RECLAMATION
Managing Water in the West

Lessons Learned While Implementing an Operations Model of the Klamath Project

Project Team

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RiverWare User Group Meeting
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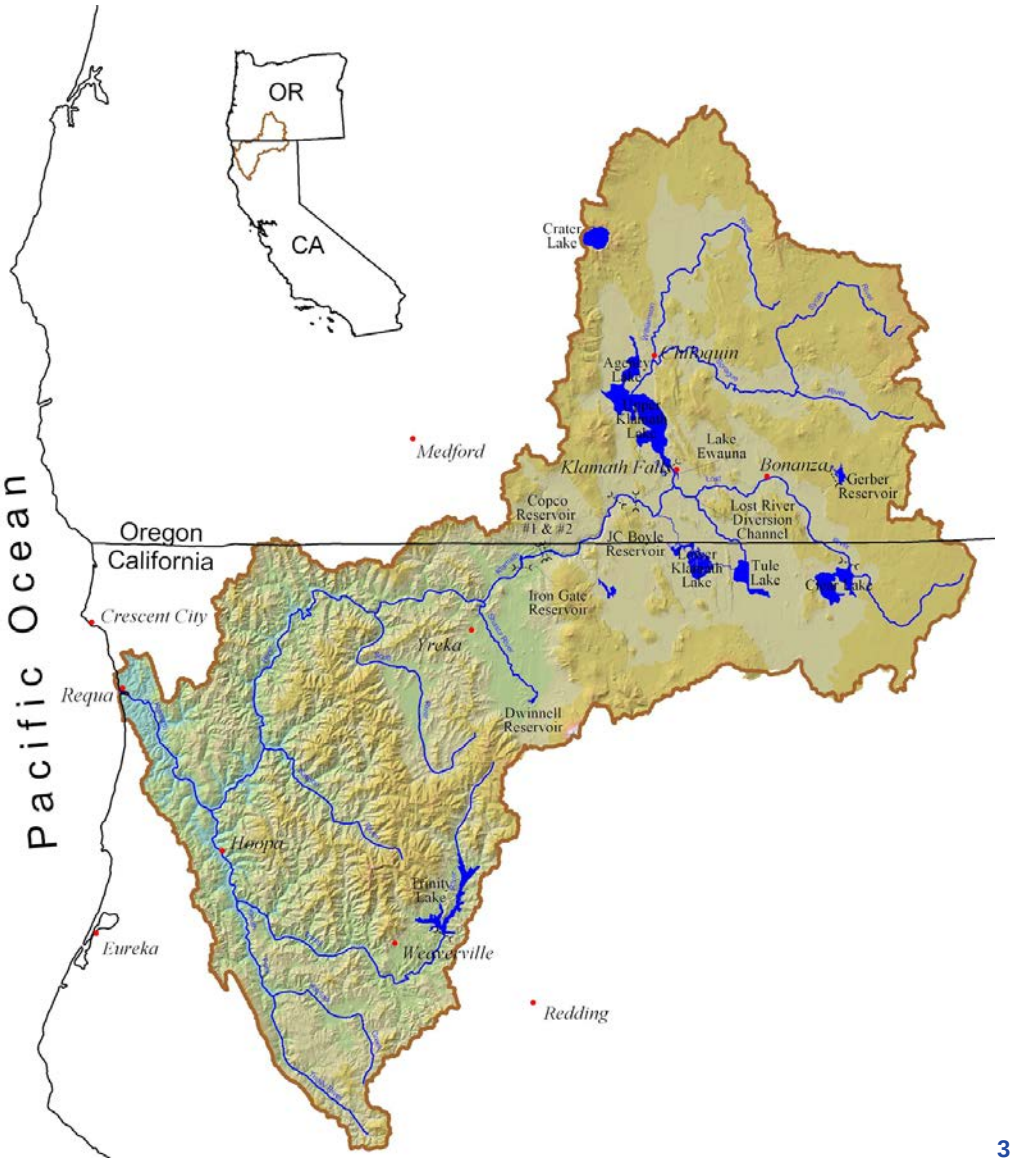
Outline

- Klamath Basin Overview
- Previous Modeling Tools for Operations and Planning
- Motivation and Description of RiverWare Operations Model
- Model Testing
- Lessons Learned
- Future Work

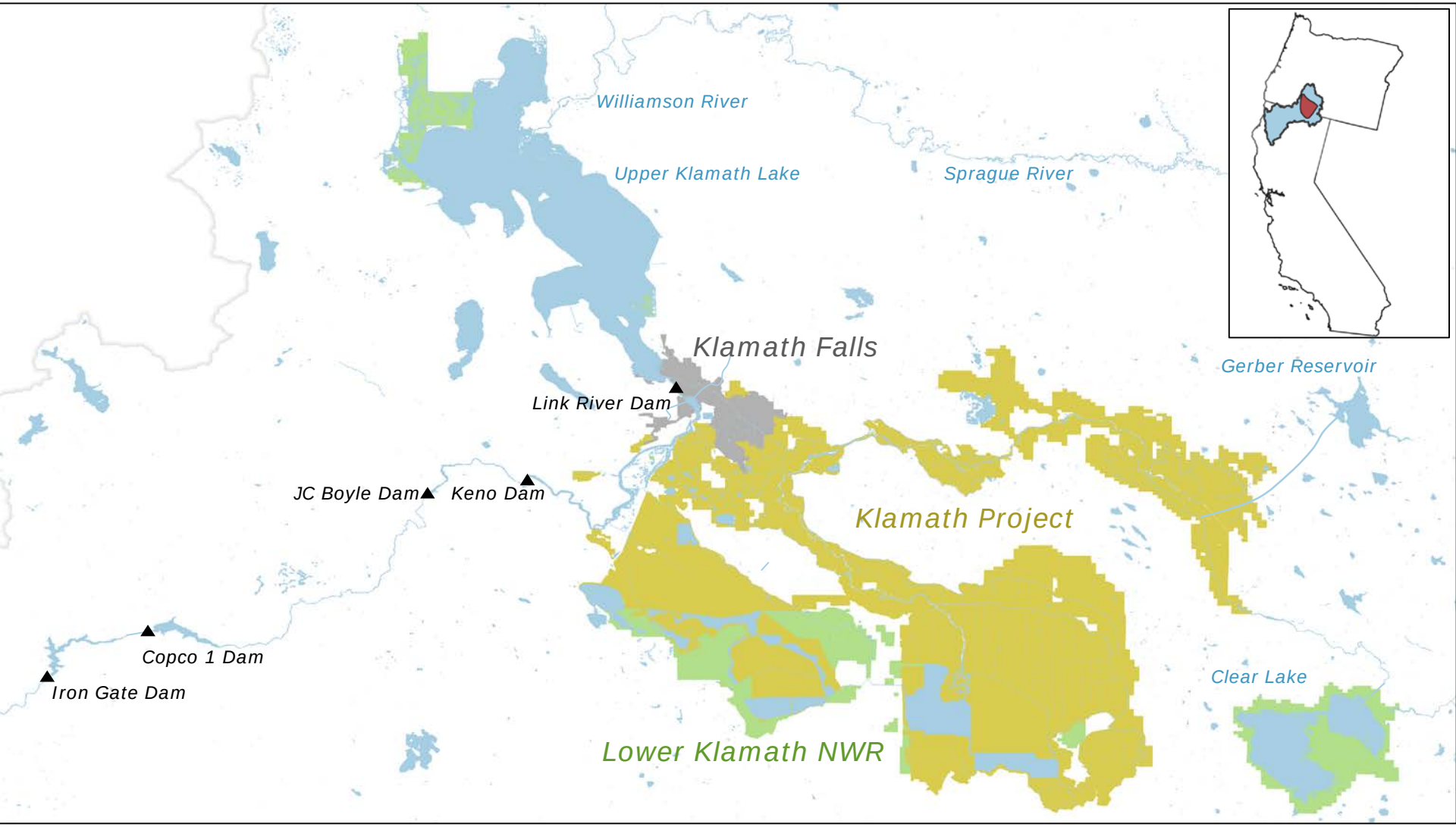
Klamath Basin Overview

Management Objectives -

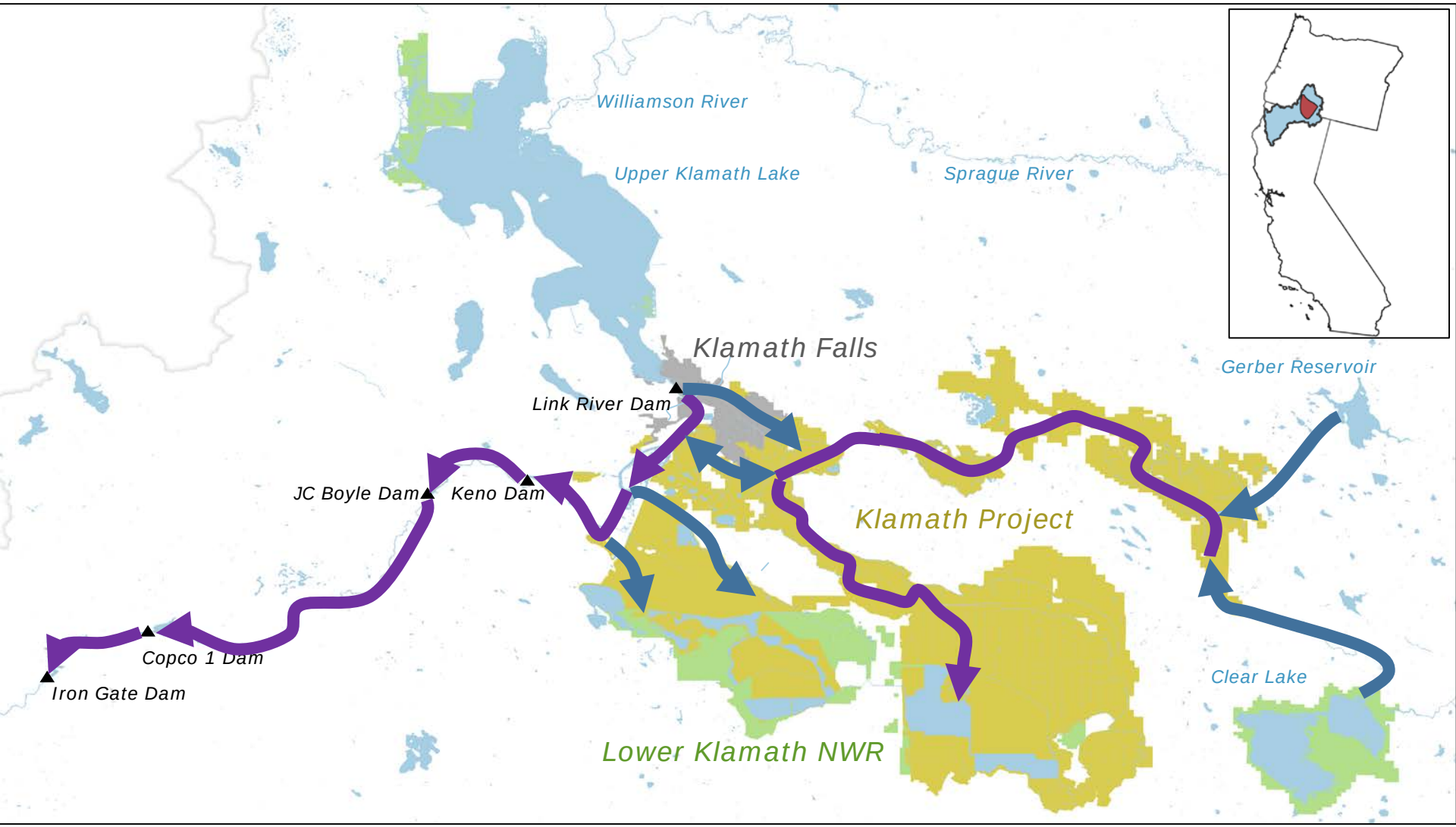
- Delivery of irrigation water to Reclamation's Klamath Project
- Flood control
- ESA-listed species
  - In-stream flow targets for SONCC coho salmon
  - Flushing and dilution flows for water quality and to reduce fish disease
  - Lake level targets for short-nose and Lost River suckers
- Tribal trust responsibilities



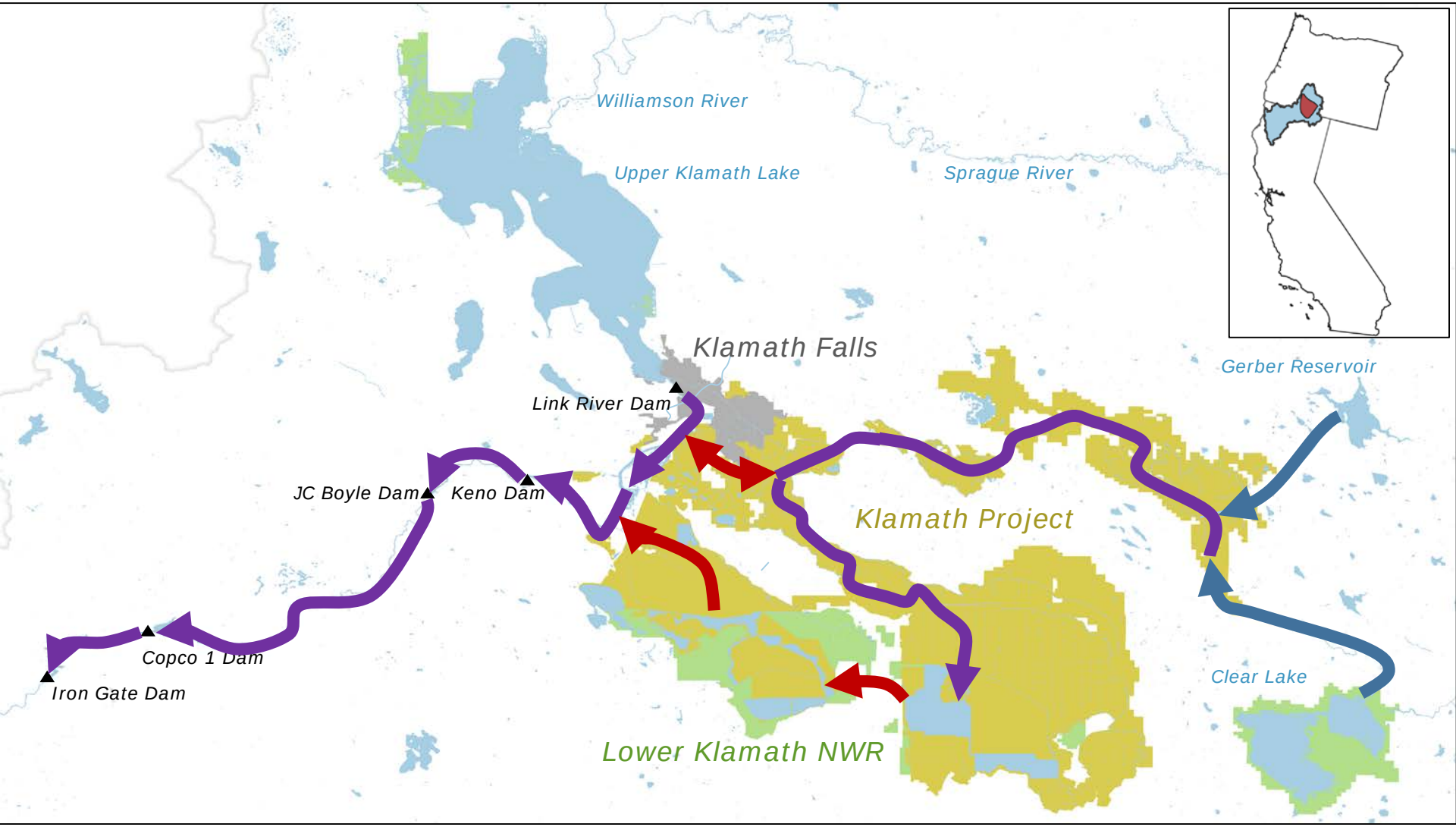
Klamath Project Overview



Klamath Basin Overview



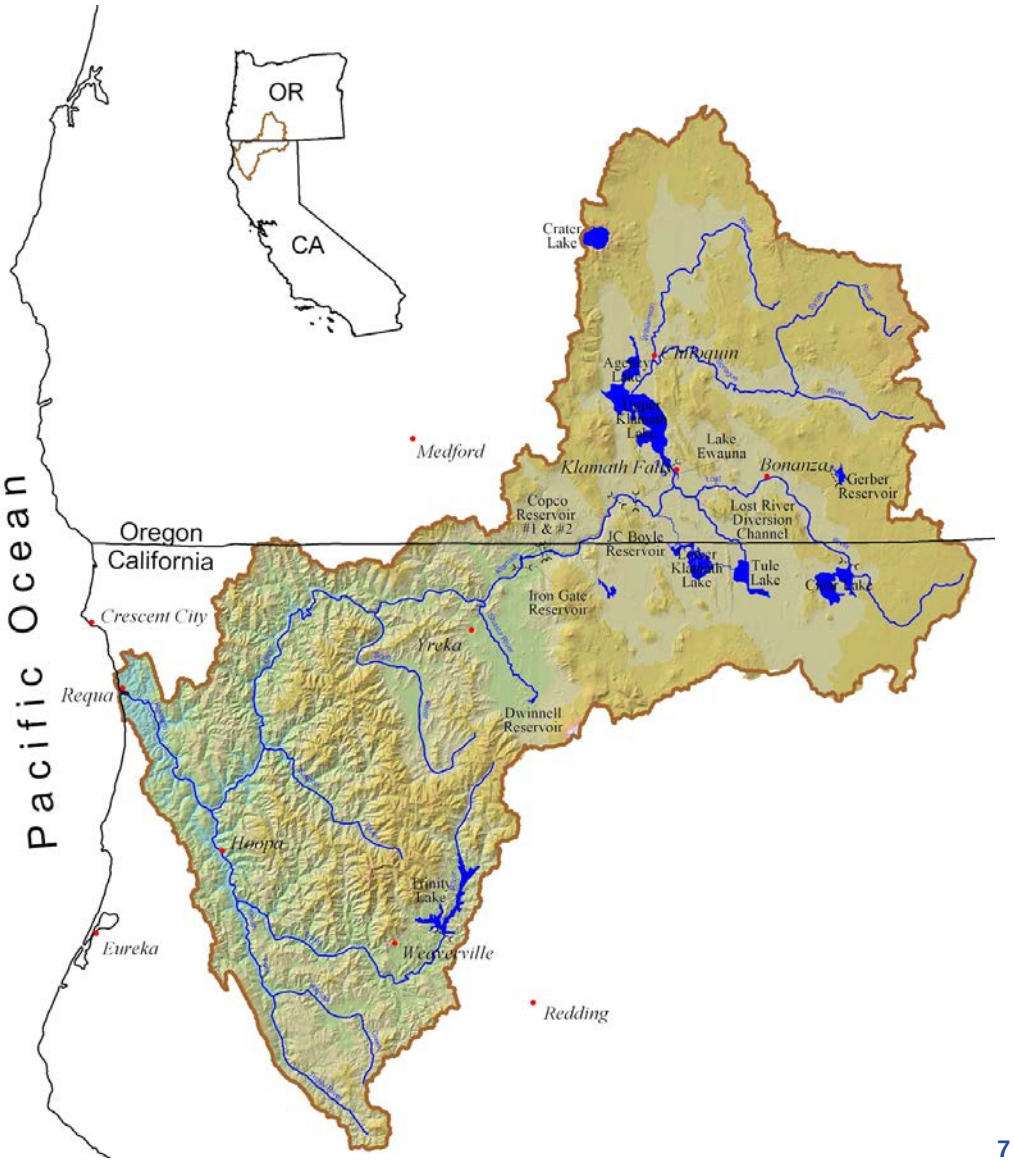
Klamath Basin Overview



Klamath Basin Overview

Management Challenges -

- New science changing environmental compliance targets
- Water rights adjudication
- Water quality
- Overallocation
- Declining populations of ESA-listed species
- Competing needs of ESA-listed species
- Litigation

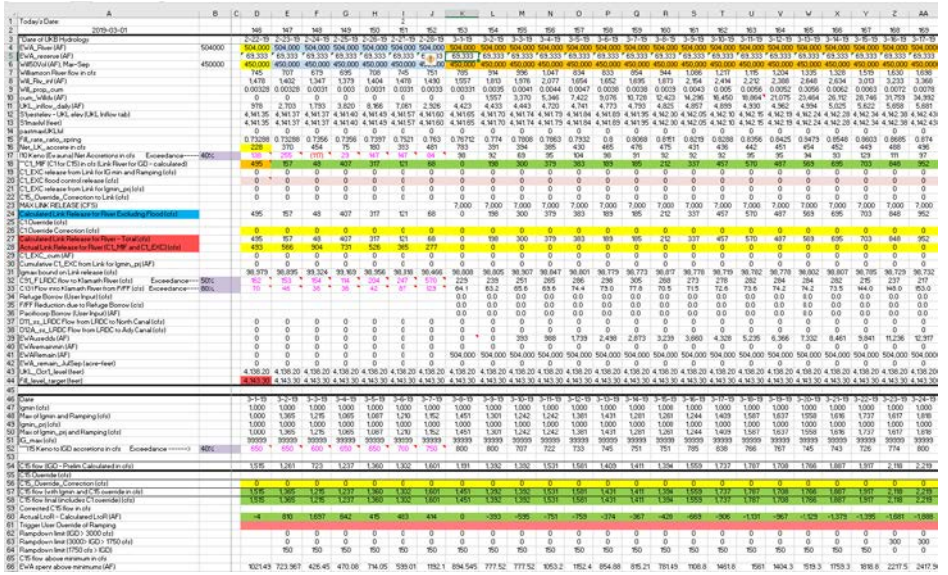


Previous Modeling Tools

Excel IGD Calculator Model

Purpose: operations

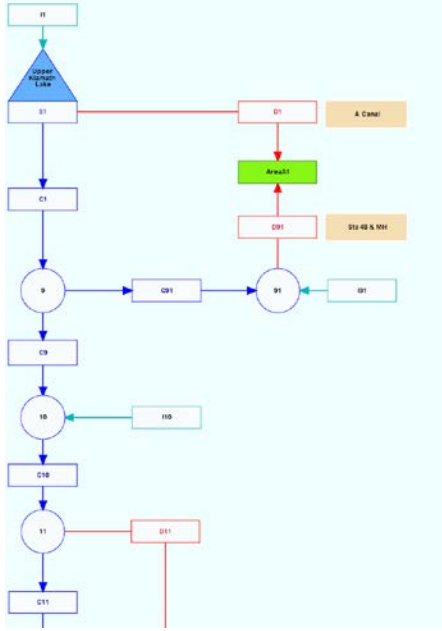
- Strengths
  - easy to use
- Weaknesses
  - difficult to update or debug
  - difficult to track data



WRIMS model

Purpose: ESA consultations & operational policy development

- Strengths
  - basin wide acceptance
  - vetted and tested
- Weaknesses
  - limited spatial extent
  - requires specialized knowledge
  - not set up for operations use
  - limited “transparency”



RiverWare Model Motivation

Link River Dam

One-size-fits-all Tool

- Operations
- ESA Reconsultation / operating policy development
- Long-term planning

Flexible Tool

- Handle changing operating policy well
- Manage data
- Provide consistency in reports to stakeholders
  - Example – Deliveries and Demands reports
- Provide increased transparency of model development and results

RiverWare Model Requirements

- Daily-timestep model runs
- User selects start date and model run length
- DMI ‘raw’ data and process within RiverWare
- Informative and flexible spatial structure
- Rulebased simulation rules for initial solution, overridden as needed

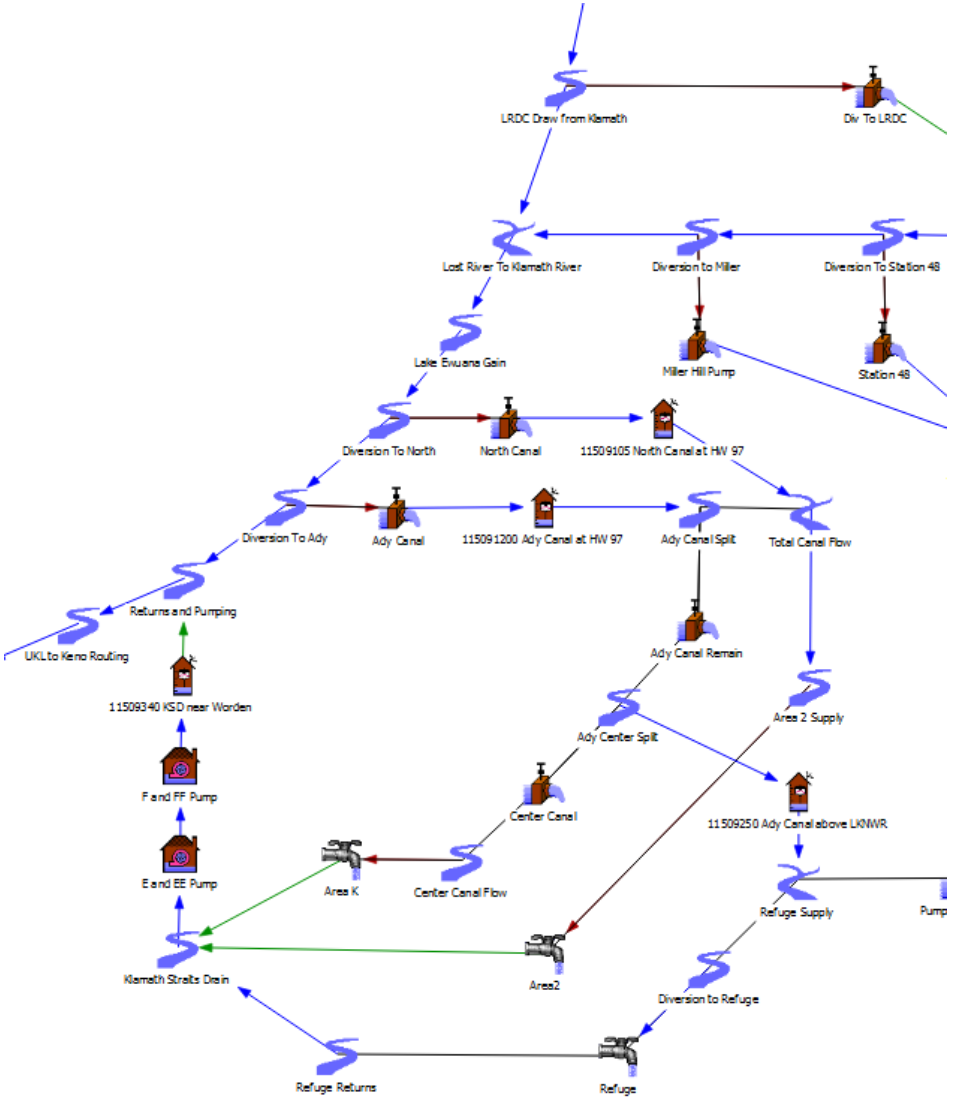
RiverWare Modeling Process

Familiarization with the basin

- Reviewed the 2013 Biological Opinion
- Documented the IGD Calculator Spreadsheet Model

Developed Model Layout

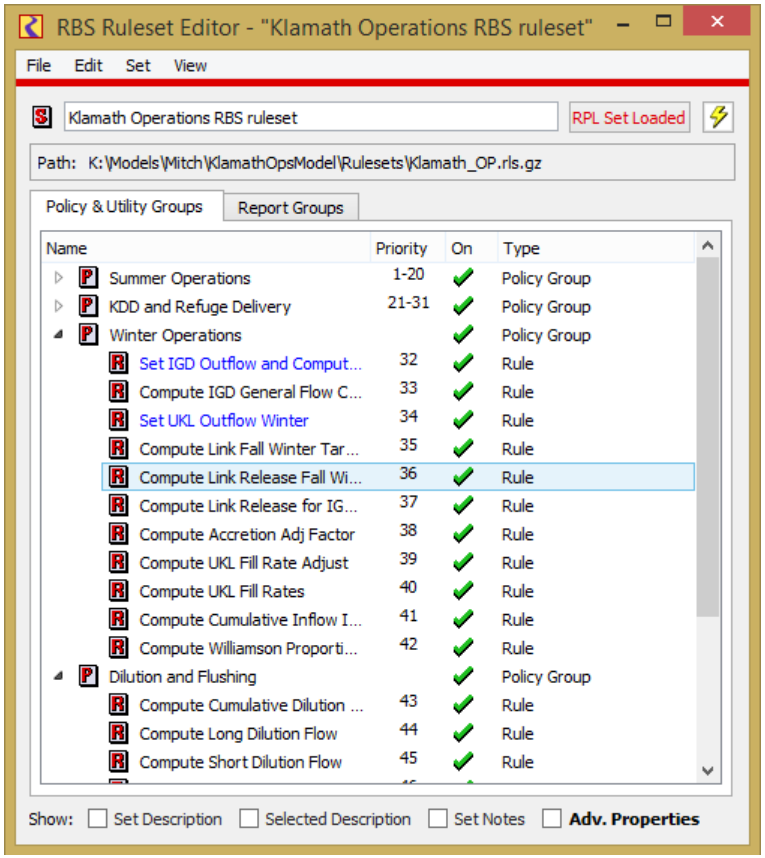
- Identified major features required
  - Reservoirs and reach segments
  - Diversions, pumps, and water users
- Confirmed the network could route water
- Reviewed for extensibility

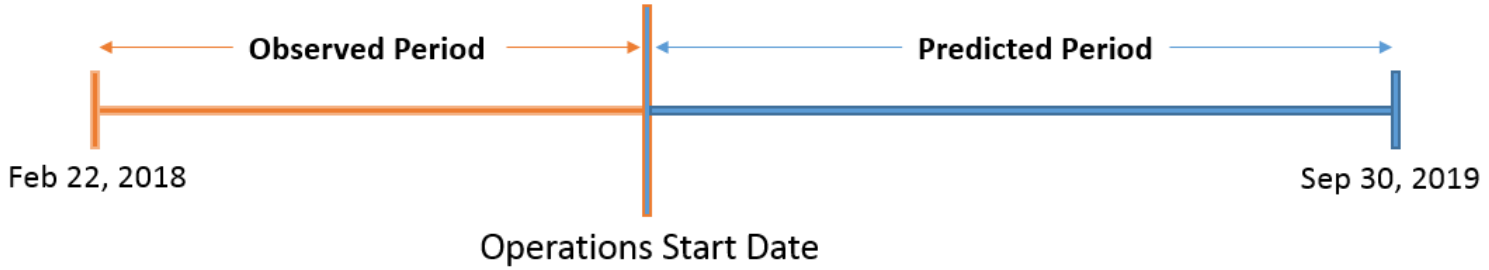


RiverWare Modeling Process

Developed RiverWare rules to replicate IGD Calc logic

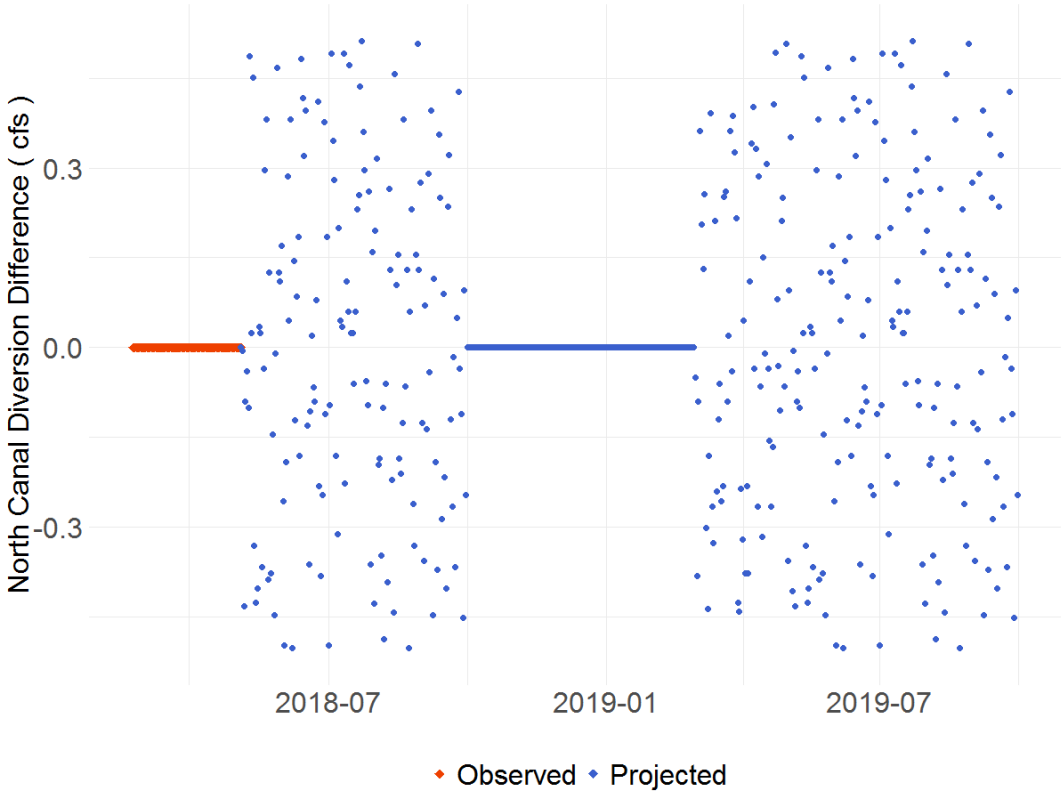
- Rules generally broken down by Summer or Winter operation
- Inputs are observed until an ‘Operations Start Date’. From that timestep forward, the model predicts those values
- Many assumptions needed to replicate IGD logic





RiverWare Model Testing

- Created methodology to compare RiverWare and IGD Calc spreadsheet outputs - using R scripts
- Used comparison to identify and fix rule or model issues
- Ran at 14 different ‘Operations Start Dates’ over 2 years



Lessons Learned - Model Structure

Gerber Dam

- **Modeling a moving target is difficult!**
- **In a rapidly evolving management environment, we found it necessary to consider the moving parts carefully to allow for flexibility in the model structure**
- **Accounting was not needed for daily operations, as we initially expected**
- **Incorporating automated features is important for easier regeneration of results**
  - **Examples: model initialization and model testing**

Lessons Learned - Policy Aspects

Mt McLoughlin, Upper Klamath Lake

- **Buy-in from stakeholders comes when you can demonstrate results**
- **Mismatch between the timing of a needed new operations tool and RiveWare model completion delayed possible stakeholder buy-in**
- **Developing a 'one-size-fits-all' tool may help streamline modeling updates (and reduce cost) when new policy is implemented**
- **An improved data management plan is needed (now using manually built excel DMIs)**

Future Work

- Meet with basin parties to demonstrate the daily operations model and general RiverWare functionality (November 2019)
- For the daily operations model, develop a ruleset for the 2019 Proposed Action
- For the daily operations model, develop policy for operation of the Lost River (east side of Klamath Project)
- Develop scripts and data sets to run model in ‘planning’ mode
- Improve external data management
- Refine operations of PacifiCorp reservoirs (including J.C. Boyle, Copco1, Copco2, Iron Gate)

Thank You!

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