The Long Long Journey: How the Truckee Basin RiverWare Models Have Become Central to Truckee River Basin Operations and Planning Under TROA

RiverWare User Group
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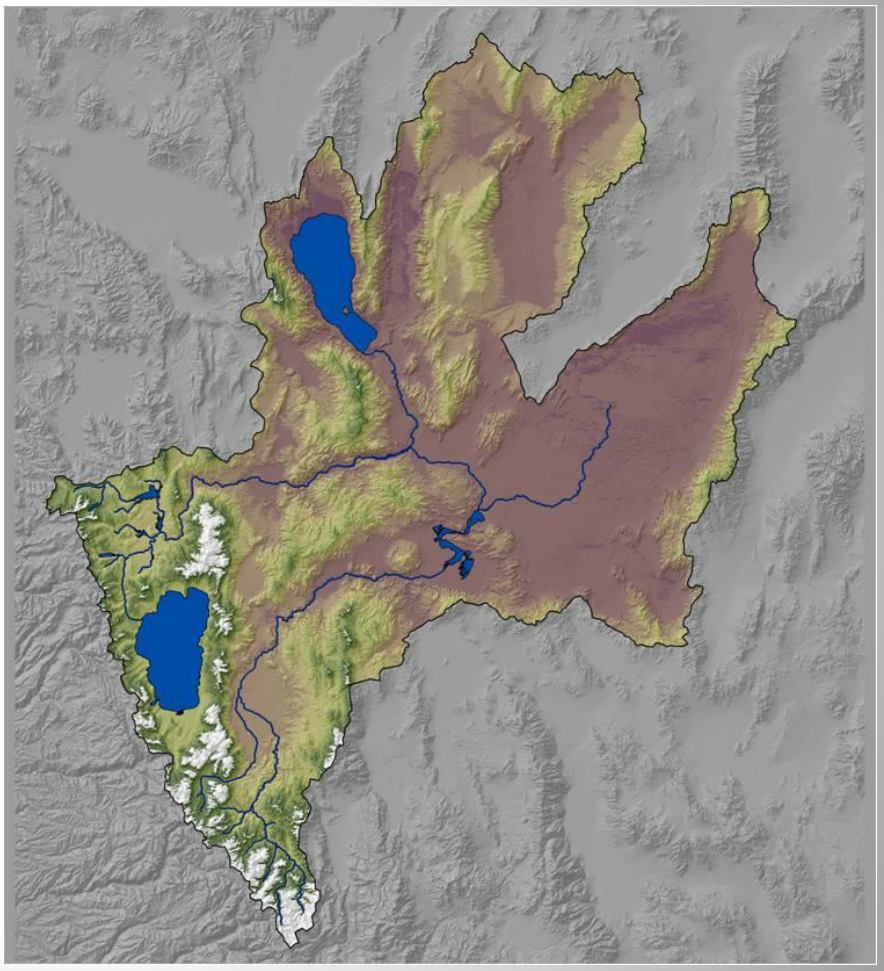

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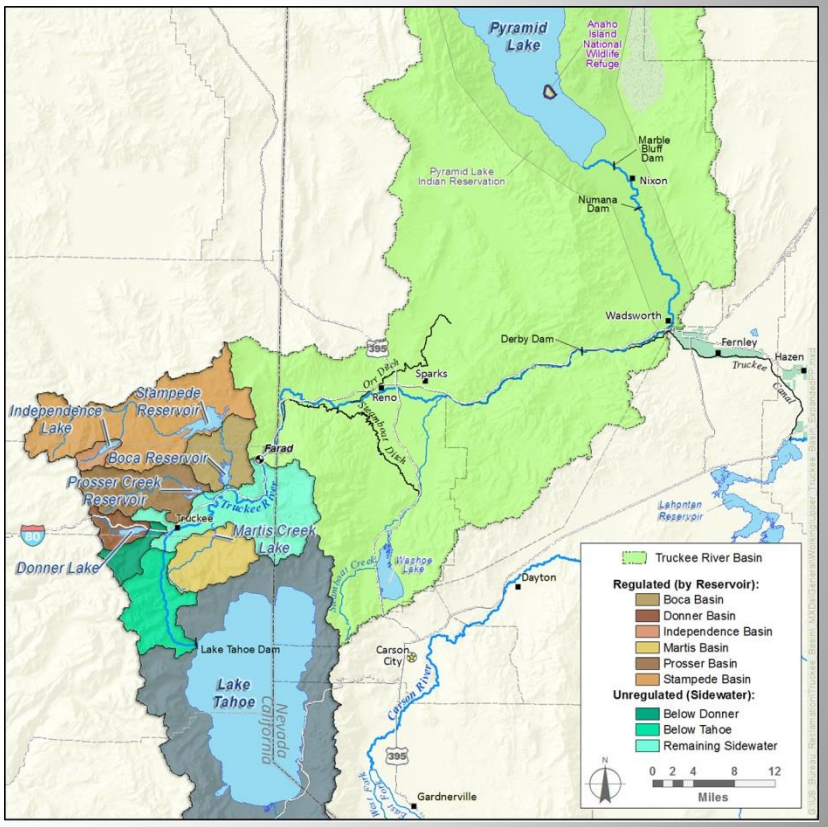
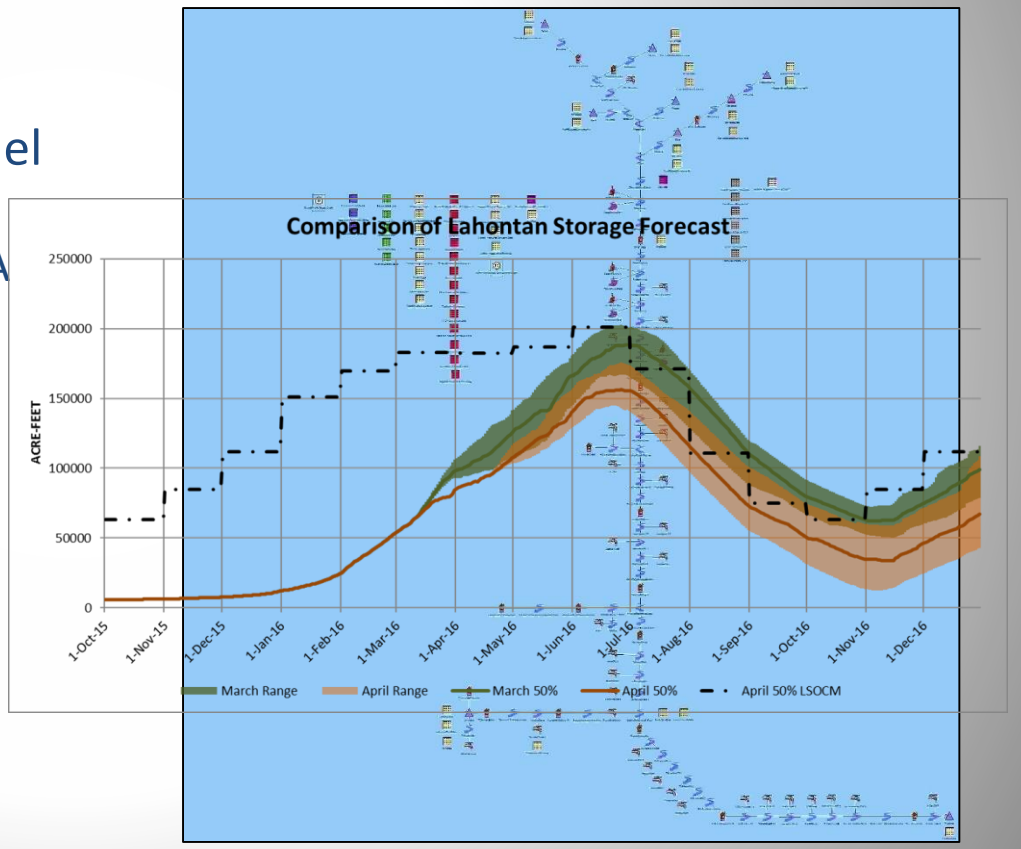
Truckee Basin Location



Truckee Basin RiverWare Models

TROA Accounting / Operations Model

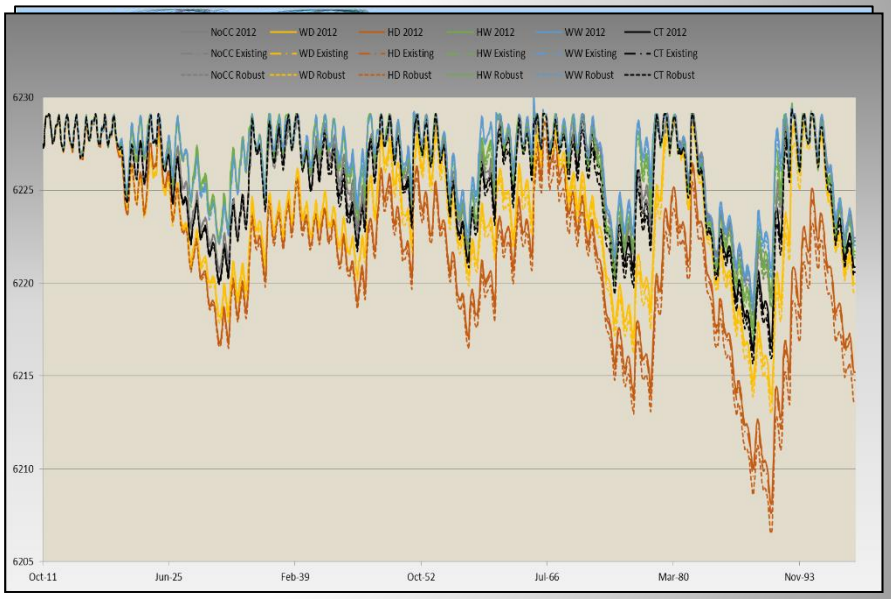
1. Short-term (15 months)
2. Primary tool for implementing TROA
3. Federal Watermaster
4. Development began in 2002/2006
5. Backward-looking Accounting and Operations Forecasting
6. Used frequently for probabilistic decision support



Truckee Basin RiverWare Models

TROA Planning Model

1. Long-term (~100 years)
2. Primary tool used for basin-wide planning efforts
3. Development began in 2009 by BOR-LBAO
4. Collaboratively developed with all basin stakeholders
5. Can be driven by historic or non-historic (climate change, stochastic, etc.) data



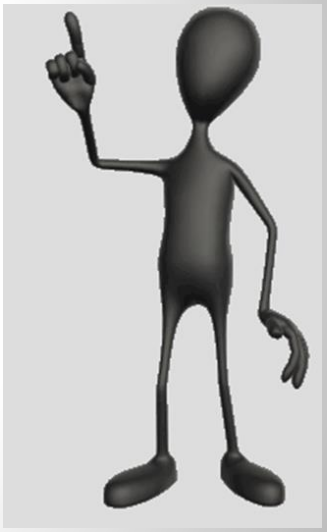
Truckee RiverWare Success Story Milestones

2002 – Begin development of Pre-TROA Models
2003 – First RiverWare User Group Meeting with a TROA presentation. TROA in 3 yrs…
2004 – Ops model begins to support monthly TROF stakeholder meetings
2006 – RiverWare Accounting model is backup to Federal Watermaster official accounting
2006 – TROA Model development begins.
    Accounting and Operations in one model
    Preliminary linkage to HDB
2006 – Develop and use of probabilistic analysis capabilities
2009 – Begin development of Planning model by USBR – model belongs to the basin
2009-Present – Collaborative development of Planning Model with basin stakeholders
2011 – First use of the Planning Model. Newlands Project Planning Study
2012 – Begin Mock-TROA exercises using TROA Operations model with TROA parties
2013 – Comparison of RiverWare with legacy Fortran model
2014 – Begin TROA Preparation Tabletop exercises with Federal Watermaster
December 1, 2015 – TROA Implementation. Official accounting, official forecast, schedule coordination, operations support
2016 – TMWA begins to use RiverWare extensively in-house for management of its system
2016 – Cal DWR begins to use RiverWare extensively for support for TROA transactions
2016 – City of Fernley begins to use Riverware model to develop a management plan

Benefits of the Models

The benefits of a technically sound, collaboratively developed, and widely accepted model are tremendous

- Better, more precise operations
- Better policy development
- Better basin management
- Reduced conflict and even litigation
- Reduced cost to utilize the model for all parties
- Enables risk-based management.(water resources systems are inherently uncertain)



“Costs” to Develop a Model

- A RiverWare model is a large investment.
- The requirements to develop a useful model are significant and are easily underestimated
  - Time – model development takes time, usually more than expected
  - Money – financial cost to develop a model is significant. This cost is minimized with a clear development plan
  - Expertise – the shortest and least expensive path to a useful model is to acquire dedicated and experienced model developers (in-house or contract)

Plan the Process

- It is critical to have a plan in place for the model development process.
- There are two parts to the plan that are equally important
  - Plan for technical development
    - This plan must include provision for ongoing maintenance and development
  - Plan for model adoption and integration
    - Just because a model has been built does not guarantee it's effective use
    - This part of the process is often forgotten
    - Often requires patience and tenacity

Technical Lessons Learned

- Simpler is better – Keep the model as simple as possible, but not simplistic. Minimize model abstraction
  - Is there data to support the abstraction?
  - Does the abstraction make results better?
  - Does the task at hand require it?
- Be very informed, thoughtful, and deliberate about key modeling decisions early on.
  - Timestep
  - Geographical Extent
  - Accounting…
- Close collaboration with system operators during development is essential
- Documentation should be a “living” document, not static. RiverWare utility is ideal.
  - Can’t have too high of expectations for documentation
  - You can definitely document too early

Programmatic Lessons Learned

- Begin with the end in mind. Make sure to assemble sufficient resources to complete the job. A partially completed model has no value. Poor investment
- Dedicated modeler(s) is essential. Both expertise and consistent, guaranteed time allocation are required.
- Make and implement a succession plan for model expertise
- A good model can be passed on to a new modeler who is not the author, but it takes time. Don't underestimate this.
- Ownership is an impediment to usefulness. Collaborative development is powerful, most efficient, and most successful. The model is most useful when not perceived to be owned by any particular party
- Think of a RiverWare model as being more like a horse than a wagon.
  - Living thing that develops and changes and requires ongoing care
  - Very versatile, powerful, and capable of bringing great benefit to the owner

Truckee RiverWare Model Use #1

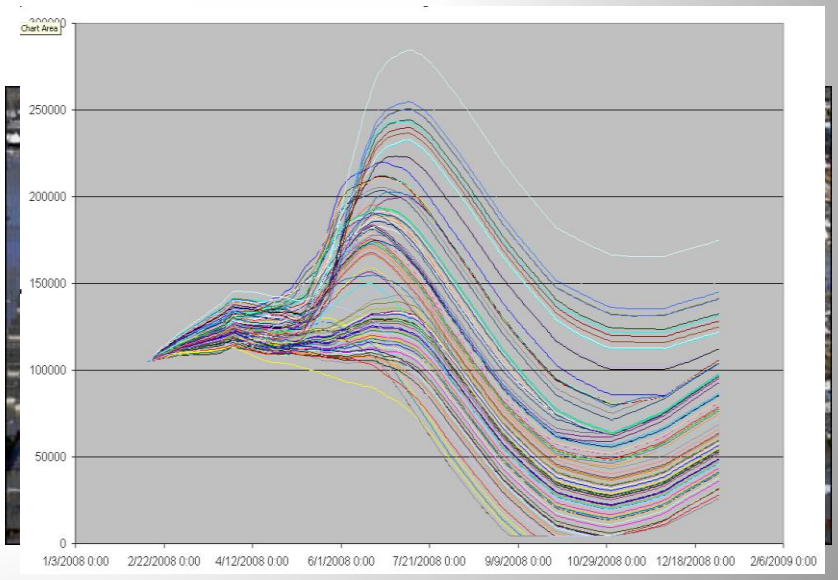
Need: After the 2008 Truckee Canal breach, determine the ongoing risk of shortage to Newlands Project water right holders depending on restored Canal carrying capacity and reopen date

Role of RiverWare: Initiate many runs of Truckee Operations Model to assess the probability of shortage to Newlands Project irrigators based on canal capacity and reopen date

Benefits from using RiverWare model :

"The Water Supply Report generated by the LBAO RiverWare modeling system was essential to our ability to forecast the economic impacts under a variety of hydrologic scenarios. Since the water year became increasingly dry as we were making and implementing the decision to restore flows under a staged, conditional regime, this data was of particular importance…the reports helped us understand the consequences of our decisions and provided a major incentive to meet to the fullest extent possible the schedule for staged reopening" – Betsy Rieke, LBAO Area Manager

- Improved Decision Support



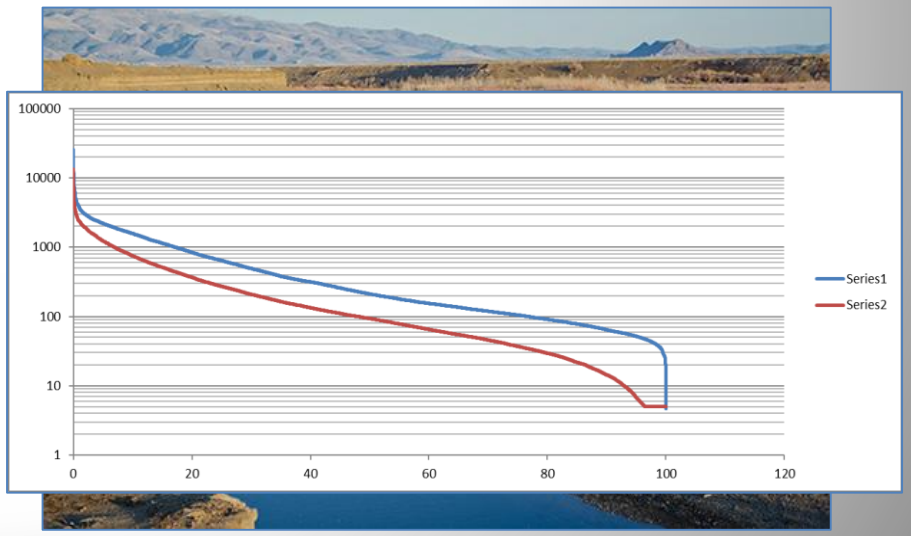
Truckee RiverWare Model Use #2

Need: Identify feasible locations in Truckee basin for micro-hydropower generation facilities – Pyramid Lake Paiute Tribe

Role of RiverWare: Drive TROA Planning model with 40 years of historical hydrology data to develop flow-duration curves at all prospective hydropower plant locations throughout the basin for hydropower feasibility.

Benefits from using RiverWare model:

- More accurate results from being able to correctly simulate basin operations under TROA
- Time savings versus developing an in-house TROA model, or doing an approximate analysis
- Cost savings to be able to utilize the RiverWare model which was collaboratively developed



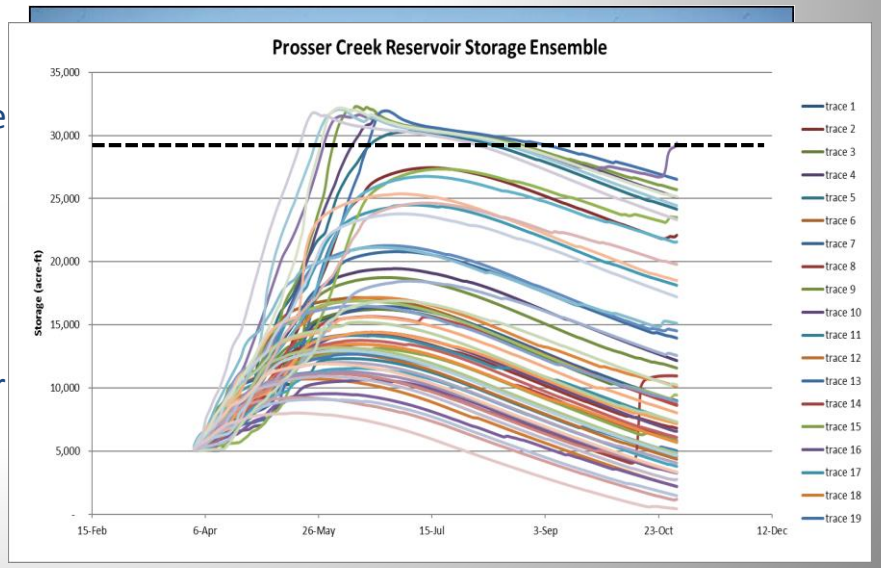
Truckee RiverWare Model Use #3

Need: Determine the ongoing risk associated with temporarily replacing the outlet works from Prosser Creek Reservoir with a pipe with carrying capacity of ~30cfs for seven months in 2015 - Federal Watermaster and Bureau of Reclamation

Role of RiverWare: Run the TROA Operations model many times using the RFC's ESP forecast ensemble, collect and analyze results to determine the risk of overfilling the reservoir or spilling a party's water. This analysis was performed regularly throughout the maintenance period to continually update the risk level

Benefits from using RiverWare model :

- Having an up-to-date assessment of the risk of negative consequences due to the maintenance on the dam allowed the Bureau of Reclamation to make a well-informed decision to proceed/continue with the maintenance, and to size the pipe
- Responsible, informed decision support
- Cost savings versus developing a customized analysis or model to assess risk
- Time savings versus developing an alternative tool
- Provided mechanism to the Federal Watermaster to develop an operational/accounting strategy to minimize impacts on stakeholders throughout the basin



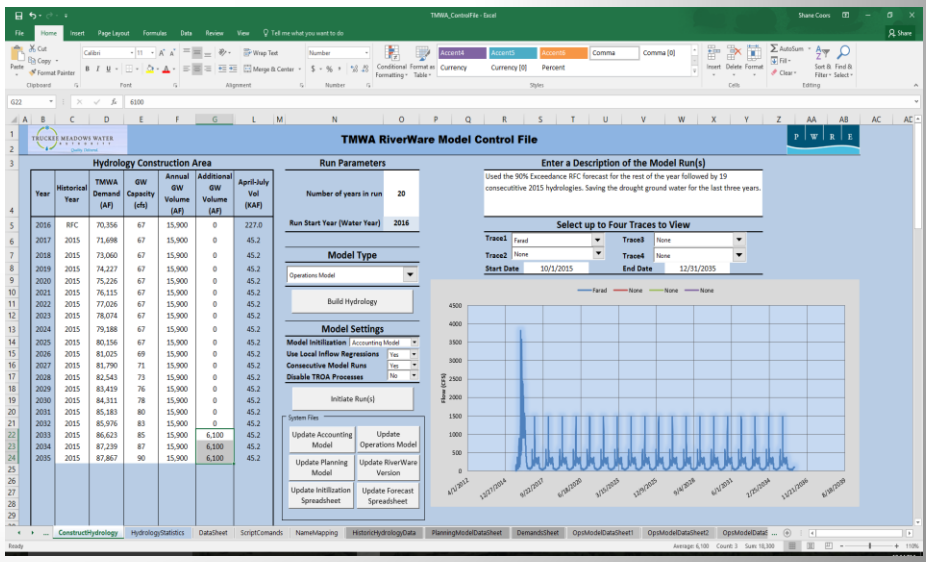
Truckee RiverWare Model Use #4

Need: Truckee Meadows Water Authority had a need for in-house operations support and long term planning activities under TROA

Role of RiverWare: Developed a RiverWare Model Controller that facilitates changes to key variables and initiates both Planning model and Operations model runs and collects output for visualization and analysis

Benefits from using RiverWare model :

- Better informed short-term operational decisions
- Better-informed long-term planning decisions like optimizing drought source utilization, optimizing credit water establishment, and water rights portfolio management
- Cost savings to be able to make model runs in-house
- Time savings to be able to make model runs in-house
- Cost savings to be able to take advantage of collaborative development of the model



Questions ?

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