RECLAMATION

Managing Water in the West

RiverWare and the 2008 Truckee Canal Breach

RiverWare User Group Meeting

August 13th, 2008

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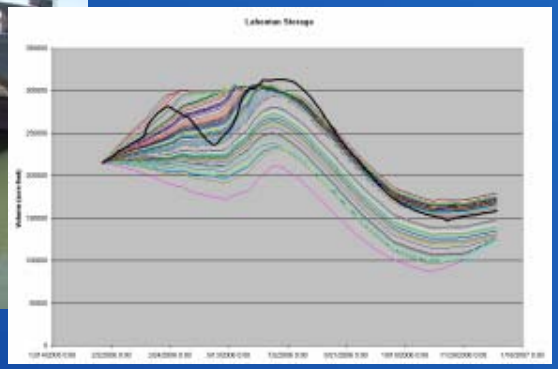
U.S. Department of the Interior
Bureau of Reclamation

RIVERWARE IN THE LBAO

- **2006 – High water!**



- **2007 – No water!**

- **2008 – Breach/flood… and no water!**

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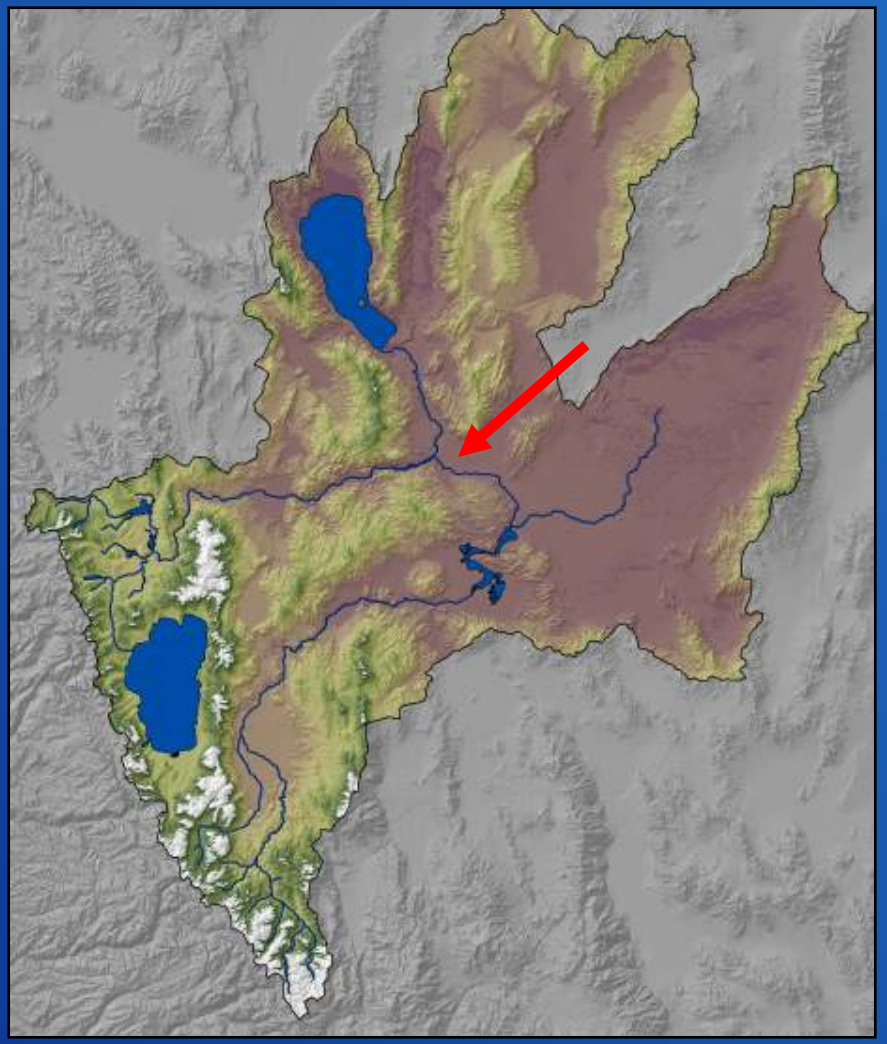
Truckee Canal

- Owned By Reclamation
- Operated and Maintained By the Truckee-Carson Irrigation District
- Constructed in 1902 (first Reclamation Project)
- Diverts water from the Truckee River to the Carson Basin to serve Newlands Project water rights
- Average annual releases from Lahontan Reservoir to Newlands Project – 270 kaf
- Average April-July volume from Carson River – 178 kaf
- Truckee River Water is used to supplement Carson River in order to meet Newlands Project Water rights



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JAN 5, 2008 – CANAL BREACH

- Jan 4/5 - Intense rain/snow storm caused flow spike on Truckee River
- Flow increase into Truckee Canal, peaking at ~ 750 cfs (capacity 900-1,000 cfs)
- ~4:15 AM – Breach into city of Fernley, NV

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- 590 properties damaged
- No lives lost!
- Sealed by 4:30 PM

RECOVERY

- **Construction**
  - **Began within 2 weeks**
  - **Complete Feb. 18, 2008**

- **Investigation**
  - **Cause**
  - **Conditions for safe resumption of flow**

The Role of RiverWare

- Quantify for senior Reclamation management the consequences associated with hypothetical dates for reopen and reopen capacity
- Provide information to Truckee-Carson Irrigation District water managers as to shortage likelihoods and magnitudes
- Provide the most complete and accurate water-supply information possible for communication with the public, media, and congressional staff

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Task Breakdown

QUESTIONS TO BE ADDRESSED

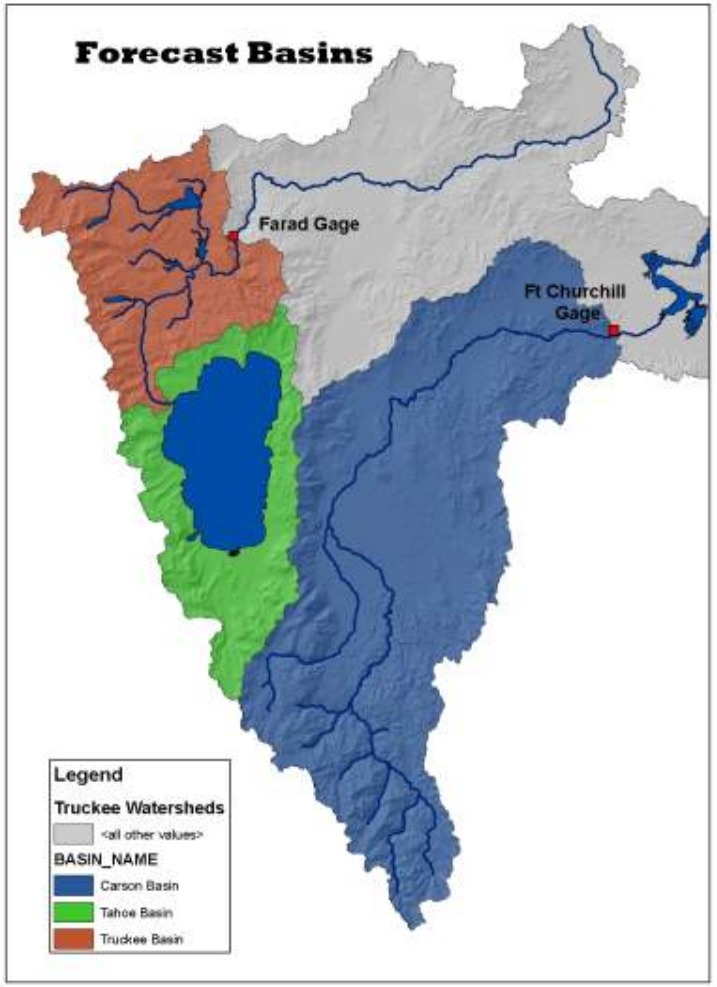
- Will the Newlands Project experience shortage in 2008?
- If so, what will the volume of the shortage be?
- How much water will be in Lahontan Reservoir going into 2009?

MOST SIGNIFICANT VARIABLES

- Two Controllable Variables in the analysis
  - When will the Canal be reopened
  - What will its capacity be
- One random (uncontrolled) variable in the analysis - water supply

Water Supply Forecast

- Water supply to Newlands Project starts with the hydrologic forecast for the region
- NRCS forecasts April-July volume yield of 3 basins
  - Tahoe Basin
  - Truckee Basin
  - Carson Basin
- Forecasts are given as normal distributions
- The whole distribution needs to be considered
- The three distributions are non-independent



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Analysis Procedure

- List potential opening dates at 30-45 day intervals from current day to end of the year (March 15, May 1, June 15…Closed All Year)
- List potential capacity limits (150cfs, 250cfs, 350cfs, 500cfs)
- For each combination of the above two variables sample the entirety of all three forecast distributions using a Monte Carlo scheme and run through the RiverWare Forecast and then Operations Models
- Analyze RiverWare output for each scenario collectively to answer the three questions in terms of probabilities
- Summarize results

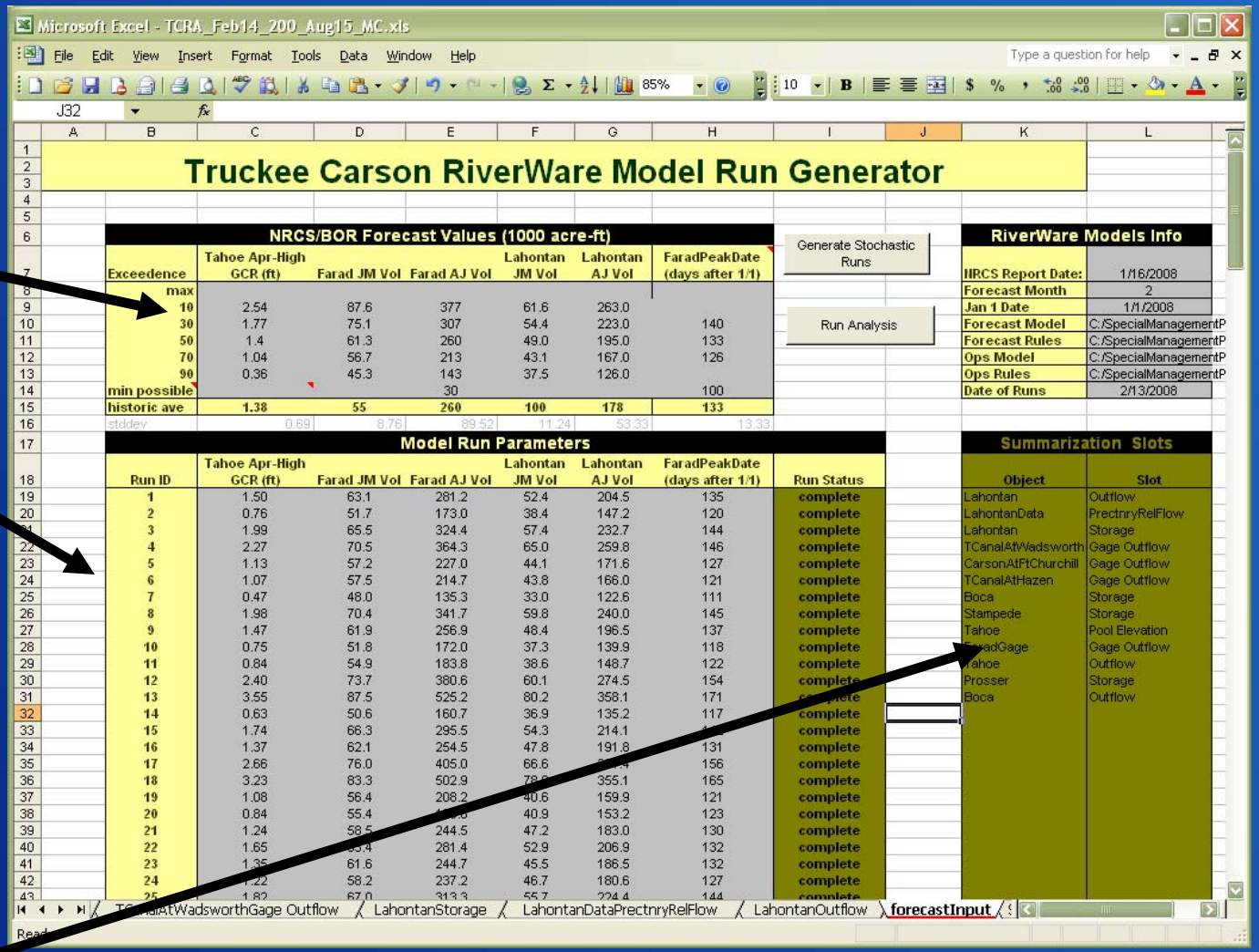
Excel / RiverWare Multiple Run Tool

NRCS forecast values

Run Parameters – Stochastically generated forecast values

Each row has all forecast parameters needed for a RW modle run

RiverWare Slots to be output after each run



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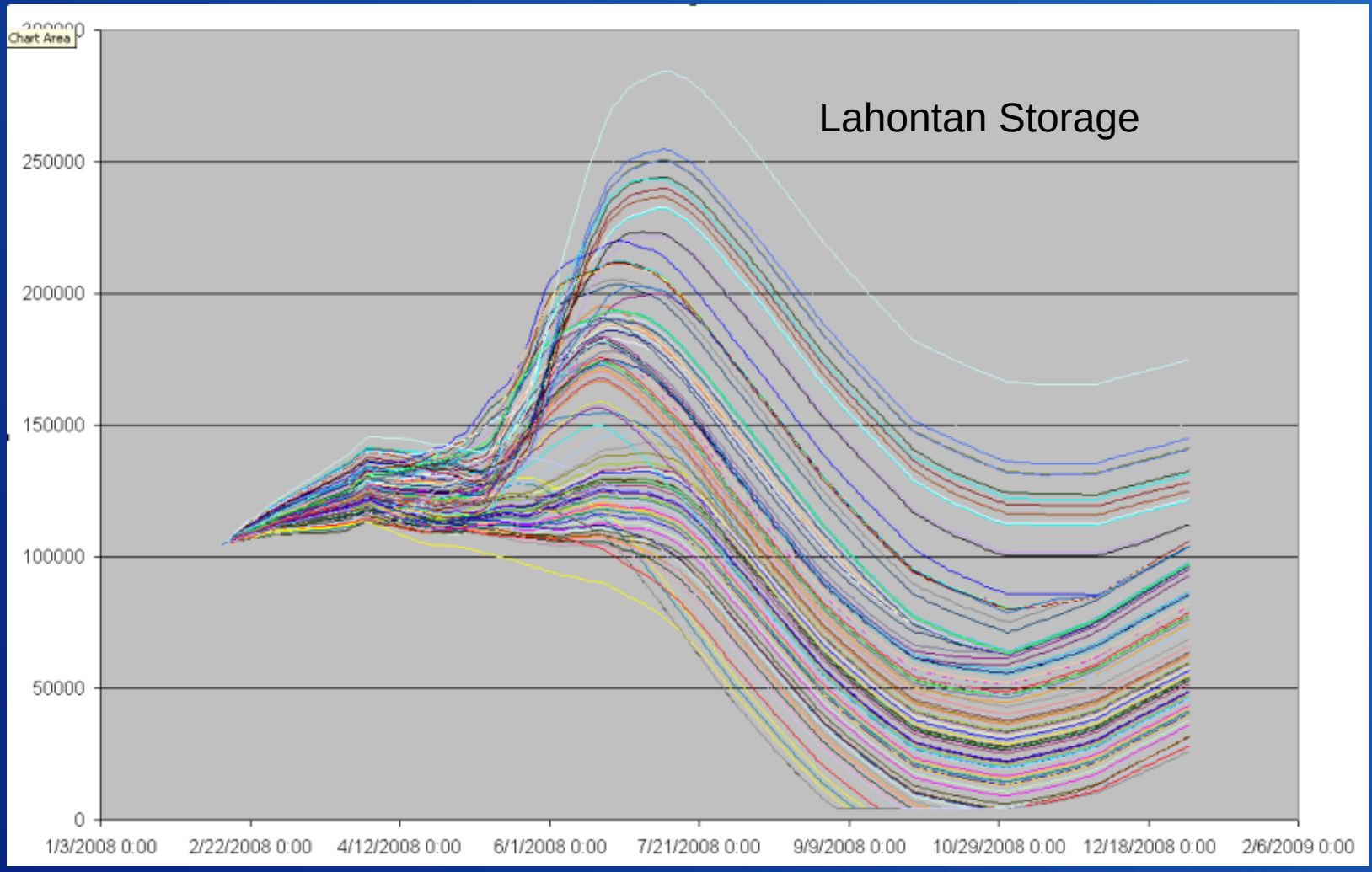
Scenario Output from RiverWare



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Water Supply Report

- Tremendous amount of output from the RiverWare runs
- Water Supply Report went out weekly to largely non-technical recipients
- Had to strike a balance so that the final report was both succinct and accurate

Likelihood of Shortage for Carson Division

Canal Capacity	April 1st	May 15th	July 1st	Aug. 15th	Oct. 1st	Nov. 15th	Closed all Year
200 cfs	13%	19%	26%	30%	38%	45%	
350 cfs	7%	12%					
500 cfs	6%	10%	22%	26%	34%		

Maximum Shortage (Reasonably) Possible
(shortage resulting from driest possible forecast)

Canal Capacity	April 1st	May 15th	July 1st	Aug. 15th	Oct. 1st	Nov. 15th	Closed all Year
200 cfs	17,000 af	24,000 af	35,000 af	40,000 af	45,000 af	54,000 af	
350 cfs	6,000 af						
500 cfs	0 af	20,000 af	34,000 af	39,000 af	44,000 af		

Most Probable Carryover Storage – Lahontan Resrvoir (12/31/08)

Canal Capacity	April 1st	May 15th	July 1st	Aug. 15th	Oct. 1st	Nov. 15th	Closed all Year
200 cfs	83,000 af	75,000 af	66,000 af	62,000 af	55,000 af	40,000 af	24,000 af
350 cfs	At or near target (110,000 af)						
500 cfs			83,000 af	80,000 af	72,000 af	51,000 af	

Conclusions

- **Drier Feb. 20th forecast makes shortage more likely**. If the Canal is not reopened during CY 2008, there is a 45% chance that the Carson Division will experience shortage.
- **Little benefit is realized by increasing the Canal capacity from 350cfs to 500cfs**. For most of the year availability of Truckee River water will limit the Canal flows irrespective of any imposed limits above 350 cfs.
- **If the Canal can be open by May 15th with a capacity limitation of at least 350 cfs,** chances are less than 1 in 8 for shortage to the Carson Division, and if expected runoff is realized, Lahontan Reservoir will be near its 2009 carryover storage target.

TION

MARCH 20, 2008 – FLOW RESTORED

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OUTCOMES

- **Most likely cause**
  - **Piping failure due to rodent burrowing**
- **Safe flow limitation**
  - **350 cfs**
- **Water supply**
  - **Will incur ~15% - 30% shortage this water year**

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Effective Decision Support by RiverWare

- **"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

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Future Development

- Take concept of the existing tool and using rule driven MRM and DMI execution, do the same processs entirely within RiverWare
- Devise a sampling scheme that can take any number of input uncertainty distributions and use RiverWare to effectively propagate distributions to selected output locations.
- If available, this would be used extensively in administration of TROA
- Outlook for 2009: potential for widespread drought and shortage
    - Tahoe will near the natural rim this fall
    - Canal remains at a limited capacity
    - Lahontan Reservoir will be at dead pool by fall

RIVERWARE

- **Many challenges**
  - **Typical surprises from Sierra Nevada snowpack**
  - **Forecasts:**
    - **February – 109% avg Carson River snowpack ; 110% avg runoff**
    - **March – 109% avg Carson River snowpack ; 110% avg runoff**
    - **April – 84% avg Carson River snowpack ; 70% avg runoff**
    - **May – 61% avg Carson River snowpack ; 42% avg runoff**

    - **Final runoff – 35% avg**

- **Model is only as good as input data**
  - **Good thing we're using Monte Carlo & probabilities!**

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THE END

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