COUPLING RIVERWARE AND STATEMOD TO EVALUATE WATER BANKING IN THE COLORADO RIVER BASIN

RIVERWARE USER GROUP MEETING

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Current 16-year Drought (2000-2015*) Natural Flow at Lees Ferry









BACKGROUND AND CATALYST

- Ongoing drought in Colorado River Basin since 2000
- Colorado River Basin Study 2012
- July 2013: Secretary Jewell pushes 7 states to look for consensus solutions
- Upper Basin (CO, UT, NM, WY) and Lower Basin (CA, AZ, NV) begin coordinated, but independent development of drought contingency plans (DCPs).
- Lower Basin DCP anticipates annual reduction in deliveries of up to 1.2 MAF annually depending on conditions at Lake Mead
- Mexico contributing via Minute 323 of the 1944 Treaty

UPPER BASIN DROUGHT CONTINGENCY PLANNING AND ACTIVITIES IN COLORADO

- Upper Basin DCP components:
 - Drought Operation of CRSP reservoirs (First line of defense)
 - Demand Management
 - Continue Augmentation (Cloud Seeding) Activities
- Related Work in Colorado:
 - Colorado River Risk Study (West-Slope Basin Roundtable Process; funding through those entities (via CWCB), the Colorado River District, and Southwestern District)
 - Water Banking Work Group
 - Statewide Water Supply Initiative (SWSI) update
 - Water Shepherding Group (Anne Castle et al.)

DEMAND MANAGEMENT AND WATER BANKING

- Objective: Provide for pre-emptive, voluntary, and compensated water conservation activities, and a means of "banking" that water for use in supporting critical Lake Powell elevation if and when the need arises.
- Need: A tool or tools to simulate the conservation, banking, and release of conserved water
- Colorado River Simulation System (CRSS): Reclamation's planning model of the Colorado River
 - 7 States + Mexico
 - Federal Reservoir operations
- StateMod: Colorado's water rights administration and permitting tool
 - Detailed models of each Colorado River Basin drainage (Yampa, White, Gunnison, San Juan, etc)

CRSS / STATEMOD COUPLING

• Why?

- Colorado River Simulation System (CRSS)
 - Good: representation of "Big River" operations; Powell/Mead;
 Drought Operations of CRSP facilities
 - Bad: Not sufficient resolution nor representation of water rights in Colorado (~2 dozen nodes in CR mainstem to represent hundreds of diversion structures and thousands of water rights)
 - StateMod
 - Good: Simulates priority administration of water, additional yield from demand management activities
 - Bad: models are state-specific, end at Colorado state line; No "knowledge" of Powell/Mead or other "big river" conditions; limited ability to "control" banked water
- Concept: Utilize StateMod for development of demand management flow series, use CRSS to manage the resulting bank and usage of water



DEMAND MANAGEMENT METHODOLOGY

- Baseline model datasets: current demands, 1988-2012 hydrology
- Demands reduced by 5%, 10%, 15%
 - Fixed efficiency = commensurate reduction in consumptive use
- "Non-Shepherded" Scenario: Increased river flows may be picked up by downstream juniors
 - Junior rights who may have been shorted initially may receive additional water by virtue of upstream reductions, even though their own <u>demands</u> are also reduced
- Shepherded Scenario: reductions arrive undepleted at state line (loss factor may be applied if desired)



WATER BANK MODELING

- StateMod Demand Management
 - Capitalize on StateMod's expertise in water rights simulation
 - Difficult to condition demand management on water bank storage (i.e., the model cannot actively monitor storage and tell diverters when to conserve)
 - Changing this would require a change to StateMod code, or complex model iterations
- CRSS Water Bank
 - Concept: fill bank w/ conserved water, then use and refill as necessary
 - CRSS (Powell) is the "triggering mechanism" for banking releases, so we need CRSS to trigger banking operations
 - But CRSS is a poor substitute for StateMod's water rights simulation
- How do we make "best use" of each model's strengths?
- Recommendations for enhancements

COUPLED STATEMOD / CRSS MODELING OF WATER BANK

- All scenarios for demand management are identified and run in StateMod before inclusion in CRSS
 - 5%, 10% reductions; specific water users, etc.
- Take advantage of well-developed StateMod water rights solver to better quantify demand management yields
- Outputs from StateMod (flows at State line and conservation yields) can be fed into CRSS.
- Does not allow for use of StateMod reservoirs, but could possibly add those to CRSS
- Makes use of CRSS rules for bank operations, which are very flexible and easy to use
- Water bank(s) and Powell contained within single model framework







- NEED TO SIMULATE "BIG RIVER" POLICY AND OPERATIONS TOGETHER WITH SUB-BASIN SPECIFIC WATER RIGHTS ADMINISTRATION QUESTIONS
- REMAINING CHALLENGES:
 - ENSURE "SYNCHRONIZATION" OF DATA ACROSS MODELS, ESPECIALLY HYDROLOGY AND DEMANDS
 - HOW TO HANDLE DYNAMIC DEMAND MANAGEMENT & RESERVOIR OPERATIONS



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Comments or Questions:

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