Draft Report

Beach Habitat Building Flow Resource Criteria Analysis for January-July 1999: Analysis Methods and Materials for BHBF Recommendation

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Beach Habitat Building Flow
Resource Criteria Analysis for January-July

Summary

This analysis is divided into a summary that provides an overview of the action/no action hydrologic releases, a summary for 10 significant resources, and a comparative table for action/no action for water year 1999 Flow Scenario 2 (Table 1) relative to management objectives. The summary highlights effects of no action/action of resources of concern. The table provides managers a way to compare the effects of no action with alternative actions in relationship to management objectives.

Table 1 provides a comparison of the effects of no action versus the alternative of conducting a BHBF in January-July following water year 1999 Flow Scenario 2. The intent of this analysis is to illustrate the methods and materials that are available to consider a BHBF for the months of January to July, should a hydrologic trigger be met. This is a analysis, not an action recommendation. The documents used to develop this analysis include the resources matrix, the resource narrative that pertains to biological resources and the state of the resources report (SCORE Report). The objectives that are driving this analysis are listed in Table 1 and are derived from management objectives. The purpose of the analysis is to point out areas that may need further consideration before a recommendation can be made.

General Overview

The effect of no action under water year 1999 Flow Scenario 2 would be high steady releases above 25K cfs for a month followed by daily high fluctuating releases. A no action decision would have the effect of increasing sediment transport downstream, increasing erosion of beaches and inundating and altering marsh habitats. Most eddy return channels that serve as backwater habitats would be inundated under both scenarios, although some reformed channels would be available. A BHBF would temporarily increase backwater number, but subsequent flow volumes (> 15,000 cfs) would likely inundate these habitats.

Resources of greatest concern are either affected equally though time (e.g. sediment, archeology sites), or the effects change over time (e.g., native fish, whitewater rafting). Often with these time dependent resources, later timed BHBF events have greater effects associated with recovery and immediate effects. For example, a BHBF in May could effect the interactions between young fish and a nursery habitat (aquatic food base, habitat), and non-native fish. While a BHBF in March would also affect nursery habitat (via reworking), but would be less likely to disrupt the use of these habitats by young fish later in the year. The overall effects of a BHBF versus no action are positive for sediment conservation, camping beaches, and the delayed erosion of archeological resources. Early timed BHBF would have small negative effects for native fish, the aquatic food base, avifauna, and riparian vegetation. Immediate effects and recovery

time of these resources increase after April. Increased negative impacts for whitewater rafting occurs after April.

Resources that scored in the -1 to -2 range of the resource matrix included aquatic and terrestrial habitat, aquatic food base, life history stages of native and non-native fish, breeding birds and waterbirds, the Kanab ambersnail, and recreation. The following is a brief summary of the possible effects of a BHBF on the resource areas and specific resources with attention paid to those resources that were ranked at -1 or lower.

Sediment Resources

Sandbars and beaches - The effect of a BHBF on sandbars and beaches is dependent on channel and eddy storage and sediment input, and when a BHBF last occurred. A maintenance flow occurred in October 1997. Sediment storage increased from February to April of 1997 as well as in the summer of 1998. Volume gains were larger below the LCR than above in 1997. More recent analysis for channel storage in the Marble Canyon Reach suggest that sediment input from the Paria in 1998 have replenished this reach. Channel bed thickness increased and average of .4 m system-wide in 1997.

The steady high flows in between April and June of 1997 were erosional with respect to sandbars (Kaplinski et al 1997.). However, sandbar created during the 1996 BHBF are still larger than they were prior to the 1996 BHBF event. In most cases sandbars would be rebuilt with erosion occurring overtime.

Backwaters - backwater numbers that exist at 8,000 cfs stage have increased since April 1996 (Stevens & Hoffnagle, unpublished). However these data do not indicate utility of these backwaters, nor the location of these backwaters relative to fish distribution. Overtime, deposition of sediment into the return channel and erosion of higher elevation reattachment bars will fill-in these habitats. The BHBF had the effect of filling in some return channels thus reducing backwater numbers. A BHBF would temporarily increase backwater number, but subsequent flow volumes (> 15,000 cfs) would likely inundate these habitats, making them unavailable as "backwaters". The benthic community associated with return channel environments might also be disrupted temporarily. The months of May-July may be critical times for backwaters to be stable and productive for young fish (native and non-native). A BHBF in May could effect the interactions between young fish and a nursery habitat. Alternatively, unstable environments (i.e., backwaters) may favor native fish.

Terrestrial Resources

Kanab ambersnail - a single population in Grand Canyon at Vaseys Paradise continues to persist. Growth of primary habitat occurs in April – October. Most individuals mature and reproduce in mid-summer. A BHBF in January – March results in take of habitat and egg masses, while a later BHBF results in take of reproductively active snails and habitat. Regardless of the timing, the action affects annual reproductive output (see Narrative). An earlier BHBF may reduce provide opportunities for habitat recovery than a later timed

event. Habitat in 1997 within the impact zone was estimated to be 11-16% of total primary habitat.

Southwestern Willow Flycatcher - the matrix suggests that SWWF would not be impacted by a BHBF in January - May. A BHBF in June- July may affect food resources of adults and hatchlings.

Breeding Birds & Waterbirds- other birds that inhabit the river corridor may be impacted by a BHBF if these birds nest in low-lying areas (e.g., marshes or the ground within the inundation zone). Recent survey data from avifauna census is needed for this evaluation. A BHBF in May - July could result in the loss of a year's recruitment in the riparian bird community.

Riparian habitat - near shore habitat (marshes) will be affected by either being buried by sediment, or scoured to some extent. The rate at which recovery/response occurs is influenced by the subsequent flows (i.e., high steady flows may hasten recovery of vegetation in the marshes and along the shoreline). April and early May are primary growing seasons for vegetation so that a BHBF after mid-April may delay recovery by these plants and encourage non-native plants to become established.

Tamarix germination - Seed production by Tamarisk occurs from April through July is of concern. Subsequent flow management may lessen the impact of this resource concern.

Aquatic Resource

Humpback Chub - the larval stage of the humpback chub is of concern during May and June. Concern is over larvae being pulled/swept into the mainstem from the LCR. Pooling at the tributary during a BHBF may result in larvae moving into the slow water and them being subsequently swept into the mainstem with little chance of survival (see narrative). Impacts to HBC larvae that get into the mainstem from the LCR are dependent when spawning occurs in the LCR. Spawning by HBC was reported to be late in 1998 due to the high flows coming out of the LCR. Spawning may be occur as late as May or as early as March for any given year.

Flannelmouth Sucker - the larval stage of the FMS is of concern during May and June. Habitats utilized by larvae and juvenile suckers (backwaters, shoreline) may be impacted by BHBF and become unavailable for use, or the benthic community utilized by the FMS in the sand/silt may also become unavailable at time when growth and survivorship is a primary concern. Alternatively, high steady flows associated with no action would result in backwaters being inundated and unavailable, as well as possibly not reworked/reformed. In both cases these habitats are unavailable to juveniles. Some backwaters reworking during the BHBF may create temporary habitats for juvenile FMS during the summer months if reattachment bar elevations are high enough to sustain subsequent flows.

Trout - Fry come off redds from January through May. The number of fry reach maxima in electrofishing samples during the spring and fall, reflecting extended spawning periods. Fingerlings are present throughout most of the year. High flows did not show a significant loss of fingerlings in the Lees Ferry population (McKinney et al 1996b see narrative). Small fish (fry and fingerlings) show affinity for low velocity near-shore habitats. High scouring flows may transport small fry downstream, but this has not been documented. Fingerlings and adult seek cover from high velocity flows. Little or no downstream displacement of fish was apparent due to the experimental spate of 1996.

Aquatic Food Base - The BHBF had an significant immediate negative affect on the filamentous green algae: reducing biomass to 15% of the total representation, but one month later had increase to 65% of the ash free dry mass. The difference between a recovery from a January -April vs. a later event is not known. Recovery time for both phytobenthos and macroinvertebrates occurred within one months time for some monitoring sites in 1996. Variables affecting recovery time were light availability (i.e., clear water with no tributary inputs), and discharge patterns: steady vs fluctuating flows (McKinney et al 1996a, 1997; Shannon et al 1996). Steady flows following a BHBF may enhance recovery of this resource.

Macroinvertebrates that use the algal community as a substrate follow a similar pattern of productivity. There is a lag time associates with this interaction. 1995-96 data indicate that macroinvertebrate biomass was lowest in February and showed an increase through September (Ayers and McKinney 1996a, McKinney et al 1996; Shannon et al 1996). A BHBF in May/June would likely show a decrease in biomass and recovery by September.

Cultural Resources

Archeological sites - Archeological sites within the inundation zone are determined to be either not impacted or can be mitigated for.

Traditional Cultural Properties - Properties associated with marshes and near shore may be impacted but would likely recover in a pattern similar to those described for riparian vegetation.

Table 1. Summary of comparison of No Action and BHBF Action for a "January-June Analysis" for Water Year 1999 Flow Scenario 2.

Objectives (based on management objectives)	Resource	No Action	Proposed Action (Scenario 2 for Water Year 1999)
	Hydrologic Scenario	Steady releases of at least 25K to 31K cfs for one month (Jan/June) followed by daily averaged fluctuating releases of 20-25K cfs through July.	Same as no action but with BHBF for 2-4 days at 45K cfs release followed by daily average fluctuating releases of 20-25K.
Increase height and area of existing sandbars	**Sediment**	Continued erosion of sandbars with some accumulation of sand in river channel and eddies. High steady flows increase erosion rates.	Conservation of sediment through sand deposition, especially if eddies storage capacity is full. Sand deposition on sandbars/beaches (3 feet or more), followed by erosion overtime. High steady flows increase erosion rates.
Reform/rework backwaters for native fishes **Displace non-native fish**	**Aquatic resources**	Aquatic food base continues development. Drift loads downstream remain within observed patterns for flow following ROD. Backwater habitats fluctuate in temperature and are likely unavailable due to inundation. Spawning patterns of trout undisturbed. Native -Non Native interactions continue. Stabilized return channels not inundated may favor non-natives.	Potential reduction in food base with increased drift downstream. Recovery of food base becomes delayed after May and consequently impact to fish is greater Some disruption of trout fry through displacement (Mar-May). Some backwaters temporarily reformed, or filled-in due to discharge/force dynamics. Potential downstream drift of juvenile or larval native fish, or increased habitat via pooling of tributary mouths (May-July)—Needs to be monitored. Native-Non-native interactions temporarily interrupted, but rapidly return to no action conditions.

Table 1 Cont.

Provide water to Old-High Water Zone Vegetation. **Maintain open sandbars for camping**	**Vegetation and Habitat**	Continued woody vegetation development to the 25K cfs shoreline. Marsh areas inundated and some development of emergent marsh vegetation. Replacement of marsh vegetation with transitional riparian plants (e.g., cattails, willows), gradual loss of marsh habitat. Vegetation utilized by riparian bird community. SWWF nesting areas unaffected. Potential transport and establishment of Tamarisk seedlings. KAS habitat inundated to 25K stage possibly to 31K with associated incidental take of snails	Some emergent marsh and woody riparian vegetation lost due to burial. Recovery to no action levels within six months **(Jan-April)** or 1 year **(April-July)**. Some wildlife habitat lost with 6 month recovery time. Ground nesting sites may be inundated **(April-July)**. Recruitment of some riparian song birds may be affected, but the extent and species are not known **(April-June)**. Nesting sites of SWWF unaffected. Potential transport and establishment of Tamarisk seedlings **(May-July)**.
Not cause significant adverse effects on aquatic food base, trout fishery, endangered species, economics, cultural resources	**Endangered Species and Other Special Status Species**	Endangered species not significantly affected at flows to 25 K cfs. Habitat for native fish remains unchanged. Non-native/native fish interactions remain at current levels given current state of knowledge. Raptors food base not significantly affected. KAS habitat inundated to 25K stage possibly to 31K with associated incidental take of snails.	Possible habitat improvement for native fish or non-native fish (unstable backwater habitats). KAS habitat scoured to 45K cfs stage with incidental take of $\leq$10% of population. Recovery of KAS habitat 1-2 years to 24K cfs stage based on 1996 results. Raptors food base not significantly affected. Potential downstream drift of juvenile or larval native fish **(May-July)** or increased habitat via pooling of tributary mouths--Needs to be monitored.
Protect cultural resources from erosion	**Cultural Resources**	Continued erosion of high terraces containing archeological sites by wind, rain and backward erosion from river channel.	Deposition of sand temporarily reduces erosion rates. Restoration of natural processes generally beneficial.
Preserve and restore camping beaches	**Recreation**	Anglers, day rafters and white-water rafters experience high fluctuating daily flows. Continued reduction of camping beaches. Beach numbers and sizes are still greater than pre-1996 flood event	Recreation activities disrupted for 2-4 days. Downstream safety and available camping areas reduced during BHBF, Safety a greater concern **April- July**. Number and size of beached increased subsequently.
	Hydropower	Operations constrained to high steady flows and moderate fluctuating flow that average 20-25K cfs daily.	More energy is generated during the BHBF, when generating a full capacity, but overall less energy is generated due to the water by-passing the turbines.