

Incorporating Climate Change into Water Supply Planning Using a Decision Support System

Presented
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Agenda

- Climate Change Problem For Water Planning
- Supply Issues
- Policy Questions
- Water Resources
- Decision Support System
- Results

Climate Change Problem

- When will the Climate Change Impact the water supply?
 - 40 years, 50 years, 60 years ?
- What will the impact be?
 - Increase in water?
 - Decrease in water?
 - Change in timing of that water?
- Answer: Unknown at this time.

Economic Solution

- Lets just assume an answer and move on.
- Assume that climate change will systematically reduce river flows in all time periods (This study uses 5% reduction) .
- Or that climate change will increase the frequency of multi-year droughts.
- This frames the climate change problem as a classic water supply problem.

Supply Issues

- TMWA depends on drought storage and demand management policies to supply water in times of drought.
- The operations of surface water, surface storage, groundwater, aquifer storage and recovery (ASR) over time are key factors in efficient water supply.

Supply Issues (cont.)

- Current planning models do not optimize Supply Operations
- Current models are based on water accounting and trial and error analysis.
- Some models use worse case analysis.
- Many models are limited to a single year.

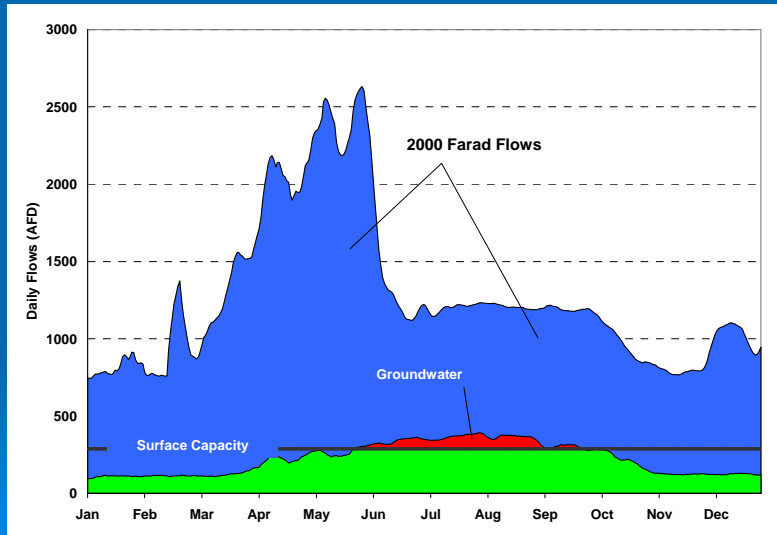
Policy Questions

- What is the maximum level of water commitment that can be made given current operational and institutional policies?
- What is the associated level of reliability for this water commitment?
- If there is a change in river supplies as the result of climate changes, can the effects be evaluated?

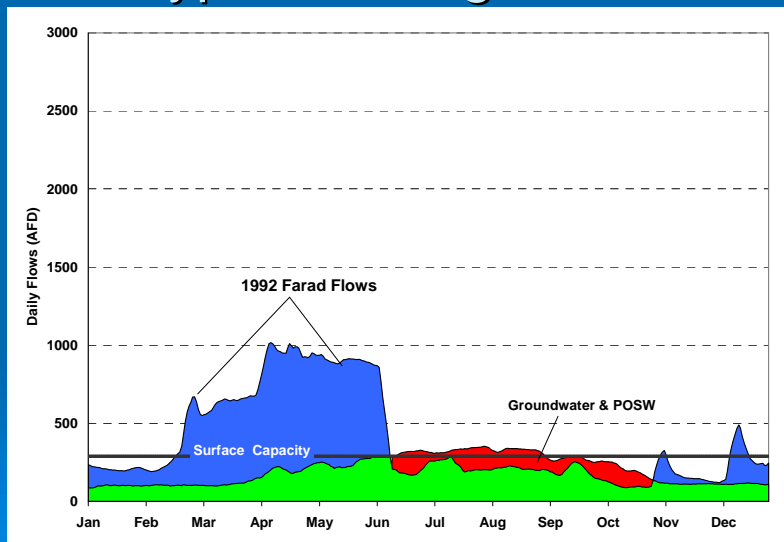
Water Resources

- Truckee River flows are the primary supply
- In drought river flow will be greatly reduced in late summer to early fall.
- Other sources of supply include
 - Surface storage – Donner and Independence Lakes, and Interim Storage Agreement
 - Groundwater permit and recharge credit.
- Watering Restrictions

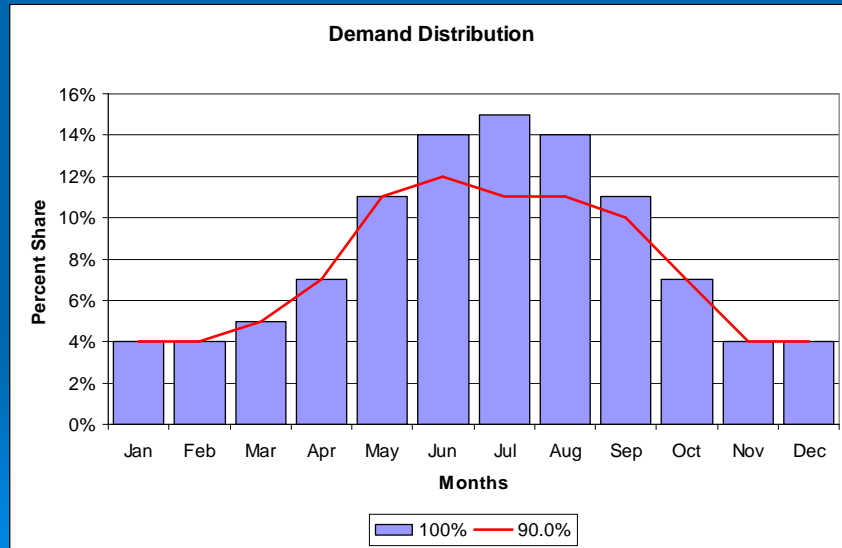
Typical Normal Year



Typical Drought Year



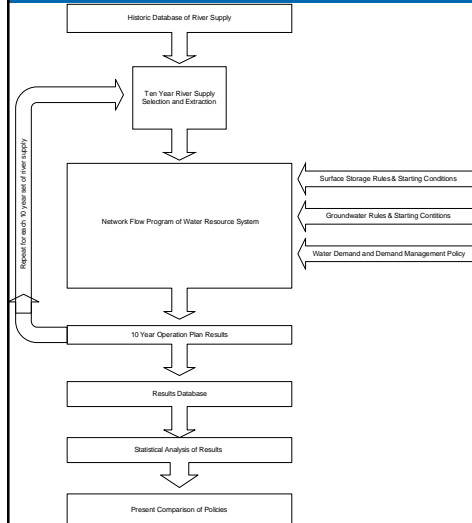
Water Consumption



Decision Support System

- A decision support system (DSS) is developed with the following elements.
 - Network Flow Programming Model
 - Models surface water management
 - Models groundwater management including ASR
 - Includes ability to include demand management policies.
 - User controlled databases

The DSS

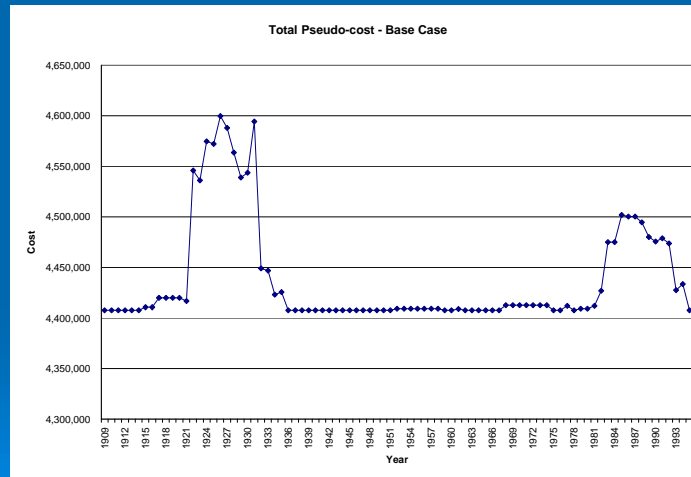


- Excel model
- River supply database
- Network Flow Program
- User supplied parameters
- Provide both tabular and graphical output
- Allow user to modify some of the model constraints and/or parameters

Results

- The Maximum level of commitment with current resources and no conservation is approx. 99,000 acre-feet per year.
- The Maximum Level commitment with current resources and 10% conservation is approx. 119,000 acre-feet per year.
- Past droughts can be used to model climate change.

Should use all drought periods



Results

- Climate Change Problem is a classic water supply problem.
- The DDS is able to perform climate change analysis using current economic models.
- Assuming a drought effect, conservation is able to address system shortages
- A 5% systematic reduction did not have significant effect on the model.

Possible Operational Changes

- In both past droughts, reserves are not required until the third year of drought.
- In normal year no need to do recharge.
- In normal year no need to store water in the Interim Storage Agreement.
- In first year of drought water can be moved from Donner to ISA, and ASR can be built up.

Water Restrictions

- Water restrictions do improve reliability.
- The cost to TMWA is in lost revenue at a time period where marginal revenue is at its highest.
- The cost and pricing structure is such that a large portion of fixed costs are included in the variable portion of water rates.
- Thus, for water not sold, a portion of fixed cost is not covered.

Questions?

Typical River Flows

