
Integrated Water Resources Management Model for the Great Salt Lake Basin

Public Information Meeting

June 24, 2015



GREAT SALT LAKE
INTEGRATED WATER RESOURCE
MANAGEMENT MODEL

Agenda

- Project Introduction
- Vision/Objectives
- Project Approach
- Project Schedule
- Question and Answer

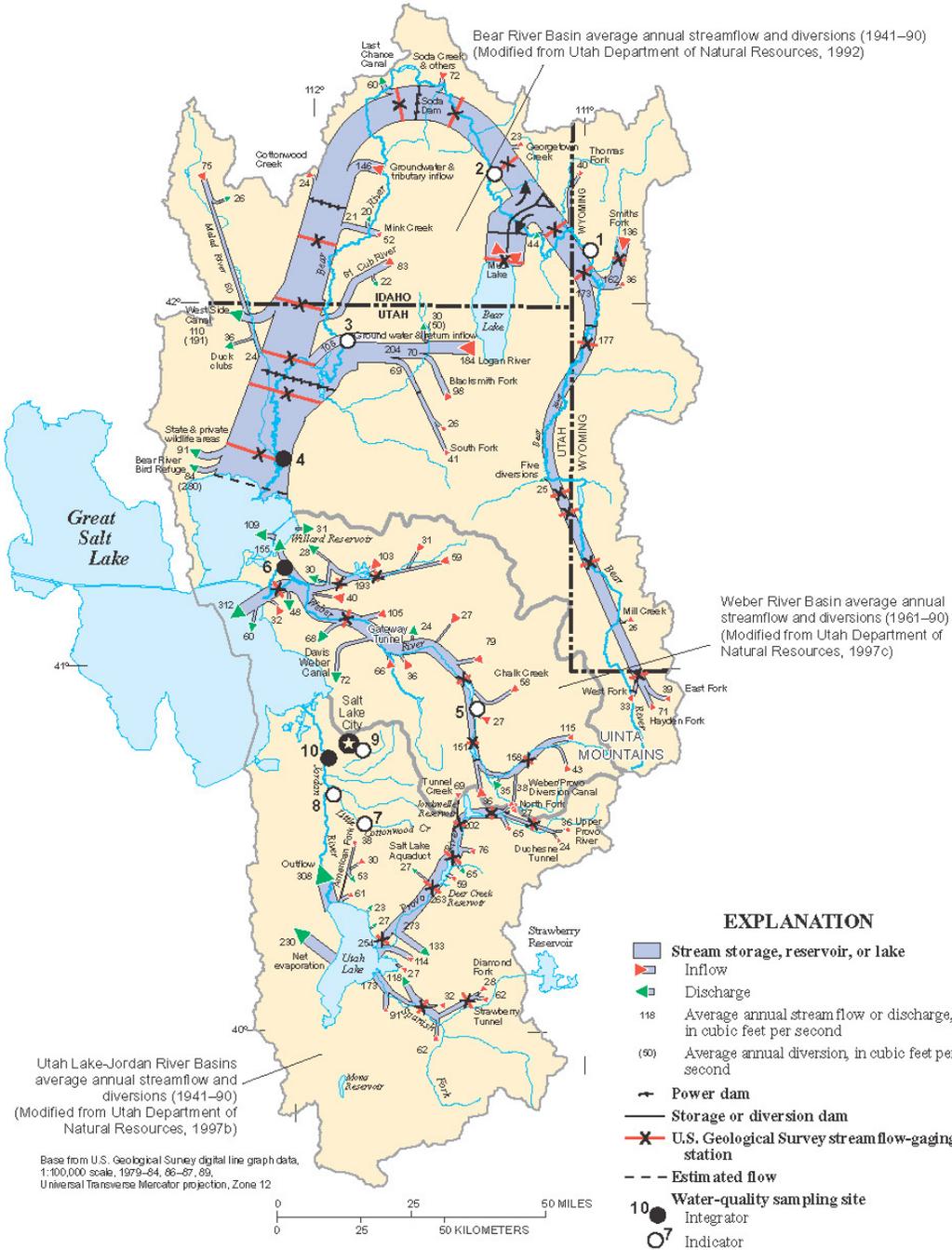
Outcomes

- Information
- Your input



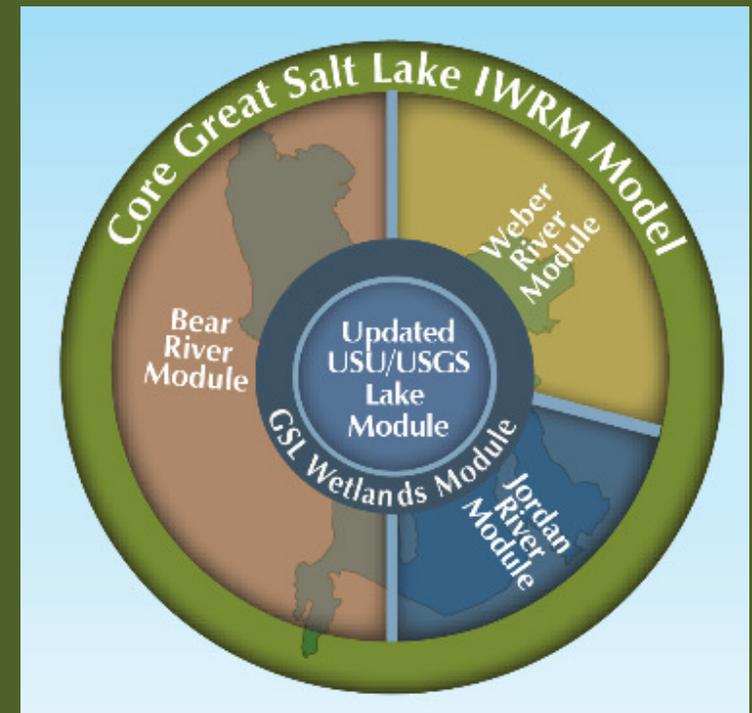


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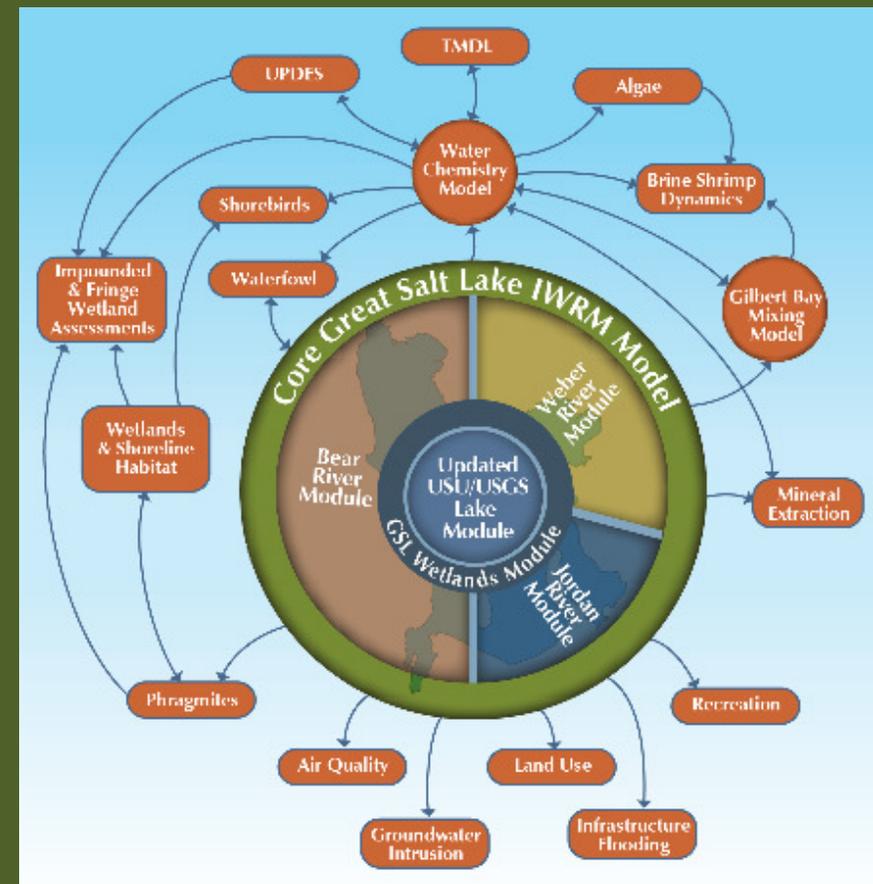
IWRM Approach

- Building a core model to support management decisions
- Common platform
- Evaluate scenarios
- Communication tool



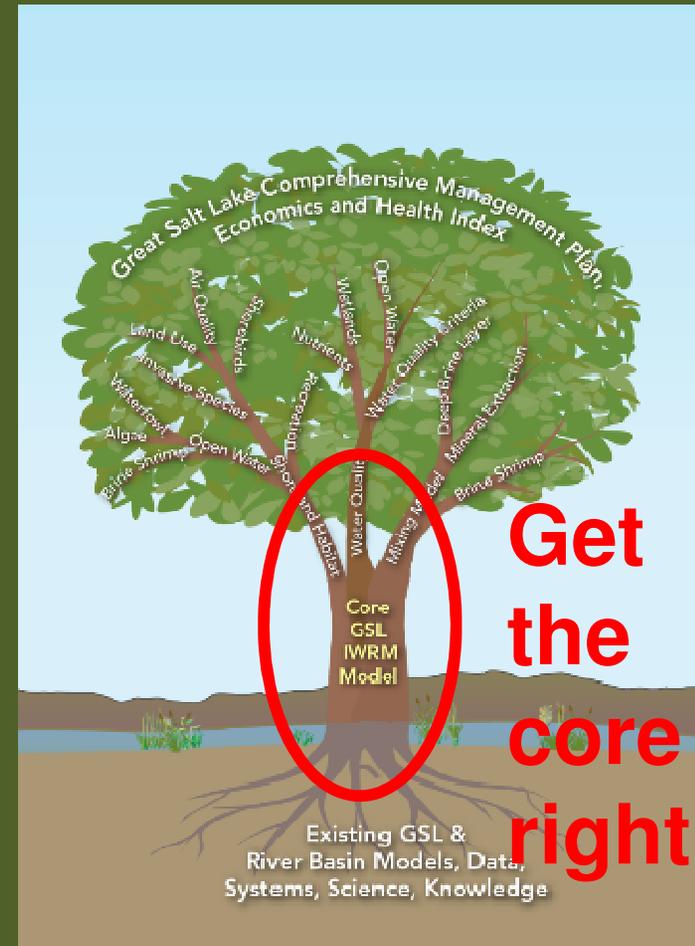
The Challenge

- Balance the details with structure to answer the right management questions
- AND provide flexibility for adding additional detail and functionality in the future



The Challenge

- Rooted in accepted science
- Develop an accepted core model
- Support current and emerging decisions



GSL IWRM Model Vision

- Develop a tool that will help clarify the relationship between Great Salt Lake water levels and salinity and potential changes in the lake and its watershed.



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GSL IWRM Model Purpose

1. Describe changes in GSL/Watershed that impact GSL water level/salinity
2. How do changes effect the lake's resources
3. Foundation for addressing future challenges
4. Communication tool



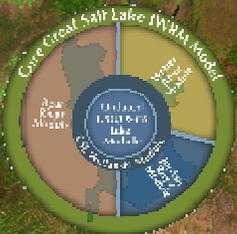
Issues Identified

Watersheds

1. Climate (e.g. drought)
2. Water Diversions
 - Bear River, ASR
3. Population dynamics
 - Land use
 - Density/water demand
 - Water conservation/reuse
4. Infrastructure
5. Inter-basin transfers
6. Water supply/development
7. Return flows

GSL

1. Mineral extraction
2. Infrastructure change
3. Duck club and other impoundments
4. Ecological stressors (e.g. *Phragmites*)
5. Link to GSL Management Plan



GSL IWRM Model Outputs

Watersheds

1. Water budget to GSL
 - Available & imported water
 - Total consumption
2. Salt load to GSL

- Water distribution
- Water delivery/diversions
- Water use
- Reliability

GSL

1. Water Level
2. Salinity
3. Water budget factors (e.g. inflows, ET, precip, abstraction)

- Socio-economic
- Ecological
- Link to GSL Comprehensive Management Plan



GSL IWRM Model - Communication

Stakeholder Tool

Inputs (dials, knobs):

- *Watershed - landuse, density, demand, climate*
- *GSL – abstraction, impoundments, phragmites*

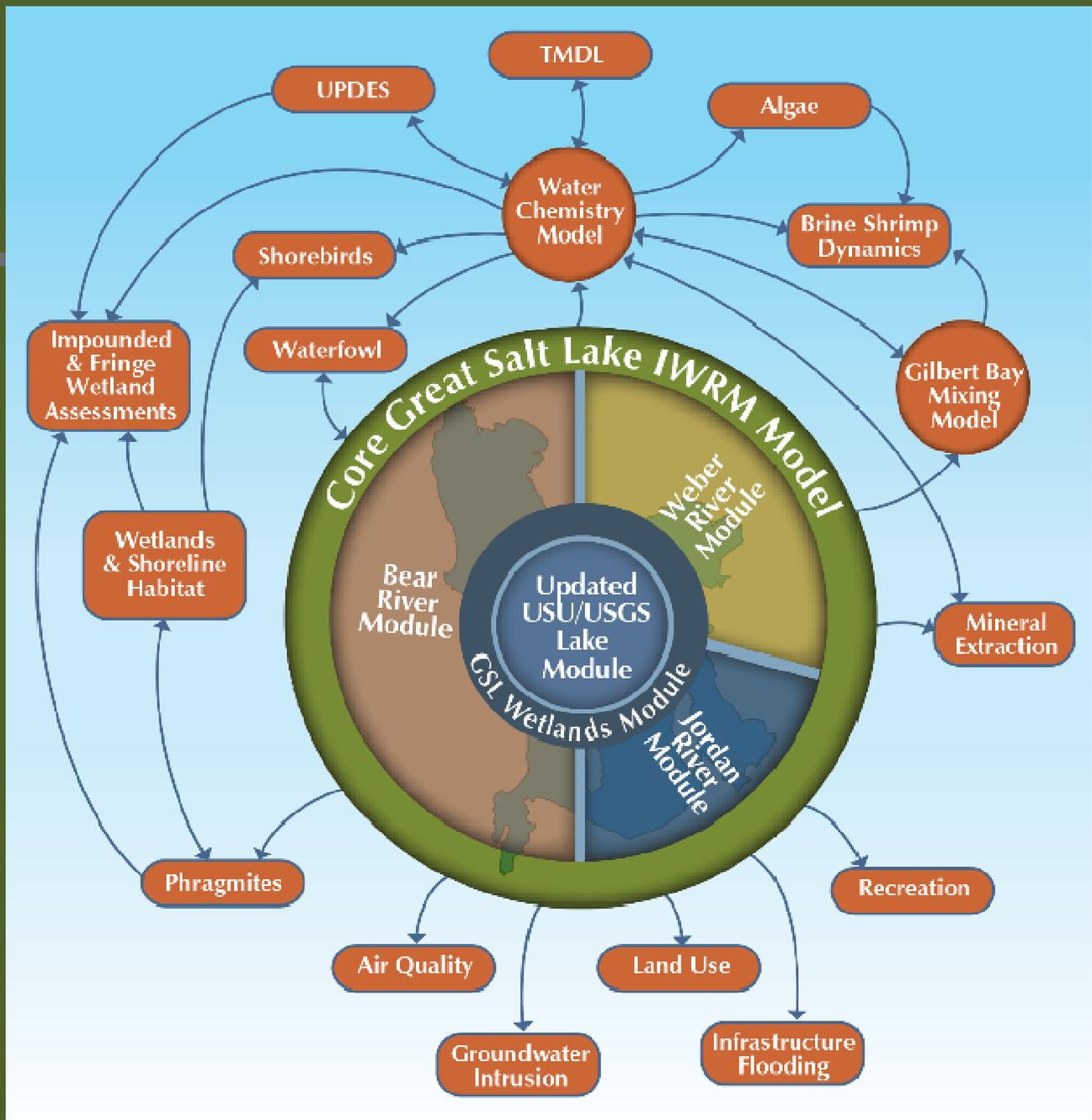
Outputs:

- *Statistics*
- *Time series output to Excel*

Public Information

- Website posting simulations results





Future Output

GSL LAKE LEVEL MATRIX		Zone boundary transition		Beneficial for resource		Transition		Advise for resource		Gray scale is descriptive only to show differences in categories etc.		Blue scale represents value-neutral changes in lake characteristics		Incomplete data or information gap															
Elevation		Lake Level Category Resource Summary		Lake Morphometry		WATER		WETLANDS		AIR		BIOLOGY		ECONOMICS		SAFETY													
Elevation in South Arm Variable Location		Lake Level Category Resource Summary		Lake Morphometry		WATER		WETLANDS		AIR		BIOLOGY		ECONOMICS		SAFETY													
Elevation in South Arm Variable Location		Lake Level Category Resource Summary		Lake Morphometry		WATER		WETLANDS		AIR		BIOLOGY		ECONOMICS		SAFETY													
4,213+	4,212	4,211	4,210	4,209	4,208	4,207	4,206	4,205	4,204	4,203	4,202	4,201	4,200	4,199	4,198	4,197	4,196	4,195	4,194	4,193	4,192	4,191	4,190	4,189	4,188				
Zone 6 (4.8% probability) High (31.4%)		Zone 5 (24.9% probability) High (31.4%)		Zone 4 (13.0% probability) Medium (24.2%)		Zone 3 (21.0% probability) Medium (24.2%)		Zone 2 (12.0% probability) Low (31.4%)		Zone 1 (1.4% probability) Low (31.4%)		Zone 0 (0.0% probability) Low (31.4%)																	
Bear water system		Bear water system		Diverse ecosystem and habitat																									
Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Proposed Categories for Plus (Elevations below 4,200 feet do not include Bear River of Farmington Bay)			
Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)		Total Lake Area (million acres) (Elevations below 4,200 feet do not include Bear River of Farmington Bay)			
Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands		Islands			
Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay		Connectivity of Bays Relative to Gilbert Bay			
Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity		Salinity			
Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater			
Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands		Fringe Wetlands			
Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands		Impounded Wetlands	
Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality		Air Quality			
Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology		Biology			
Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining		Mining			
Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use		Land Use			
Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation		Recreation			
Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics		Economics			
Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety		Safety			



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Source: GSL CMP, DFFSL

Supporting Infrastructure



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Centered Consulting
International, LLC

Communication during Development

- Website
- Quarterly newsletters
- Stakeholder Group
 - Informed on development
 - Provide suggestions
 - Read reports
 - Attend meetings

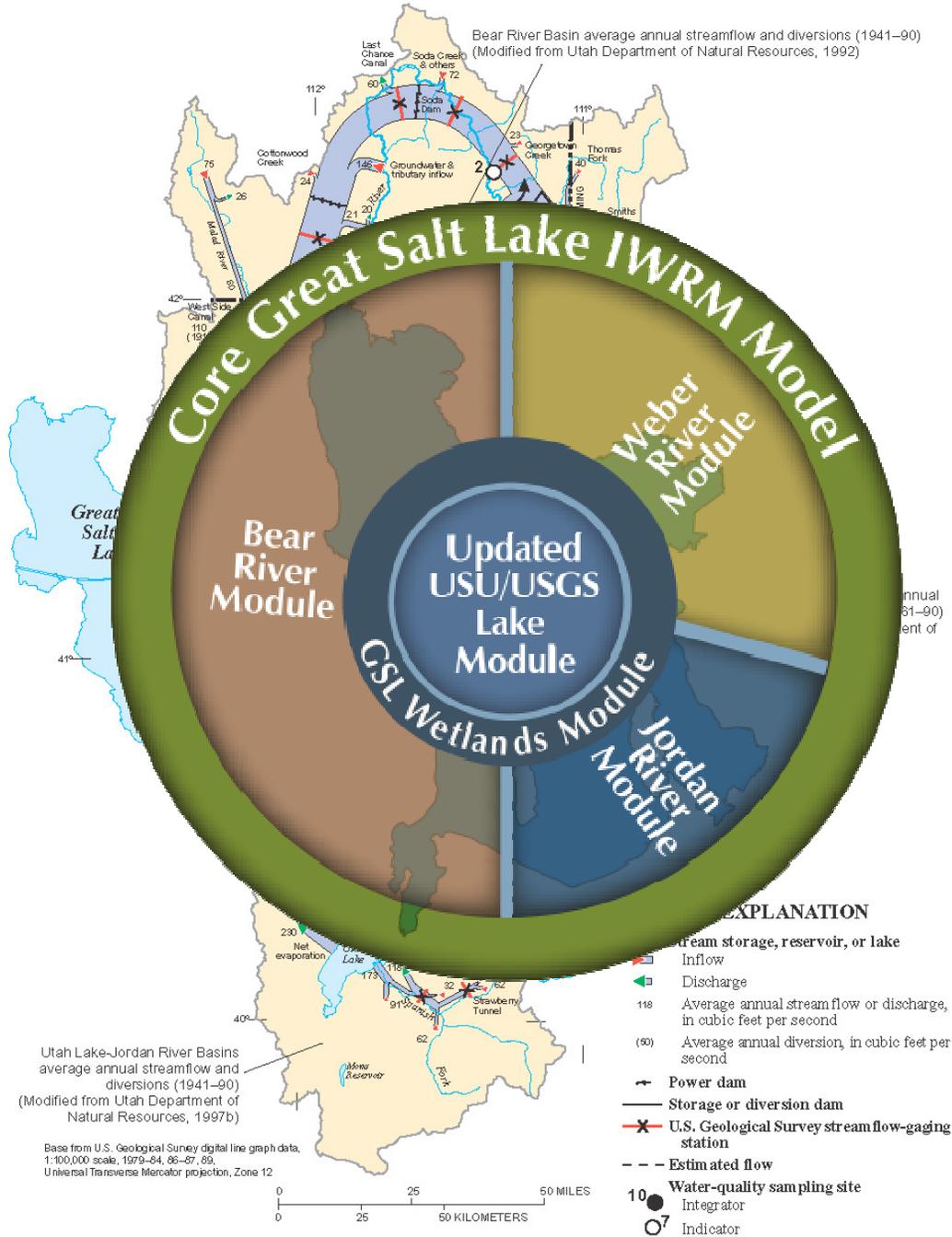


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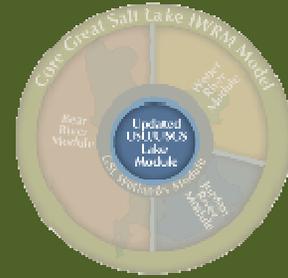


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annual
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GSL Modeling Past & Present



USGS GSL Model Evolution

1973

- Predict future trend of salt balance
- Investigated upsizing culverts
- Model period - 1965-1972

1997

- Updated model for causeway improvements, high water levels, desert pumping
- Improved capabilities for water/salt balance
- Model period - 1980-1986

1998

- Updated water and salt balance relationships/data
- Model period – 1980-1998

UPRR/USGS GSL Model

- Address UPRR Causeway Modifications

2014

2014

USU/USGS GSL Model

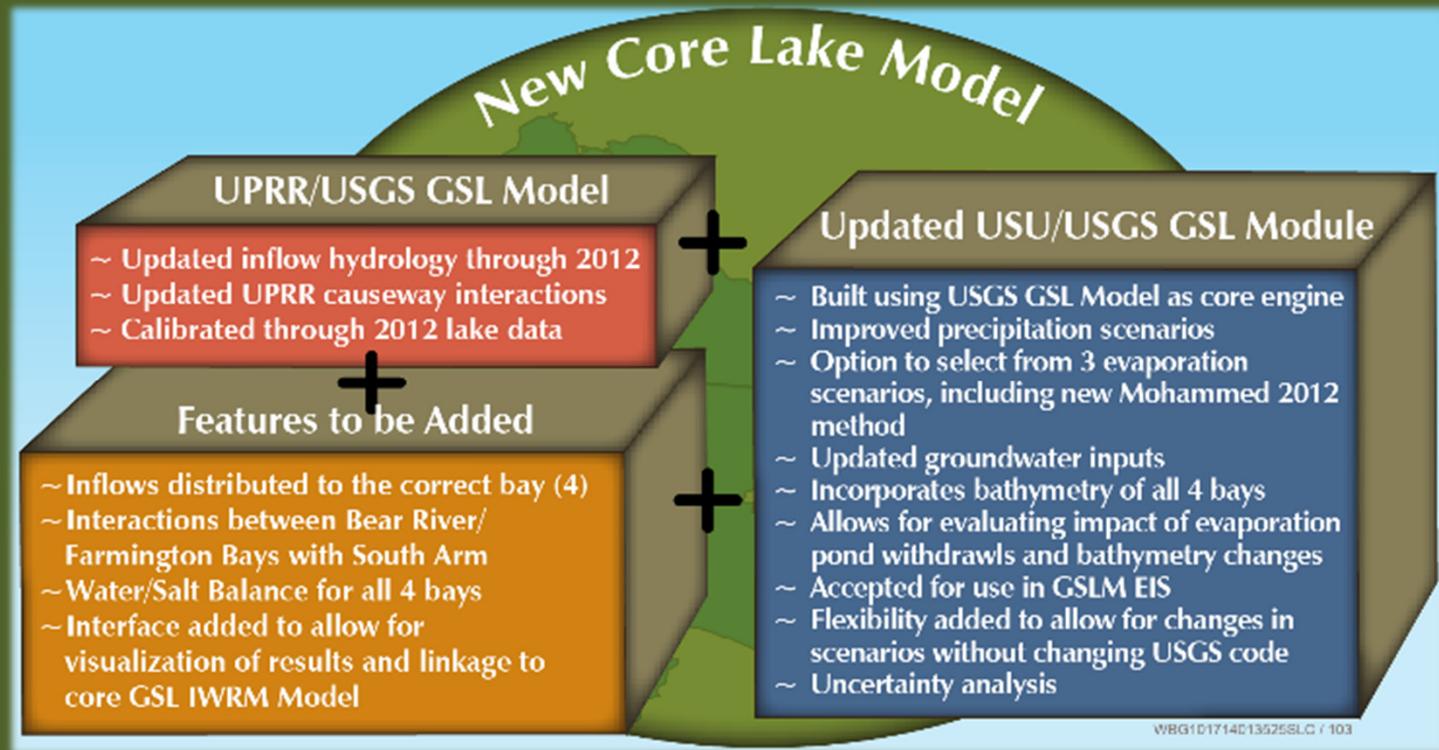
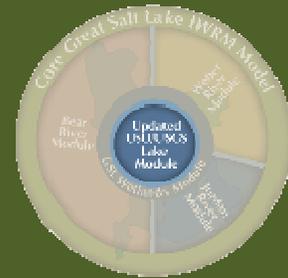
- Address Evaporation Basin Expansion

GSL IWRM Model

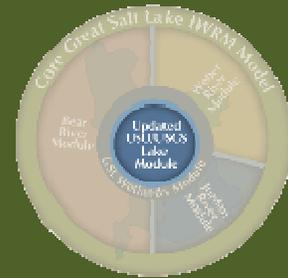


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Integrating Existing GSL Models into Core Lake Model



Core Lake Model



- **Challenges**

- Interactions between bays

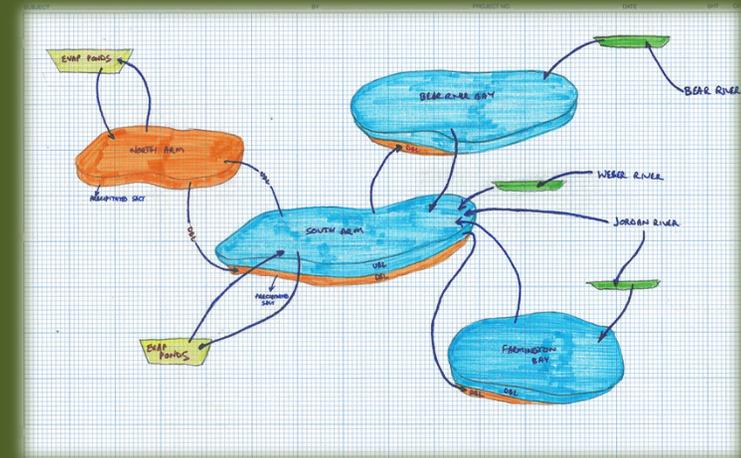
- Bathymetry

- *Addressing changes from evaporation basins*

- Salinity

- *Precipitated salts*
- *Incoming vs extracted load*
- *Two brine layers*

- Integrating wetlands



Core Lake Model - Wetlands



- Goal – what are the depletions - ET?
- Use state map of impounded/fringe wetlands
- Vegetation class



Source: GSL CMP, DFFSL

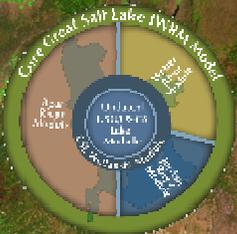
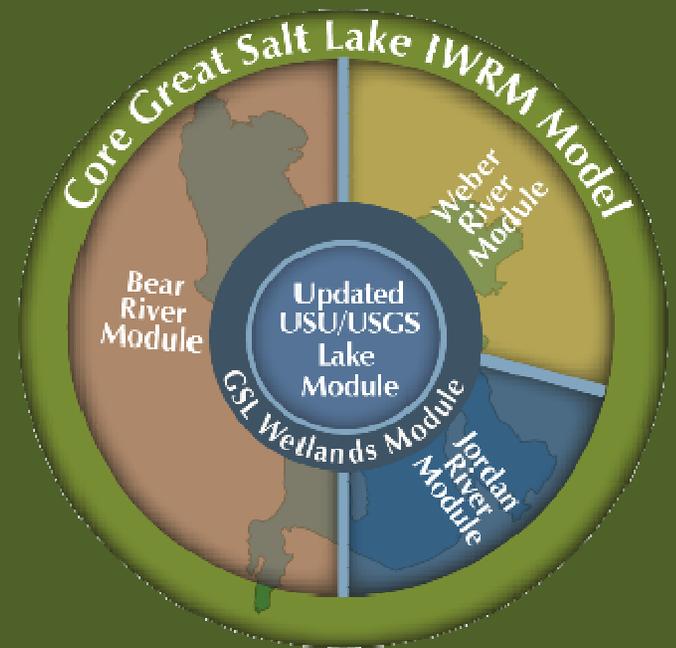


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River Basin Models

Key objective:

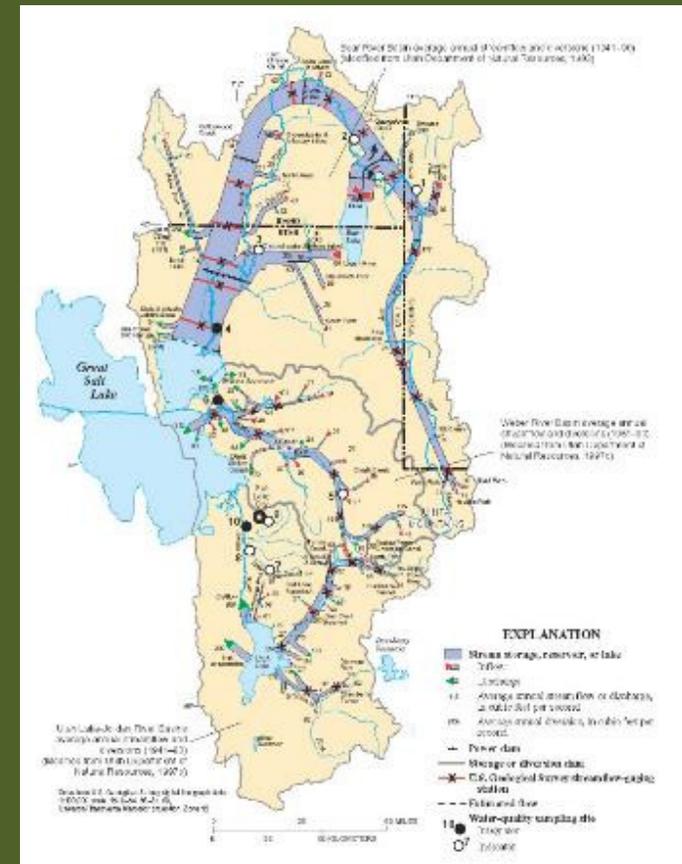
Characterize how changes in the watershed may change flows to Great Salt Lake



River Basin Models

Key challenges:

- 1. Defining key variables and scenarios**
- 2. Balancing appropriate level of detail to meet objectives**



Source: UDWR



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Approaches for River Basin Models

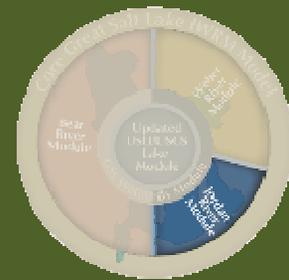
- **Option A: Water Balance Models**
 - River basin summaries
 - Planning area level analysis
 - *Population, land use, and water use information*
 - *Climate information*
 - *Water supply/demand balances*
 - *Some management information*
- **Option B: River Basin Management Models**
 - Same as above, plus ...
 - Major water infrastructure and operations simulation
 - Allocation and water rights characterization
 - Greater detail at water provider levels
- **Options have implications on budget, schedule, and policy overlap**



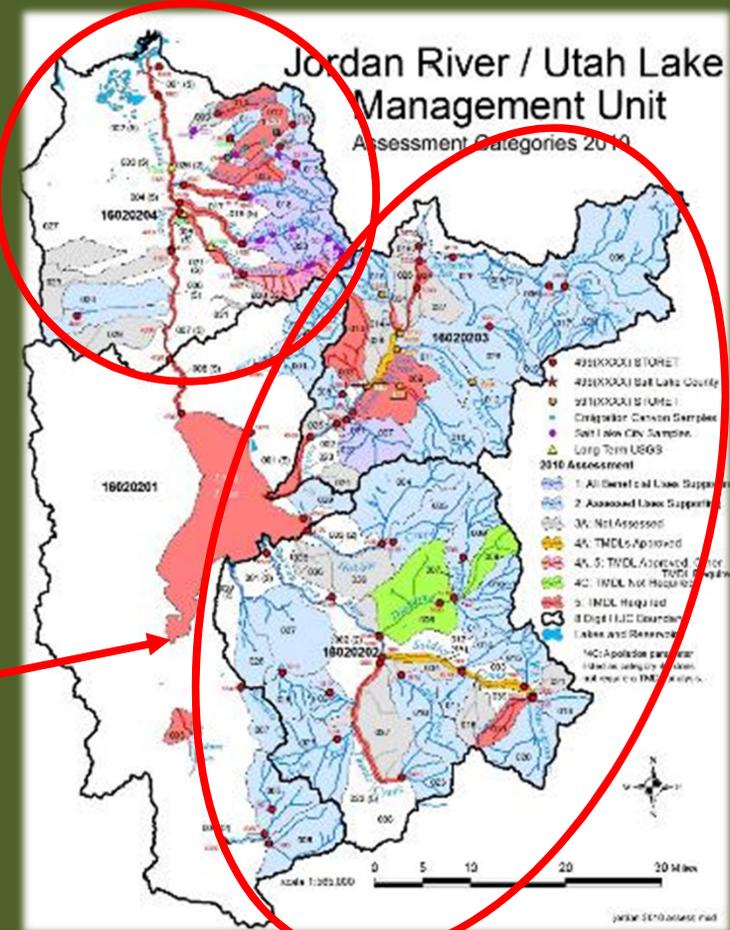
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Jordan River Module



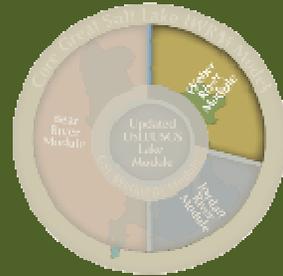
- Several basins
- Existing GoldSIM models
 - Valley-wide model, 2007
 - Salt Lake City/Farmington Bay model, 2014
- Riverware operations model by CUWCD



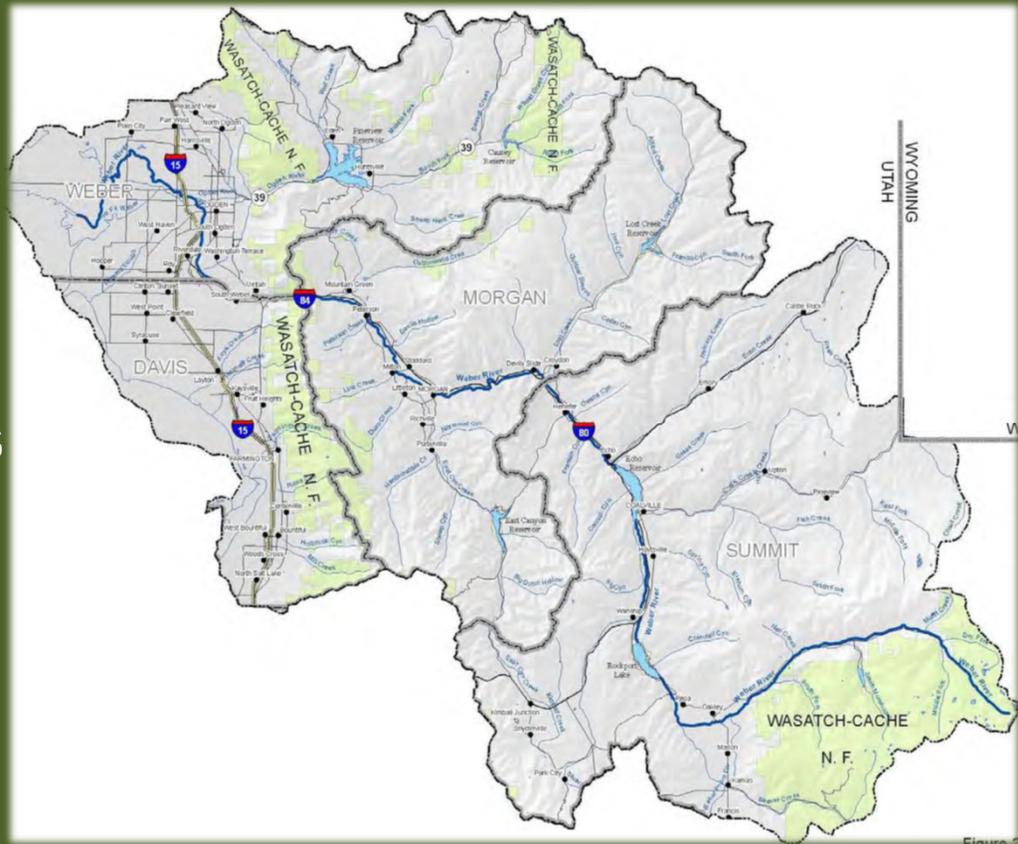
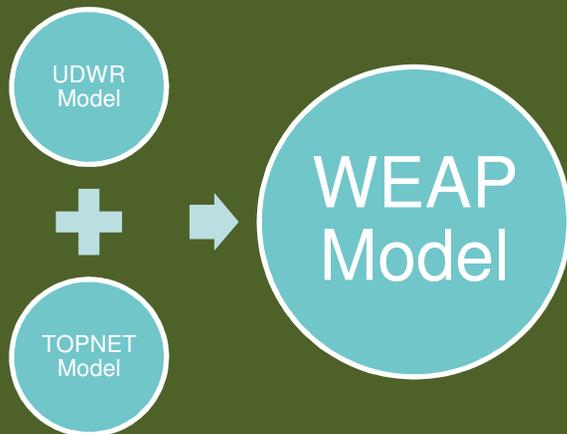
Source: UDWQ



Weber River Module

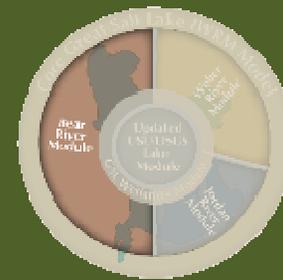


- Several options
- Dr. Rosenberg has already combined some models
- Mostly operations

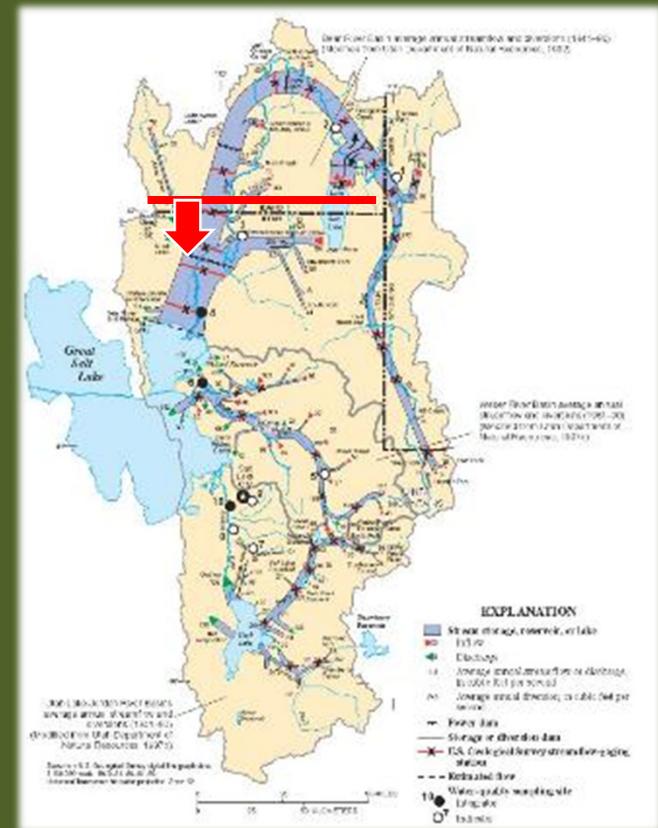
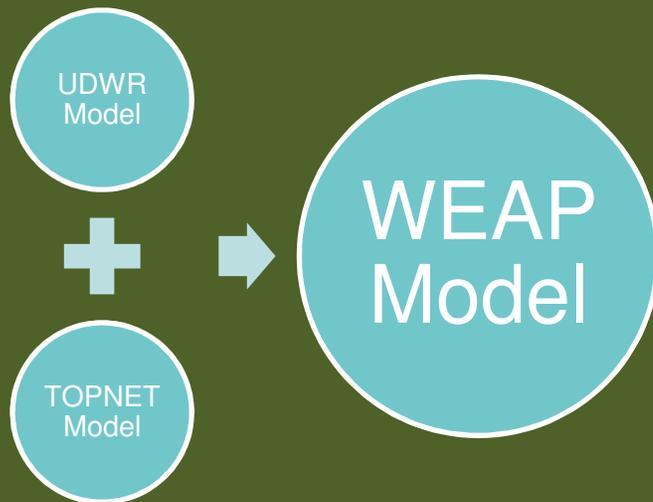


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Bear River Module

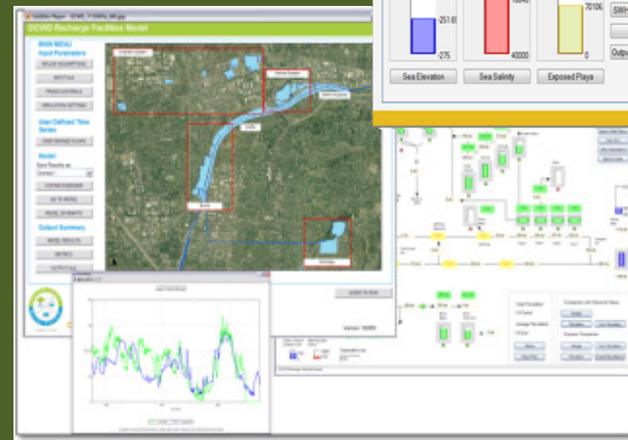
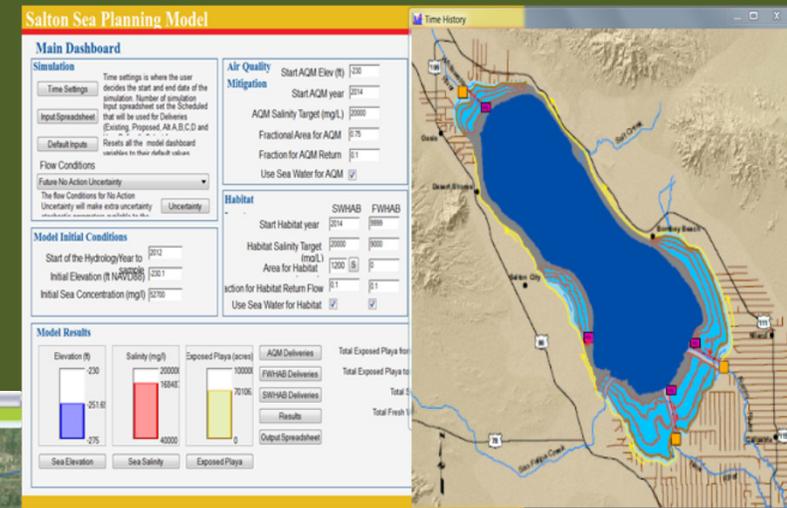


- Dr. Rosenberg has started to combine models
- Mostly Operations
- Will need to add WY and ID



What will we have at the end?

- Model that will allow the user to evaluate various scenarios, change input, understand the lake's response



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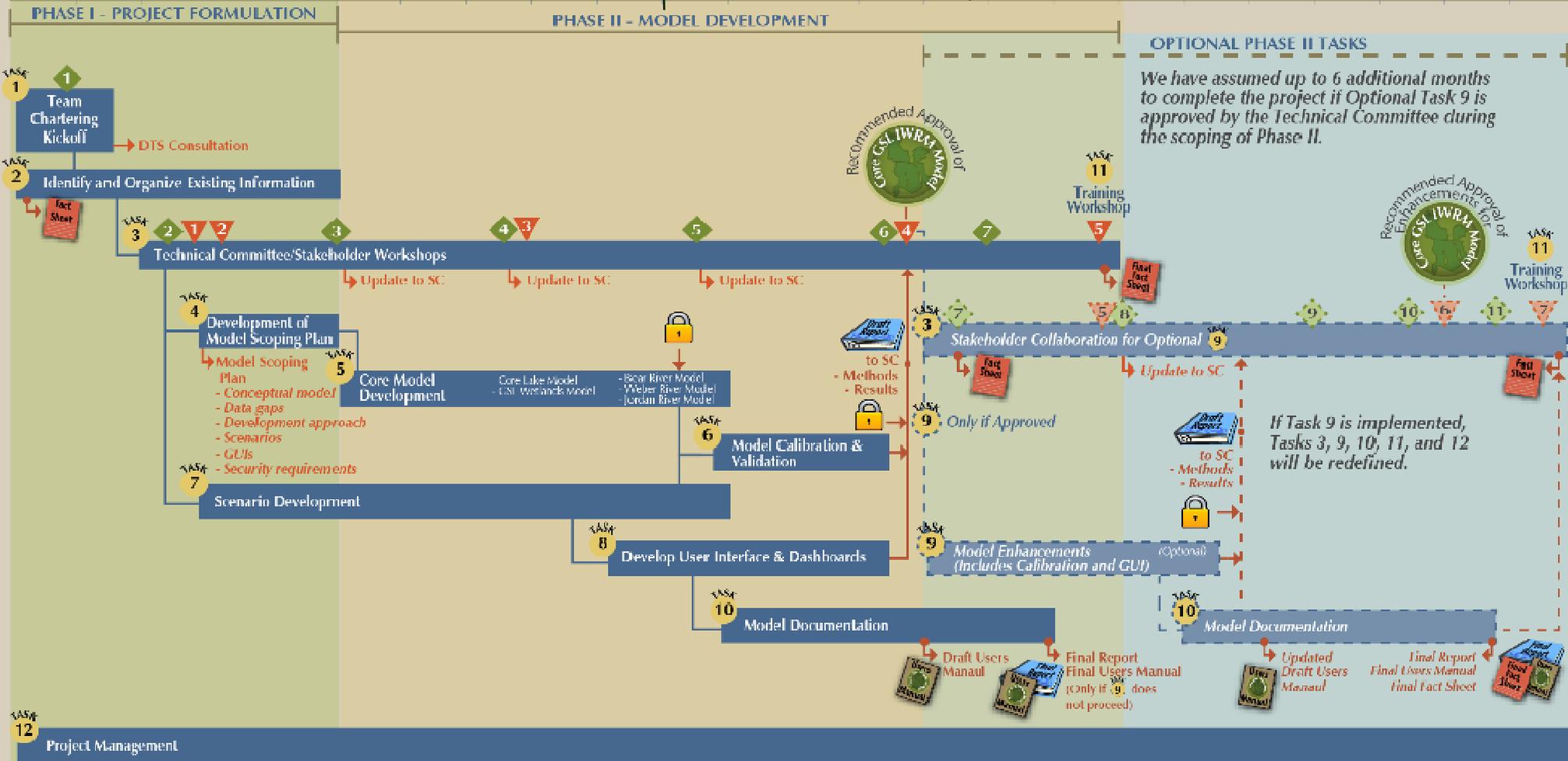
Approach to Developing the GSL IWRM Model

1. Defining objectives
 2. Model Scoping Plan
 3. Core model development
 4. Review & acceptance
 5. *Customization*
- Phase I
- Phase II
- Phase III



2015 | 2016

Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul



- LEGEND**
- TASK** Task Number
 - 1** Technical Committee (TC) Meeting
 - 2** Technical Committee (TC) Meeting for Optional Task 9
 - 3** IC / Stakeholder Committee (SC) Workshop
 - 4** IC / Stakeholder Committee (SC) Workshop for Optional Task 9
 - 5** Planned Tasks
 - 6** Optional Tasks
 - 7** Deliverable
 - 8** Software Code Review (Security)

How can you participate?

- We want your input!
- Website: <http://bit.ly/gsliwrm>
- Please sign up for mailing list at website
- If interested in joining the journey please sign up for the Stakeholder Group
- Contact Jeff DenBleyker:
 - Ph: 385-474-8515
 - Jeff.denbleyker@ch2m.com



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Questions

- General questions/clarification?
- What information do they need from the model for making a decision?
- How could GSL IWRM Model results be presented?
- Technologies or data to be included?
- What future applications do they see for the tool?



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