

**Bighorn River System Working Group
Meeting Summary
Lovell, Wyoming
September 29, 2009**

Meeting Outcomes

- 1) Results of sediment management study
- 2) Results of flood pool reallocation study
- 3) Results of geomorphology study
- 4) Review of reservoir operating curves

Welcome

Lenny Duberstein welcomed participants. The primary purpose of this meeting is to hear the results of the technical studies—most of which have been underway for a year now and are wrapping up. Attendee introductions were deferred for later in the agenda due to time constraints.

Reservoir Operations (Aycock - Reclamation)

Gordon reviewed the proposed revised criteria explaining that Reclamation would like to use them on a trial basis this water year, starting in October. The reservoir would operate differently under the revised criteria. The goal is to improve overall operation's project benefits--specifically higher lake levels, more consistently meet river flow needs, enhance power generation, provide flood control, and manage more transparently.

The proposed changes include;

- 1) Modify reservoir elevation targets: targets would be raised for October 31 and March 31, eliminated for November 30, and stay the same for July 31.
- 2) Using a revised method for calculating river gains from November - March.
- 3) Improved methodology for forecasting winter gains.
- 4) An improved and more transparent procedure for setting the winter release. Preference will be given to the river when releases are below 2000 cfs and to the reservoir when releases are 2500 or above.
- 5) There is a new operating procedure for spring runoff using reservoir operational rule curves. Rule curves will be revised throughout the spring as April-July inflow forecasts are updated.

Gordon went back and applied the proposed criteria to the period 1988-2000. Lake levels would have been higher throughout the year with the smallest increase in lake levels during May and June and the largest during March and April. The river releases would have been slightly lower over the winter, higher in

April and May, lower in June, and a little higher in the fall. Minimum flow desired for fish (1500 cfs) in the river would have been met 100% of the time, with a flow of 3500 cfs met a little less often. Annual power generation would have increased approximately 2% due to higher head. Flood control would have improved slightly.

If the revised criteria had been applied to this past water year, 2009, it would have increased the November-March releases by 96 cfs. The lake would have been four feet lower at the end of March. More water would have been released to the river in June, cutting the peak release. However, the release would have still been around 11000 cfs for approximately a month. The April-July inflow was significantly more than forecast last year due primarily to a number of timely rain events in June.

Looking ahead to 2010, under the revised criteria and assuming releases from Boysen of 900 cfs and Buffalo Bill of 350 cfs, the November – March gain would be forecast as 244,000 acre feet and the lake would be at 3639-3640 feet at the end of October. The November – March releases would be between 2700-2800 cfs and is based on an end of March lake level target of 3620.6 feet.

During discussion following the presentation participants were complimentary of Gordon's efforts. The following issues were raised as concerns, but, when asked, no one suggested that Reclamation not proceed with trying the revised criteria in the coming water year.

- Impacts to MDFWP infrastructure along the river
- Lake level at the end of May
- Going into the flood pool
- Forgone revenues for power generation
- New rule curves won't eliminate possibility for long duration, high flows because the forecasts are not perfect
- Yellowtail is part of a larger flood control system. Releases could be affected by situations in the rest of the system such as downstream flooding.

MTAO Manager, Dan Jewell, asked that any additional concerns be submitted as soon as possible. That way a final decision can be made about implementing the revised criteria and new rule curves in the water year starting in October.

Flood Pool Reallocation Study (Yonts – Corps of Engineers)

The draft report for this study is done and will be posted on Reclamation's website. The project objective was to evaluate the change in flood benefits as a result of raising the joint use pool from 3640 to 3645 feet. Travis used the HEC-ResSim Model which is a reservoir operations model well suited for this purpose. The study process included gathering and entering data, calibrating the model,

establishing a baseline, developing the reallocated condition, and evaluating the change in net flood benefits between the baseline and the reallocated simulations. Two period of record models were created, fixed and time series guide curves. Under the fixed curve, pool elevation increased, the magnitude of outflows was similar, and years of high flow tended to increase pool elevation. Flood damage decreased slightly overall but not everywhere. Under the time series guide curve, the pool stays higher longer using the revised rule curves. The timing of snowmelt strongly affects releases to the river. The peak annual pool elevation is higher and flood damage increased in all reaches. The flood damage curves were developed in 1974 and do not include properties that have been built along the river since that time.

Results Summary

- 1) Comparing baseline to reallocated joint use pool, the increased outflow could be categorized as a dam safety concern.
- 2) Changes in operations could be categorized as a dam safety concerns.
- 3) Dependent upon the model results used maximum outflow would be 1,150 to 8,050 cfs above the listed afterbay design flow capacity.

Next steps include taking comments and finalizing the study, identifying mitigation for the concerns, update and sensitivity analysis of downstream flood damage curves, analysis of downstream river capacity, updating the flood control manual, and approval of the new manual by both the Corps and Reclamation. During discussion, Travis responded that at this point he does not see anything that prohibits this from moving forward, but there are some issues that need to be studied. He is available to do more work applying the revised rule curves. Reclamation's experience is that if an EIS is required, the cost would be \$2-3 million and the time frame could be anywhere from 1-3 years on up to a decade to get it accomplished.

Bighorn Lake Sediment Management Study (Pridal – Corp of Engineers)

The draft report for this study is done and will be posted on Reclamation's website. The purpose of this study was to look at sediment management alternatives and impacts of the alternatives. Six alternatives were identified, five of these were studied.

- 1) Higher pool during the recreation season
- 2) Trap sediment upstream of Lovell
- 3) Lower pool, flush sediments through Horseshoe Bend (HSB)
- 4) Dike in HSB
- 5) Manage sediments in watershed (not evaluated in depth)
- 6) Dredging in HSB

The alternatives were modeled based on the historic record and then the alternatives were compared to each other. Previous surveys show sediment accumulation at an average rate of .8-1.1 feet per year, but deposition is highly episodic. The alternatives have a big impact on the sediment delta or front, where it is and how rapidly it advances towards the dam. All alternatives affect sediment over base condition. The report has a table that lists the costs, pro's and con's of each alternative. Discussion following the presentation was about the long-term sediment picture and life expectancy of the project (at design projected to be 100 years, but may be longer.) The BLM is currently updating its Resource Management Plan and some in the group would like to see sediment from BLM lands in the basin addressed in that plan.

Bighorn Side Channel Study (Godiare, Hilldale – Reclamation)

The problem being researched was the progressive abandonment of side channels in the Bighorn River and resulting loss of fish habitat. Side channels are important for fish production and offer different habitat than the main channel.

The study has looked at 16 river miles with three objectives.

- 1) Look at vertical changes along the river: they found this situation to be very stable.
- 2) Investigate lateral change and stability: they found the river changed from a laterally-active channel with highly-variable flow regime and sediment load to lower sediment load, reduced peak discharge, sediment retention in side channels, berms at side channels, and changes in vegetation.
- 3) Identify side channels that have been lost or are at risk of being lost: they found that the general configuration has been in place since 1969 and that the side channels had stabilized by 1980. Some side channels have been in place since 1939.

Cross sectional data shows evidence of stability rather than incision or lateral migration. Geomorphic mapping shows there has not been much loss of side channels. Channel configurations have been fixed in place since 10 years after dam construction. Side channel loss is occurring by deposition. In the next year they plan to look at what discharges would be needed to inundate critical side channels.

Reclamation conducted a bathymetric survey both on foot and by boat this past summer during two different discharge flow levels. There is some concern with aerial data accuracy related to island height and overall channel width. The hydraulic modeling will provide information on flows that will activate side channels. It may be possible to design high intensity, variable duration flows that will open side channels. The high flows this past year did not open them. Reclamation believes it possible to stop the trend of sediment deposition at the

mouth of side channels and perhaps reverse this trend. Additional results will be available in another year.

Bighorn River: Effects of Moss on River Stage (Duberstein – Reclamation)

Lenny has observed that the amount of moss build-up in the river below the dam has a significant effect on surface elevations in the river at the same flow levels. This affects brown trout spawning among other things. The moss grows throughout the water column and plugs the channel raising the water level and temperature by slowing the velocity. The impact is that there is dramatically different quantity of side channel habitat at the same flow. To keep accurate flow measurements at the St Xavier gage, the gage height has to be shifted to compensate for the effect produced by the moss. The shift at the gage at St. Xavier is expected to be 1.73 feet in 2010. The effects diminish downstream, disappearing at 15-20 miles from the dam. Lenny proposed two options for using the moss as an opportunity in river management.

- 1) Reduce fall flows and use the moss effect to increase wetted areas. Then raise the flow later when the benefits of the moss are gone. Average discharge to the river of 2700 cfs from October - April
- 2) Reduce flow more significantly in the fall and raise it higher in the winter and spring, still averaging 2700 cfs October - April.

The data needs to be refined over the next year. Reclamation will work with FWP to identify channel complexes that are most critical for brown trout. Group reaction to the presentation was that it merits further investigation.

Next Steps, Comments, Questions

Reclamation reminded everyone that the operations' meeting is scheduled for October 8 in Billings. Participants were encouraged to visit the website, review the reports from the technical studies, and submit comments. Comments about implementing the revised winter gains, winter release procedure, and reservoir operational rule curves need to be submitted as soon as possible. Overall the group was complimentary about the efforts and results of all of the work that has been accomplished on the technical studies. Reclamation will convene the issues group again in late January in Billings.