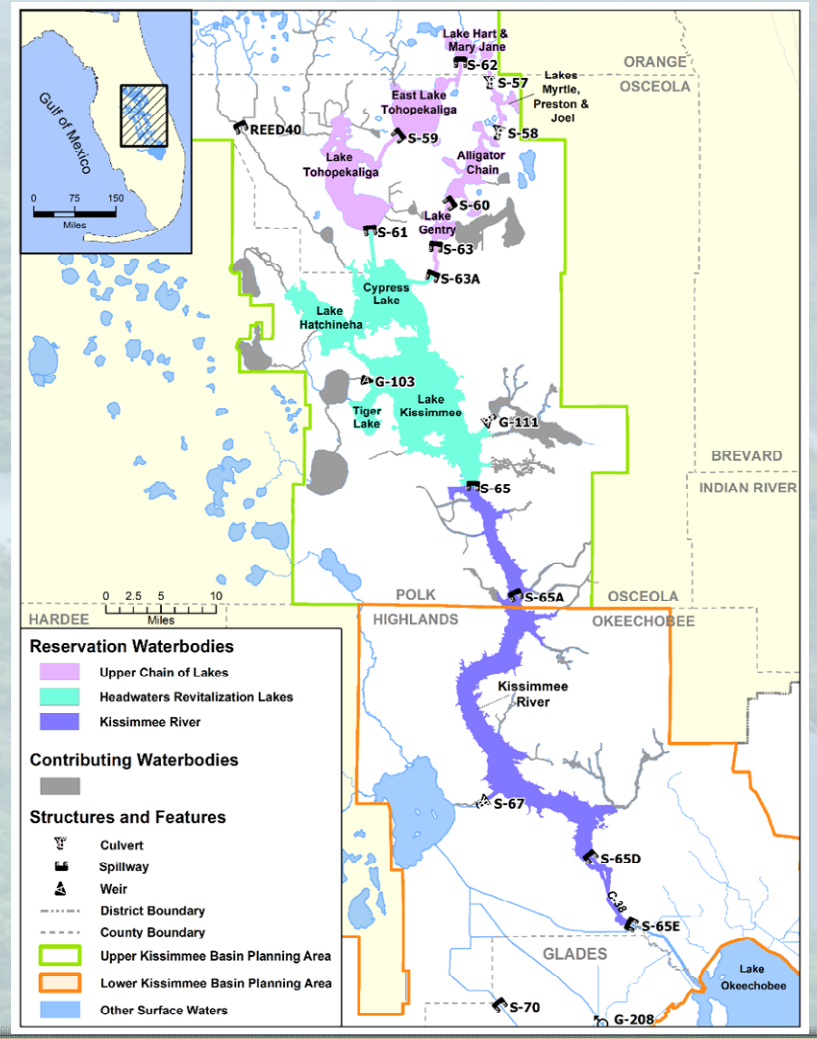
Headwaters Revitalization Lakes
Lakes Kissimmee, Cypress, Hatchineha, and Tiger, and associated canals

Kissimmee River and Floodplain
To S-65E structure north of Lake Okeechobee; includes Istokpoga Canal and floodplain, C-38 Canal, and remnant river channels from S-65 to S-65E

Kissimmee River and Chain of Lakes Water Reservations

- 172,500 acres, spanning portions of UKB (CFWI) and LKB Planning Areas
- Upper Chain and Headwaters Lakes – primary sources of water for the Kissimmee River
- Reservations support Kissimmee River Restoration Project (~$800 million public investment)

Kissimmee River Restoration Project (KRRP): Looking north from the south end of the Phase I restoration area. Source: SFWMD



Kissimmee River and Chain of Lakes Water Proposed for Reservation from Allocation

Surface Water

- Upper Chain of Lakes reservation waterbodies
  - All surface water up to specific water reservation stages
- Kissimmee River and Headwaters Revitalization Lakes reservation waterbodies
  - All surface water

Groundwater

- Surficial aquifer system
  - Groundwater contributed to the reservation waterbodies that is required for the protection of fish and wildlife

Contributing Waterbodies

- Surficial aquifer system groundwater and surface water that is required for the protection of fish and wildlife

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Recap of Past Rule Development Efforts

Don Medellin

Applied Sciences Bureau

Photo: Kissimmee River

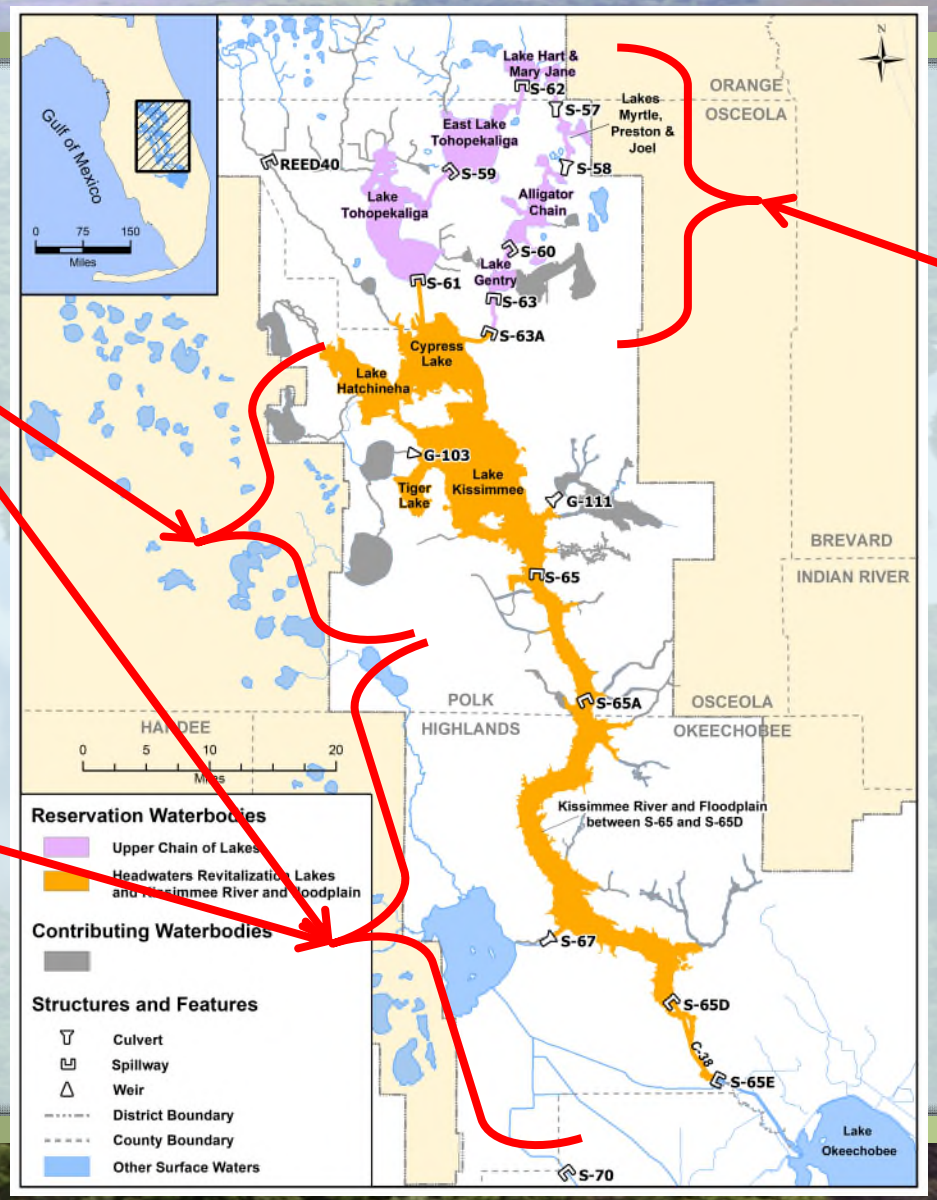
Kissimmee River Restoration Project

Implement re-established hydrology

- Headwaters Revitalization Schedule

Restore the physical form of the river

- Fill C-38 Canal
- Remove water control structures
- Reconnect river oxbows



Water reservation lines protect water for the Kissimmee River Restoration Project

Past Reservation Activity

- Reservation initiated in 2008-2009
  - Technical document and draft rules developed
  - Positive peer review on foundational concepts
  - Delayed due to conflicts with Kissimmee Basin Modeling & Operations Study
- Reinitiated in 2014-2015
  - Public workshops held July 30 and December 12, 2014
  - Draft rules developed and technical document revised in March 2015
  - Delayed due to listed species concerns within Lake Okeechobee
- Current effort 2019-2020

Changes Since 2015

- New modeling tool: Upper Kissimmee – Operations Simulation Model
  - Used as a regulatory tool
  - Evaluated different withdrawal scenarios
- Updated technical document to include the best available data
- Revised rules (Chapter 40E-10, F.A.C., and Applicant's Handbook)
  - Revised water reservation lines for the Upper Chain of Lakes
  - Updated permitting criteria
  - Regulation of contributing waterbodies
  - Downstream Lake Okeechobee constraint

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Kissimmee River Restoration Project and Basis for the Water Reservations

Steve Bousquin

Applied Sciences Bureau

Photo: Kissimmee River

Central & Southern Florida Flood Control Project

- The C&SF Project had severe environmental impacts on the Kissimmee River and Headwaters Lakes
- Construction of the C-38 Canal and the associated regulation schedule for S-65 resulted in:
  - Complete loss of flow in the Kissimmee River channel
  - Elimination of inundation of the Kissimmee River floodplain
  - Reduction of stage variability in the Headwaters Lakes
- Profound consequences for the ecology of the ecosystem

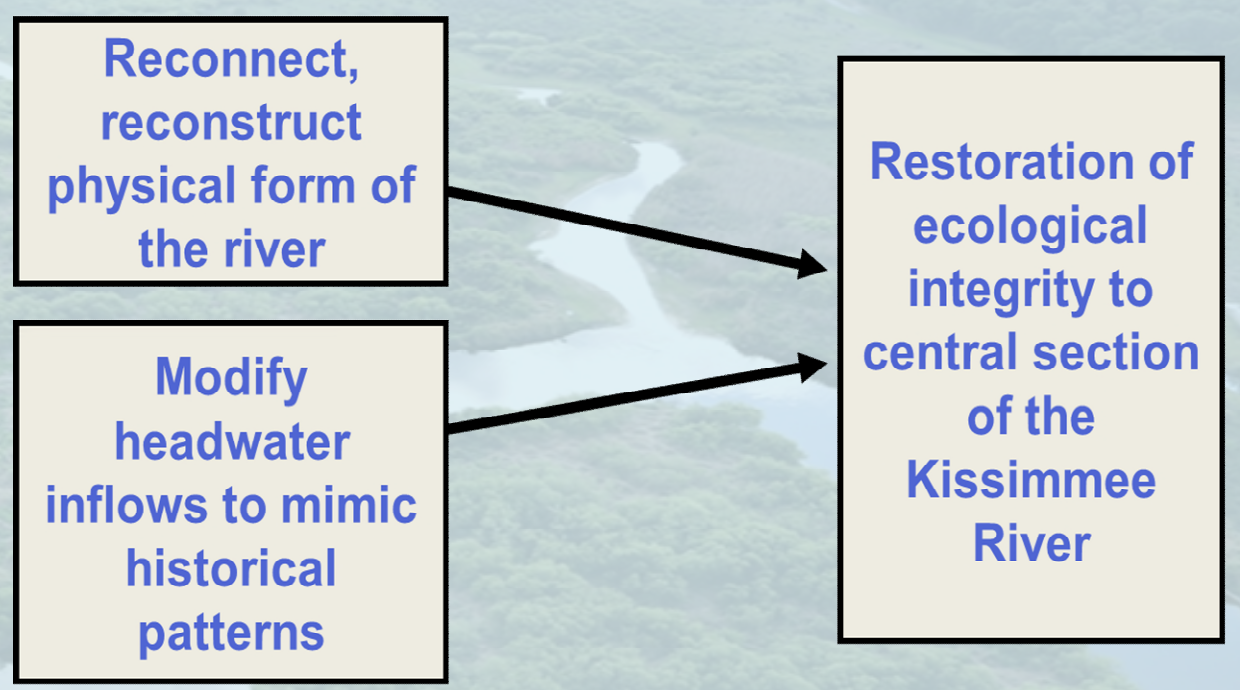
C-38 Canal through remnant meanders of the Kissimmee River

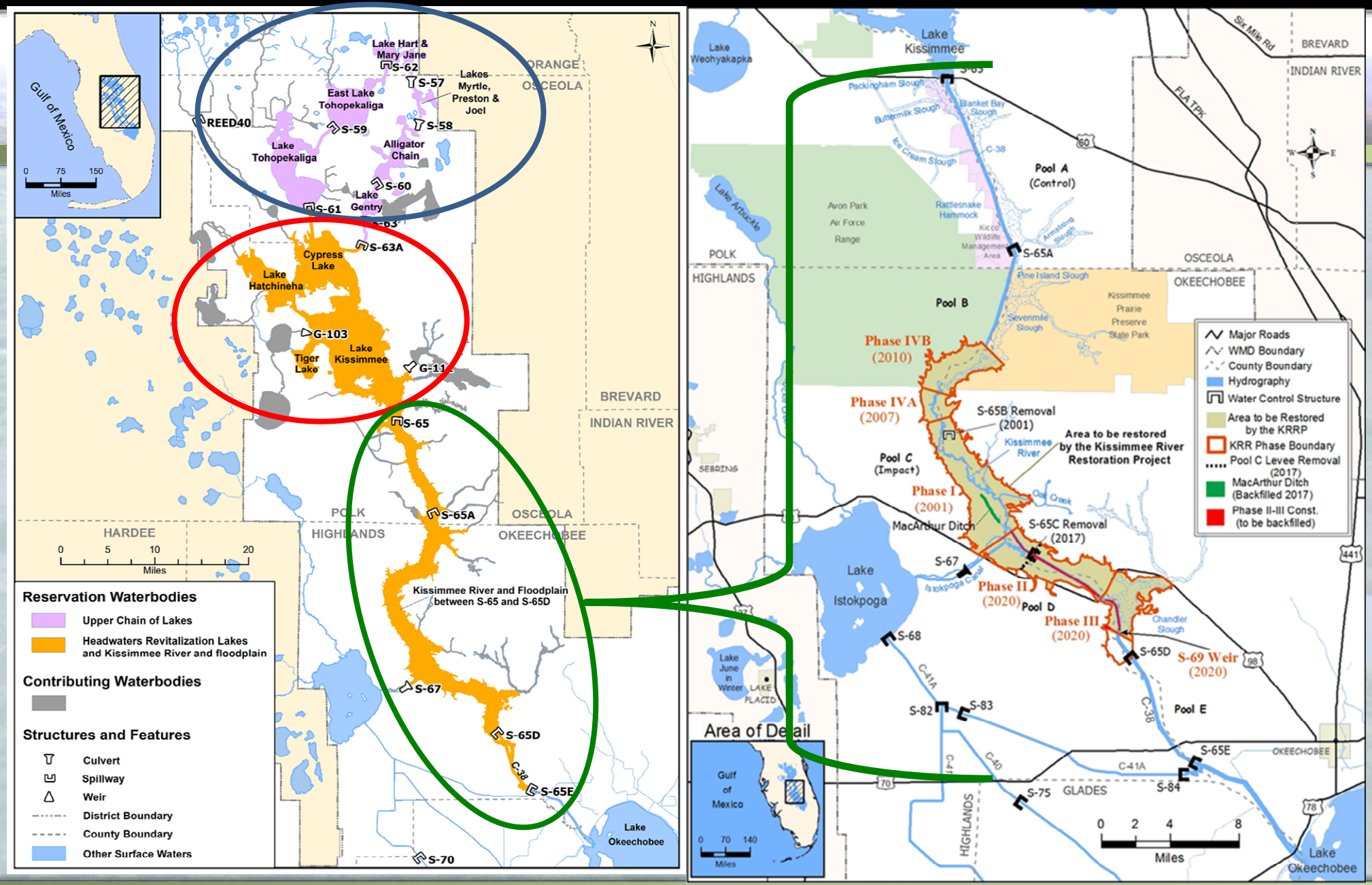
Kissimmee River Restoration Project Goals

- Kissimmee River
  - Re-establish the river's historical hydrology, including:
    - Flow in the river channel
    - Inundation of the Kissimmee River floodplain
    - Re-establishment of lost habitat
    - Recovery of fish and wildlife populations
    - Recovery of the ecological integrity of the ecosystem
- Headwaters Lakes
  - Improve the quantity and quality of littoral habitat due to higher lake stages

Kissimmee River Restoration Project

- The KRRP is restoring approximately one-third of the Kissimmee River to its historical condition by backfilling a section of the C-38 Canal
  - This will re-establish flow in the river channel and inundation of the floodplain
  - The key to river restoration is hydrology – achieving the historical timing and volume of flow from the Headwaters Lakes to the Kissimmee River
  - Headwaters Revitalization Schedule was developed to achieve this




Gulf of Mexico
0 75 150
Miles
Lake Hart & Mary Jane
S-62
S-57
Lakes Myrtle, Preston & Joel
East Lake Tohopekaliga
REED40
S-59
S-58
Alligator Chain
Lake Tohopekaliga
S-60
Lake Gentry
S-61
S-63
S-63A
Cypress Lake
Lake Hatchineha
G-103
Tiger Lake
Lake Kissimmee
G-11
S-65
S-65A
S-67
S-65D
C-38
S-65E
S-70
Lake Okeechobee
ORANGE
OSCEOLA
BREVARD
INDIAN RIVER
POLK
HIGHLANDS
HARDEE
OKEECHOBEE
0 5 10 20
Miles
Kissimmee River and Floodplain between S-65 and S-65D
Reservation Waterbodies
Upper Chain of Lakes
Headwaters Revitalization Lakes and Kissimmee River and floodplain
Contributing Waterbodies
Structures and Features
Culvert
Spillway
Weir
District Boundary
County Boundary
Other Surface Waters
Lake Kissimmee
Lake Weohyakapka
Six Mile Rd
FLA TPK
Packingham Slough
Buttermilk Slough
Blanket Bay Slough
Ice Cream Slough
C-38
Pool A (Control)
Avon Park Air Force Range
Rattlesnake Hammock
Kissimmee Wildlife Management Area
Armstrong Slough
Lake Arbuckle
Pine Island Slough
Pool B
Sevenmile Slough
Kissimmee Prairie Preserve State Park
Phase IVB (2010)
Phase IVA (2007)
S-65B Removal (2001)
Kissimmee River
Area to be restored by the Kissimmee River Restoration Project
Pool C (Impact)
SEBRING
Phase I (2001)
Oak Creek
MacArthur Ditch
S-65C Removal (2017)
S-67
Istokpoga Canal
Lake Istokpoga
Phase II (2020)
Pool D
Phase III (2020)
Chandler Slough
S-68
S-65D
S-69 Weir (2020)
Lake June in Winter
LAKE PLACID
C-41A
S-82
S-83
Pool E
C-40
S-65E
S-75
GLADES
S-84
0 2 4 8
Miles
Major Roads
WMD Boundary
County Boundary
Hydrography
Water Control Structure
Area to be Restored by the KRRP
KRR Phase Boundary
Pool C Levee Removal (2017)
MacArthur Ditch (Backfilled 2017)
Phase II-III Const. (to be backfilled)
Area of Detail
Gulf of Mexico
0 70 140
Miles

Hydrologic Requirements of Fish and Wildlife in the River and Lakes

Highest stages

- Inundate wetland plant communities
- Foraging habitat for fish and wading birds
- Spawning habitat for fish; nesting habitat for alligators, wading birds, and waterfowl

Gradual recession

- Wetland hydroperiods
- Reduces stranding of fish
- Maintain water under bird nests

Lowest Stage

- Maintain flow during seasonal low stage
- Stage variability for littoral habitat

Rising Stage

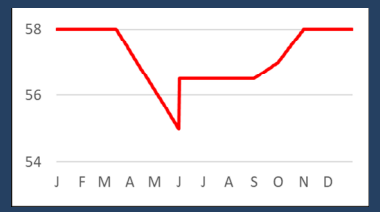
- Gradual ascension to protect apple snails, alligator nests, other species

Flow or Stage

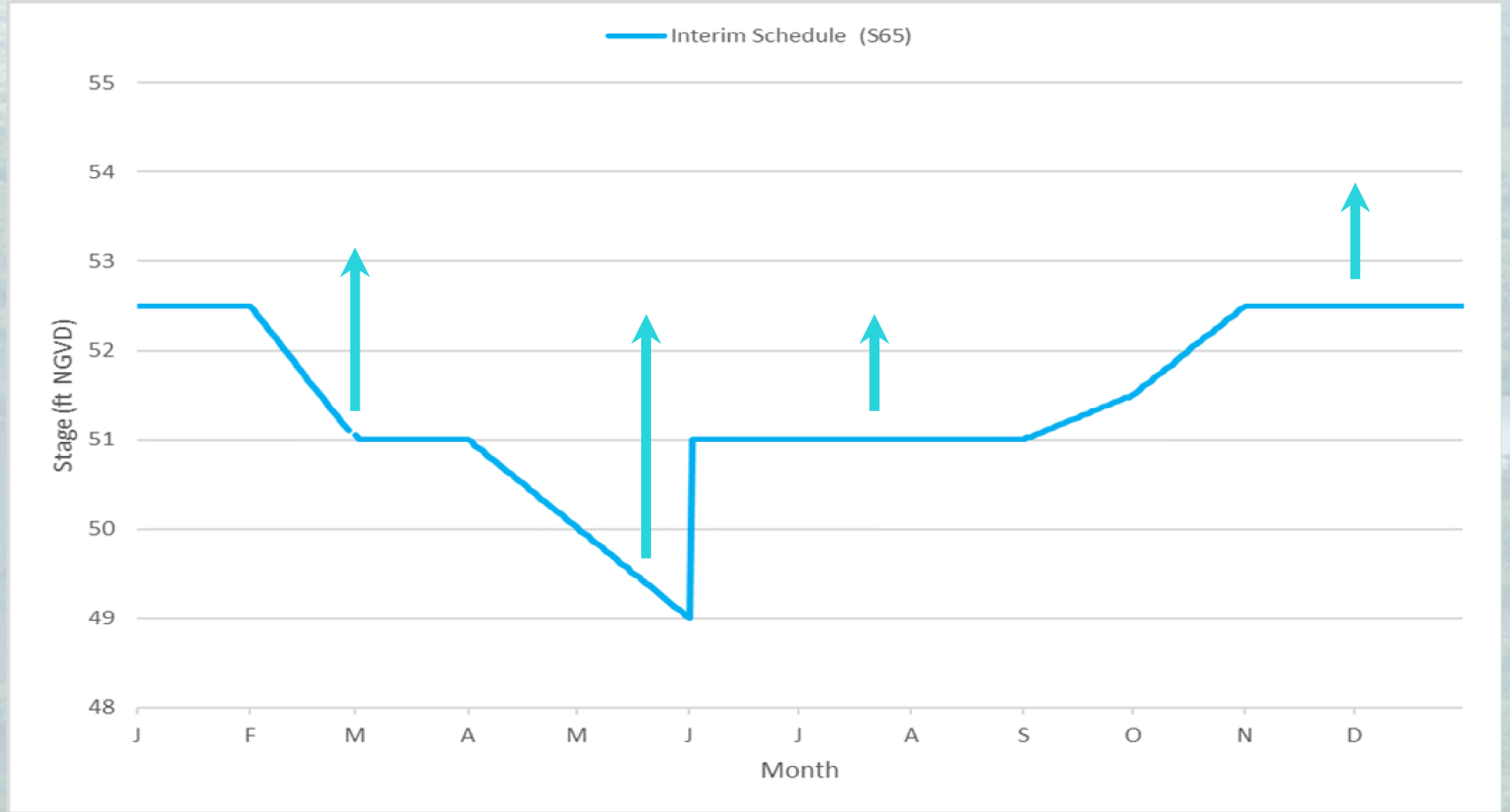
January

June

Fall-Winter

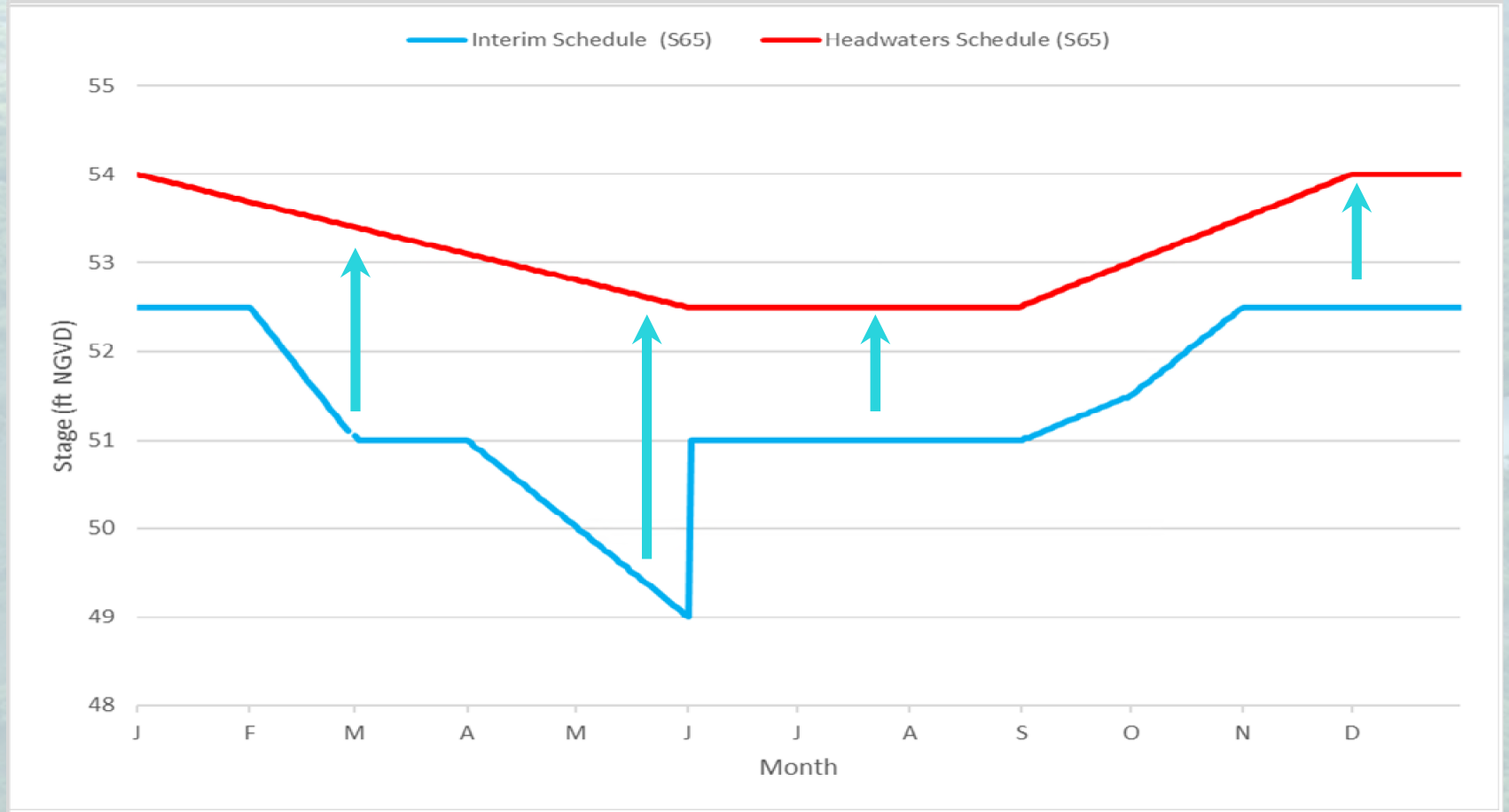


Headwaters Revitalization Schedule



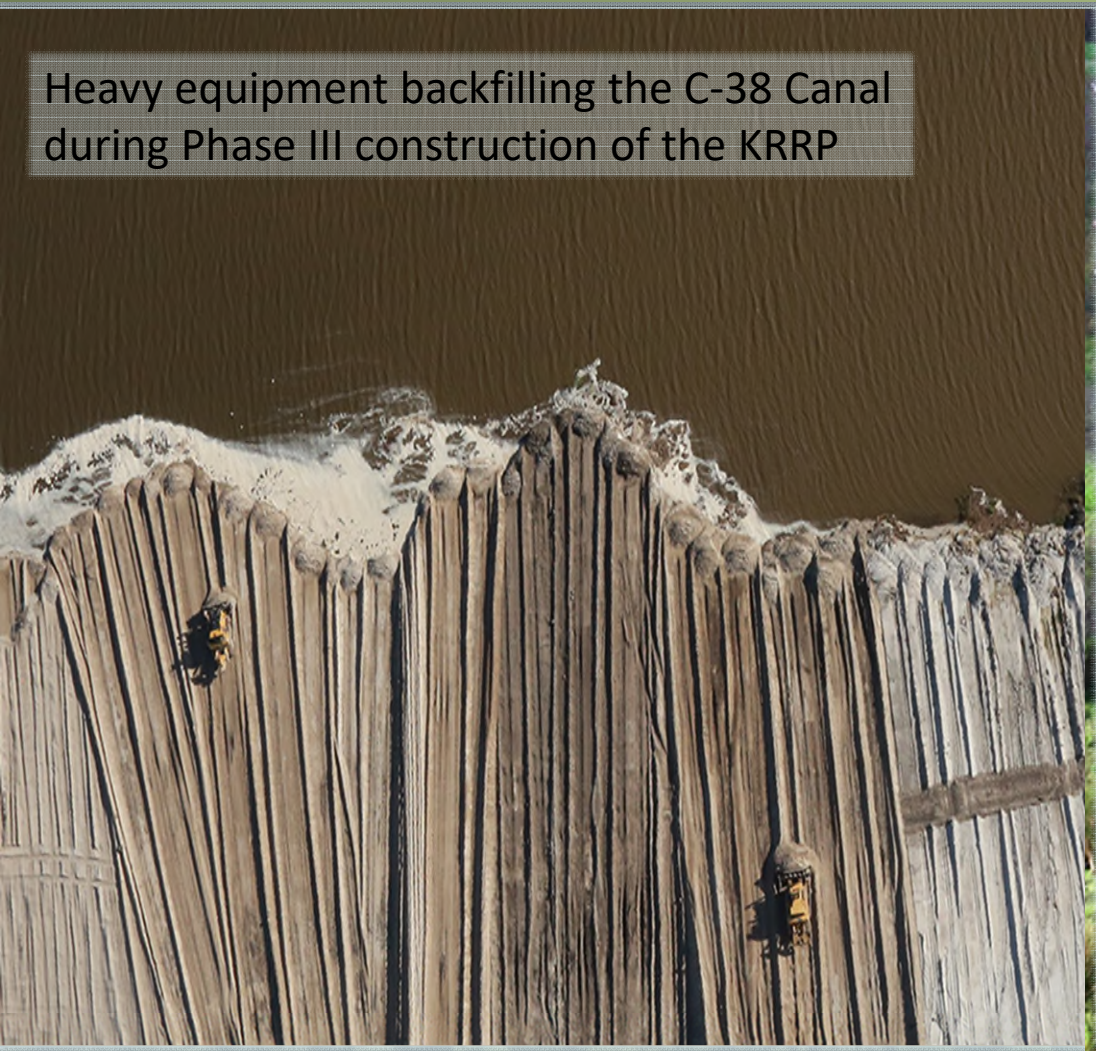
- Once construction is complete, the current interim regulation schedule with be replaced with the HRS
- The HRS raises the flood control regulation line to provide up to 100,000 acre-feet of additional storage

Headwaters Revitalization Schedule



- The additional storage allowed by the HRS will provide the flow needed for restoration of the Kissimmee River
- The HRS also will benefit the Headwaters Lakes due to higher lake stages, which will expand littoral zones

Kissimmee River Restoration Project Status



Heavy equipment backfilling the C-38 Canal during Phase III construction of the KRRP

- Decades of planning and construction
- Construction expected to be complete in 2020
- ~$800 million projected investment
- Full environmental benefits expected following implementation of the HRS in 2020-2021

A flock of wading birds in the KRRP Phase I construction area

Basis of the Water Reservations

- 2009 AFET-W* Model
  - Developed specifically for the Kissimmee Basin water reservations
  - Geographic scope: entire Kissimmee Basin
  - Period of record: 1965-2005
- With Project Base
  - A simulation with AFET-W that includes all components of the completed Kissimmee River Restoration Project

*AFET-W: Alternative Formulation and Evaluation Tool – Water Reservation

Interpretation of AFET-W Results

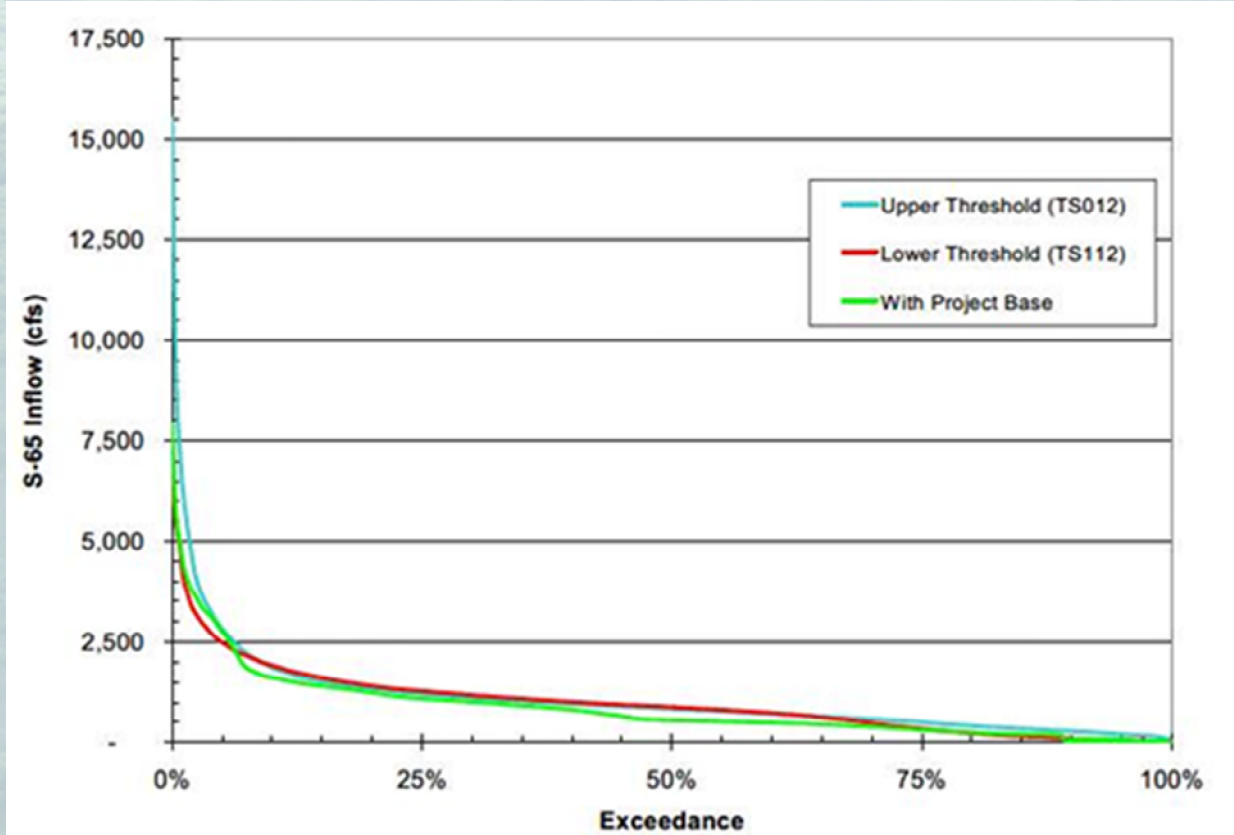


Figure 7-30. Comparison of river inflow target time series at the S-65 Structure to the 'with project' base conditions

The lines represent exceedance curves for three time-series of flow data at S-65

- **Green line**: **With Project Base**
  Represents water in the system
- **Blue line**: **Upper Target Time Series**
  Represents water needed to meet the KRRP performance measures for fish and wildlife
- **Red line**: **Lower Target Time Series**
  Represents water needed to meet a reduced set of KRRP performance measures

- A Target Time Series line that is on or above the With Project Base line indicates that the needs of KRRP fish and wildlife are not being met

AFET-W Results and Conclusion

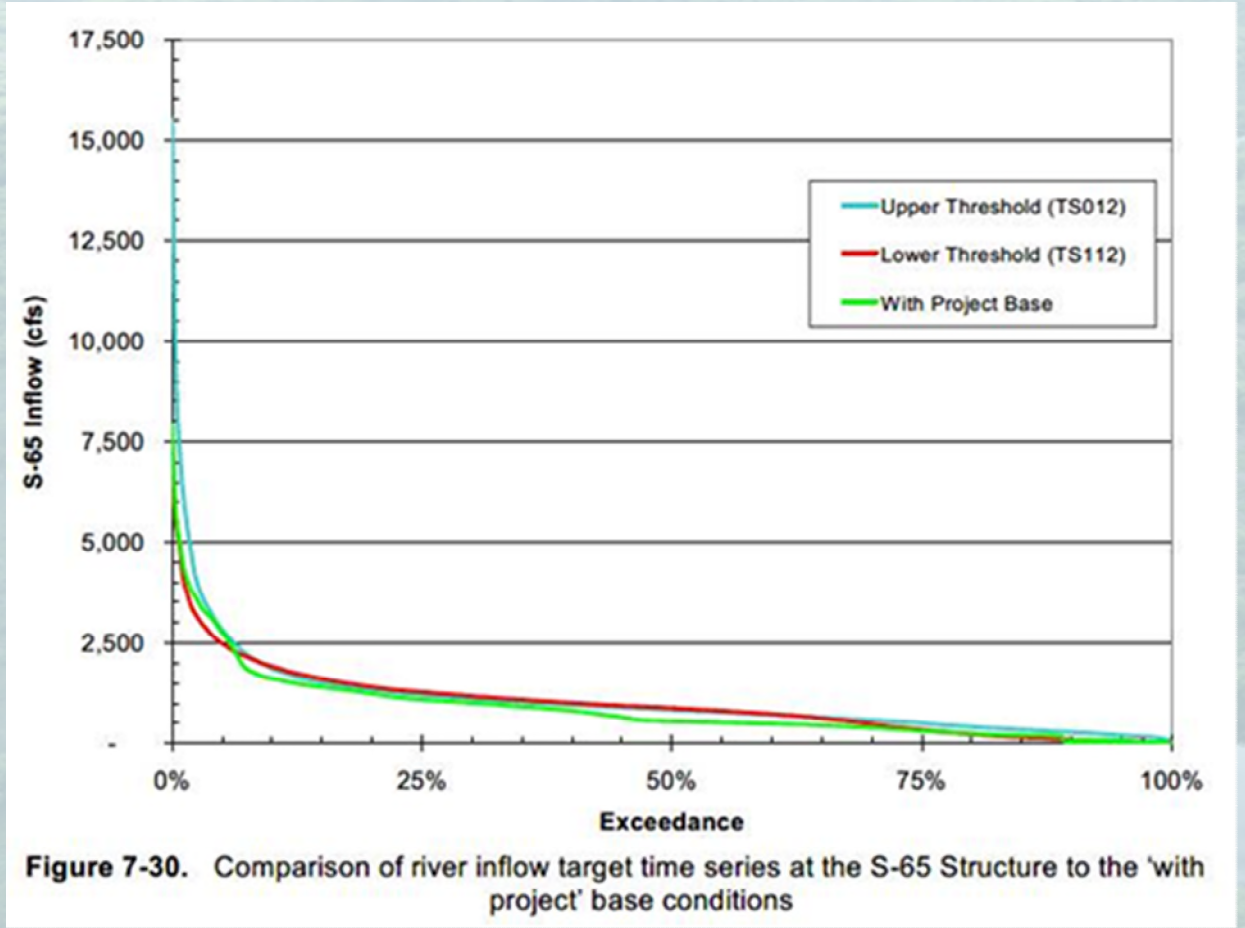


Figure 7-30. Comparison of river inflow target time series at the S-65 Structure to the 'with project' base conditions

- That the Upper and Lower Target Time Series lines are usually above the With Project Base line indicates there is no water available for allocation
- **Conclusion**:
  - **No water is available to be allocated while protecting the public's investment to benefit fish and wildlife in the Kissimmee River and Headwaters Lakes in the public interest**

AFET-W Results and Conclusion

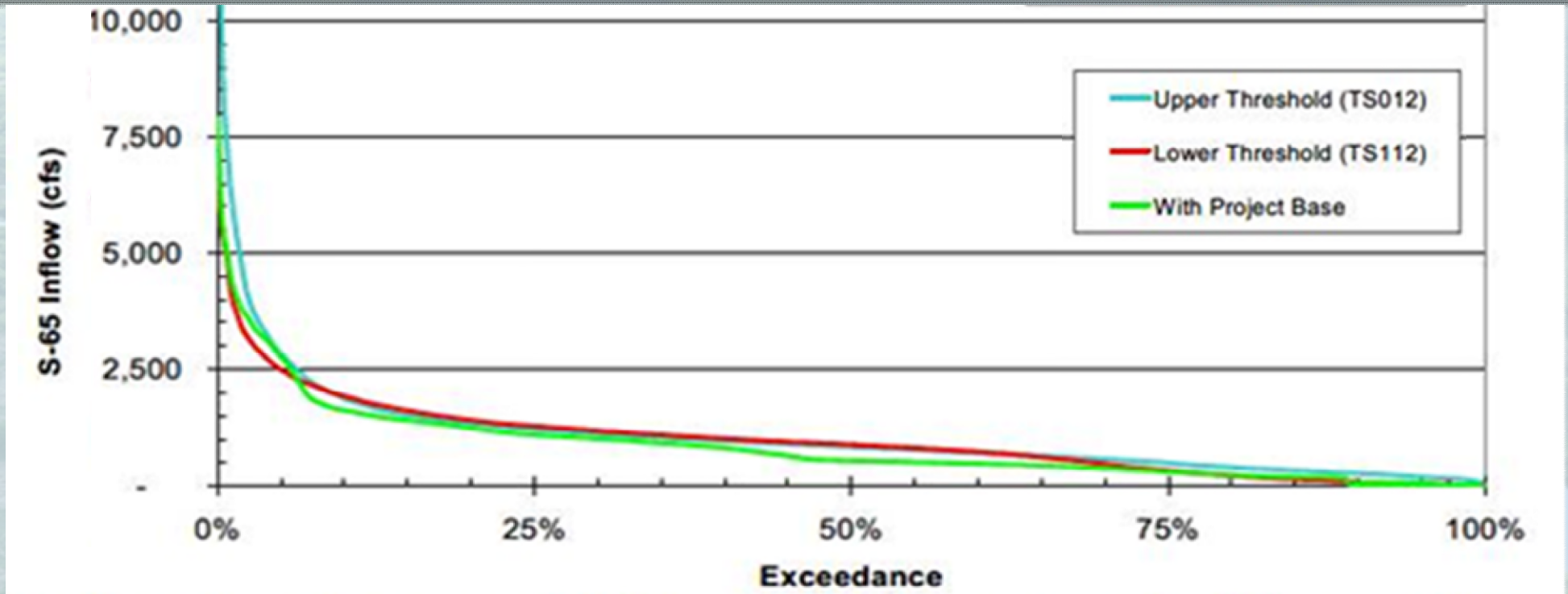


Figure 7-30. Comparison of river inflow target time series at the S-65 Structure to the 'with project' base conditions

Modeling results indicate there is only enough water to meet the needs of fish and wildlife in the Kissimmee River and Headwaters Lakes

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Overview of Technical Document

Seán Sculley, P.E.
Applied Sciences Bureau

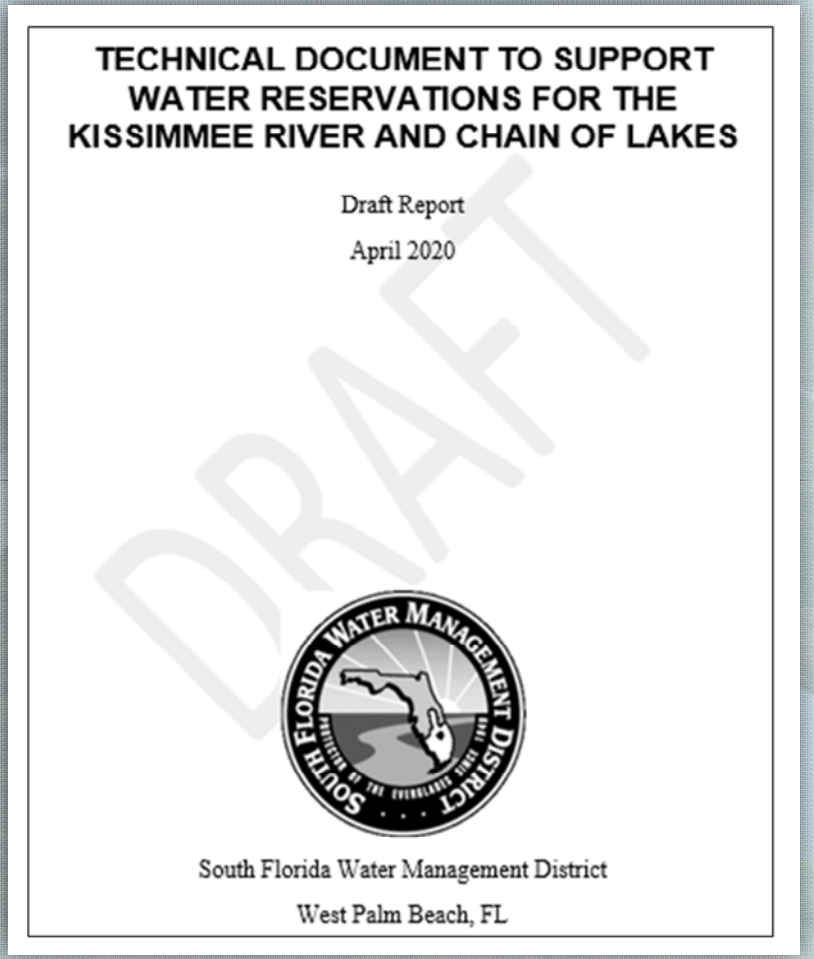
Photo: Kissimmee River

Purpose

To summarize, present, and explain scientific and technical data, methods, models, and assumptions used to determine the Water Reservations for the protection of fish and wildlife in specific waterbodies of the Kissimmee River and Chain of Lakes.

Technical Document

- Chapter 1: Introduction
- Chapter 2: Basis for Water Reservations
- Chapter 3: Reservation Waterbody Description
- Chapter 4: Fish and Wildlife Resources and Hydrologic Requirements
- Chapter 5: Methods and Analyses Used to Identify Reserved Water


TECHNICAL DOCUMENT TO SUPPORT
WATER RESERVATIONS FOR THE
KISSIMMEE RIVER AND CHAIN OF LAKES

Draft Report

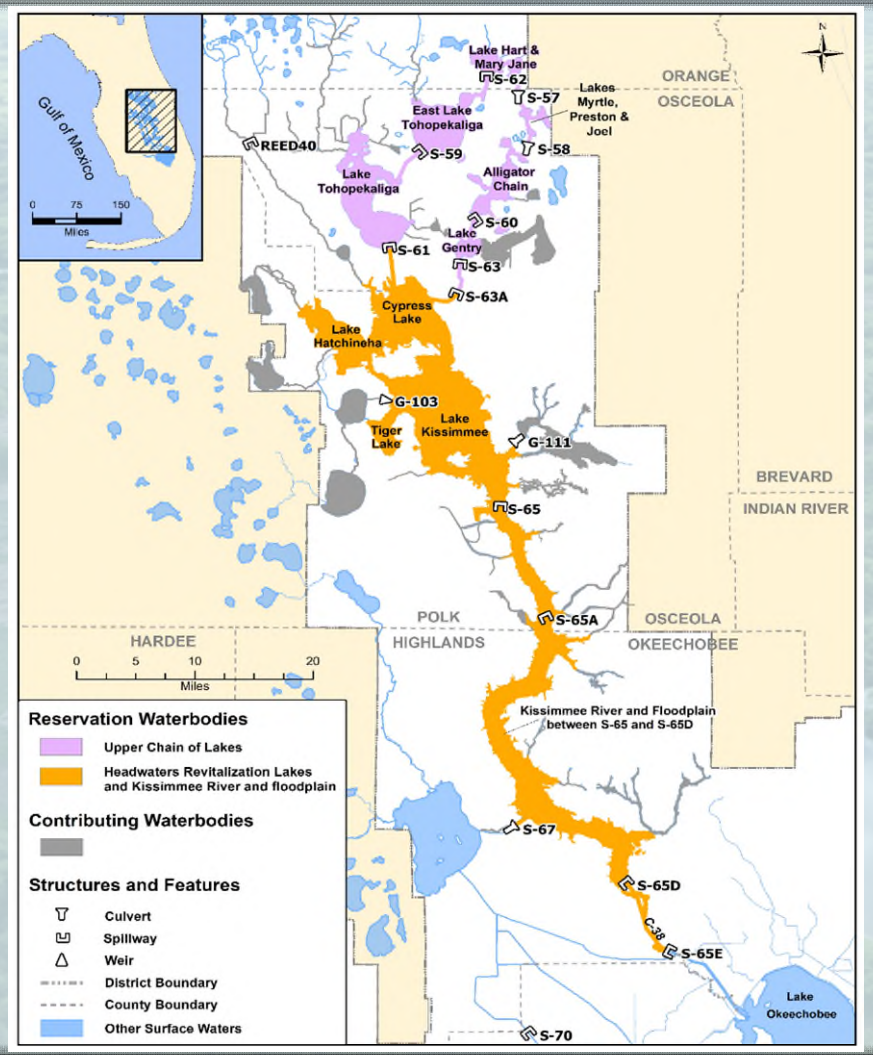
April 2020

DRAFT

South Florida Water Management District

West Palm Beach, FL

Introduction



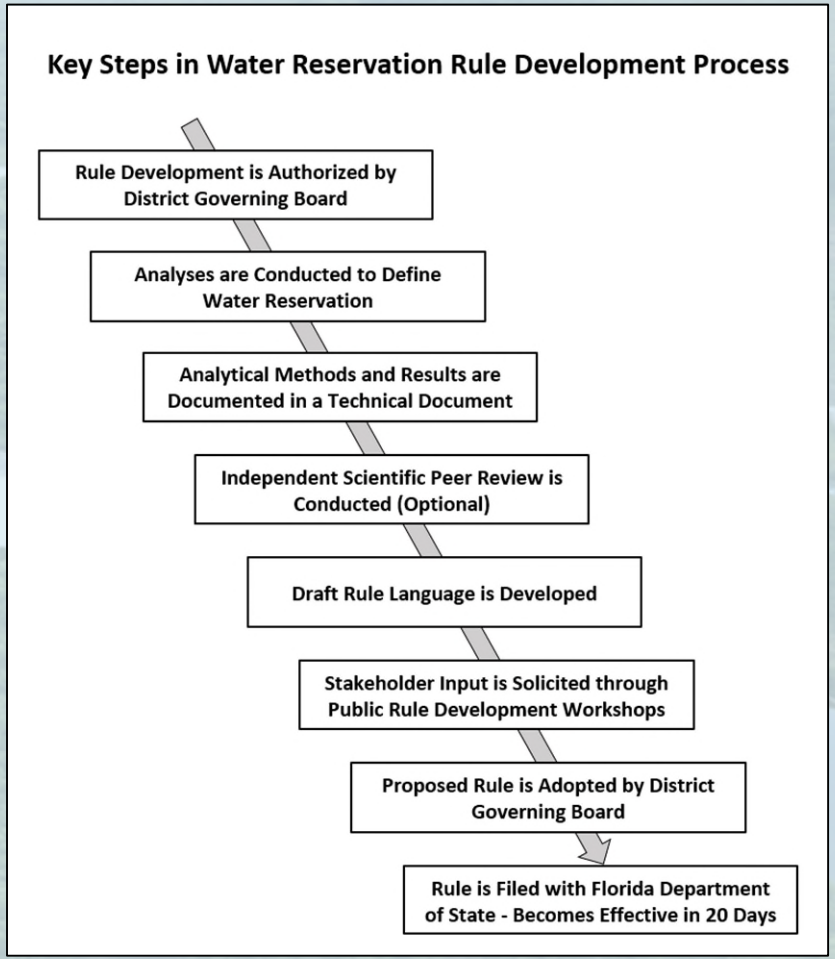
- Overview and purpose
- Reservation waterbodies
- History and background
- Prior work

Basis for Water Reservations

- Authority
- Rulemaking process

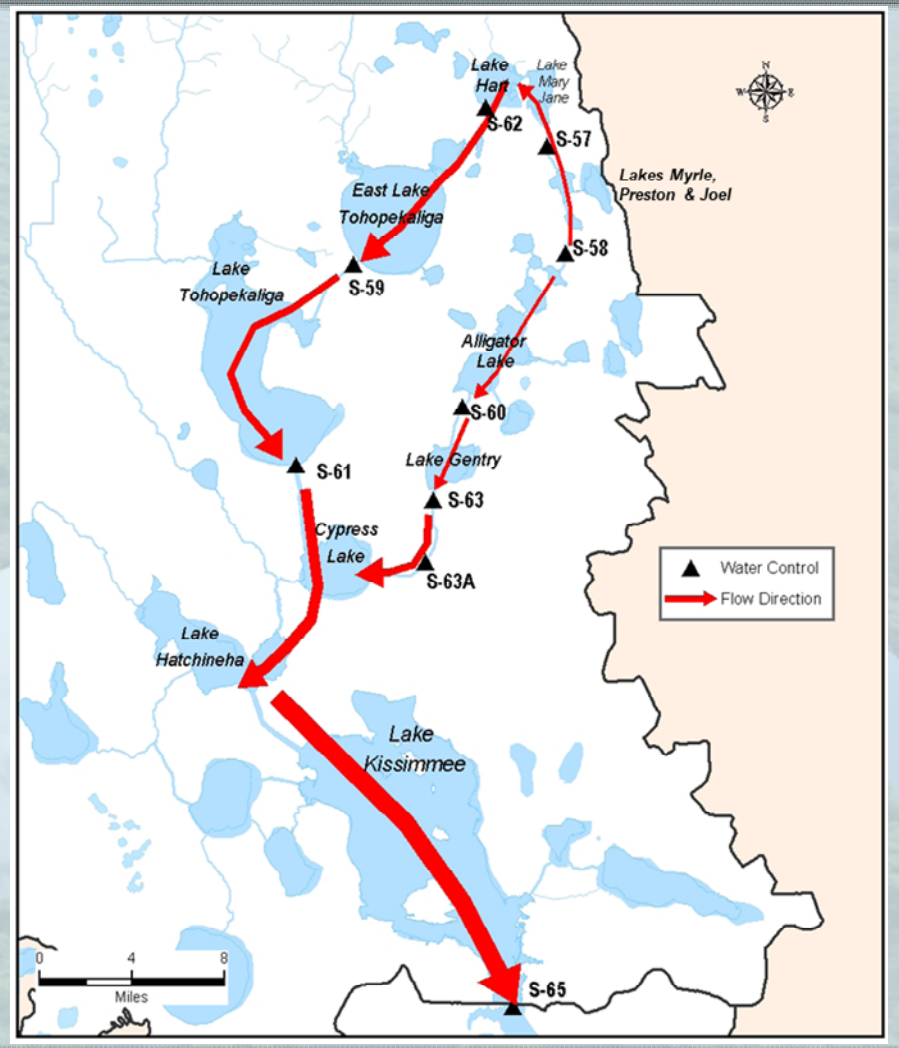
Section 373.223(4), F.S.

The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently existing legal uses of water shall be protected so long as such use is not contrary to the public interest.



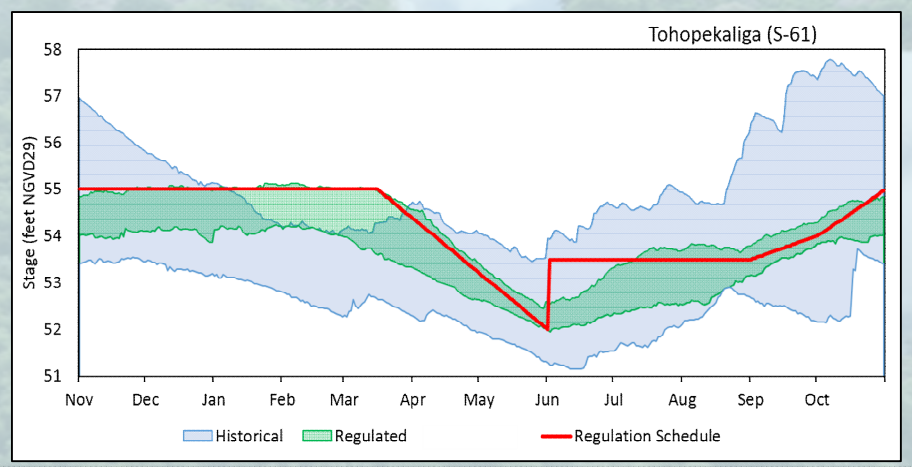
Description of Reservation Waterbodies

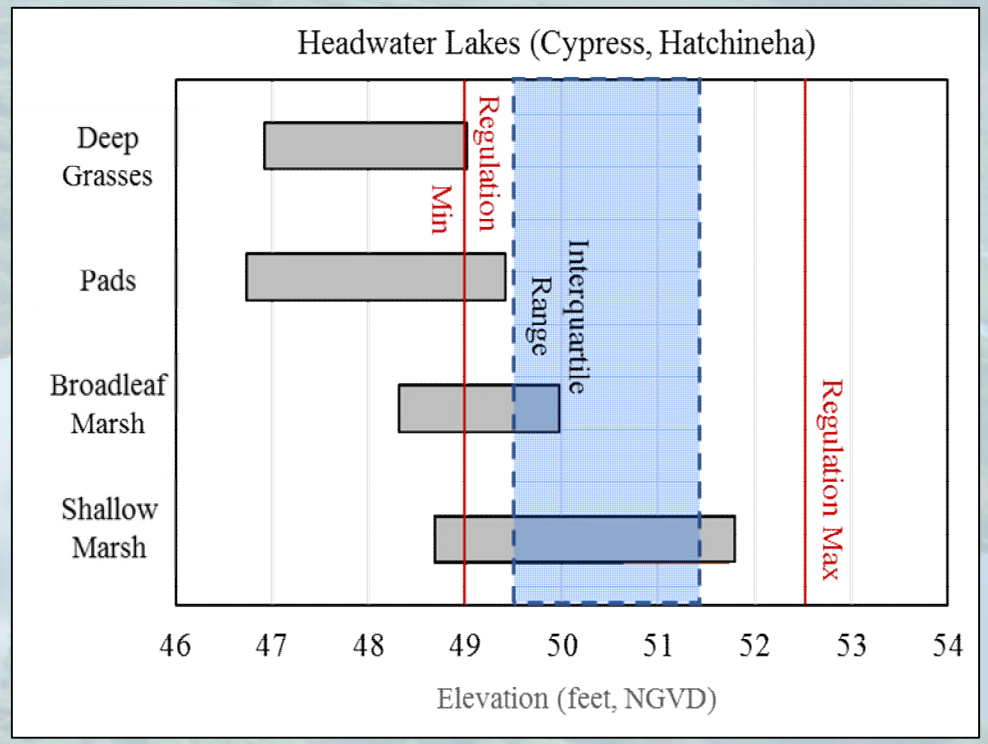
- Kissimmee Basin overview
- Descriptions of Upper and Lower Kissimmee basins
- Waterbody connectivity
- Groundwater
- Contributing waterbodies



Fish and Wildlife & Hydrologic Requirements

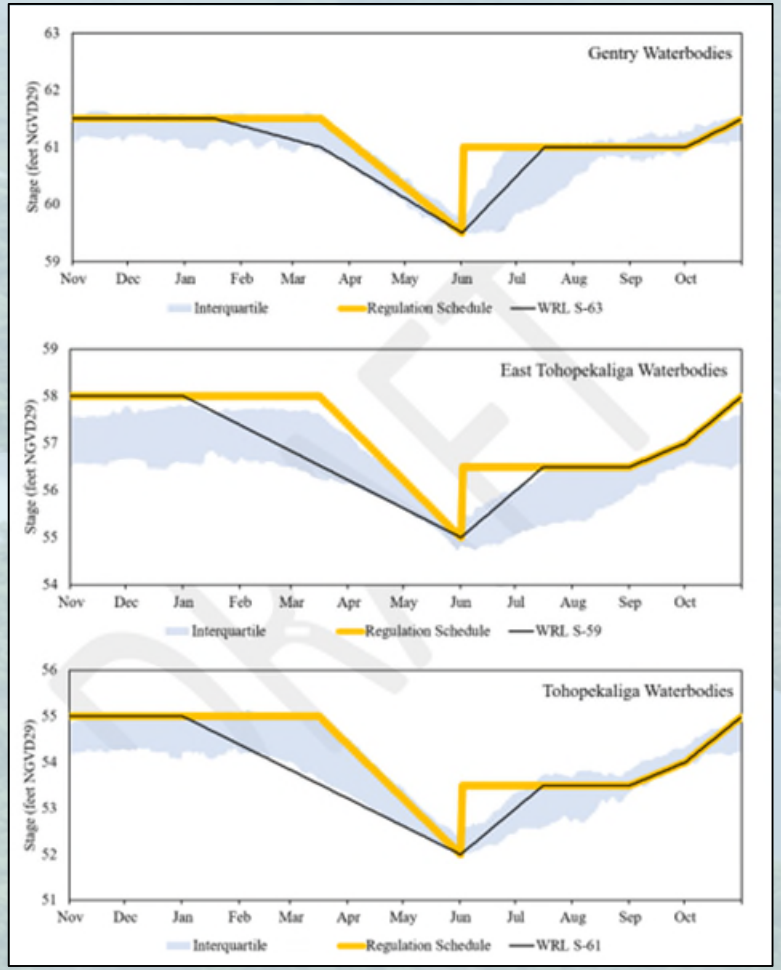
- Fish, birds, and habitat (lake littoral vegetation)
- Amphibians and reptiles
- Hydrology (regulation schedules)
- Links between biology and hydrology





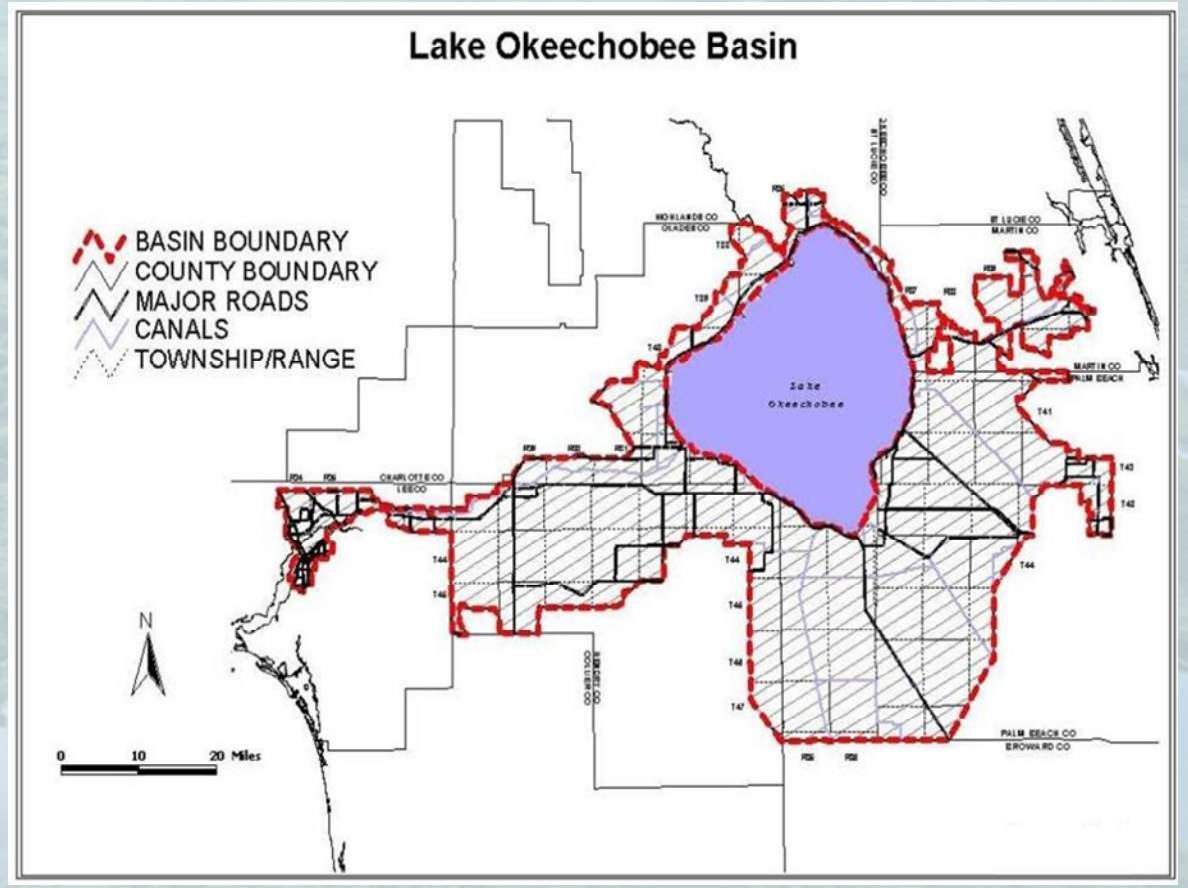
Methods & Analyses to Identify Reserved Water

- Rationale for:
  - Reserving all surface water in the Kissimmee River and Headwaters Revitalization Lakes
  - Establishing water reservation lines in the Upper Chain of Lakes
- Evaluation of impacts to existing legal users



Methods & Analyses to Identify Reserved Water

- Additional criteria :
  - S-65 “downstream threshold”
  - Lake Okeechobee constraint for the Lake Okeechobee Service Area
- UK-OPS Model to evaluate proposed future water use withdrawals



Appendices

A. Water Reservation Waterbodies and Contributing Areas
B. Water Proposed for Reservation
C. Documentation Report for the UK-OPS Model
D. Peer-Review Reports for the UK-OPS Model
E. 2009 Peer-Review Report
F. Additional Floral and Faunal Communities in the Kissimmee River and Floodplain

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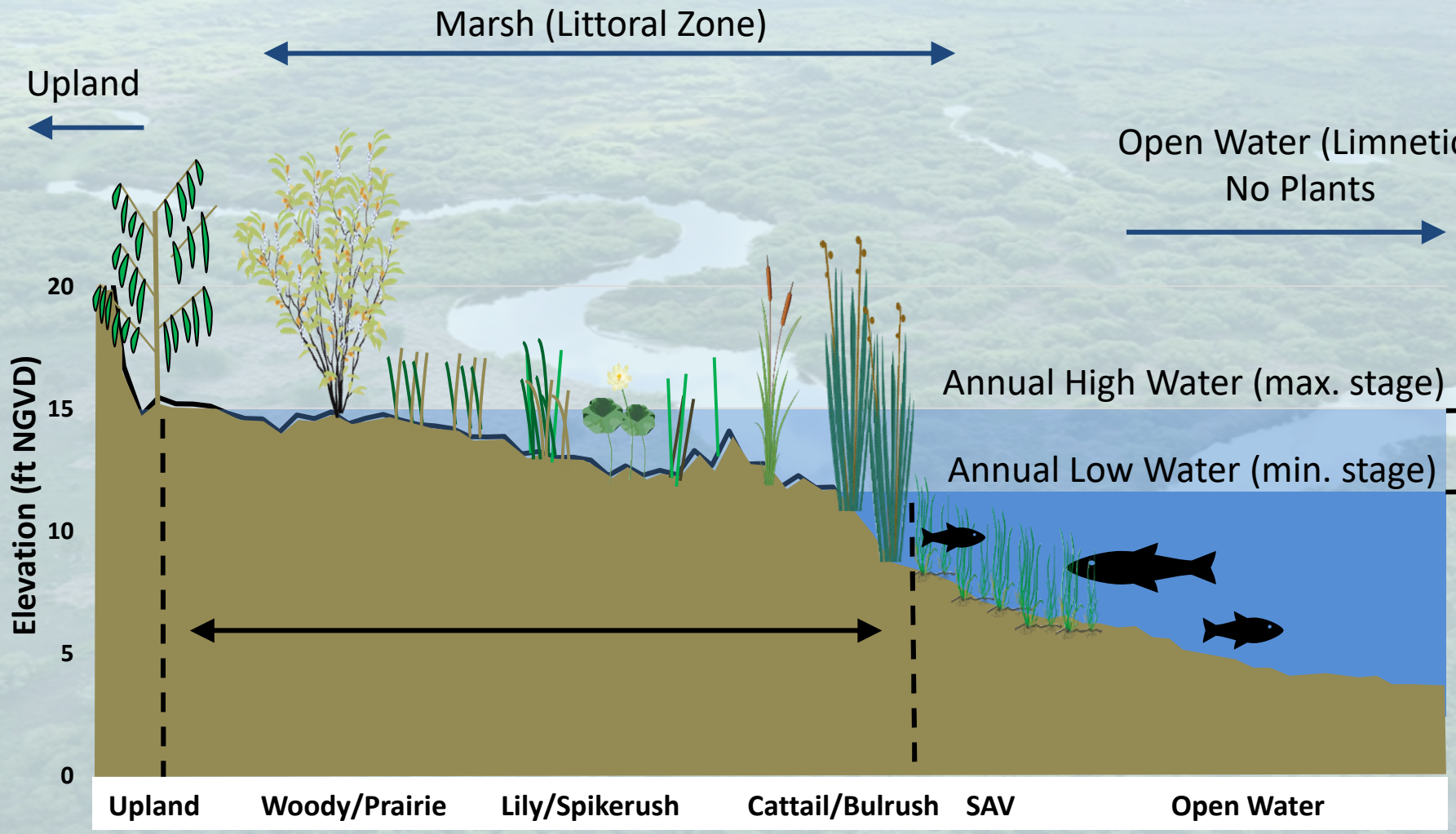
Water Reservations for the Upper Chain of Lakes

Zach Welch

Applied Sciences Bureau

Photo: Kissimmee River

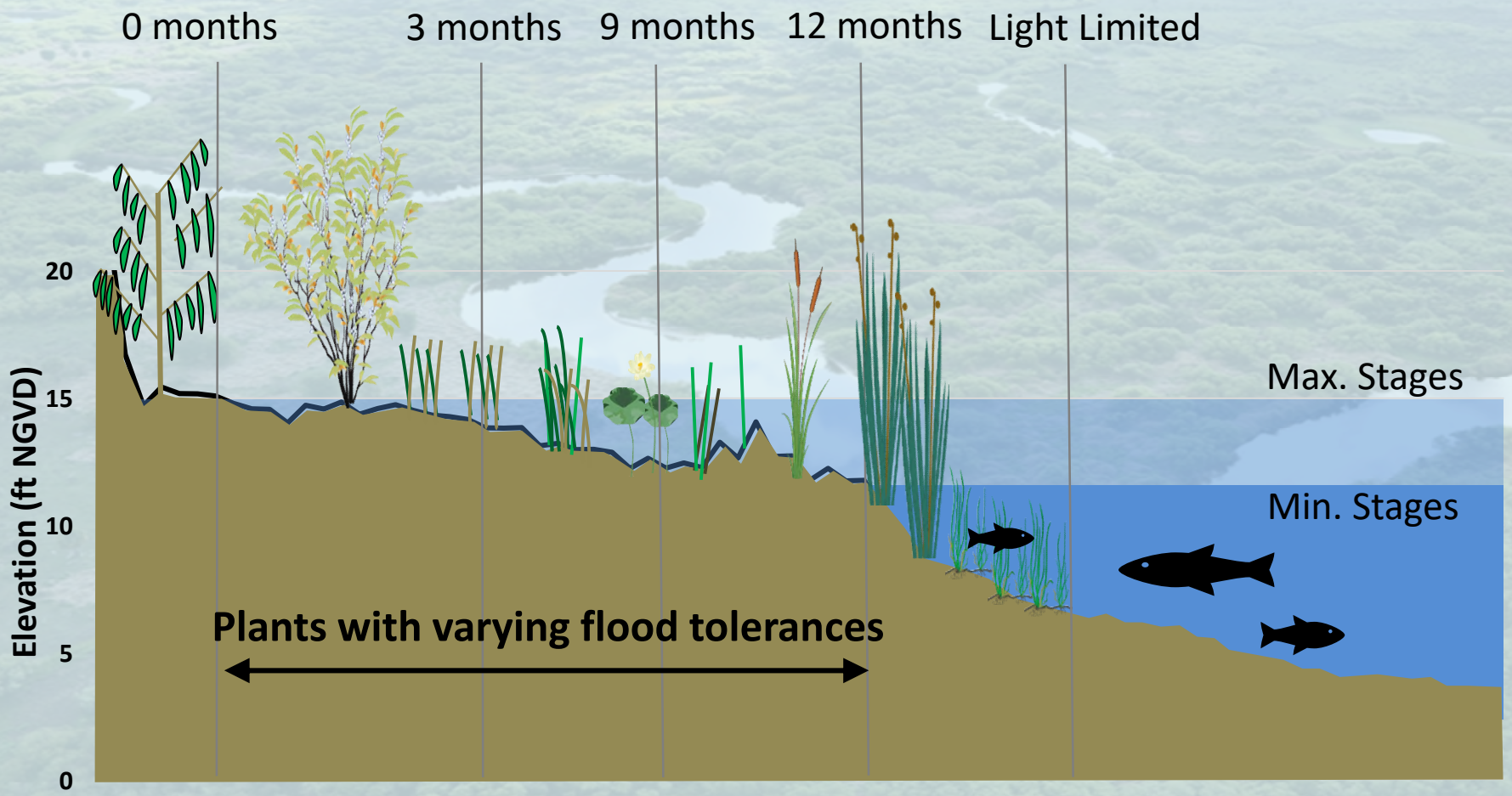
Fish and Wildlife Habitat in Waterbodies



Hydrology affects habitat

- *Type*
- *Quantity*
- *Availability*

Water Depth and Period of Flooding Affect Plant Types and Locations



Hydrology affects habitat

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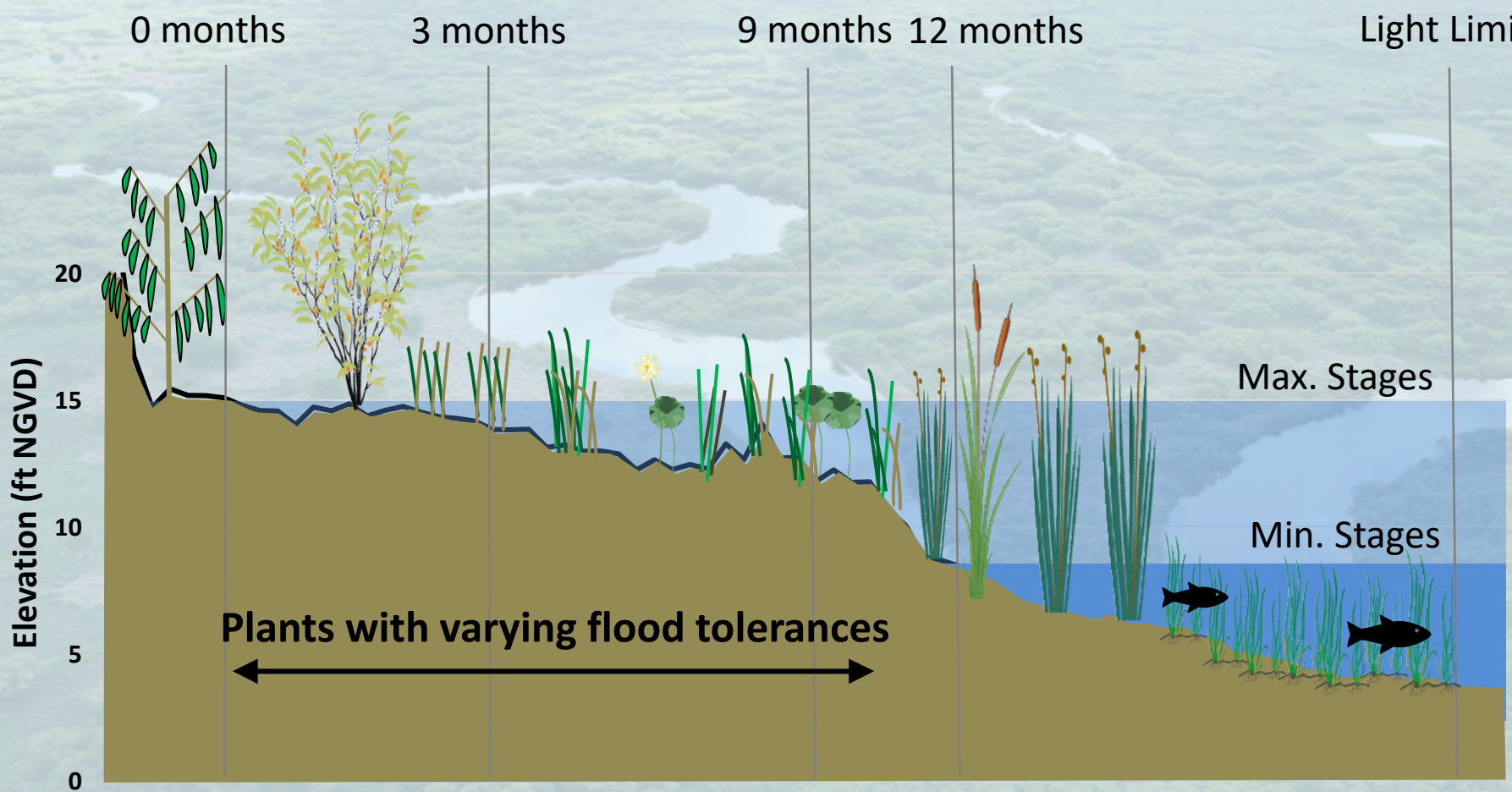
Water Depth and Period of Flooding Affect Plant Types and Locations



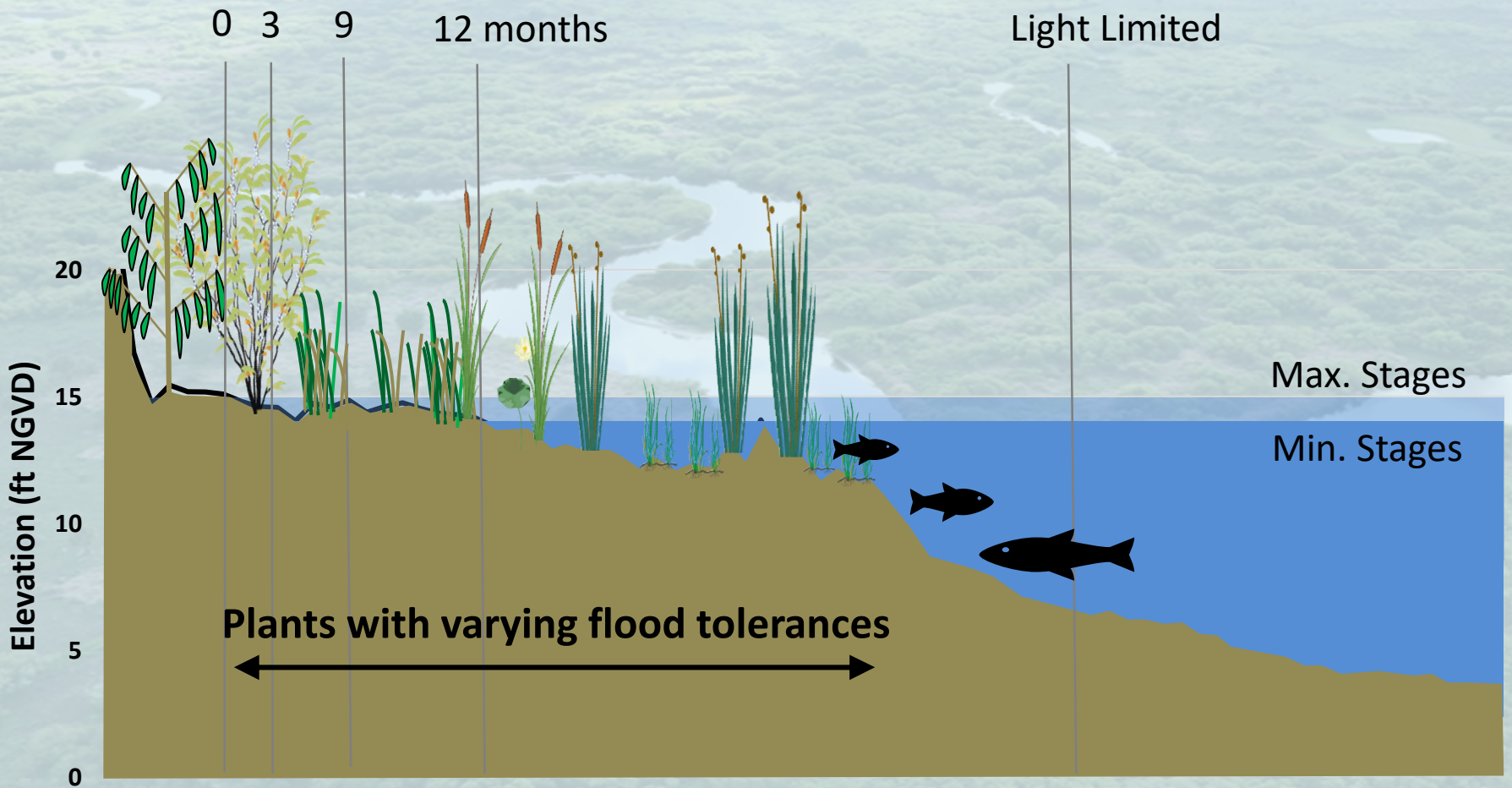
Hydrology affects habitat

- *Type*
- *Quantity*
- *Availability*

Same Maximum

Lower Annual Minimum

Water Depth and Period of Flooding Affect Plant Types and Locations

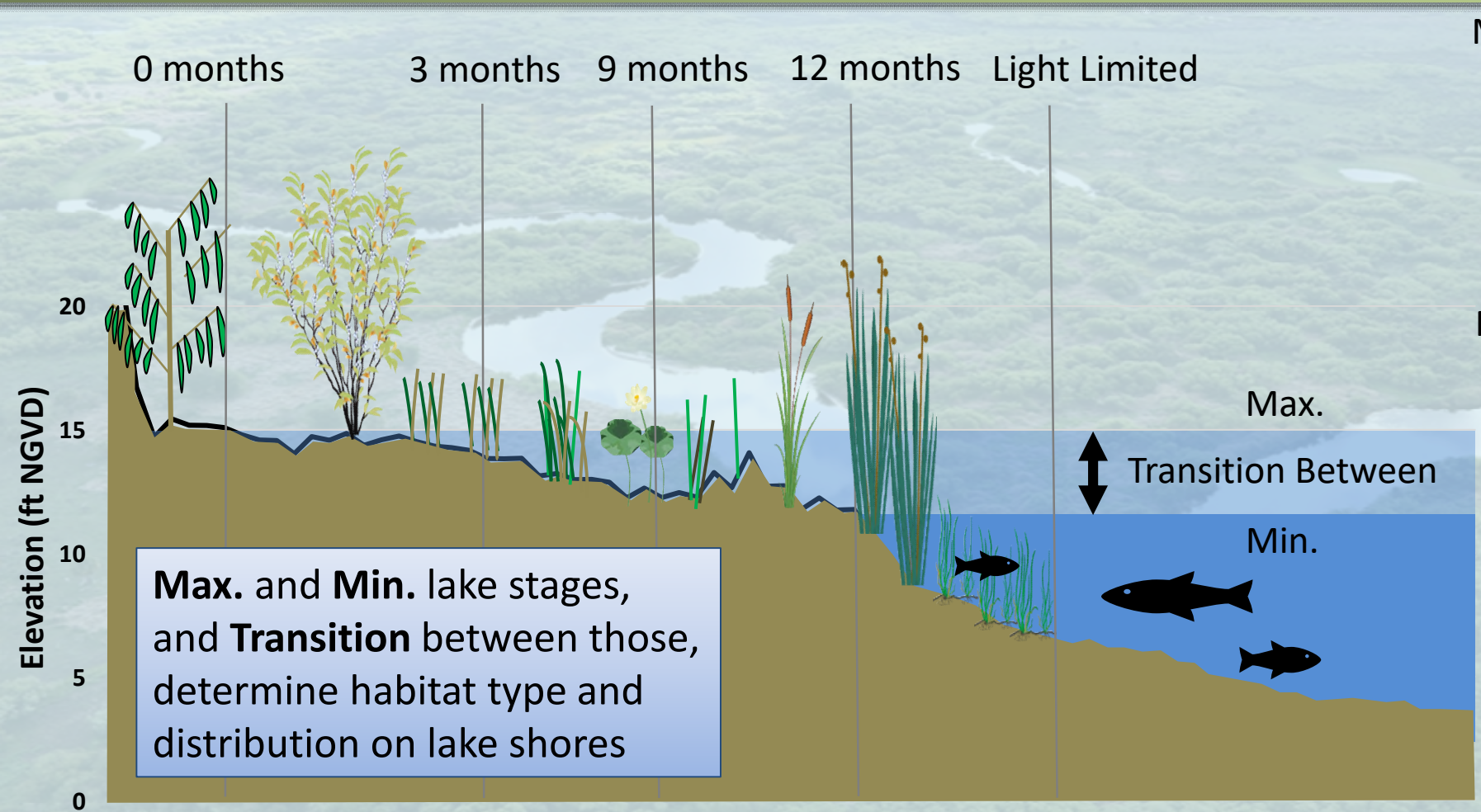


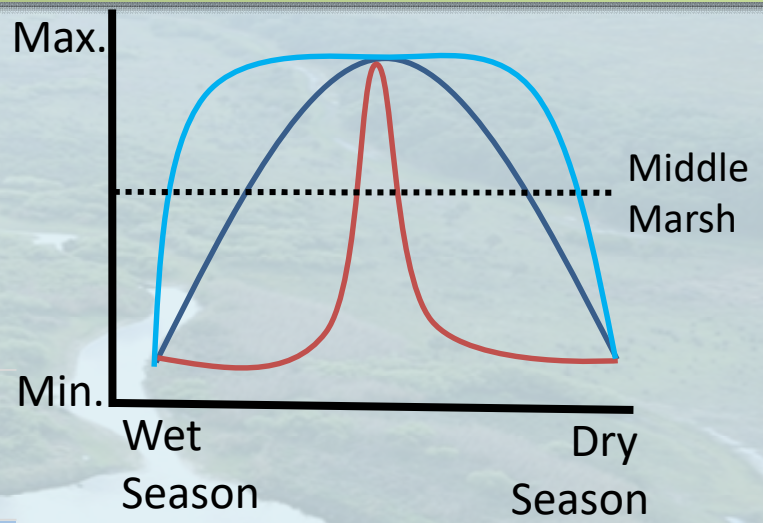
Hydrology affects habitat

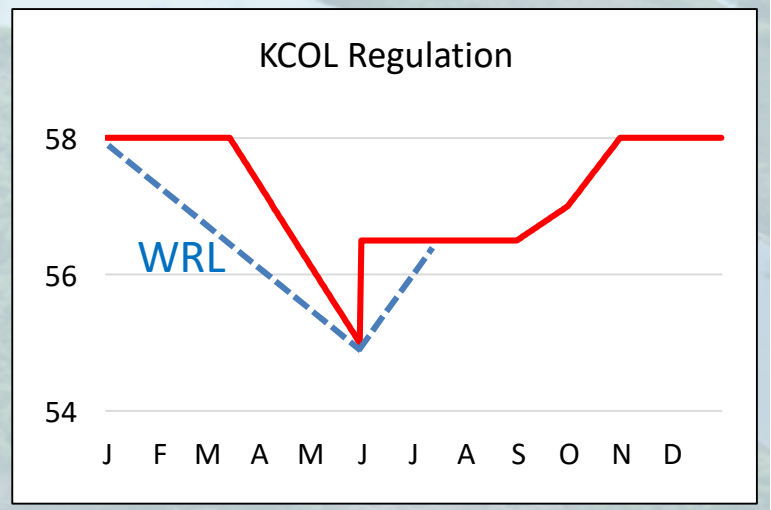
- *Type*
- *Quantity*
- *Availability*

Same Maximum
Higher Annual Minimum

Water Depth and Period of Flooding Affect Plant Types and Locations





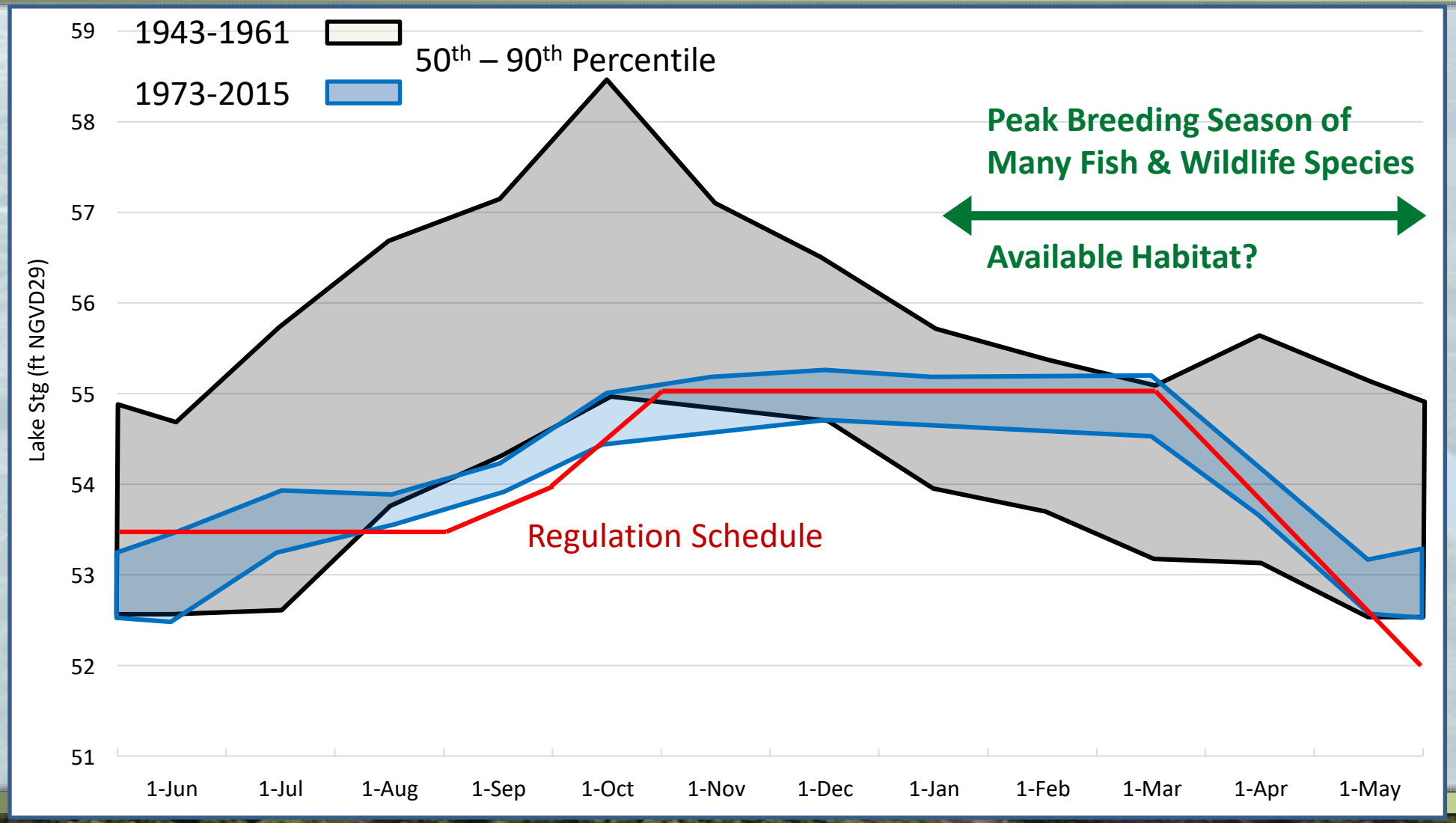


KCOL Waterbodies: Shallow, Subtropical, Nutrient-Rich

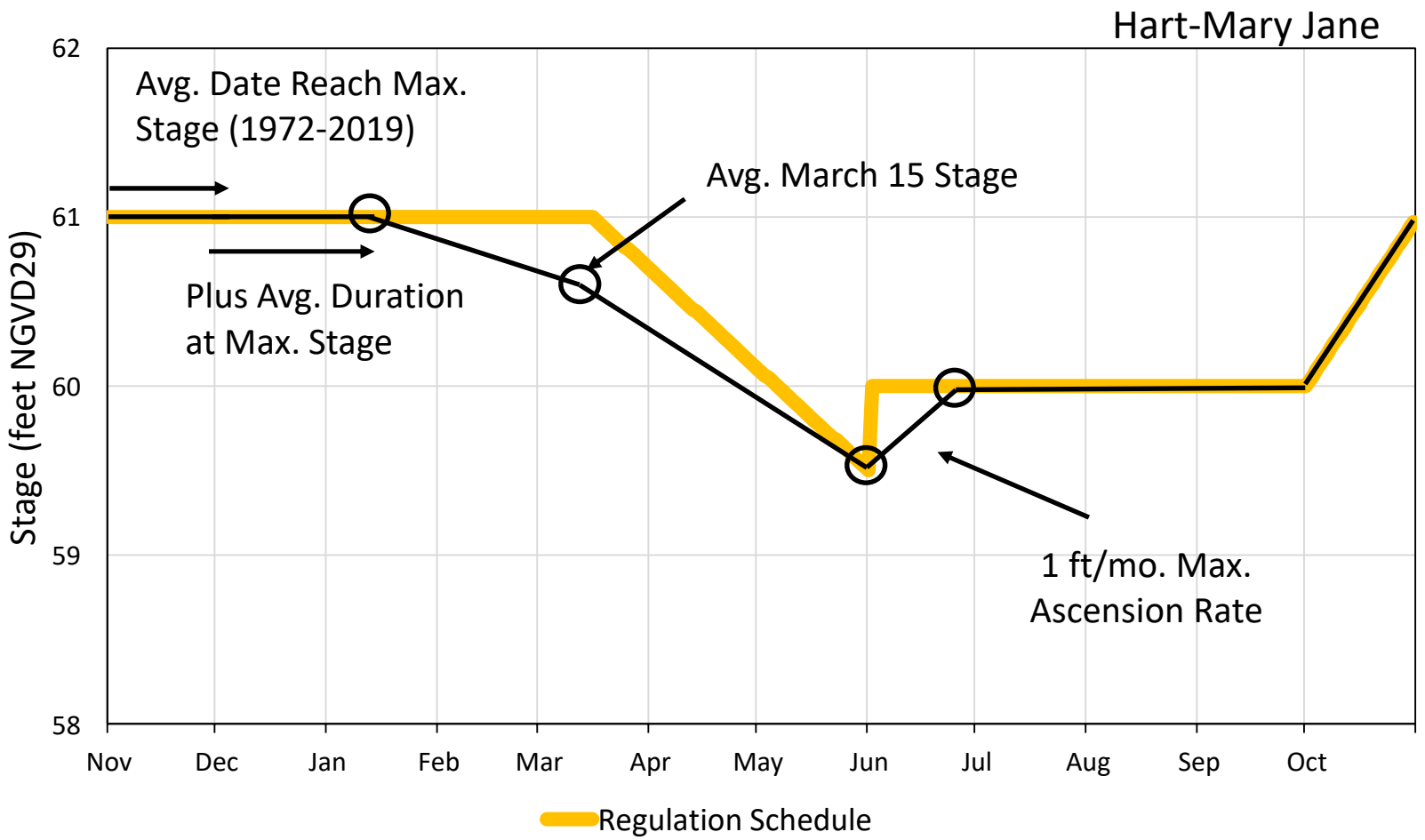
- Littoral marsh can occupy large portions of lakes
- Extremely productive habitats for fish and wildlife
- World-renowned fisheries and wildlife populations
- First filter for water headed south

Lake Tohopekaliga Broadleaf Marsh

KCOL Waterbodies: Highly Managed Water Levels



Water Reservation Lines and Historical Stages



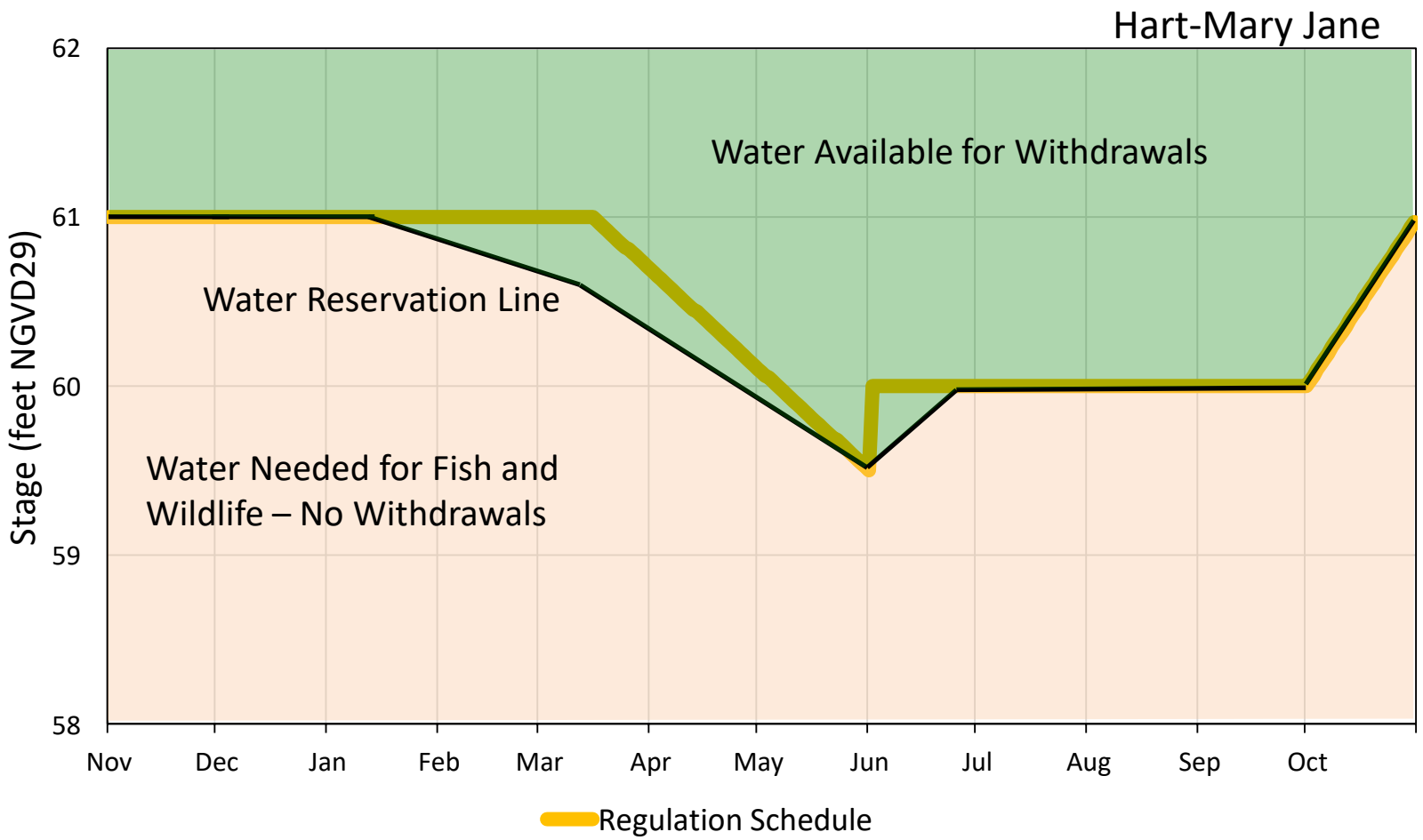
Protecting maximum lake stages and durations

Protecting breeding season stages

Protecting minimum lake stages

Protecting transition from minimum to maximum and lake refill capacity

Water Reservation Lines and Historical Stages



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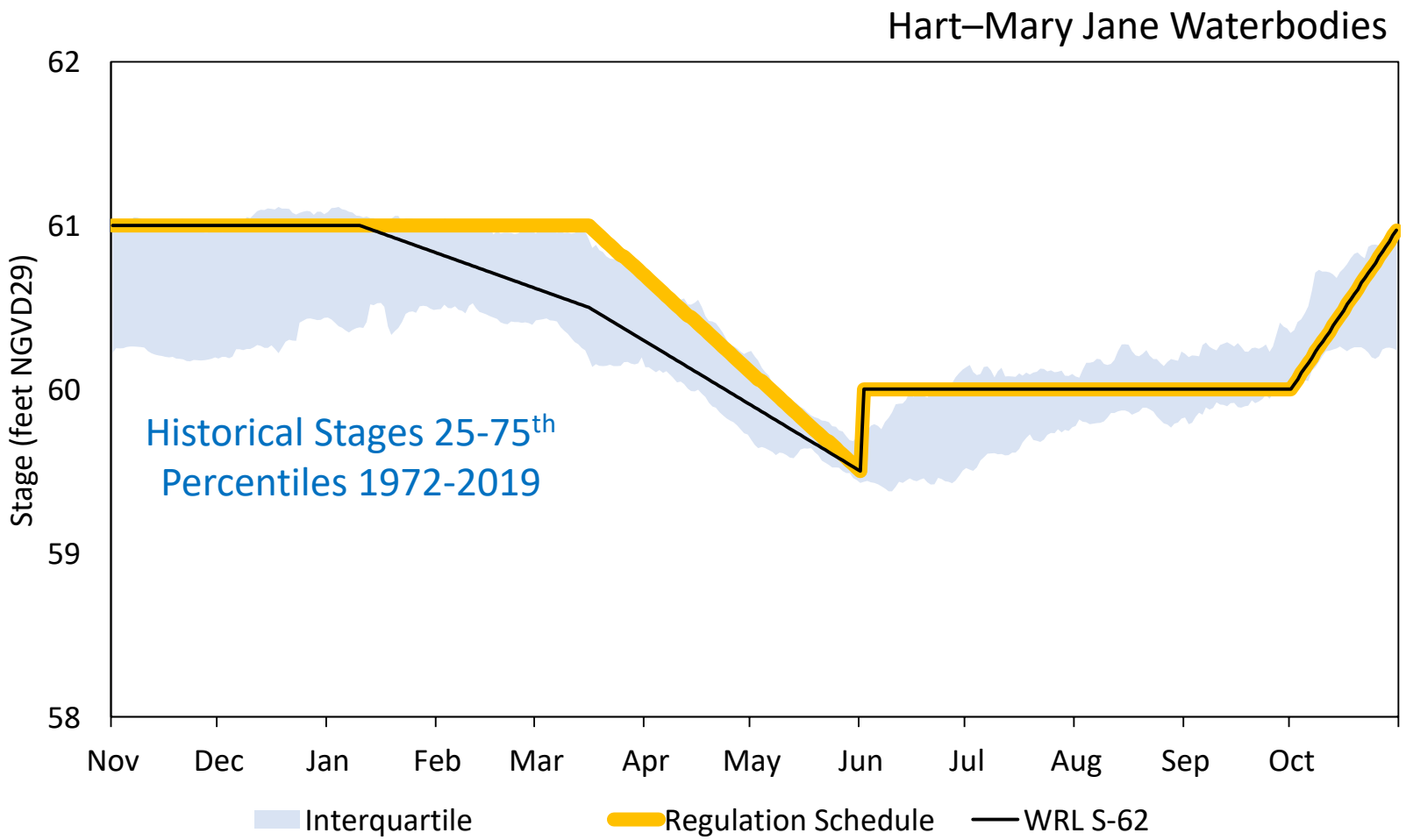
Water Reservation Lines and Historical Stages



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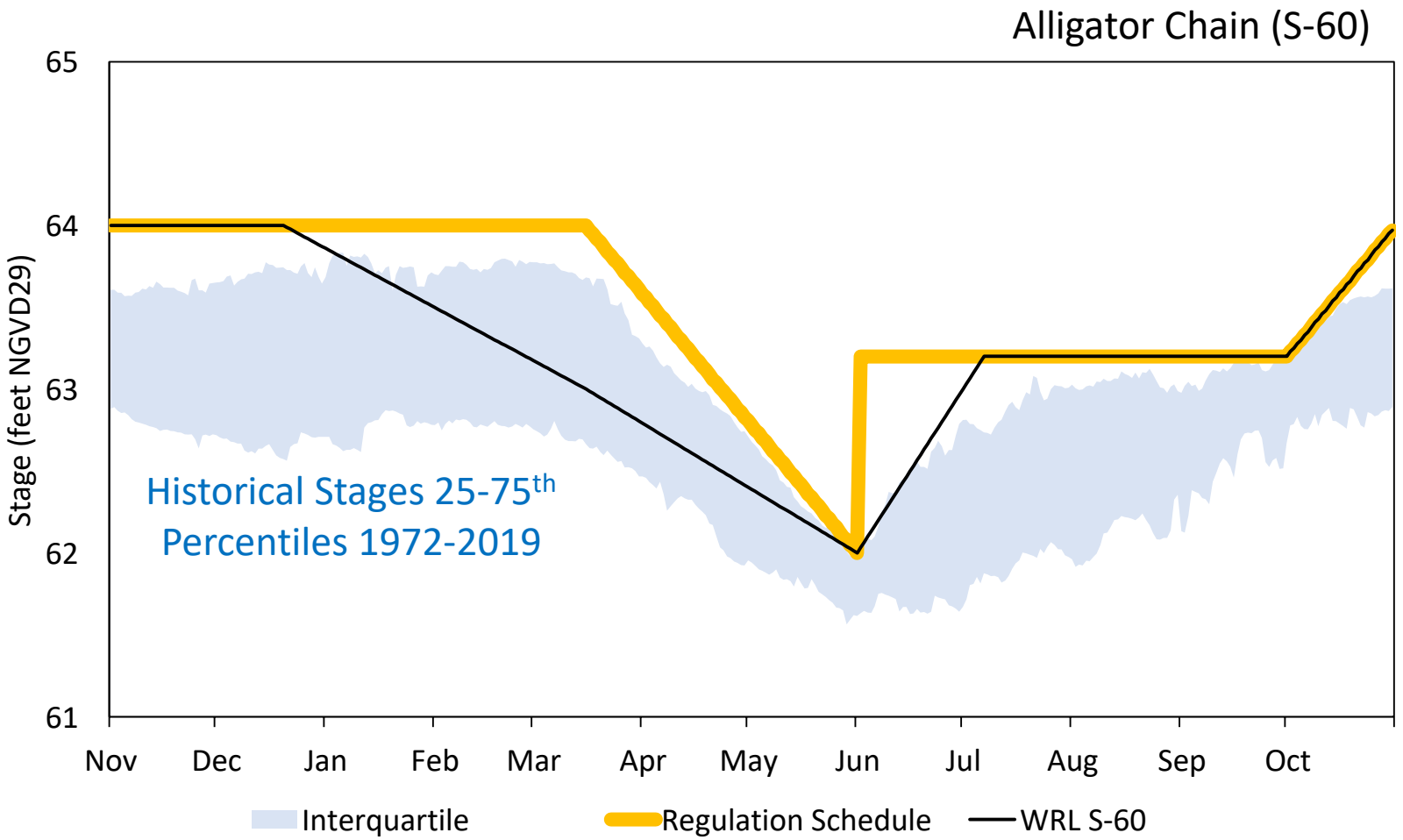

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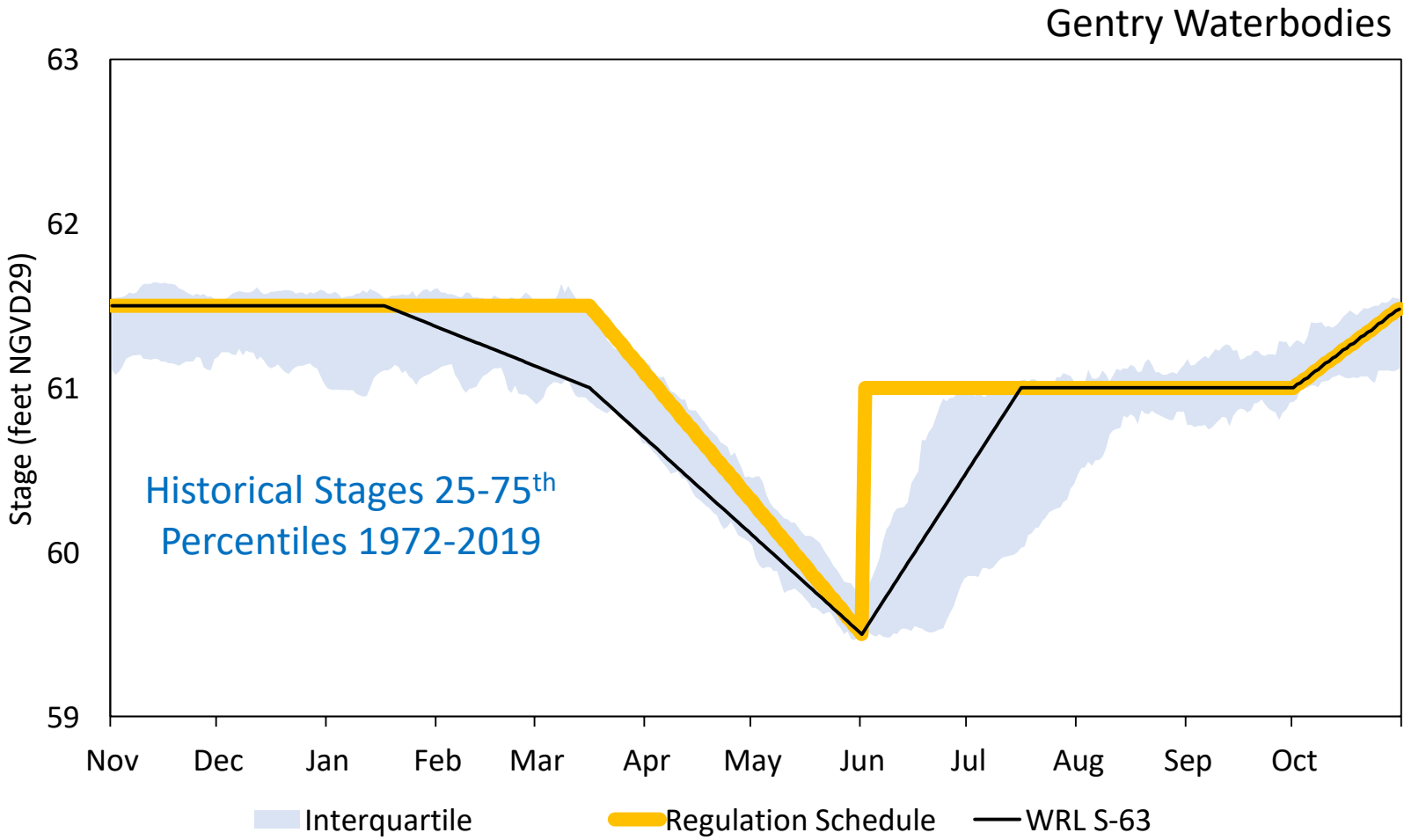
Water Reservation Lines and Historical Stages



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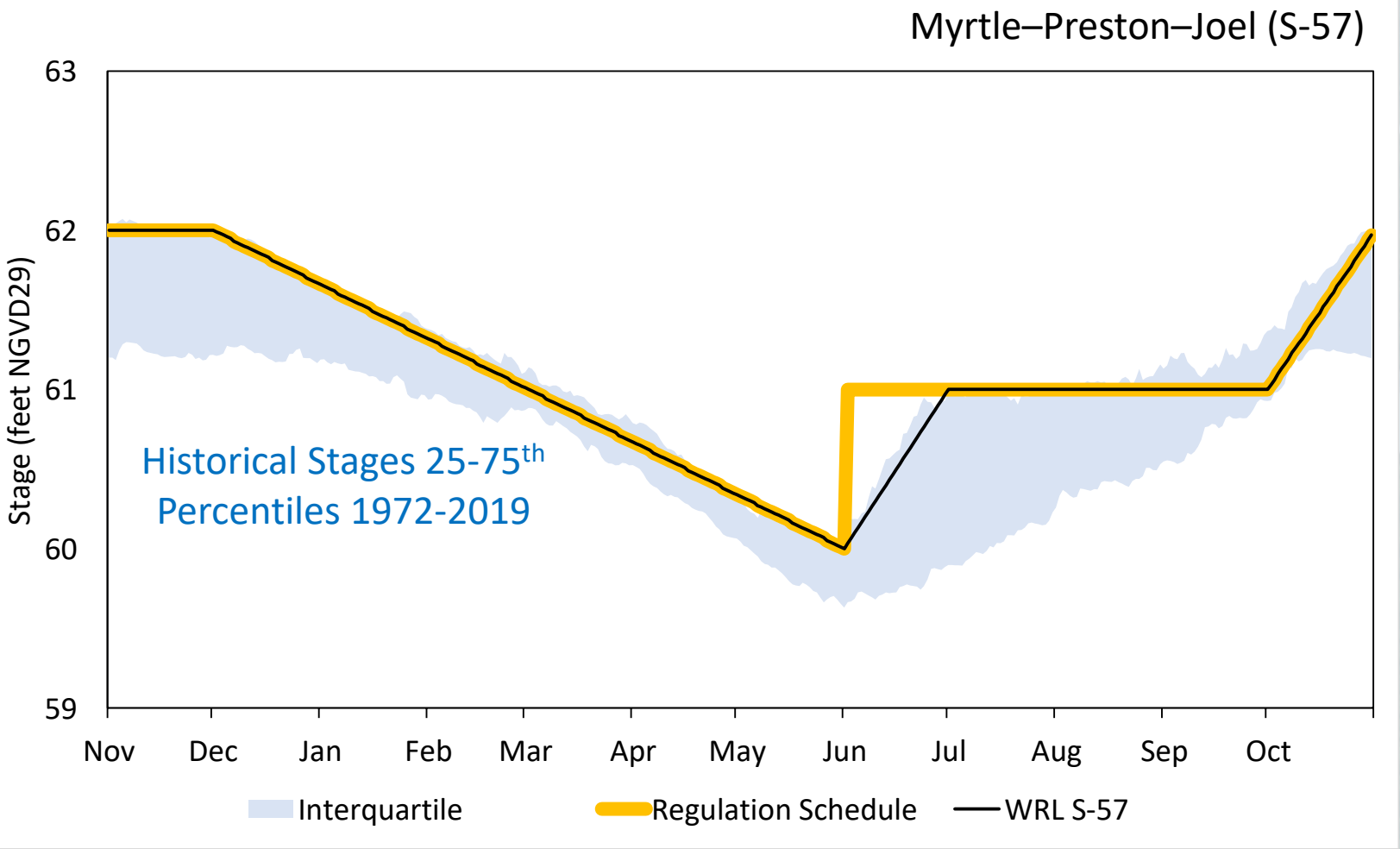
Water Reservation Lines and Historical Stages



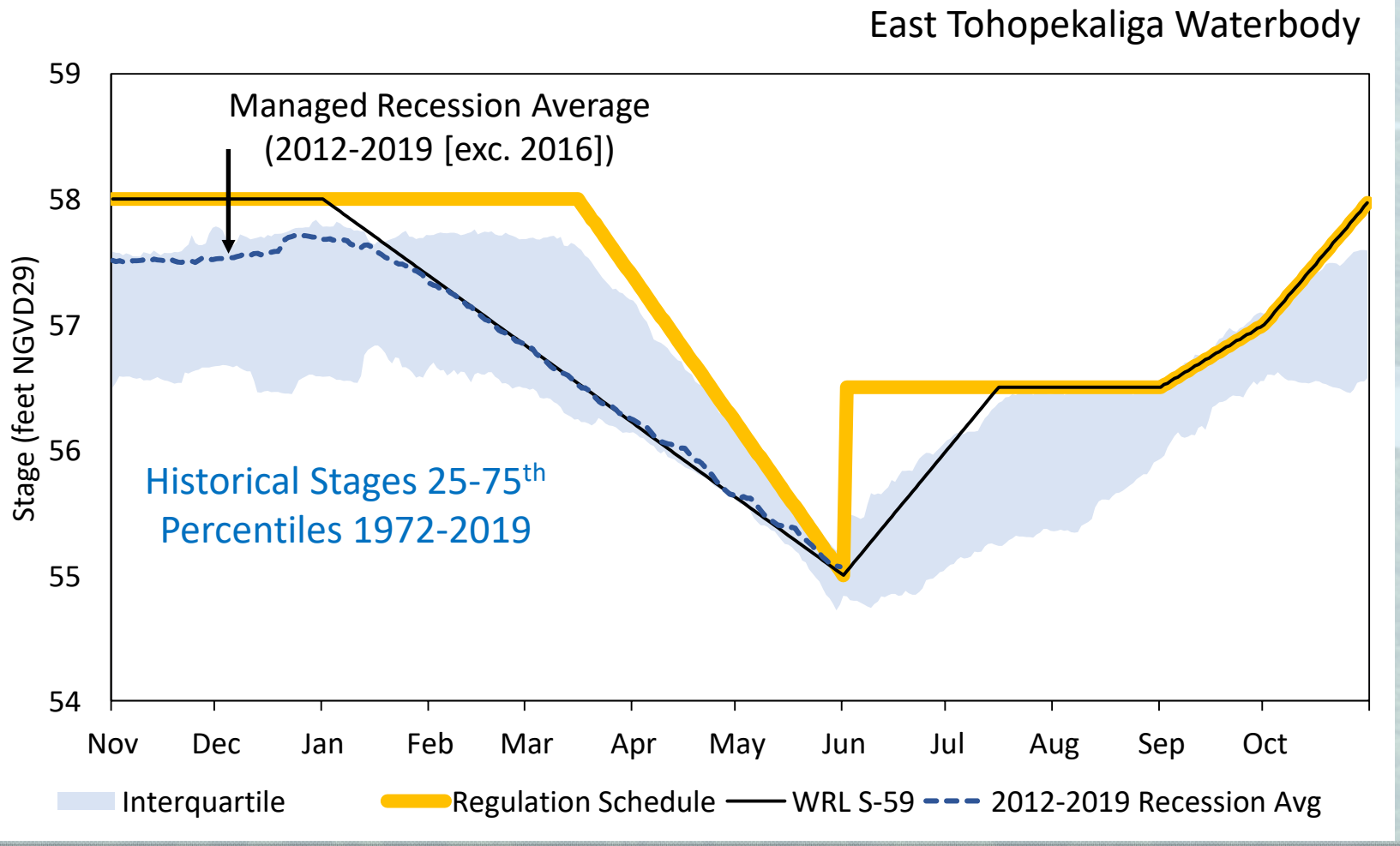
Protecting maximum lake stages and durations

Protecting breeding season stages

Protecting minimum lake stages

Protecting transition from minimum to maximum and lake refill capacity

Water Reservation Lines and Historical Stages



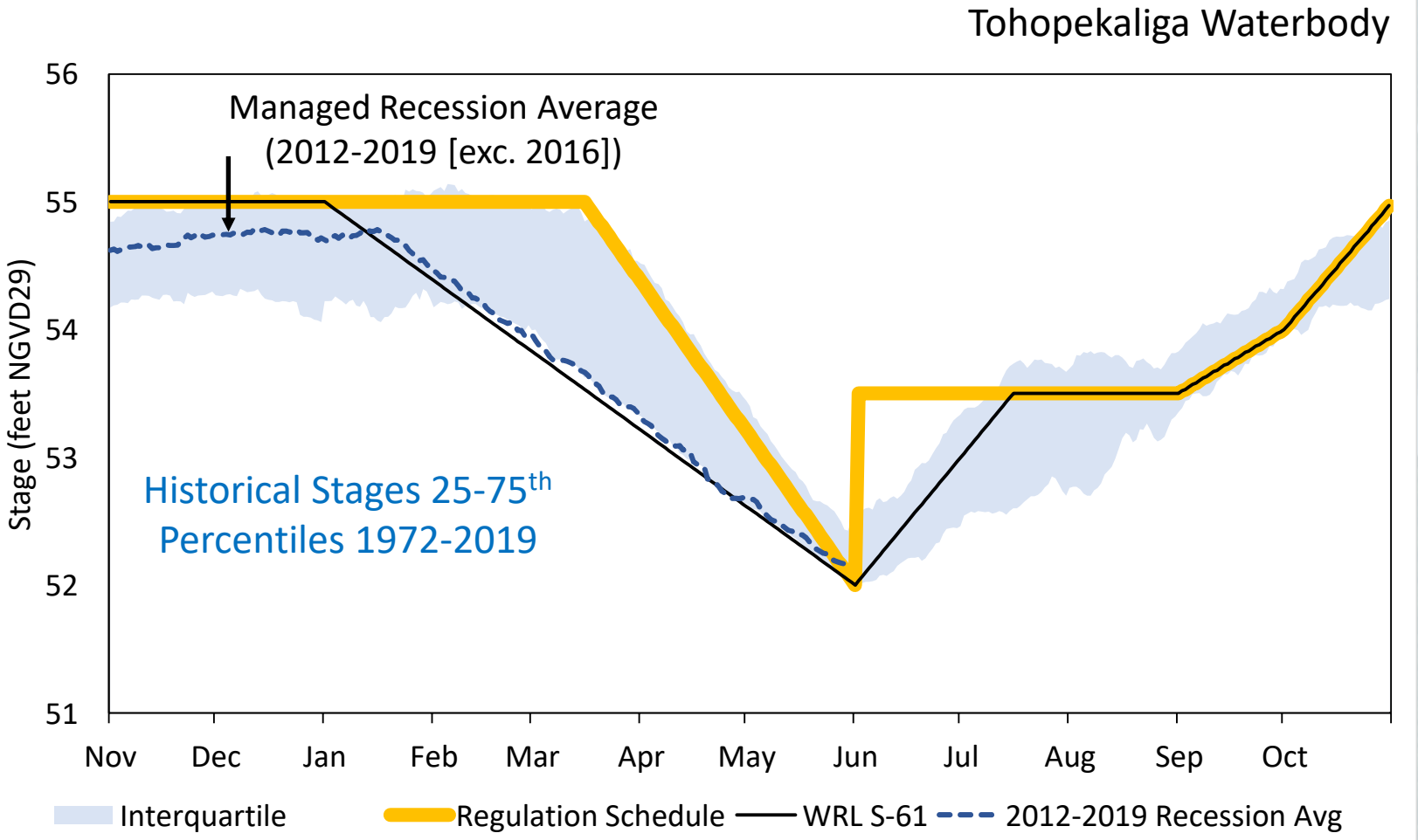
Protecting maximum lake stages and durations

Protecting breeding season stages *and recession rates*

Protecting minimum lake stages

Protecting transition from minimum to maximum and lake refill capacity

Water Reservation Lines and Historical Stages



Protecting maximum lake stages and durations

Protecting breeding season stages *and recession rates*

Protecting minimum lake stages

Protecting transition from minimum to maximum and lake refill capacity

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Downstream Check at Structure 65

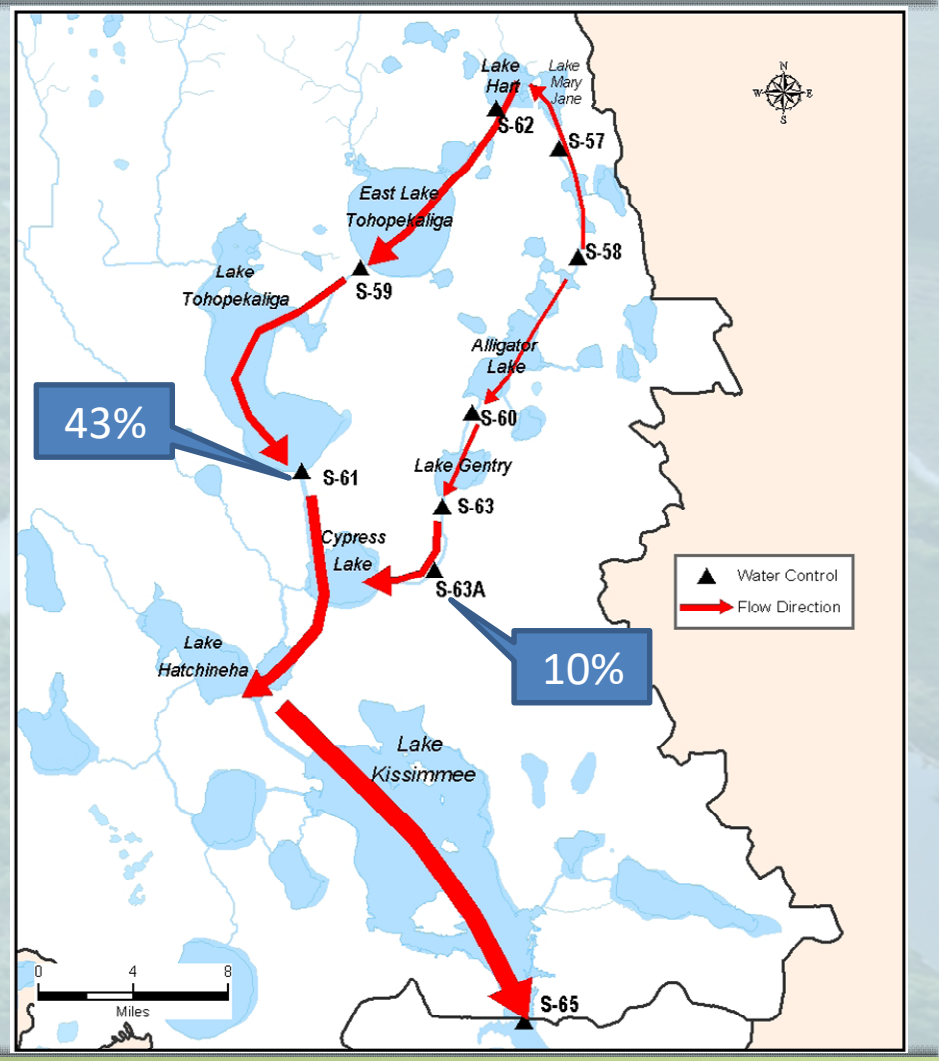
David Anderson

Applied Sciences Bureau

Photo: Kissimmee River

Downstream Check on Allocations from the Upper Chain of Lakes

- Inflows from the Upper Chain of Lakes (S-61, S-63A) account for 53% of the S-65 discharge on an average annual basis
- Allocations from the Upper Chain of Lakes could reduce S-65 discharge to the Kissimmee River
- Therefore, a check on allocations from the Upper Chain of Lakes is needed to protect fish and wildlife in the Headwaters Revitalization Lakes and the Kissimmee River and floodplain



Downstream Check Based on S-65 Target Time Series

- Upper Target Time Series just met the river performance measures
- Lower Target Time Series just met a reduced set of performance measures
- Together, the Upper and Lower Target Time Series represent a range of flows at S-65 that protect fish and wildlife in the Kissimmee River and floodplain

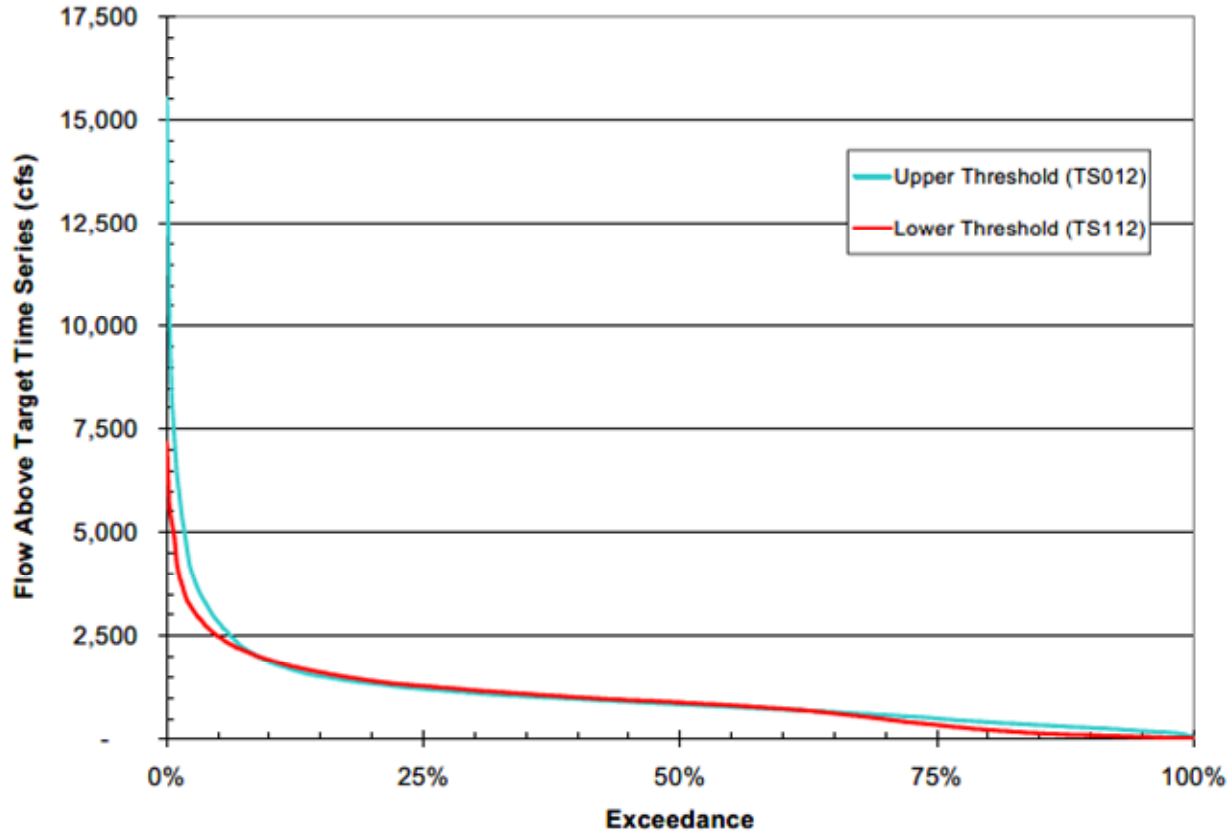


Figure 7-17. Target time series of inflows at the S-65 Structure expressed as an exceedance curve (includes upper and lower threshold)

Downstream Check at S-65

- The Upper and Lower Target Time Series indicate how much the S-65 discharge can be reduced and still protect fish and wildlife in the Kissimmee River
- Allowing a reduction from the Upper Target Time Series to the midpoint between Upper and Lower provides an additional margin of safety for the protection of fish and wildlife in the Kissimmee River
- Average annual discharge:
  - Upper Target Time Series: 1,077 cfs
  - Midpoint: 1,026.5 cfs
  - Lower Target Time Series: 976 cfs
- Reduction of the average annual discharge from the Upper Target Time Series to the midpoint is 5%
- **Limiting allocations from the Upper Chain of Lakes so that collectively they do not reduce the average annual discharge at S-65 by more than 5% should protect fish and wildlife in the Kissimmee River and floodplain**

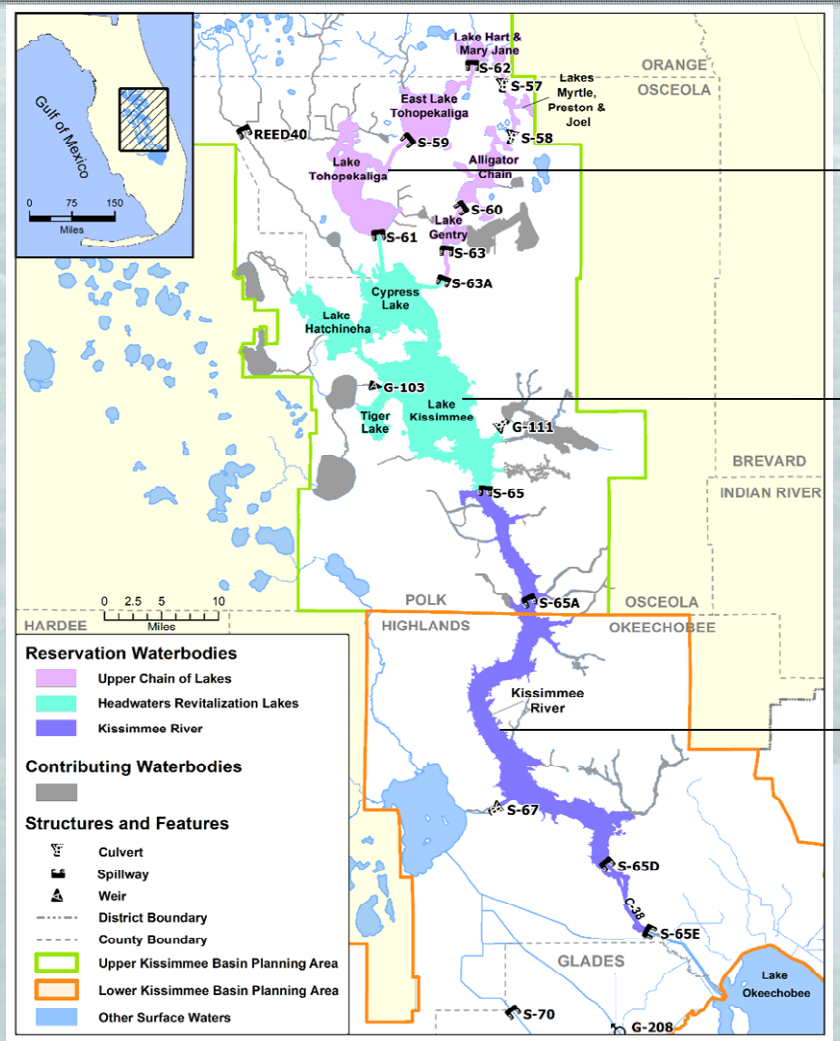
Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Changes to the Draft Water Reservation Rules & Permitting Criteria

Nicholas Vitani, P.G.
Water Use Bureau

Photo: Kissimmee River

Kissimmee River and Chain of Lakes Reservation Waterbodies



Upper Chain of Lakes
Lakes Hart-Mary Jane, Lakes Myrtle-Preston-Joel, Alligator Chain of Lakes, Lake Gentry, Lake Tohopekaliga, East Lake Tohopekaliga, and associated canals

Headwaters Revitalization Lakes
Lakes Kissimmee, Cypress, Hatchineha, and Tiger, and associated canals

Kissimmee River and Floodplain
To S-65E structure north of Lake Okeechobee; includes Istokpoga Canal and floodplain, C-38 Canal, and remnant river channels from S-65 to S-65E

Rules Being Adopted or Amended

Amended

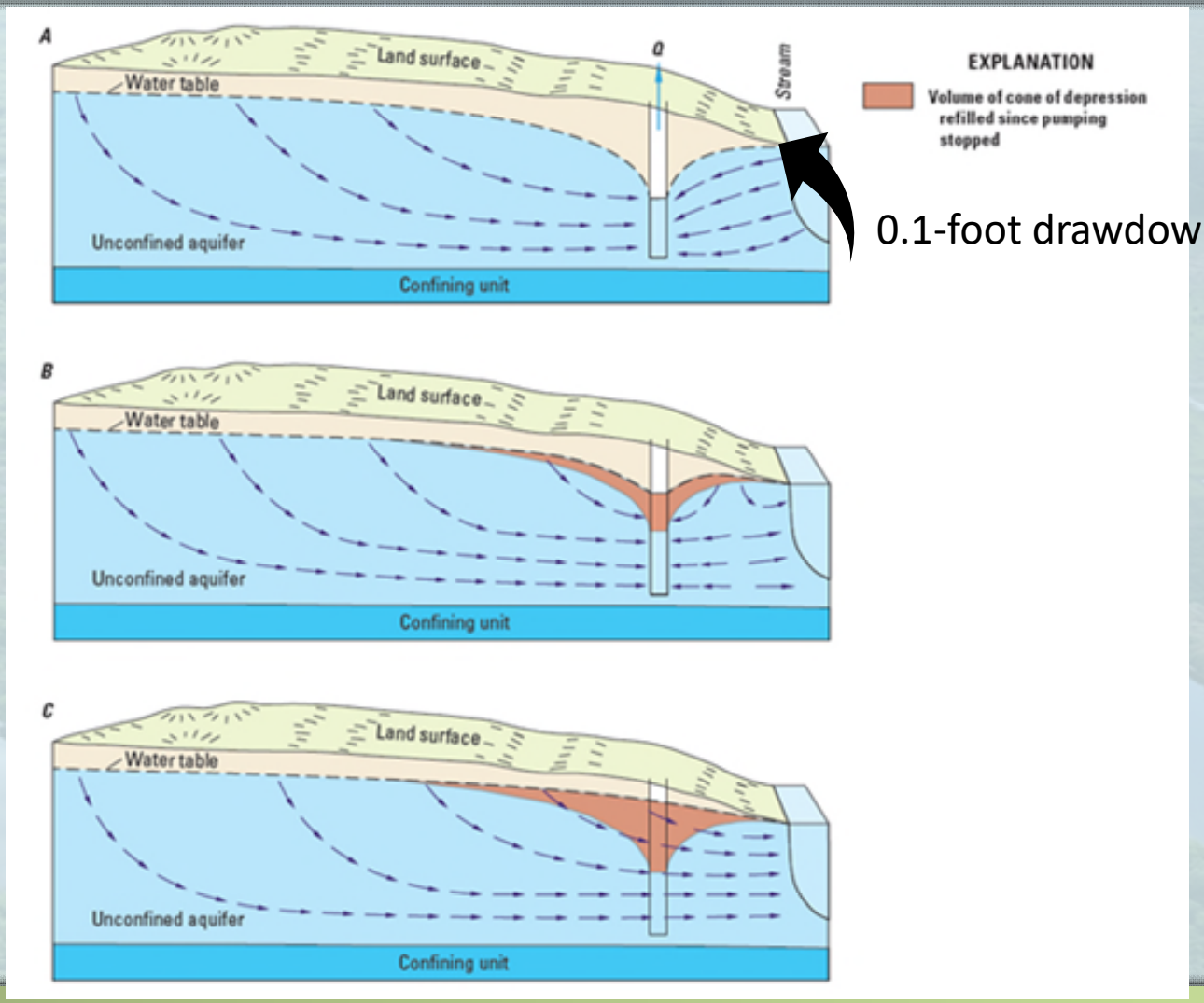
- Rule 40E-10.021, F.A.C. Definitions
- Rule 40E-10.031, F.A.C. Implementation
- Rule 40E-2.091, F.A.C. Documents incorporated by reference

New

- Rule 40E-10.071, F.A.C. Reservation
- Subsection 3.11.5 of the Applicant's Handbook: Permitting criteria

Subsection 3.11.5 Definitions

- Direct withdrawal of surface water
- Indirect withdrawal of groundwater
  - Pumping from well inducing seepage from waterbody
  - SAS wells that impose ≥0.1 foot of drawdown
  - Consistent with other portions of the Applicant's Handbook



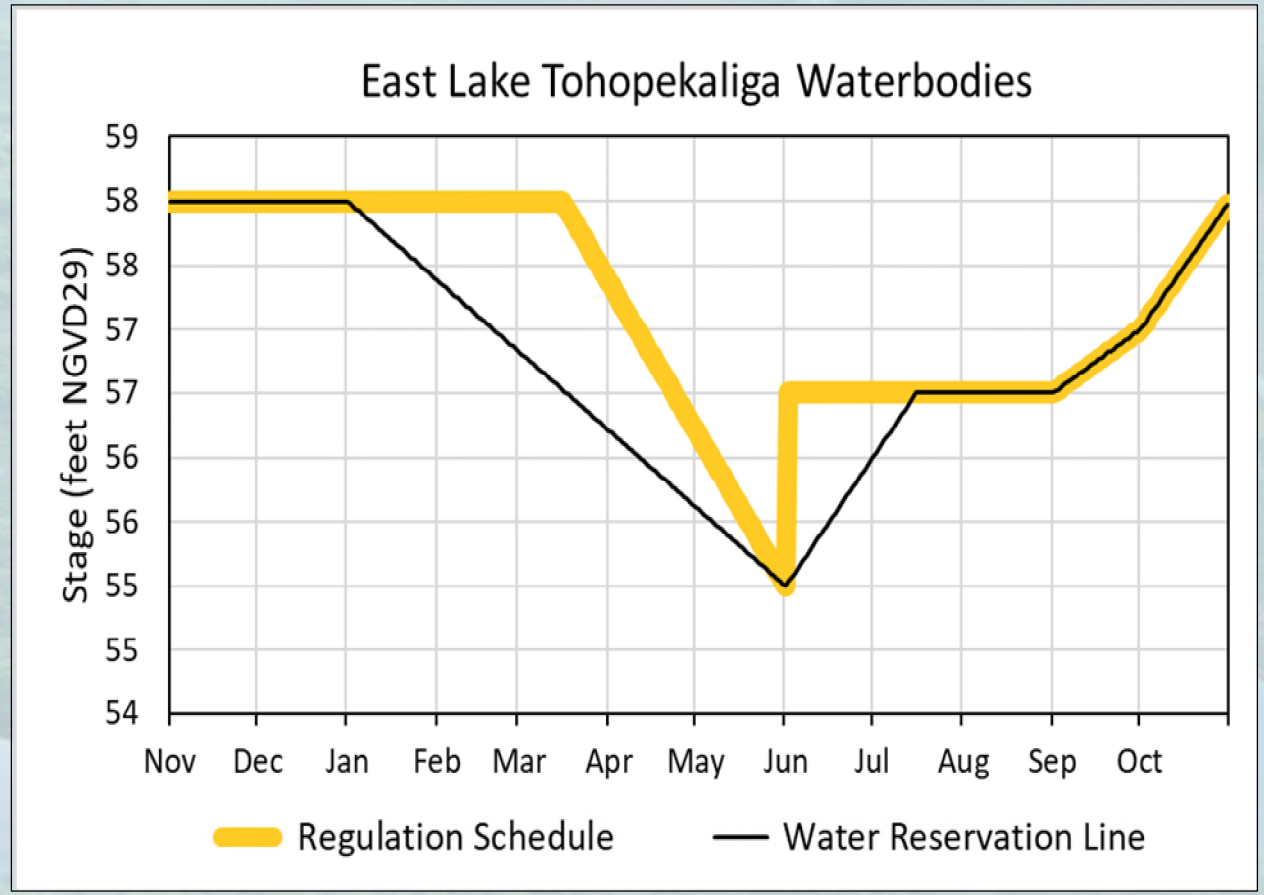
Exclusions

- Existing permitted legal users (at same or lower allocation)
- Permit renewals or transfers with no increased uses, changes in facility locations, or land use
- Withdrawals from the Floridan aquifer system
- Withdrawals by authorized dispersed water management projects
- Direct withdrawals of water when the District, as local sponsor of the C&SF Project, is discharging from reservation waterbodies for:
  - Flood protection purposes;
  - Operations associated with maintenance of C&SF Project components; or
  - Environmental releases (e.g., drawdowns)

What is Being Reserved?

Upper Chain of Lakes

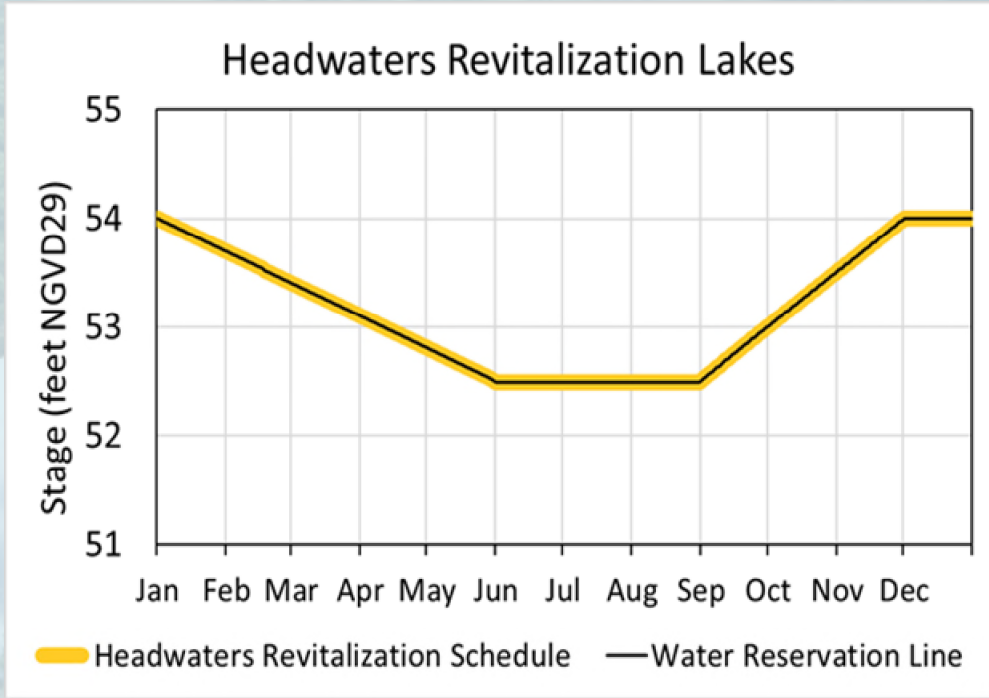
- Surface water up to the water reservation line in the lake
- Indirect withdrawals of groundwater
  - When the stage is at or below the water reservation line
- Surface water in contributing waterbodies
  - When the lake is at or below the water reservation line



What is Being Reserved?

Headwaters Revitalization Lakes & Kissimmee River and Floodplain

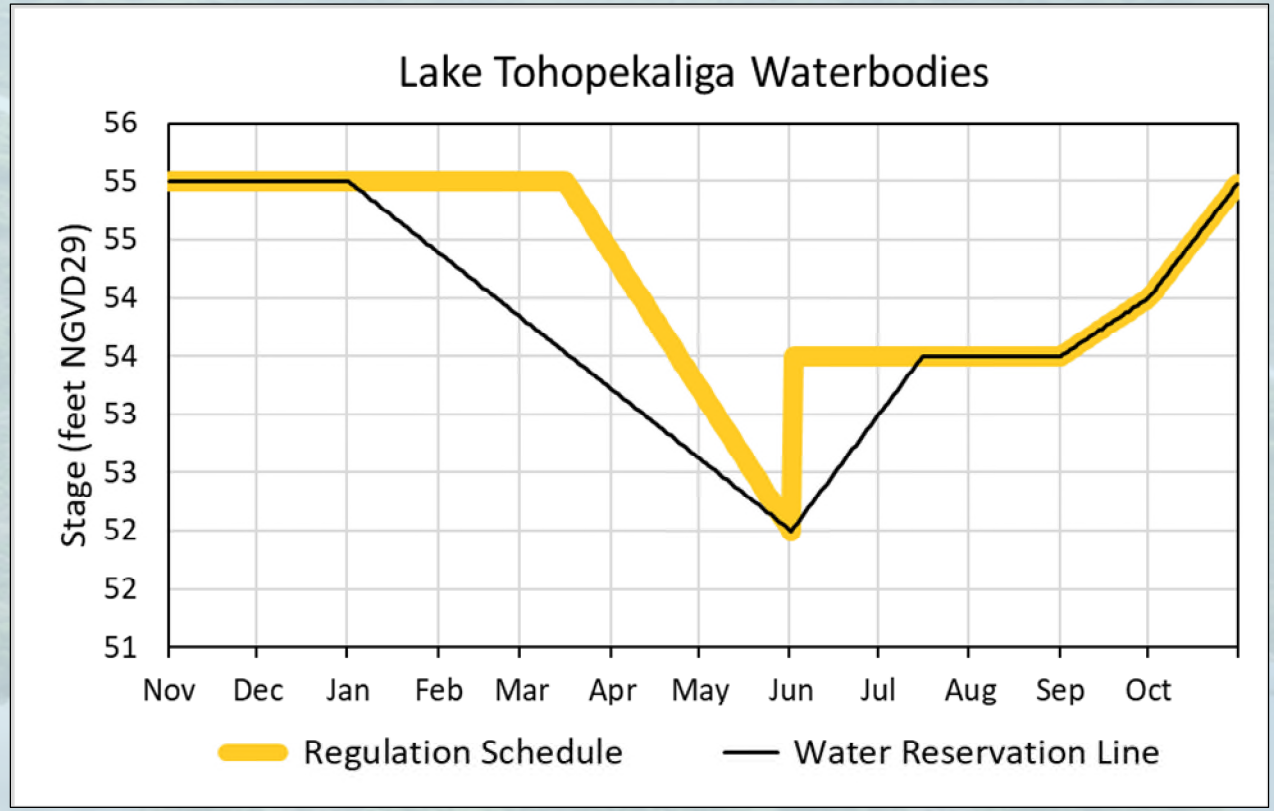
- All surface water in the lakes and river
- Groundwater and surface water from contributing waterbodies
  - When the stage is at or below the water reservation line



What is Available for Allocation?

Upper Chain of Lakes

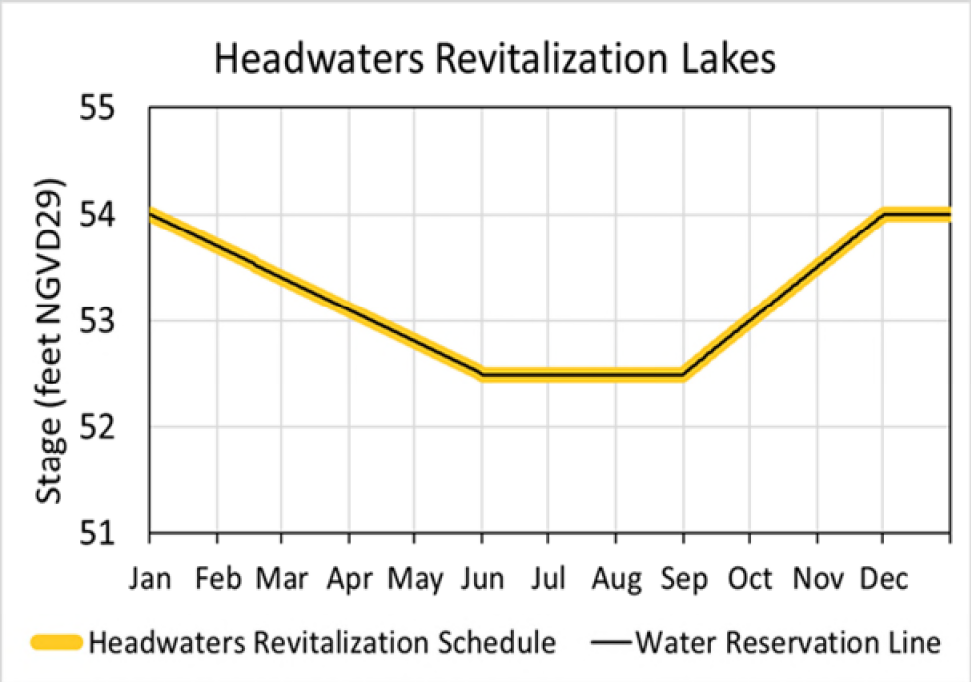
- Surface water withdrawals from an Upper Chain of Lakes reservation or contributing waterbody when the lake stage exceeds the stage in the table for that day
- Indirect withdrawals of groundwater from a reservation or contributing waterbody when the waterbody is above the stage in the table for that day



What is Available for Allocation?

<u>Headwaters Revitalization Lakes &</u>
<u>Kissimmee River and Floodplain</u>

- Direct surface water and indirect groundwater withdrawals:
  - From contributing waterbodies, **only** when the water level at S-65 is above the water reservation line



Permitting Criteria

Additional Conditions of Issuance

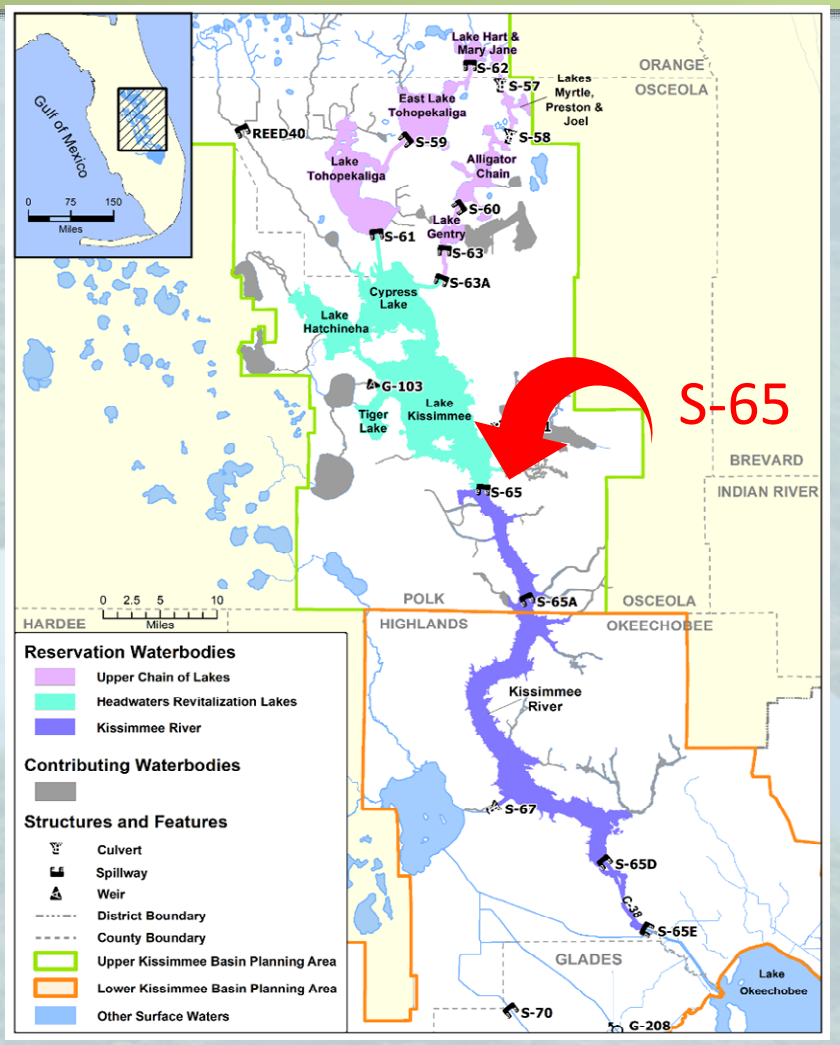
- Proposed use must be suitable to the source because allocations will not have a 1-in-10 level of certainty
- Daily allocation only
- Comply with downstream checks
- Daily checks of actual water level compared to water reservation lines before withdrawal can be made
- Daily withdrawal volumes and daily stage must be reported

Permitting Criteria

- Cumulative and proposed uses must not reduce average discharges through S-65 by more than 5% of historical avg. annual flow (4.18% remains)

Downstream Check(s)

- Daily surface and groundwater withdrawals will only be allowed when regulatory releases are being made from Lake Okeechobee to the Caloosahatchee River or St. Lucie Estuary



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Examples of Water Availability Checks and Reporting

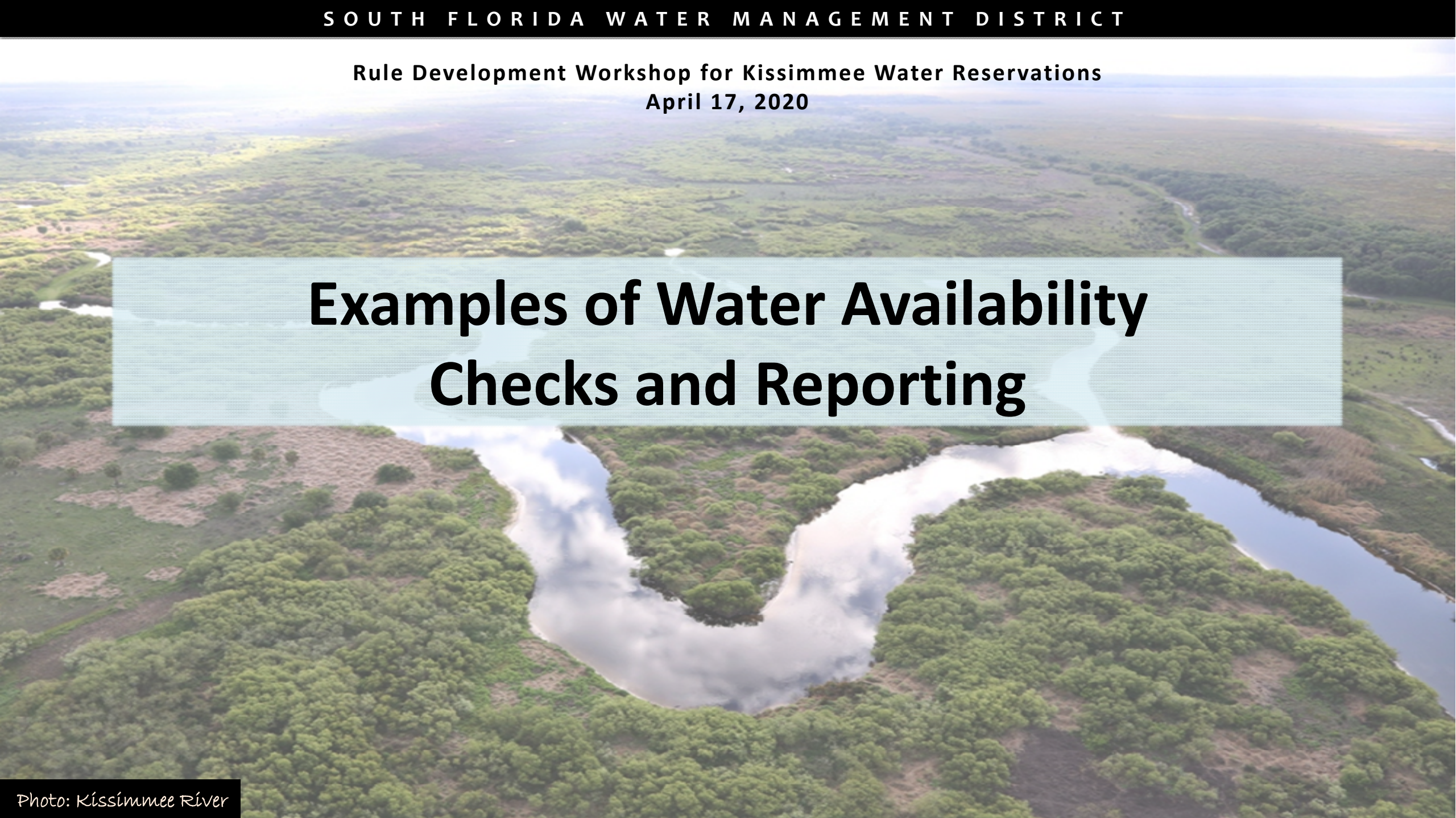
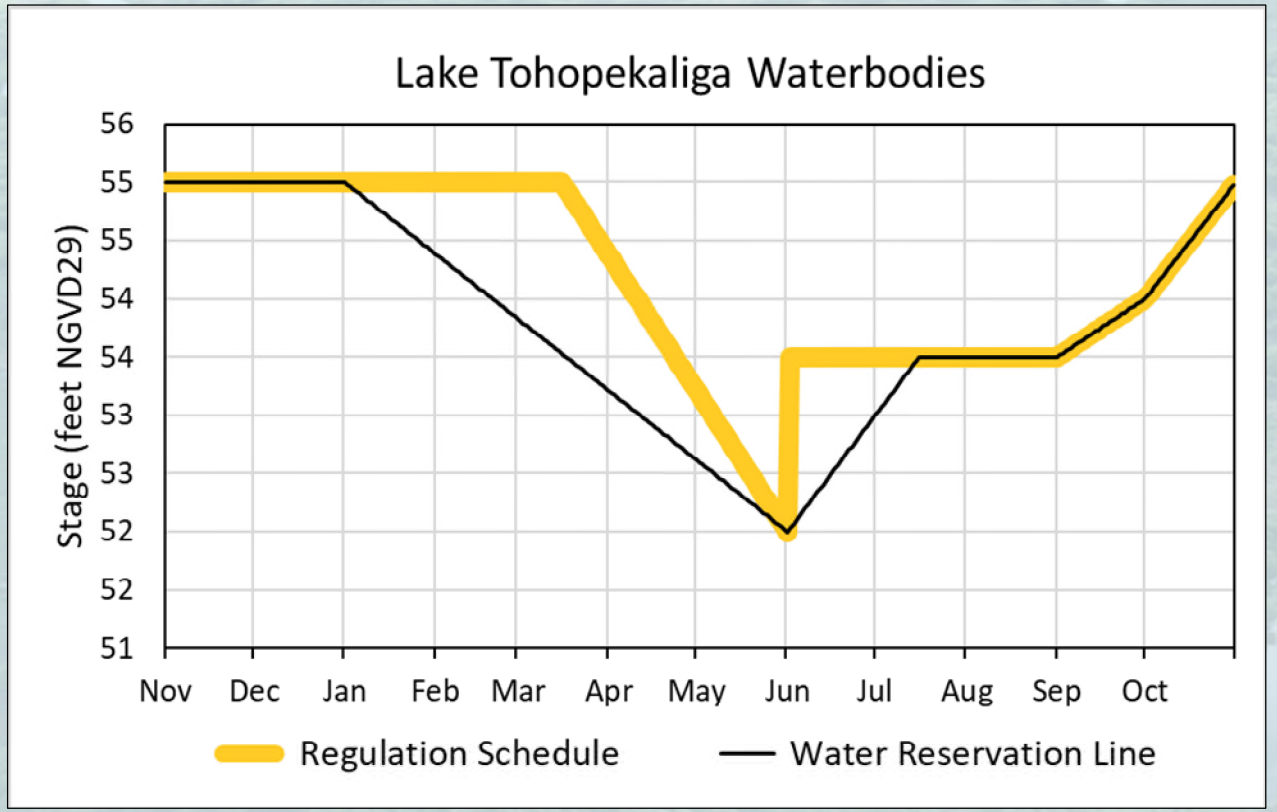


Photo: Kissimmee River

Lake Tohopekaliga Waterbodies

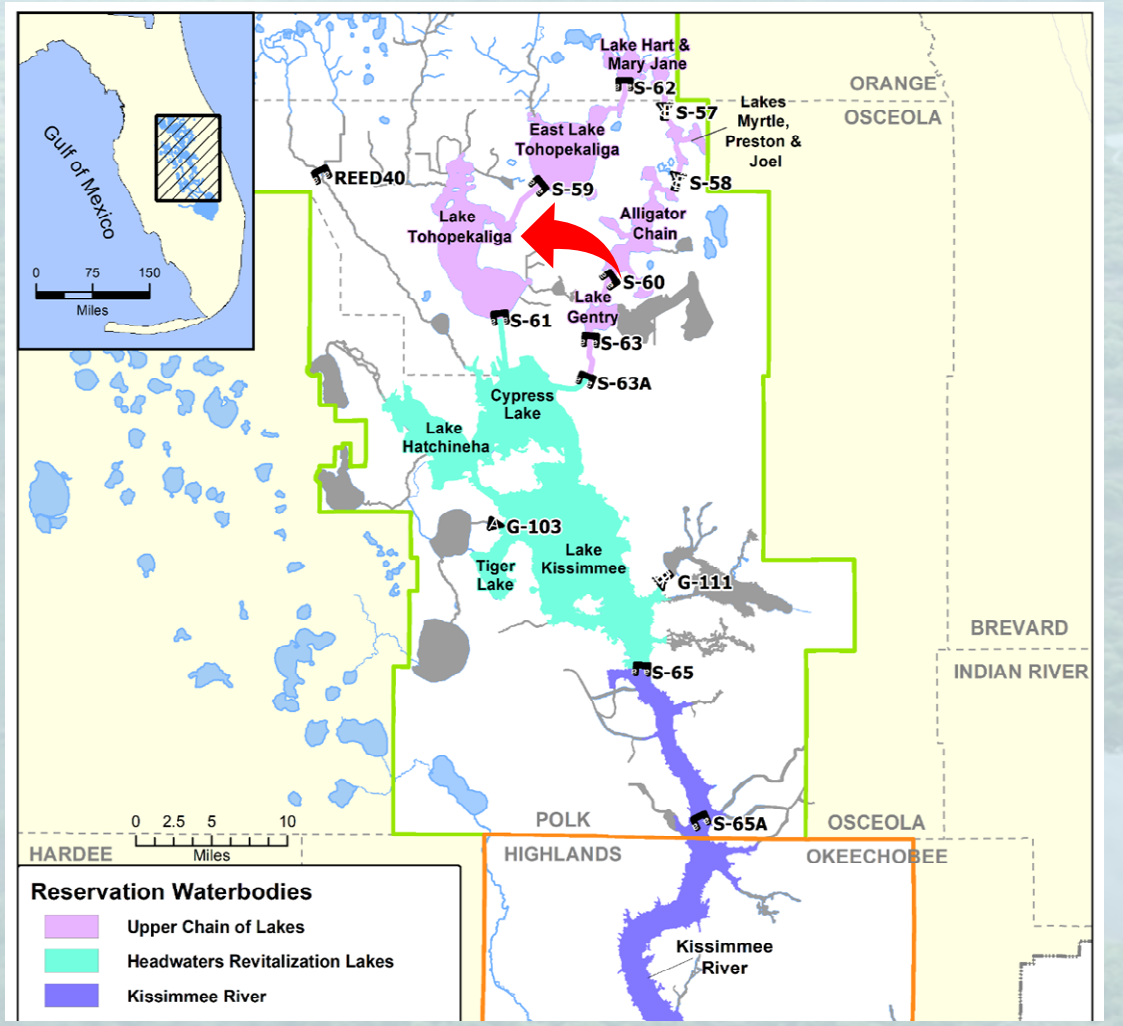
Water reservation hydrograph



Maximum daily water reservation stages

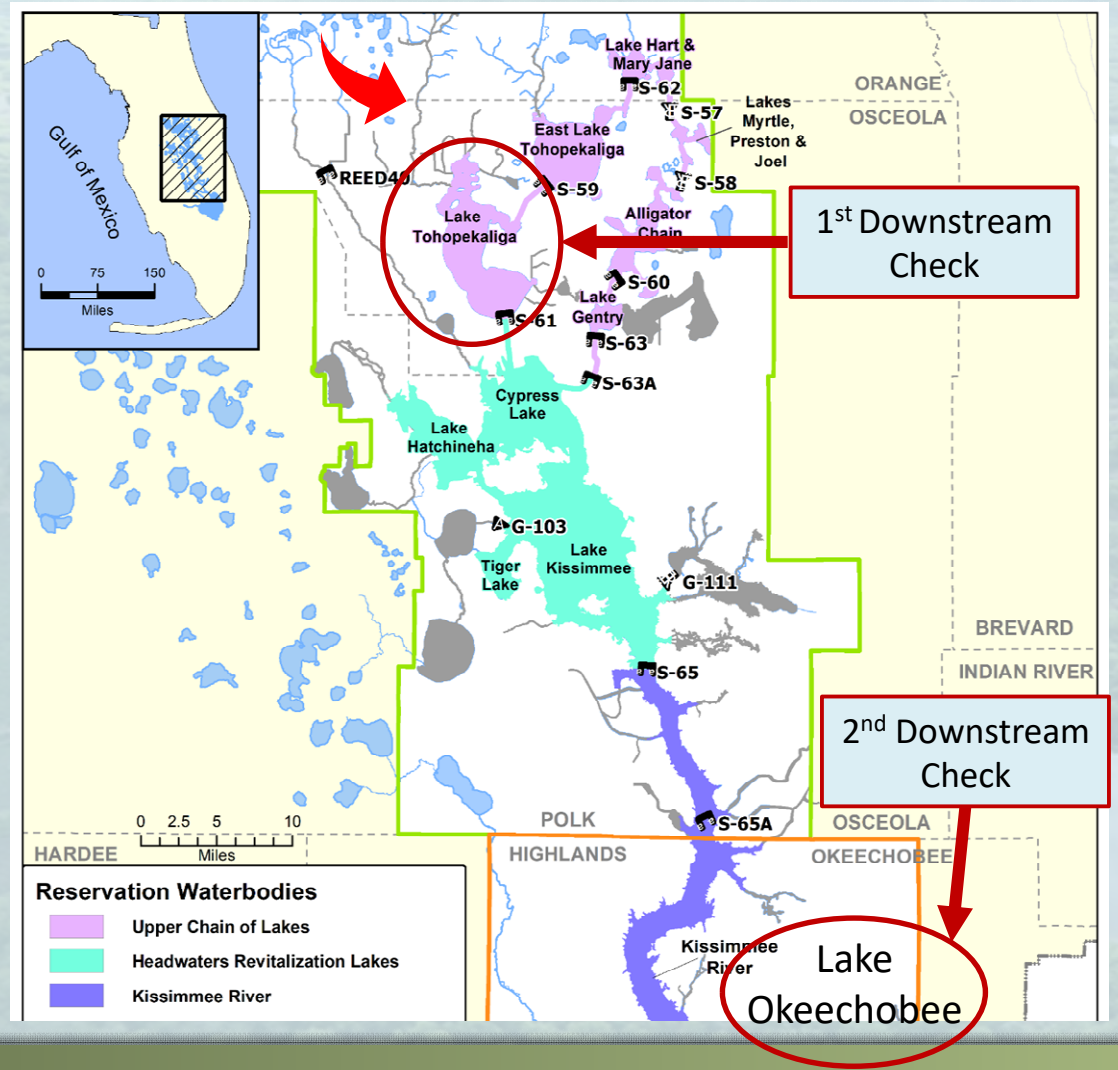
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	55.00	54.80	54.28	53.58	52.81	52.00	53.00	53.50	53.50	54.00	55.00	55.00
2	55.00	54.78	54.26	53.56	52.78	52.03	53.03	53.50	53.52	54.03	55.00	55.00
3	55.00	54.76	54.24	53.53	52.75	52.07	53.07	53.50	53.53	54.06	55.00	55.00
4	55.00	54.74	54.22	53.51	52.73	52.10	53.10	53.50	53.55	54.10	55.00	55.00
5	55.00	54.72	54.20	53.48	52.70	52.13	53.13	53.50	53.57	54.13	55.00	55.00
6	55.00	54.70	54.19	53.45	52.68	52.17	53.17	53.50	53.58	54.16	55.00	55.00
7	55.00	54.69	54.17	53.43	52.65	52.20	53.20	53.50	53.60	54.19	55.00	55.00
8	55.00	54.67	54.15	53.40	52.62	52.23	53.23	53.50	53.62	54.23	55.00	55.00
9	55.00	54.65	54.13	53.38	52.60	52.27	53.27	53.50	53.63	54.26	55.00	55.00
10	55.00	54.63	54.11	53.35	52.57	52.30	53.30	53.50	53.65	54.29	55.00	55.00
11	55.00	54.61	54.09	53.32	52.55	52.33	53.33	53.50	53.67	54.32	55.00	55.00
12	55.00	54.59	54.07	53.30	52.52	52.37	53.37	53.50	53.68	54.35	55.00	55.00
13	55.00	54.57	54.06	53.27	52.49	52.40	53.40	53.50	53.70	54.39	55.00	55.00
14	55.00	54.56	54.04	53.25	52.47	52.43	53.43	53.50	53.72	54.42	55.00	55.00
15	55.00	54.54	54.02	53.22	52.44	52.47	53.47	53.50	53.73	54.45	55.00	55.00
16	55.00	54.52	54.00	53.19	52.42	52.50	53.50	53.50	53.75	54.48	55.00	55.00
17	55.00	54.50	53.97	53.17	52.39	52.53	53.50	53.50	53.77	54.52	55.00	55.00
18	55.00	54.48	53.95	53.14	52.36	52.57	53.50	53.50	53.78	54.55	55.00	55.00
19	55.00	54.46	53.92	53.12	52.34	52.60	53.50	53.50	53.80	54.58	55.00	55.00
20	55.00	54.44	53.90	53.09	52.31	52.63	53.50	53.50	53.82	54.61	55.00	55.00
21	55.00	54.43	53.87	53.06	52.29	52.67	53.50	53.50	53.83	54.65	55.00	55.00
22	54.98	54.41	53.84	53.04	52.26	52.70	53.50	53.50	53.85	54.68	55.00	55.00
23	54.96	54.39	53.82	53.01	52.23	52.73	53.50	53.50	53.87	54.71	55.00	55.00
24	54.94	54.37	53.79	52.99	52.21	52.77	53.50	53.50	53.88	54.74	55.00	55.00
25	54.93	54.35	53.77	52.96	52.18	52.80	53.50	53.50	53.90	54.77	55.00	55.00
26	54.91	54.33	53.74	52.94	52.16	52.83	53.50	53.50	53.92	54.81	55.00	55.00
27	54.89	54.31	53.71	52.91	52.13	52.87	53.50	53.50	53.93	54.84	55.00	55.00
28	54.87	54.30	53.69	52.88	52.10	52.90	53.50	53.50	53.95	54.87	55.00	55.00
29	54.85		53.66	52.86	52.08	52.93	53.50	53.50	53.97	54.90	55.00	55.00
30	54.83		53.64	52.83	52.05	52.97	53.50	53.50	53.98	54.94	55.00	55.00
31	54.81		53.61		52.03		53.50	53.50		54.97		55.00

Example: Withdrawals from Lake Tohopekaliga



- Date: June 17
- Actual stage in Lake Tohopekaliga: 52.25 ft
- Water reservation stage, June 17: 52.53 ft
- Actual stage lower than water reservation line, therefore withdrawals are not permitted

Example: Withdrawals from Shingle Creek



- Date: April 17
- Actual stage in Lake Tohopekaliga: 53.85 ft
- Water reservation stage, April 17: 53.17 ft
- Actual stage higher than water reservation line; therefore, withdrawals may be allowed, subject to the downstream checks

Water Use Compliance Reporting Form

South Florida Water Management District
Daily Stage and Withdrawal Data Form

Online reporting is available at www.sfwmd.gov/ePermitting

Water Use Permit Number: _____ **Permittee Name:** _____

Project Name: _____ **Compliance Contact Name:** _____

Date	Time [1]	Actual Daily Waterbody Stage [2] (feet NGVD)	Daily Water Reservation Stage (feet NGVD) [3]	Withdrawal Allowed Based on Water Reservation Lake Stage? (Yes or No)	Withdrawal Allowed Based on Lake Okeechobee Regulatory Releases? (Yes or No)	Withdrawal Authorized by District-Based on Special Case? (Yes or No) (Note: Must be explained in Comments) [4]	Daily Withdrawal (Insert Waterbody Name) (MG) [5]	Daily Contributing Waterbody Withdrawal (Insert name) [5] (MG)	Daily Total Withdrawal (MG) [5]	Comments

Notes

[1] Time values recorded in DBHYDRO database always based on Eastern Standard Time (EST)
[2] Daily 10:00 AM EST stage values as calculated from monitoring stations for the (insert closest water reservation waterbody name) and obtained from District's DBHYDRO online database.
[3] Daily water reservation stages from appropriate water reservation waterbody listed in table Rule 40E-10.071 FAC
[4] Even when (insert closest water reservation waterbody) stage is below schedule, withdrawal may be authorized by District under special circumstances (flood control discharge, lake drawdown for wildlife benefit, etc.)
[5] Values listed for 24-hour surface water withdrawals are recorded on the day that flow starts; duration of flow is from approximately 10:00 AM EST on first day to 10:00 AM EST on following day

I certify to the best of my knowledge and belief that all of the information on this form is correct. I understand that any permit issued shall be subject to review and modification, enforcement action, or revocation, in whole or in part, for any material false statement in an application to continue, initiate, or modify a use, or for any material false statement in any report or statement of fact required of the permittee [Section 373.243(1), Florida Statutes].

Name of Person Submitting Data: _____ **Date:** _____ **Phone Number:** _____

Email Address: _____

Incorporated by reference in rule 40E-2.091, (F.A.C.)
Form 1392 (YYYYXXXX)

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

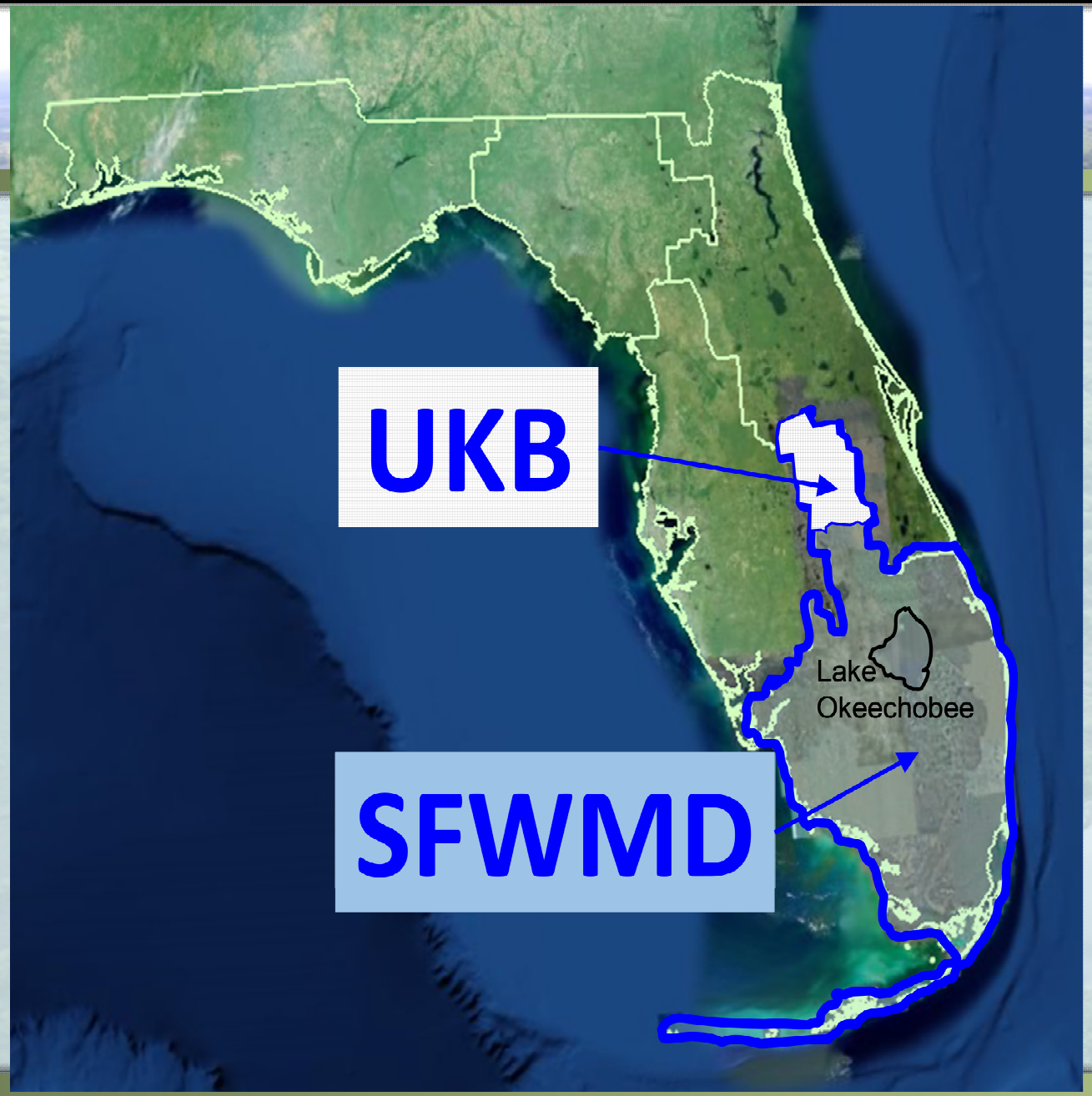
UK-OPS Modeling and Evaluation Tool

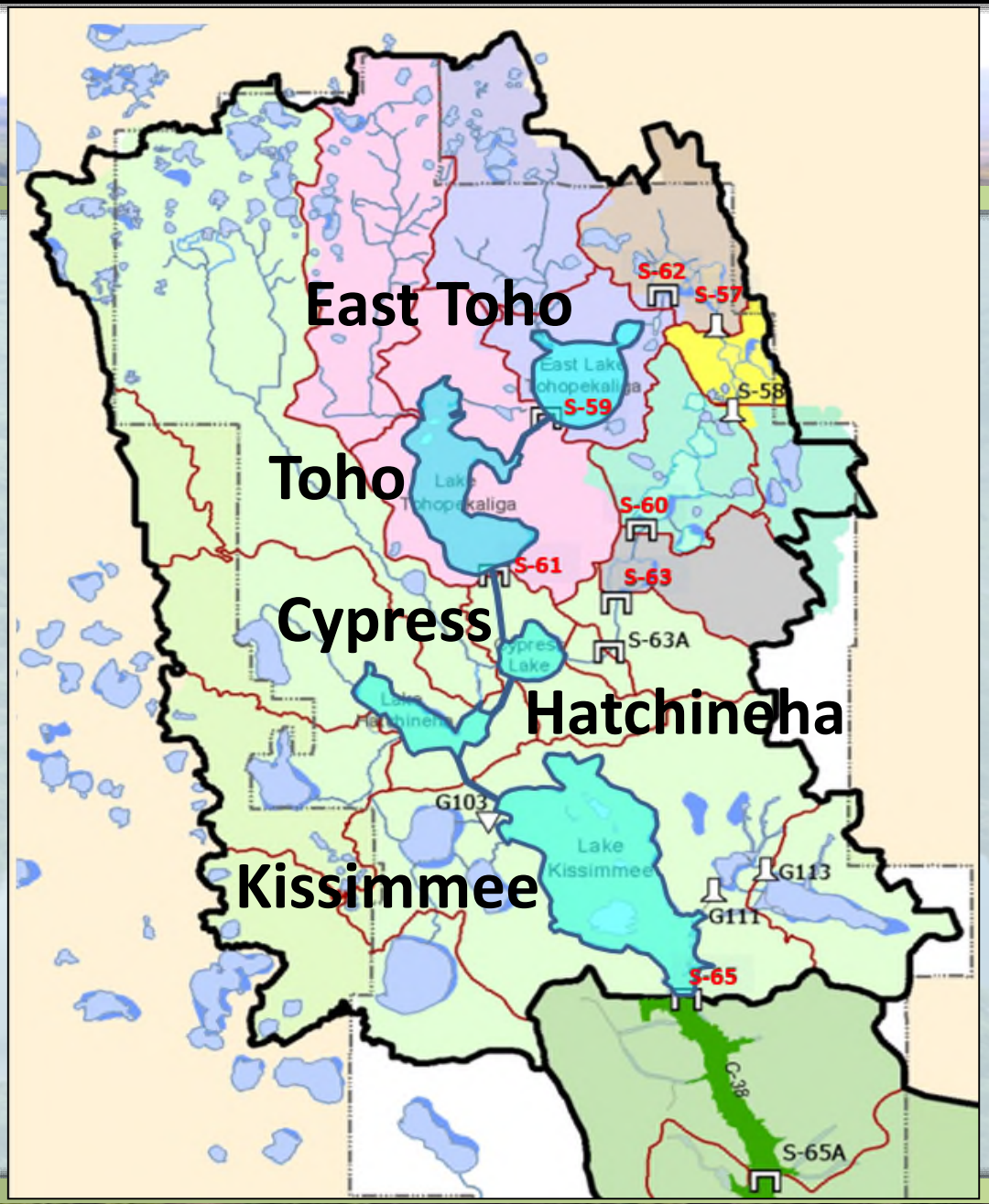
Calvin Neidrauer, P.E.
Hydrology & Hydraulics Bureau

Photo: Kissimmee River

Topics

- Brief overview of the Upper Kissimmee – Operations Simulation (UK-OPS) Model
- Sensitivity analysis of hypothetical water supply withdrawals with proposed Kissimmee River and Chain of Lakes Water Reservation criteria


UKB
SFWMD
Lake
Okeechobee


East Toho
Toho
Cypress
Hatchineha
Kissimmee
S-62
S-57
S-58
S-59
S-60
S-61
S-63
S-63A
G103
G113
G111
S-65
S-65A
C-38

UK-OPS Model Overview

- Purpose
  - Designed to quickly test alternative lake operating strategies
  - Modified to serve as a water use permitting tool to evaluate the effects of proposed water supply withdrawals subject to Water Reservation rule criteria
  - Used to test sensitivity of alternative water use scenarios and Water Reservation rule criteria
- Simple water budget routing model using a daily timestep
  - Hydrology based on historical (1965-2013) lake stages and outflows
  - Water balance (continuity) equation to simulate stages and releases resulting from lake operating rules and proposed water withdrawals
  - Detailed hydraulics at water control structures simplified
  - Automatic generation of a broad variety of hydrologic performance metrics
  - Developed using Microsoft Excel®
  - Fast run times: 3-4 minutes for a 49-year, daily timestep simulation

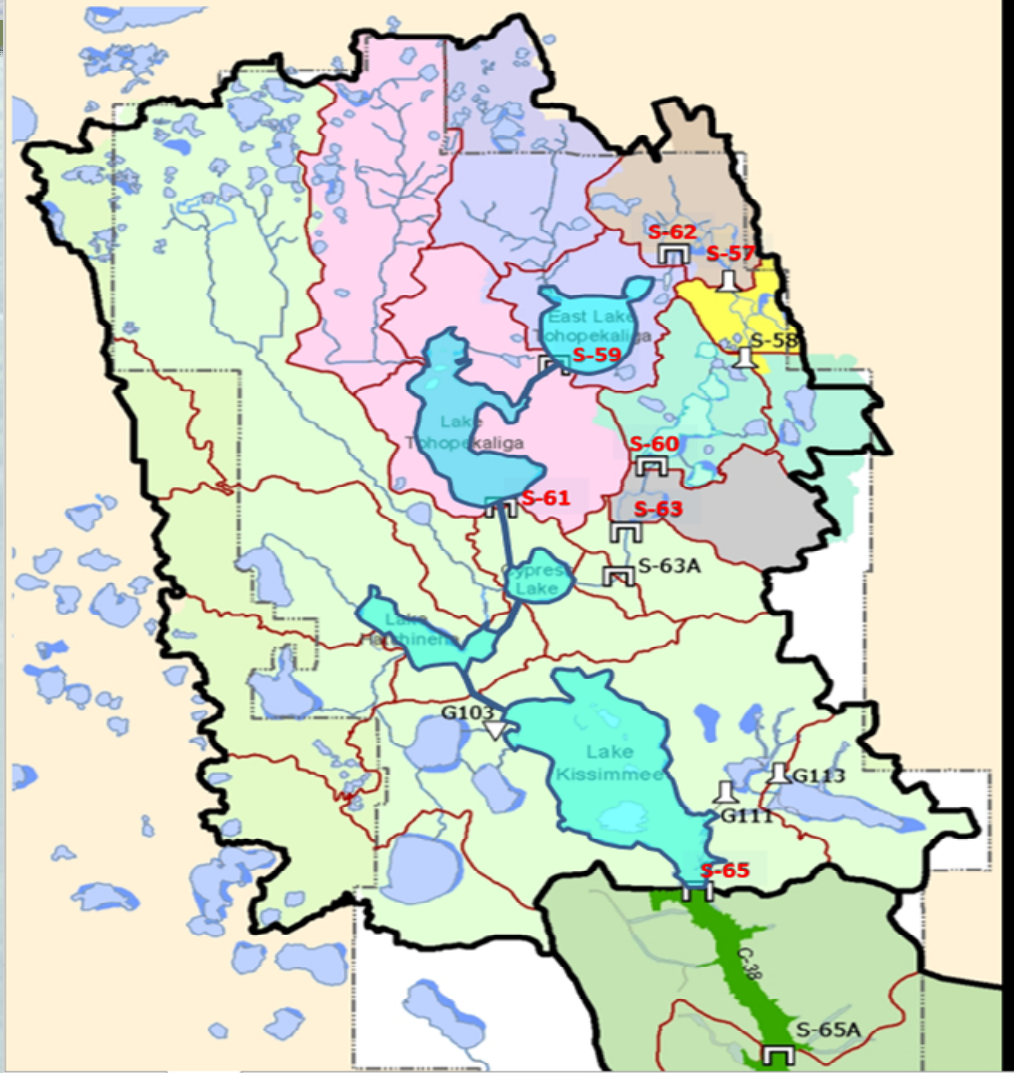
UK-OPS(v3.04)(WS-A).xlsm - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER QUICKHELP Nuance PDF

Neidrauer, Calvin

W1

Upper Kissimmee Operations Screening (UK-OPS) Model



Simulation Scenario Manager v3.04

Simulation Type

- (•) Continuous (1965-2013)
- ( ) Position Analysis

		Run Name	Description
Retrieve ALT0	Run&Save as ALT0	Base	Simulates stages and flows using current TOH & ETO Reg Schedules & Headwaters Reg Schedule for KCH
Retrieve ALT1	Run&Save as ALT1	RulWSL	Same as Base but uses WR lines for 6 lakes & Lake O constraint to restrict WS (max WS of 122 MGD corresponds to 5%)
Retrieve ALT2	Run&Save as ALT2	RuleWS	Same as Base but uses WR lines for 6 lake systems to restrict WS withdrawals (max WS of 64 MGD corresponds to 5%)
Retrieve ALT3	Run&Save as ALT3	MaxETO	Same as RulWSL but all WS from E.Toho only (max WS of 140 MGD corresponds to 5%)

Active Inputs from Simulation RuleWS
Last Saved/Active Simulation RuleWS

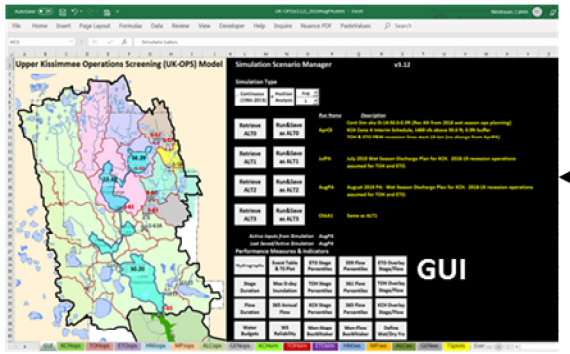
Performance Measures & Indicators

Hydrographs	Event Table & TS Plot	ETO Stage Percentiles	S59 Flow Percentiles
Stage Duration	Max D-day Inundation	TOH Stage Percentiles	S61 Flow Percentiles
Flow Duration	S65 Annual Flow	KCH Stage Percentiles	S65 Flow Percentiles
Water Budgets	WS Reliability	Mon-Stage BoxWhisker	Mon-Flow BoxWhisker

GUI KCHops TOHops ETOops HMJops MPJops ALCops GENops KCHsim TOHsim ETOsim ...

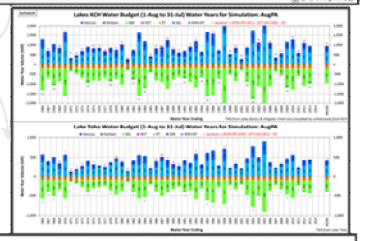
READY 95%

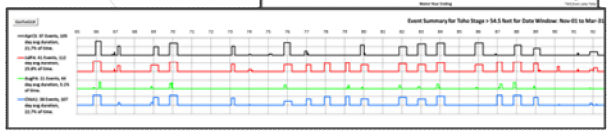
UK-OPS Model Basic Structure

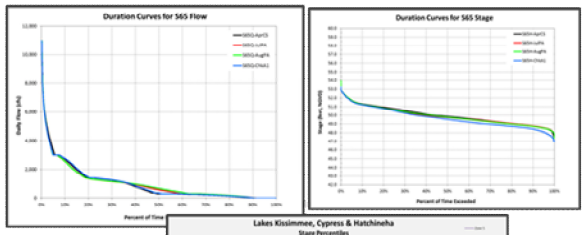


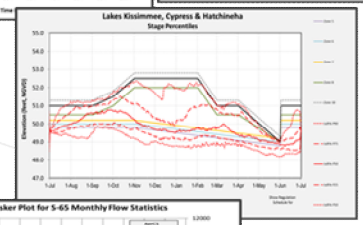
ACTIVE OPERATING SCHEDULES PER LAKE

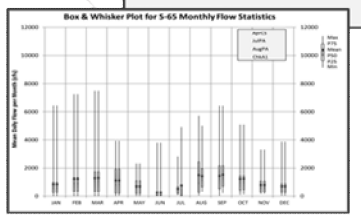
OUTPUTS FOR TIME-SERIES PLOTS AND PERFORMANCE SUMMARY GRAPHICS











HYDROLOGIC DATA
-from historical record or a supporting model (et, stage, structure flow)

ALTERNATIVE OPERATIONS AND OUTPUT WORKSHEETS

ALT0
ALT1
ALT2
ALT3

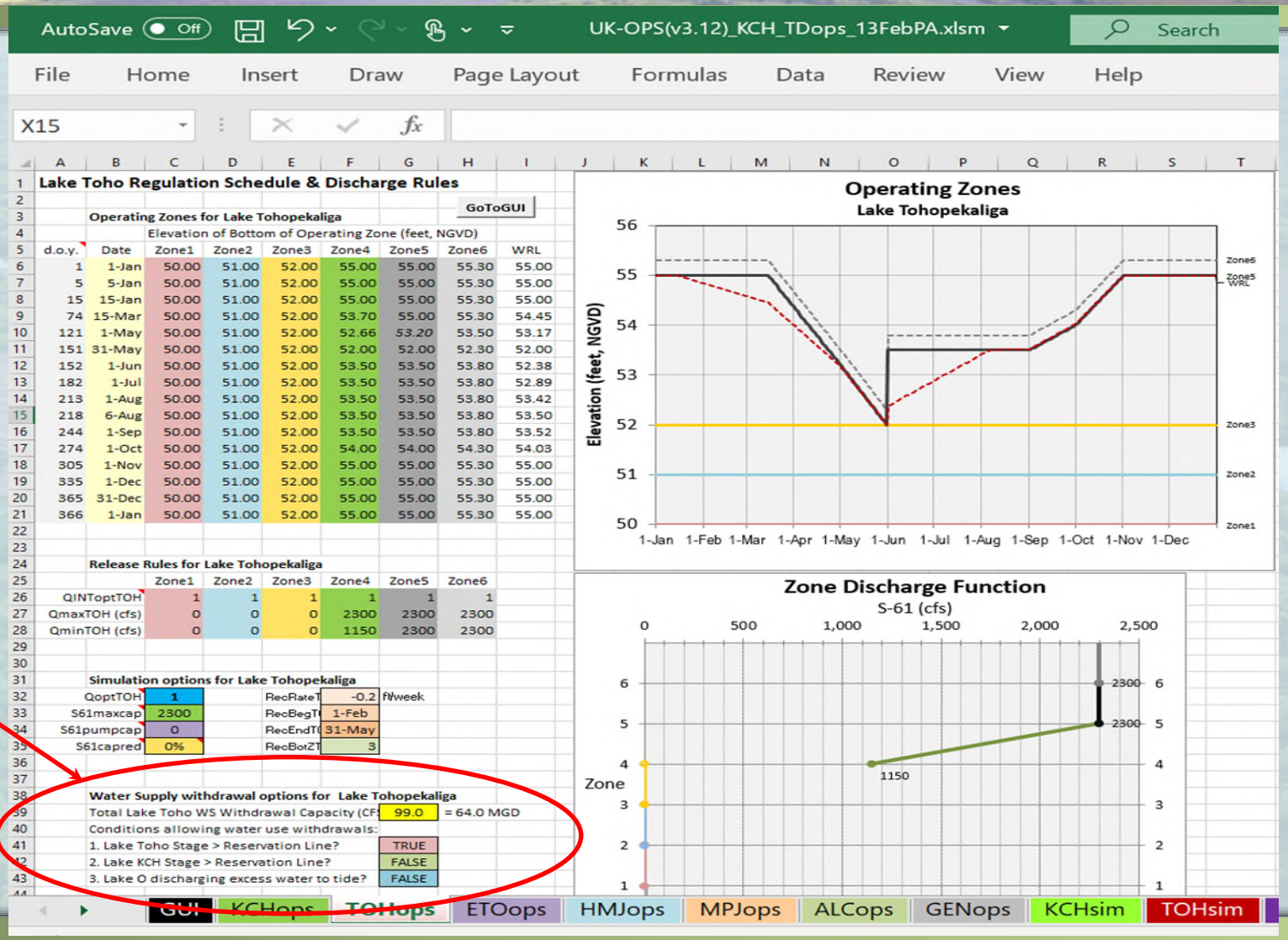
ROUTING & RELEASE WORKSHEETS

STATIC DATA PER LAKE SYSTEM
- Sto(h),
- Area(h)

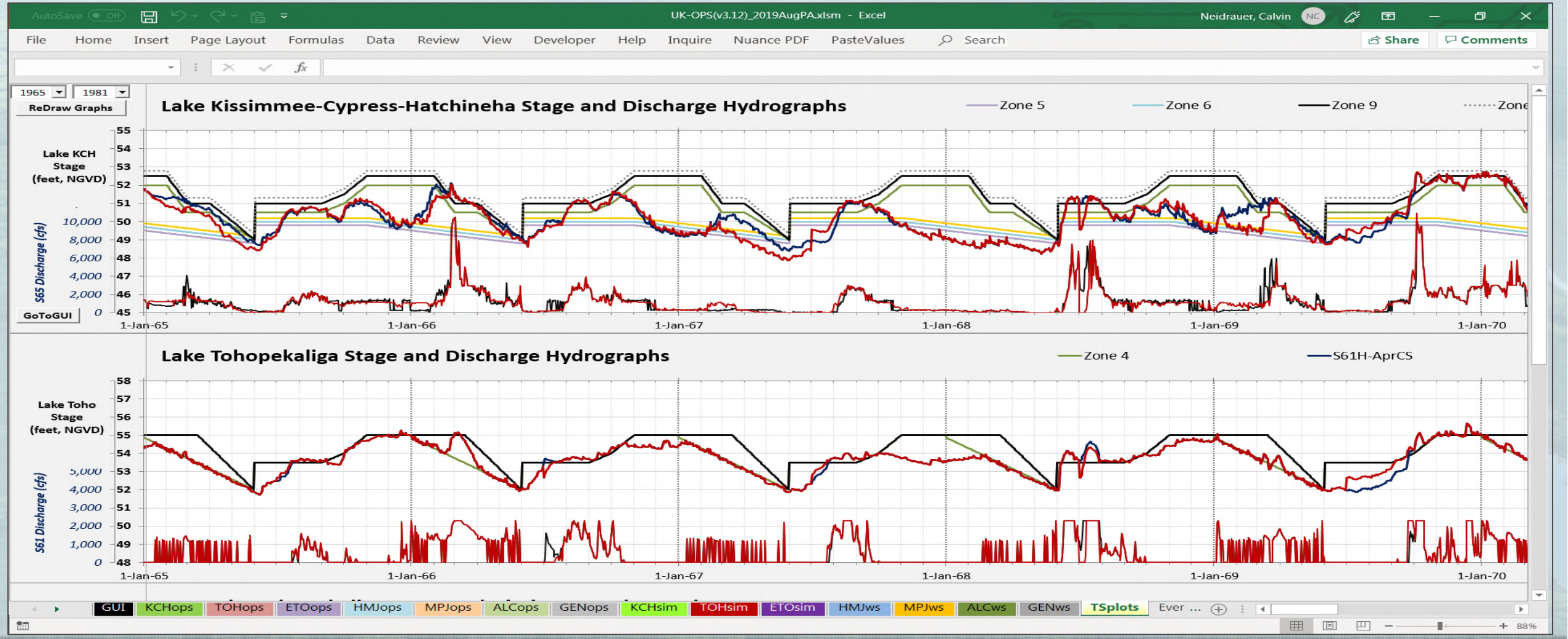
Data Management handled with simple VBA macros

Example Input Worksheet TOHops

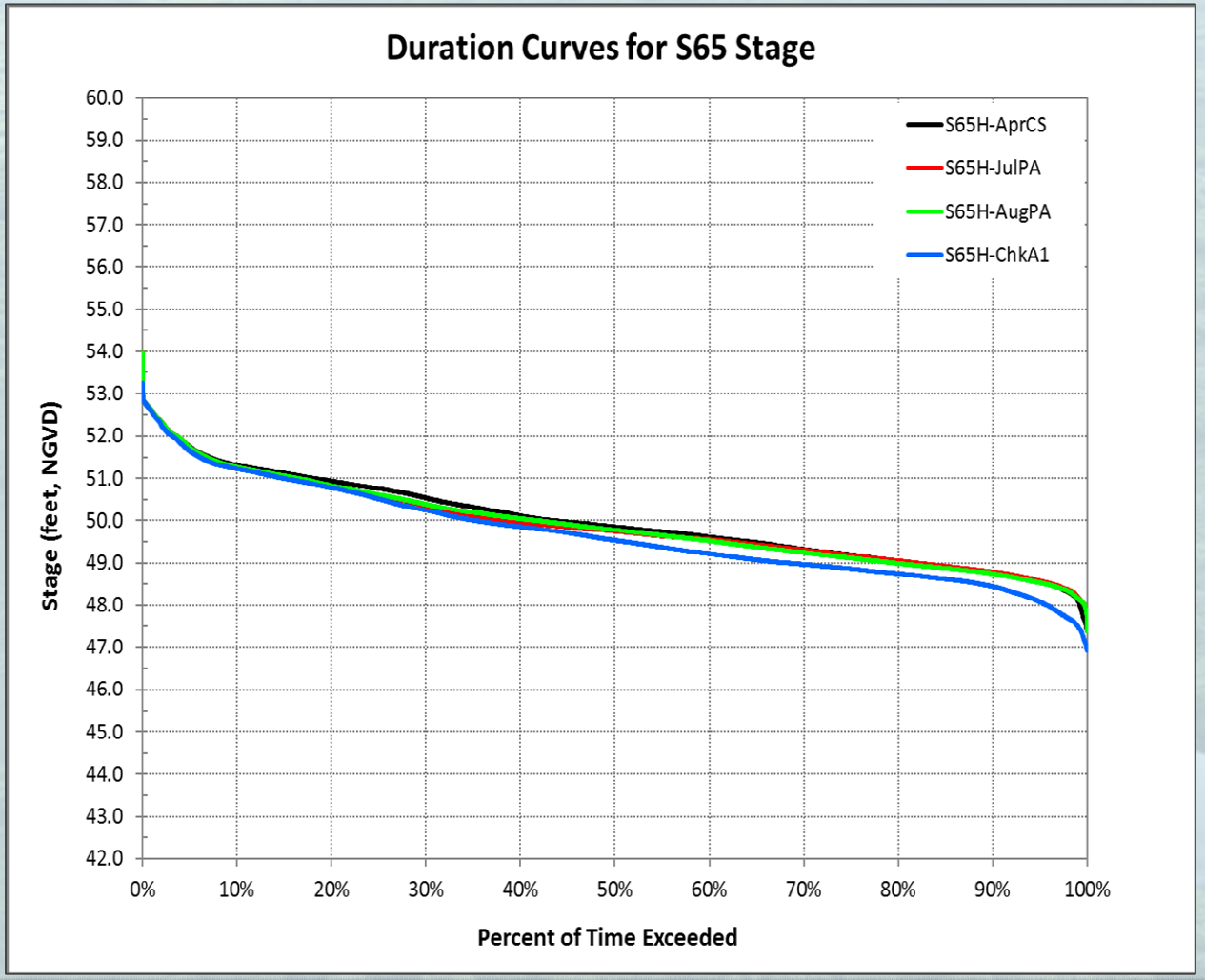
Model Options for Simulating Water Supply Withdrawals from Lake Toho

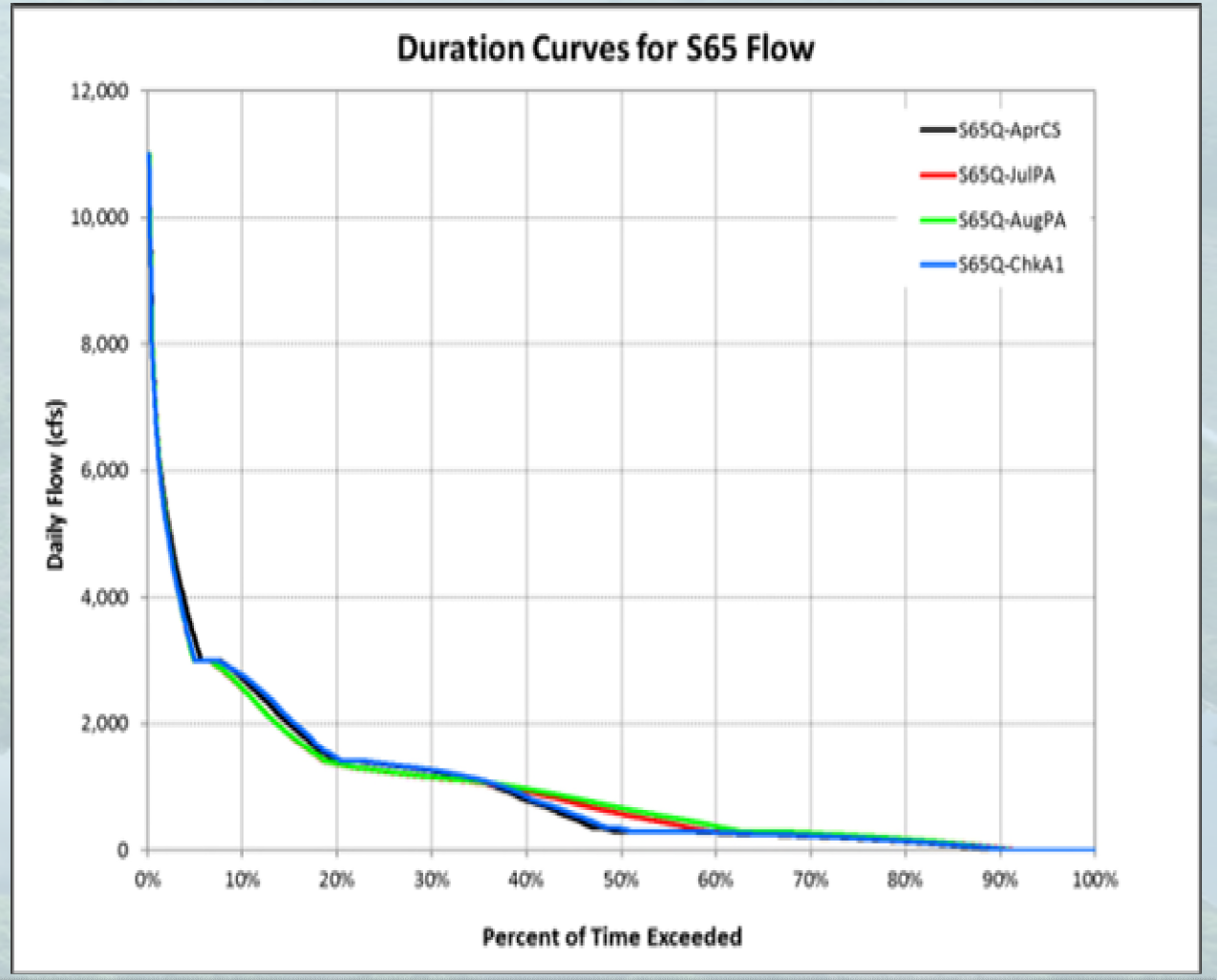


Example Outputs: Daily Stage & Discharge Hydrographs

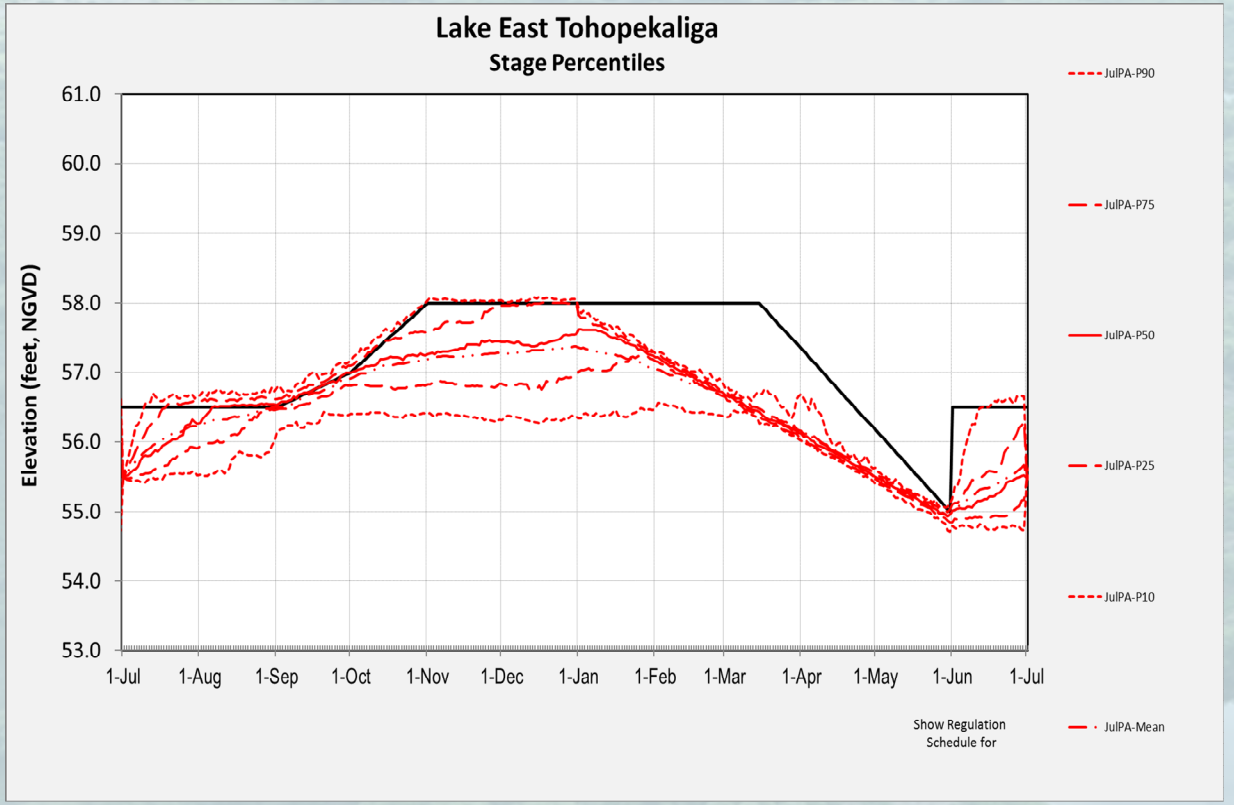


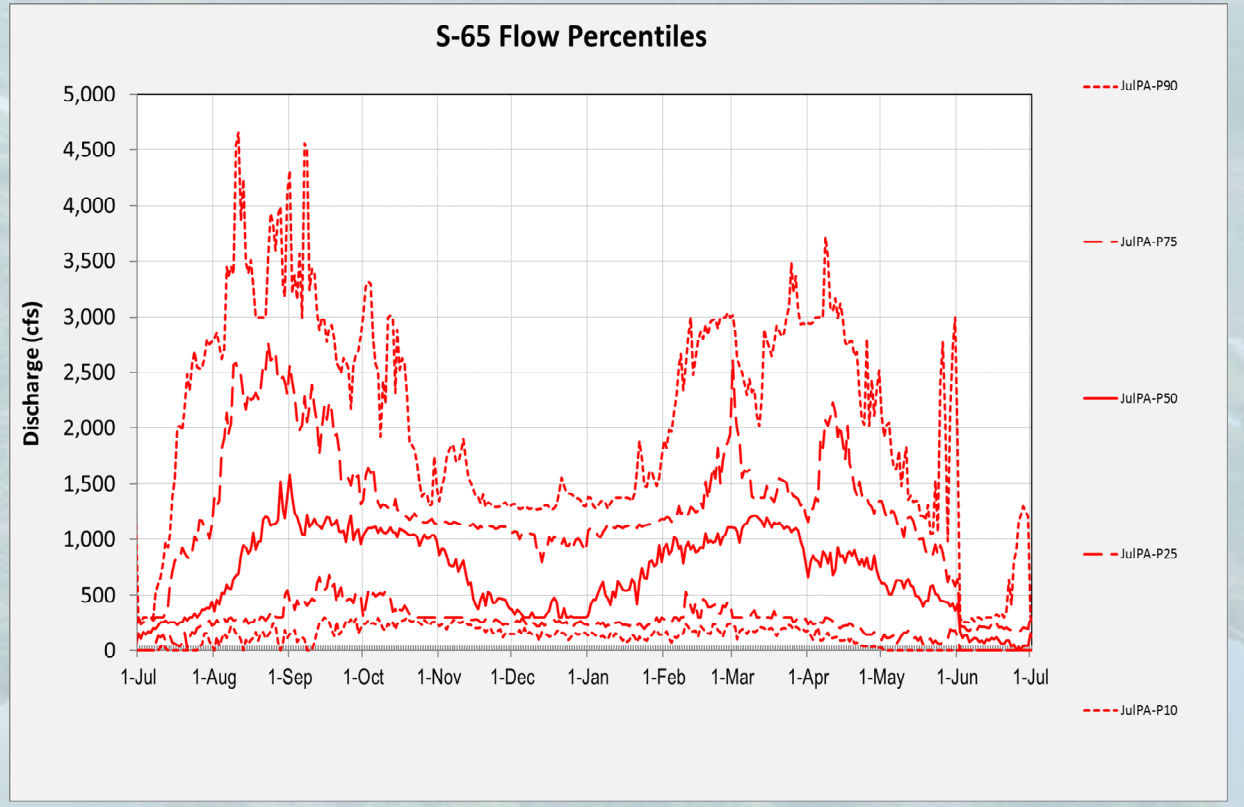
Example Outputs:
Daily Stage & Flow Duration Hydrographs





Example Outputs: Stage & Flow Percentiles





Applications of the UK-OPS Model

1. Seasonal operations planning

   - Design and simulate alternative operations for Lakes Kissimmee, Cypress, and Hatchineha; Lake Tohopekaliga; and East Lake Tohopekaliga

2. SFWMD dynamic position analysis

   - Simulate S-65 flow series in position analysis mode as inflow boundary to South Florida Water Management Model dynamic position analysis

3. Simulate temporary pump operations for Lake Tohopekaliga and East Lake Tohopekaliga

4. **Kissimmee River and Chain of Lake Water Reservation effort**

   - Sensitivity analysis of hypothetical water supply withdrawals with proposed water reservation rule criteria

5. Determine effect of Lake Tohopekaliga AWS on Lake Kissimmee outflows

   - SFWMD water use permit application no. 140318-17

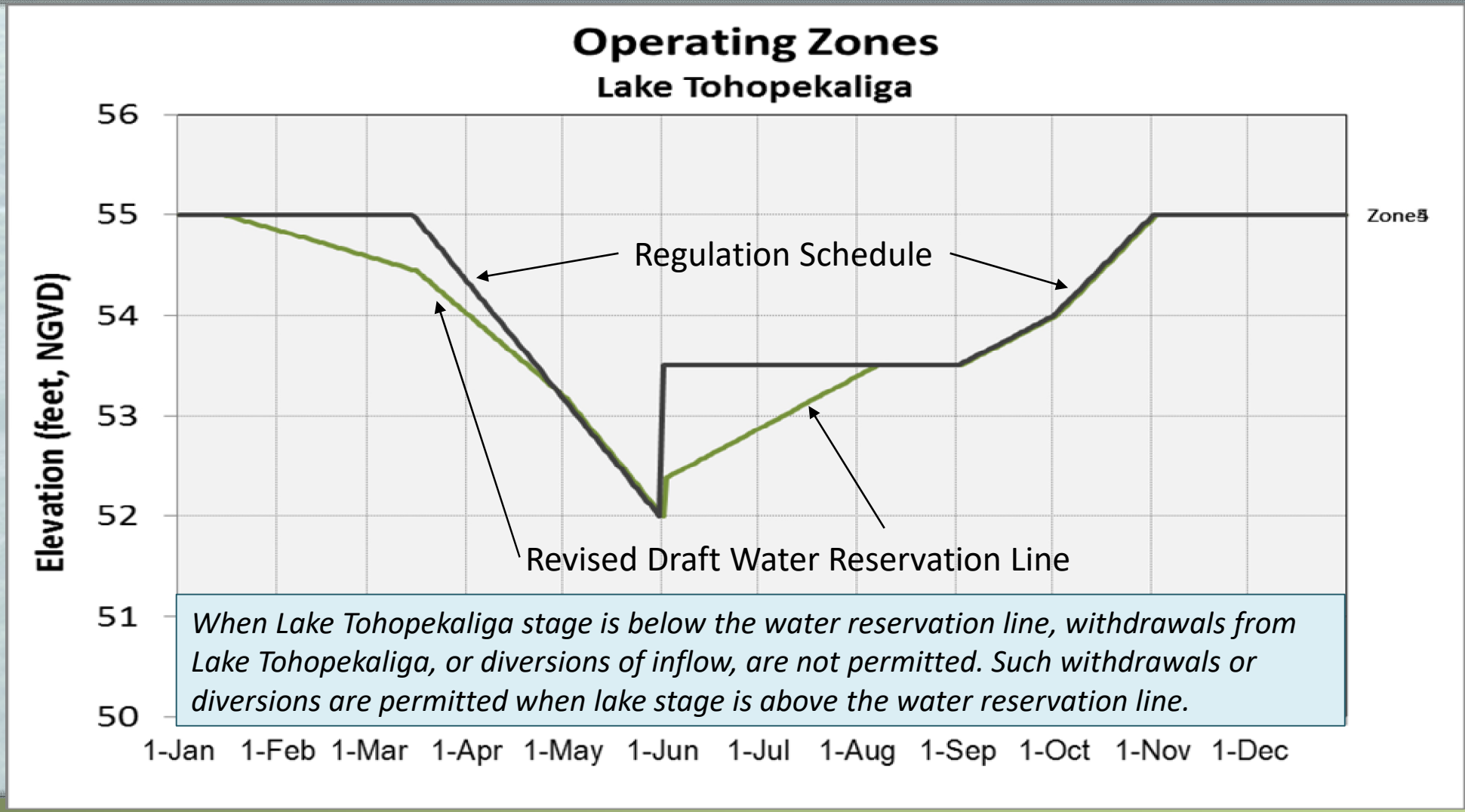
Example UK-OPS Model Application: Sensitivity Analysis of Hypothetical Water Withdrawals

- Purpose:
  - To investigate the effects of hypothetical water supply withdrawals from Lake Tohopekaliga with the proposed Kissimmee River and Chain of Lakes Water Reservations rule criteria
  - Water supply withdrawal reliability also assessed with and without the proposed Lake Okeechobee constraint

Example UK-OPS Model Application (cont.): Simulation Assumptions

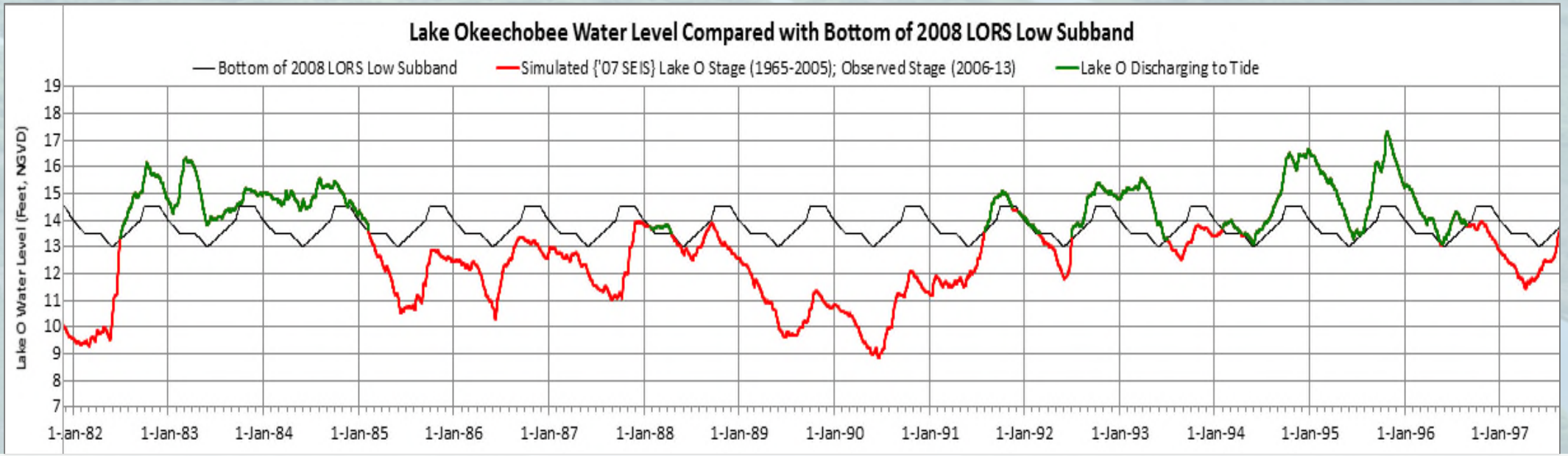
- Three simulations
  - **Base**: Baseline simulation that uses the Lakes Kissimmee, Cypress, and Hatchineha regulation schedule (HRS) and the standard schedules for East Lake Tohopekaliga and Lake Tohopekaliga
    - No new water supply withdrawals
  - **WSmax**: Same assumptions as Base, but includes water supply withdrawals from Lake Tohopekaliga (64 mgd [99 cfs] pump capacity)
  - **WSmaxL**: Same as WSmax, but adds the Lake Okeechobee constraint

Lake Tohopekaliga Revised Draft Water Reservation Line



Lake Okeechobee Constraint

- The Lake Okeechobee constraint limits withdrawals to occur only when regulatory releases from Lake Okeechobee are being discharged to tide

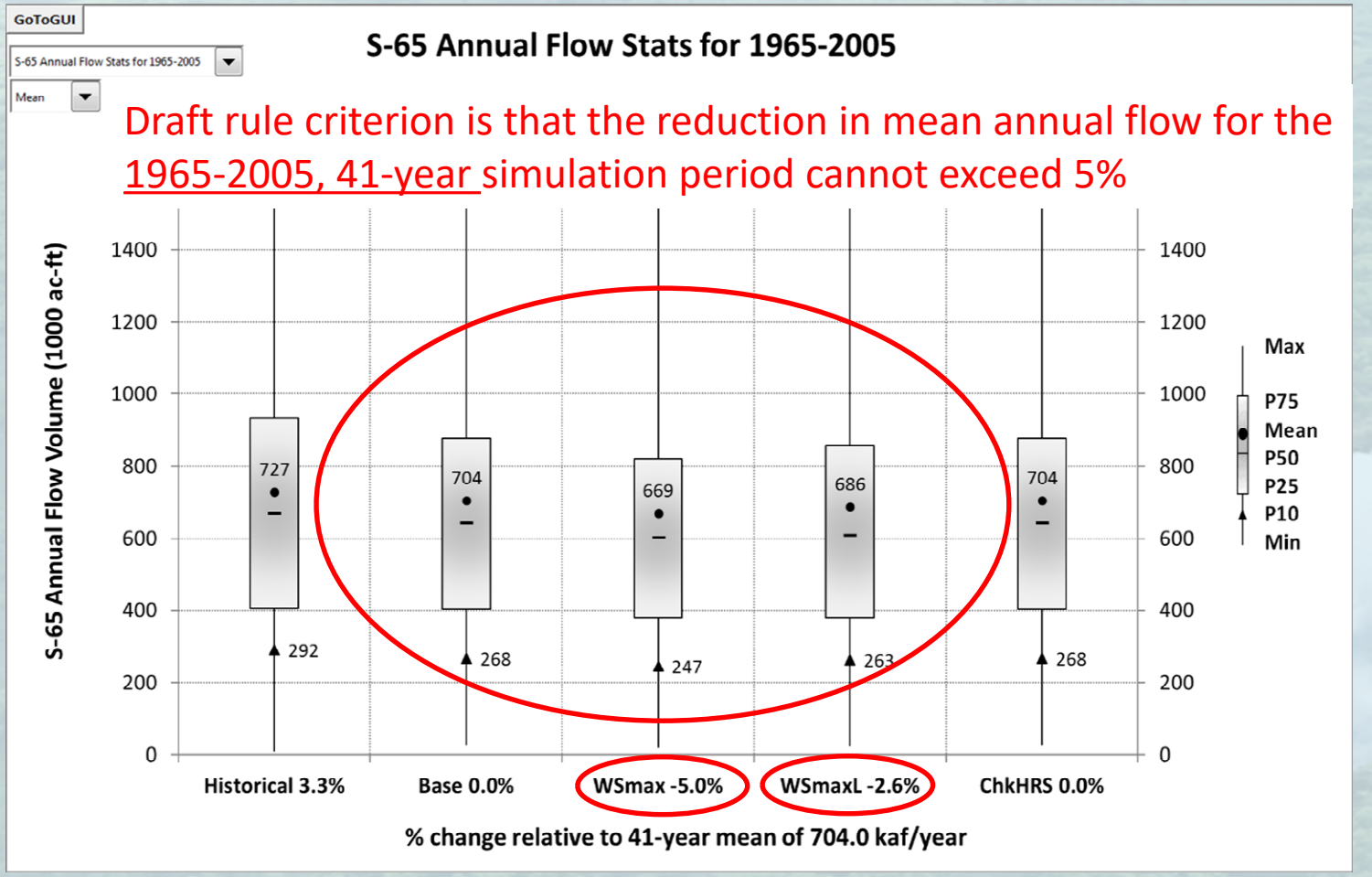


Green = stage above LORS Low Subband*, regulatory discharges to tide, water supply from Upper Kissimmee lakes not limited by Lake O
Red = stage below LORS Low Subband*, no regulatory discharges to tide, NO water supply from Upper Kissimmee lakes (59% of time)

**** Used for UK-OPS simulations to define when regulatory discharges were made; a new LORS could change the black line.***

Sample Outputs

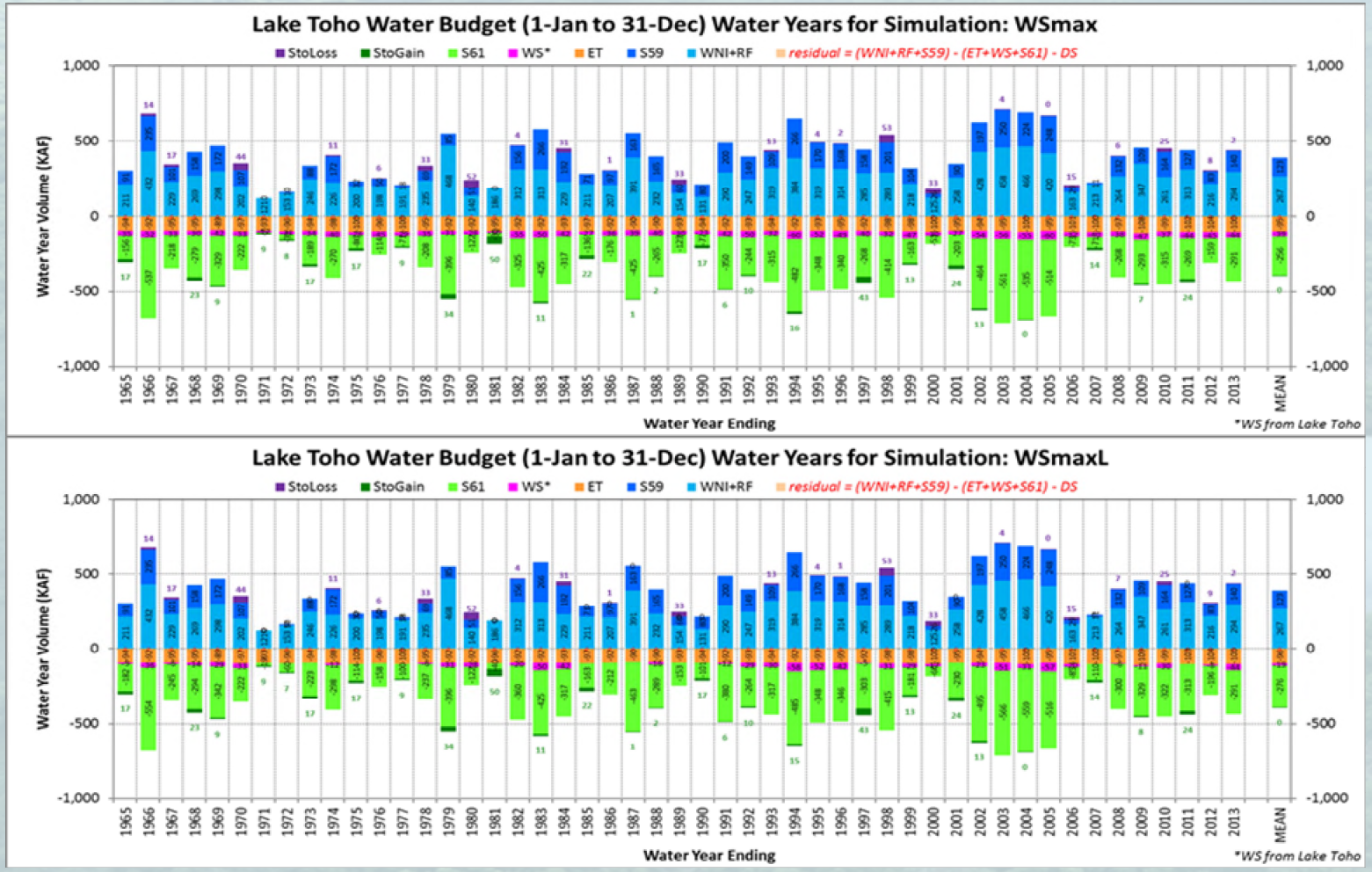
Application 2: Water Supply Sensitivity Analysis



- WSmax results in exactly 5% reduction in S-65 mean flow
- WSmaxL shows a 2.6% reduction in S-65 mean flow; less than WSmax because the Lake Okeechobee constraint reduces the time that withdrawals can be made

Sample Outputs (cont.)

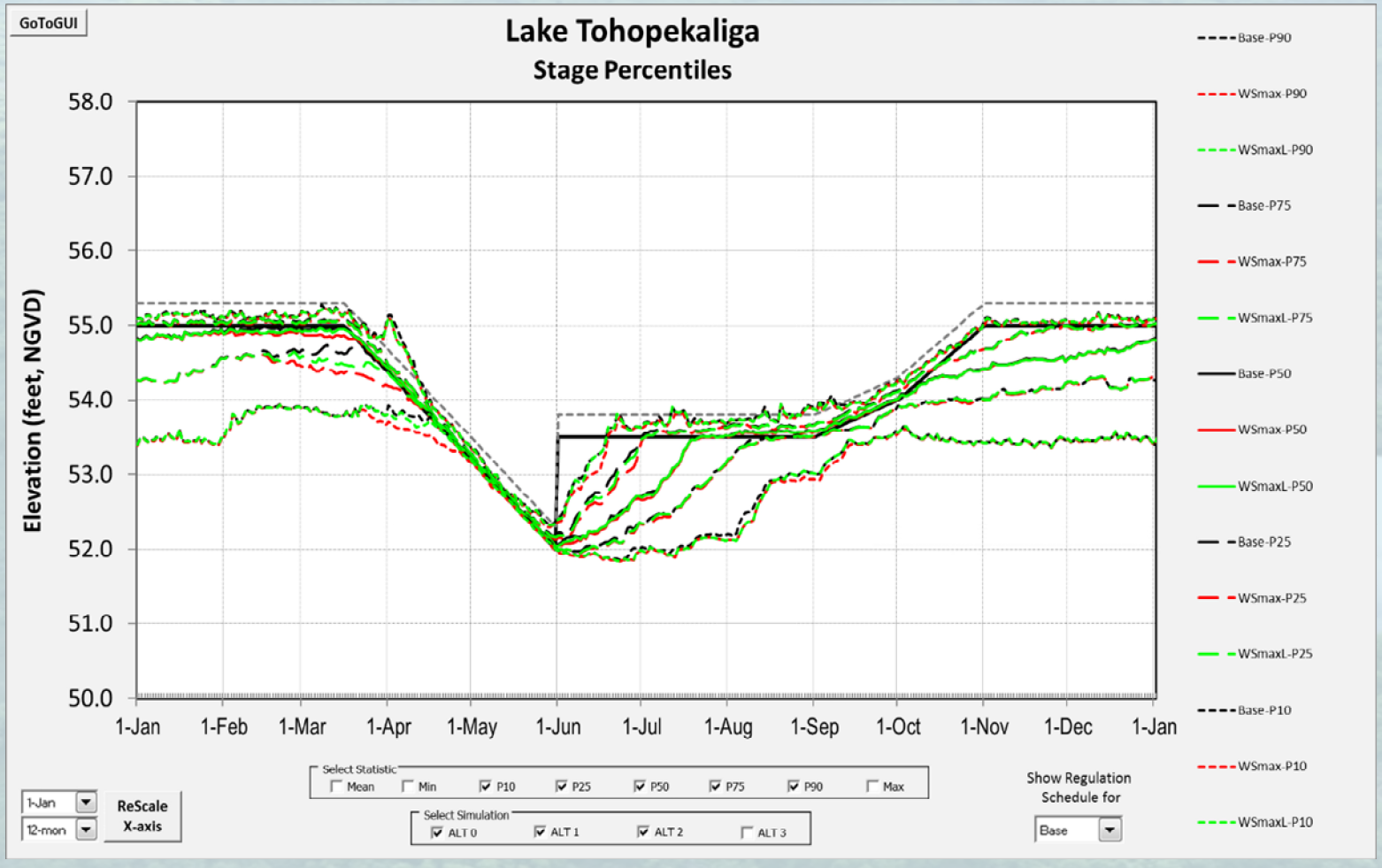
Sensitivity Analysis of Hypothetical Water Withdrawals



- Water supply component of budget is relatively small
- The Lake Okeechobee constraint reduces the average number of days with water supply withdrawals by approximately 50%

Sample Outputs (cont.)

Application 2: Water Supply Sensitivity Analysis



- Downward shift in the percentiles of the WSmax scenario (red) relative to Base (black)
- The WSmaxL scenario (green) falls between the other simulations because withdrawals are less than those in the WSmax simulation

Water Supply Reliability Statistics: WSmax

Lake TOH Water Supply Reliability Table for WSmax																Percent of Time WS Withdrawal			
No. of Days per Month with Lake Toho WS Withdrawals at 99.0 cfs (64.0 MGD)													Days	Vol(kaf)	AvgMGD	CalYear	WetSeas	DrySeas	WatYear
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	May-Oct	Nov-Apr	May-Apr
1965	0	16	31	30	31	1	9	31	8	7	0	14	178	34.96	31.21	48.8%	47.3%		
1966	23	28	31	30	31	14	31	31	30	15	0	0	264	51.85	46.29	72.3%	82.6%	74.1%	58.4%
1967	0	16	31	30	31	0	8	31	20	1	0	0	168	33.00	29.46	46.0%	49.5%	50.9%	62.7%
1968	0	0	0	25	31	26	30	31	10	0	0	0	153	30.05	26.75	41.8%	69.6%	26.3%	31.7%
1969	19	28	31	30	31	0	0	0	6	27	21	22	215	42.23	37.70	58.9%	34.8%	65.6%	64.7%
1970	31	28	31	30	31	9	0	10	0	0	0	0	170	33.39	29.81	46.6%	27.2%	91.5%	62.2%
1971	0	0	3	28	31	0	0	0	0	0	0	0	62	12.18	10.87	17.0%	16.8%	29.2%	22.2%
1972	0	0	13	30	31	0	6	23	6	0	0	0	109	21.41	19.06	29.8%	35.9%	34.7%	20.2%
1973	0	26	31	30	31	3	0	13	29	11	0	0	174	34.18	30.51	47.7%	47.3%	55.7%	41.9%
1974	0	14	31	30	31	2	30	31	30	4	0	0	203	39.87	35.59	55.6%	69.6%	50.0%	44.4%
1975	0	0	21	30	31	0	0	27	19	11	2	0	141	27.70	24.72	38.6%	47.8%	38.7%	49.0%
1976	4	29	31	30	31	19	28	29	26	2	0	0	229	44.98	40.04	62.6%	73.4%	59.6%	50.3%
1977	5	28	31	30	31	1	0	5	13	2	0	3	149	29.27	26.13	40.8%	28.3%	59.0%	62.7%
1978	19	28	31	30	31	0	6	29	3	0	0	0	177	34.77	31.04	48.5%	37.5%	67.0%	44.7%
1979	4	28	31	30	31	1	0	0	27	7	0	0	159	31.23	27.88	43.6%	35.9%	58.5%	44.4%
1980	20	29	31	30	31	3	0	0	0	0	0	0	144	28.28	25.18	39.3%	18.5%	66.2%	48.1%
1981	0	0	0	0	11	4	0	3	21	0	0	13	52	10.21	9.12	14.2%	21.2%	5.2%	9.3%
1982	25	28	31	30	31	30	31	31	28	13	0	0	278	54.60	48.74	76.2%	89.1%	74.5%	45.5%
1983	7	28	31	30	31	13	20	31	28	13	7	15	254	49.89	44.54	69.6%	73.9%	59.9%	71.2%
1984	31	29	31	30	31	3	27	30	4	0	0	0	216	42.43	37.77	59.0%	51.6%	81.7%	76.2%
1985	0	0	9	30	31	0	0	30	27	10	0	0	137	26.91	24.02	37.5%	53.3%	33.0%	36.7%
1986	30	28	31	30	31	0	0	23	12	0	0	0	185	36.34	32.44	50.7%	35.9%	70.8%	59.5%
1987	29	28	31	30	31	2	0	0	0	0	19	29	199	39.09	34.89	54.5%	17.9%	70.3%	50.4%
1988	18	29	31	30	30	0	0	12	26	0	2	28	206	40.46	36.02	56.3%	37.0%	87.3%	51.6%
1989	11	11	29	30	31	0	0	18	17	6	0	0	153	30.05	26.83	41.9%	39.1%	67.0%	49.0%
1990	0	5	31	30	31	0	0	20	0	0	0	0	117	22.98	20.51	32.1%	27.7%	45.8%	37.8%
1991	0	2	29	30	31	30	31	31	13	16	0	0	213	41.84	37.35	58.4%	82.6%	43.4%	30.7%
1992	0	22	31	30	31	13	20	27	29	19	6	27	255	50.09	44.59	69.7%	75.5%	53.5%	64.2%
1993	29	28	31	30	31	5	0	0	10	0	0	0	164	32.21	28.76	44.9%	25.0%	85.8%	79.5%
1994	2	28	31	30	31	23	25	31	30	16	28	31	306	60.10	53.65	83.8%	84.8%	57.5%	37.5%
1995	30	28	31	30	31	0	5	31	27	28	13	10	264	51.85	46.29	72.3%	66.3%	98.6%	91.5%
1996	30	29	31	30	31	30	23	21	19	5	0	0	249	48.91	43.54	68.0%	70.1%	81.7%	72.4%
1997	7	28	31	30	31	4	12	29	5	0	1	28	206	40.46	36.12	56.4%	44.0%	59.9%	61.6%
1998	31	28	31	30	31	2	0	0	5	3	0	0	161	31.62	28.23	44.1%	22.3%	84.9%	63.0%
1999	0	26	31	30	31	1	13	27	14	30	26	12	241	47.34	42.26	66.0%	63.0%	55.7%	35.1%
2000	18	29	31	30	31	0	0	9	7	0	0	0	155	30.45	27.10	42.3%	25.5%	83.1%	71.6%
2001	0	0	0	26	31	3	16	27	30	5	0	0	138	27.11	24.20	37.8%	60.9%	26.9%	20.0%
2002	0	24	31	30	31	22	31	31	30	3	12	28	273	53.62	47.87	74.8%	80.4%	54.7%	54.0%
2003	31	28	31	30	31	25	31	31	21	8	2	16	285	55.98	49.97	78.1%	79.9%	90.1%	84.4%
2004	21	29	31	30	31	0	12	29	30	31	26	12	282	55.39	49.31	77.0%	72.3%	75.1%	75.4%
2005	30	28	31	30	31	30	29	31	9	7	27	21	304	59.71	53.30	83.3%	74.5%	88.7%	79.5%
2006	10	28	31	30	31	0	2	12	21	0	0	0	165	32.41	28.93	45.2%	35.9%	84.0%	77.8%
2007	0	26	31	30	31	20	21	20	14	8	0	1	202	39.68	35.42	55.3%	62.0%	55.7%	41.9%
2008	10	29	31	30	31	0	8	30	23	4	0	0	196	38.50	34.27	53.6%	52.2%	62.0%	58.7%
2009	0	19	31	30	31	30	31	31	25	1	0	11	240	47.14	42.08	65.8%	81.0%	52.4%	48.2%
2010	16	28	31	30	31	30	19	2	0	0	0	0	187	36.73	32.79	51.2%	44.6%	69.3%	72.6%
2011	0	20	31	30	31	0	9	31	25	26	20	3	226	44.39	39.63	61.9%	66.3%	52.8%	44.7%
2012	4	27	31	30	31	6	28	29	29	13	0	0	228	44.78	39.87	62.3%	73.9%	68.5%	64.8%
2013	0	14	31	30	31	25	31	31	28	3	0	0	224	44.00	39.28	61.4%	81.0%	50.0%	57.8%
MEANS																			
48YR	11	21	27	29	31	9	13	21	17	7	4	7	197	38.71	34.53	54.0%	52.9%	61.5%	54.0%
41YR	12	21	27	29	30	8	12	21	16	7	5	8	195	**38.27**	**34.14**	**53.4%**	51.1%	61.9%	53.4%

0 15 31

Number of Days per Month with Water Supply Withdrawals from Lake Tohopekaliga

Percent of Time Water Supply Withdrawal > 70%

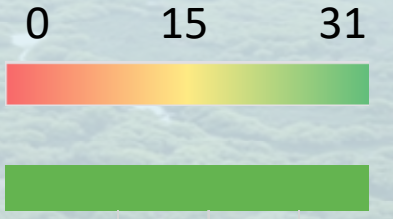
SUMMARY STATISTICS	CalYear	WetSeas	DrySeas	WatYear
No. of years used for stats	49	49	48	48
Years used for stats	'65-'13	'65-'13	'66-'13	'66-'13
# Yrs with WS duration > 70%	8	15	16	11
Annual Exceedance Frequency	16.3%	30.6%	33.3%	22.9%
Return Period (1-in-Nyrs)	6.1	3.3	3.0	4.4

*Only **8 of 49** calendar years show full 64 mgd WS occurring >70% of the time.*
***15 of 49** wet seasons (May-Oct) show full WS occurring > 70% of the time.*
***16 of 48** dry seasons (Nov-May) show full WS occurring > 70% of the time.*

Water Supply Reliability Statistics: WSmaxL

Lake TOH Water Supply Reliability Table for WSmaxL

	No. of Days per Month with Lake Toho WS Withdrawals at 99.0 cfs (64.0 MGD)												Days	Vol(kaf)	AvgMGD	Percent of Time WS Withdrawal			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec	Jan-Dec	Jan-Dec	CalYear Jan-Dec	WetSeas May-Oct	DrySeas Nov-Apr	WatYear May-Apr
1965	0	16	29	0	0	0	0	0	0	0	0	0	45	8.84	7.89	12.3%	0.0%		
1966	1	28	30	11	0	4	31	31	30	15	0	0	181	35.55	31.74	49.6%	60.3%	33.0%	19.2%
1967	0	16	15	0	0	0	0	0	0	0	0	0	31	6.09	5.44	8.5%	0.0%	14.6%	38.9%
1968	0	0	0	0	0	2	30	31	10	0	0	0	73	14.34	12.76	19.9%	39.7%	0.0%	0.0%
1969	0	0	22	26	22	0	0	0	6	27	21	22	146	28.68	25.60	40.0%	29.9%	33.0%	33.2%
1970	31	28	31	30	31	9	0	10	0	0	0	0	170	33.39	29.81	46.6%	27.2%	91.5%	59.7%
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	13.7%
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1974	0	0	0	0	0	0	0	29	30	4	0	0	63	12.37	11.05	17.3%	34.2%	0.0%	0.0%
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	17.3%
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1978	0	0	0	0	0	0	0	29	3	0	0	0	32	6.29	5.61	8.8%	17.4%	0.0%	0.0%
1979	4	28	31	30	31	1	0	0	27	7	0	0	159	31.23	27.88	43.6%	35.9%	58.5%	34.2%
1980	20	29	31	30	31	3	0	0	0	0	0	0	144	28.28	25.18	39.3%	18.5%	66.2%	48.1%
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	9.3%
1982	0	0	0	0	0	1	31	31	28	13	0	0	104	20.43	18.24	28.5%	56.5%	0.0%	0.0%
1983	7	28	31	30	31	13	20	31	28	13	7	15	254	49.89	44.54	69.6%	73.9%	59.9%	54.8%
1984	31	29	31	30	31	3	27	30	4	0	0	0	216	42.43	37.77	59.0%	51.6%	81.7%	76.2%
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	26.0%
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1988	5	28	31	16	0	0	0	0	0	0	0	0	80	15.71	13.99	21.9%	0.0%	37.6%	21.9%
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
1991	0	0	0	0	0	0	0	30	13	16	0	0	59	11.59	10.35	16.2%	32.1%	0.0%	0.0%
1992	0	20	0	0	0	0	22	27	29	19	6	27	150	29.46	26.23	41.0%	52.7%	9.4%	21.6%
1993	29	28	31	30	31	5	0	0	0	0	0	0	154	30.25	27.00	42.2%	19.6%	85.8%	67.9%
1994	1	28	31	20	31	23	25	31	30	16	28	31	295	57.94	51.73	80.8%	84.8%	52.4%	31.8%
1995	30	28	31	30	31	0	5	31	27	28	13	10	264	51.85	46.29	72.3%	66.3%	98.6%	91.5%
1996	30	29	31	30	24	30	23	16	0	0	0	0	213	41.84	37.25	58.2%	50.5%	78.4%	72.4%
1997	0	0	0	0	0	0	0	0	2	0	0	21	23	4.52	4.03	6.3%	1.1%	0.0%	25.5%
1998	31	28	31	30	31	2	0	0	1	4	0	0	158	31.03	27.70	43.3%	20.7%	81.1%	39.2%
1999	0	26	26	0	0	0	8	7	14	30	26	12	149	29.27	26.13	40.8%	32.1%	24.5%	24.7%
2000	18	29	31	10	0	0	0	0	0	0	0	0	88	17.28	15.39	24.0%	0.0%	59.2%	50.5%
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	0.0%
2002	0	25	2	0	0	0	7	31	30	3	0	21	119	23.37	20.87	32.6%	38.6%	12.7%	7.4%
2003	31	28	31	22	12	27	31	31	21	8	2	16	260	51.07	45.59	71.2%	70.7%	68.4%	55.9%
2004	21	29	23	0	0	0	0	0	16	31	26	12	158	31.03	27.63	43.2%	25.5%	42.7%	60.4%
2005	30	25	31	30	22	30	29	31	9	7	27	21	292	57.35	51.20	80.0%	69.6%	83.0%	55.1%
2006	10	28	31	30	4	0	0	0	0	0	0	0	103	20.23	18.06	28.2%	2.2%	71.2%	75.3%
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	1.1%
2008	0	0	0	0	0	0	0	4	23	4	0	0	31	6.09	5.42	8.5%	16.8%	0.0%	0.0%
2009	0	0	0	0	0	0	0	31	25	1	0	0	57	11.20	9.99	15.6%	31.0%	0.0%	8.5%
2010	0	11	31	30	31	30	19	2	0	0	0	0	154	30.25	27.00	42.2%	44.6%	48.6%	35.3%
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%	22.5%
2012	0	0	0	0	0	0	0	0	29	13	0	0	42	8.25	7.34	11.5%	22.8%	0.0%	0.0%
2013	0	14	31	30	31	25	31	31	28	3	0	0	224	44.00	39.28	61.4%	81.0%	50.0%	32.1%
MEANS																			
48YR	7	12	14	10	9	4	7	11	9	5	3	4	96	18.80	16.77	26.2%	24.6%	27.9%	26.2%
41YR	8	13	14	10	9	4	7	11	9	6	4	5	100	**19.55**	**17.44**	**27.3%**	24.6%	29.7%	27.3%



Number of Days per Month with Water Supply Withdrawals from Lake Tohopekaliga

Percent of Time Water Supply Withdrawal > 70%

SUMMARY STATISTICS	CalYear	WetSeas	DrySeas	WatYear
No. of years used for stats	49	49	48	48
Years used for stats	'65-'13	'65-'13	'66-'13	'66-'13
# Yrs with WS duration > 70%	4	4	8	4
Annual Exceedance Frequency	8.2%	8.2%	16.7%	8.3%
Return Period (1-in-Nyrs)	12.3	12.3	6.0	12.0

*Only **4 of 49** calendar years show full 64 mgd WS occurring >70% of the time.*
***4 of 49** wet seasons (May-Oct) show full WS occurring > 70% of the time.*
***8 of 48** dry seasons (Nov-May) show full WS occurring > 70% of the time.*

UK-OPS Model Summary

- Developed to easily and quickly test various water operations strategies
- Simple Microsoft Excel® model of hydrology and operation of the primary lakes in the Upper Kissimmee Basin
  - Up to 49-year simulations using daily timestep
  - Driven by historical or simulated hydrology and user-input operating rules
- Used for SFWMD operations planning
- Modified to serve as a permitting tool to evaluate surface water withdrawals consistent with Kissimmee River and Chain of Lakes Water Reservations rule criteria
- Provides immediate feedback showing multi-objective performance
- Favorable peer review completed in November 2019

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Public Comment

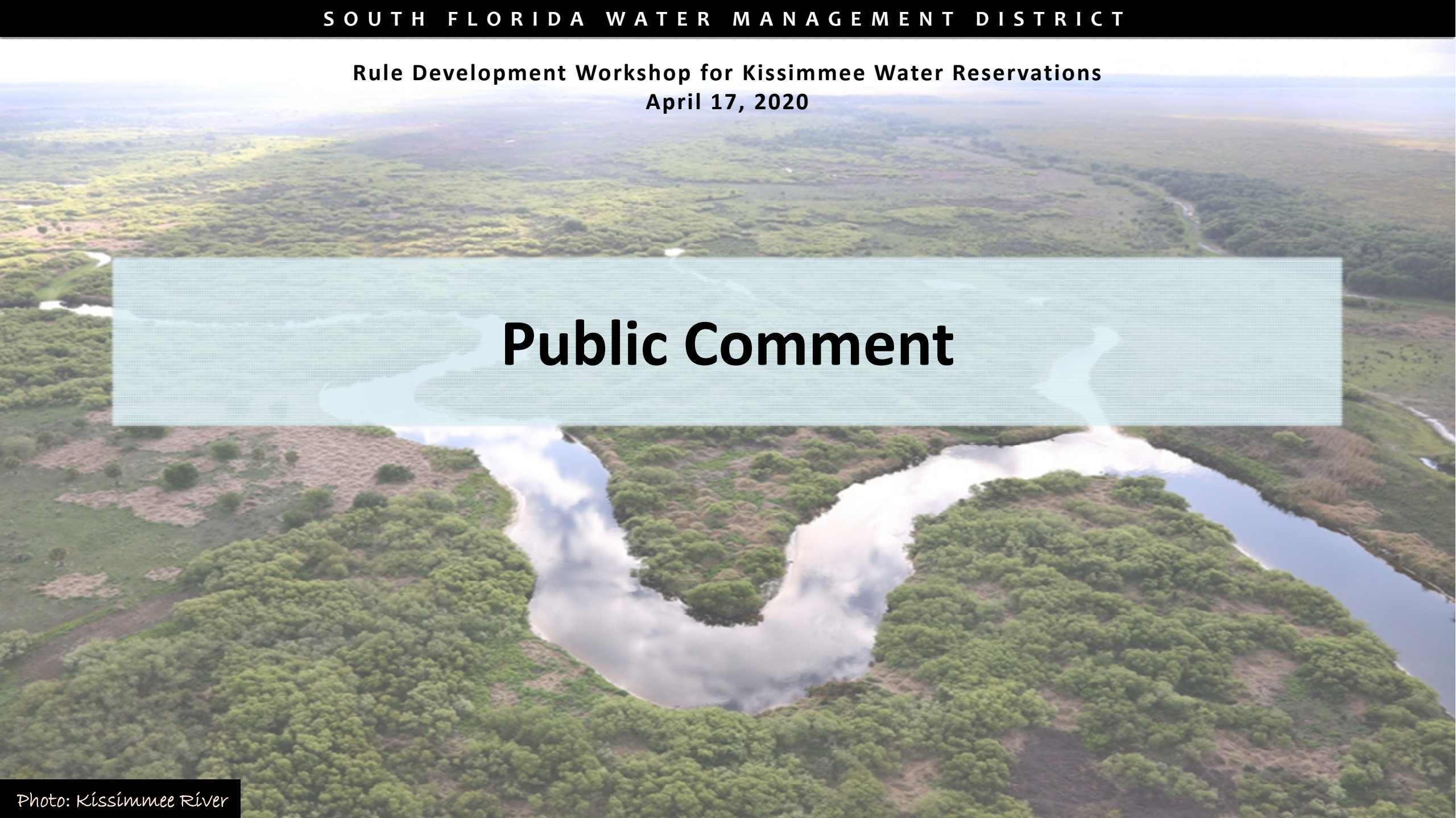


Photo: Kissimmee River

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Questions

Please use the “Q & A” (question and answer) feature on the Zoom tool bar to ask a question regarding the workshop presentations, draft rules, or technical document

Photo: Kissimmee River

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Next Steps

Don Medellin
Applied Sciences Bureau

Photo: Kissimmee River

Next Steps

- Public comments due Monday, May 18, 2020
- Comments can be submitted to Toni Edwards at tedwards@sfwmd.gov OR http://sfwmd.websitetoolbox.com/
- Workshop presentations will be posted to the Kissimmee Reservations webpage

- **Next workshop: June 9, 2020**
  (webinar similar to today's workshop)

Additional Information

- Kissimmee reservations webpage
  www.sfwmd.gov/reservations
- Kissimmee web board (under SFWMD Rule Development)
  http://sfwmd.websitetoolbox.com/
- SFWMD rules webpage
  www.sfwmd.gov/rules

Rule Development Workshop for Kissimmee Water Reservations
April 17, 2020

Thank You

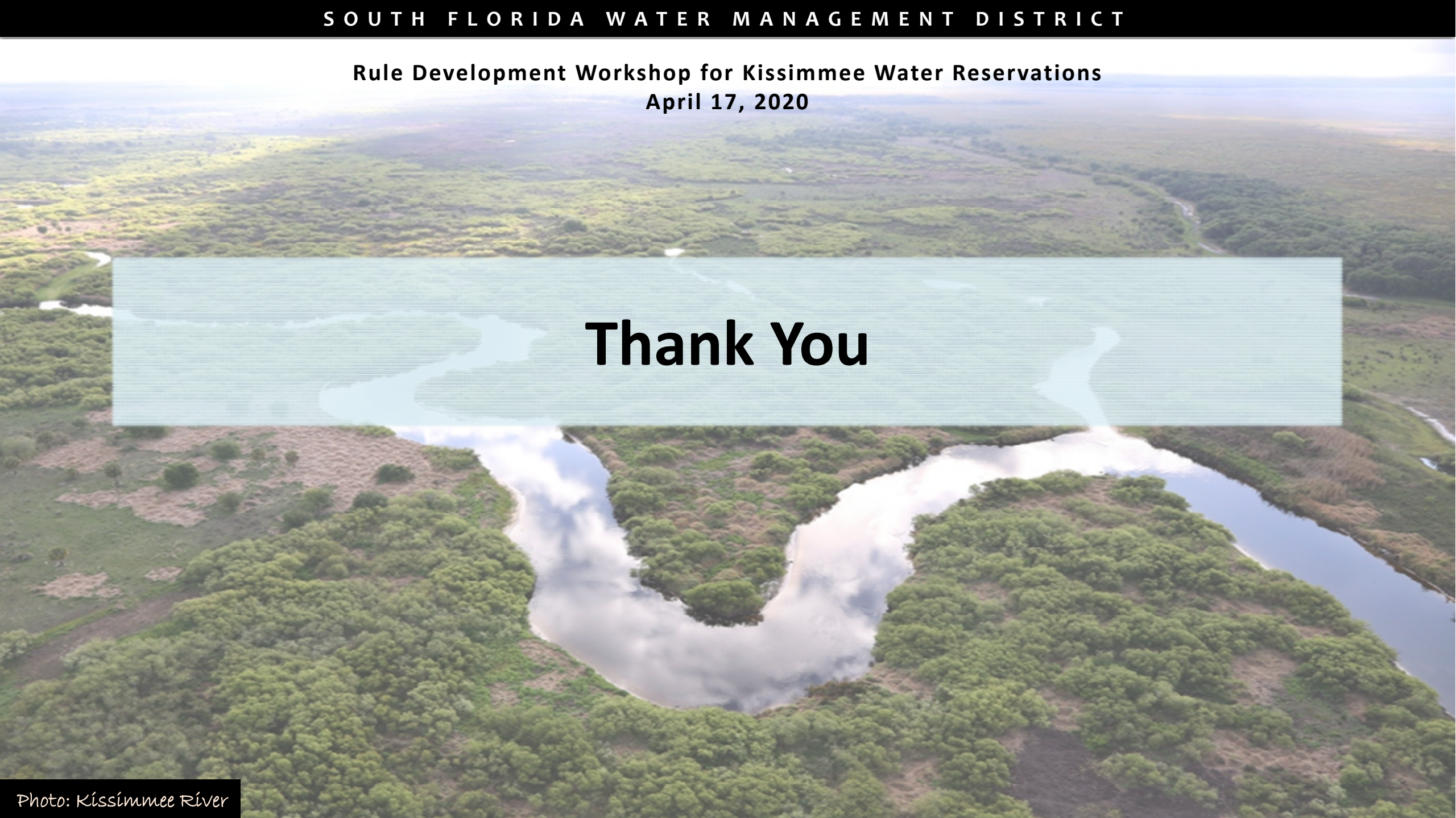


Photo: Kissimmee River