ALL

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

ENVIRONMENT, FISH AND WILDLIFE

July 25, 2002

In reply refer to: KEW-4

Mr. Lynn Hatcher
Yakama Nation Fisheries
Yakama Nation
P.O. Box 151
Toppenish, WA 98948

Dear Mr. Hatcher:

In Mr. Robert Austin's July 22, 2002 letter discussing Bonneville Power Administration's (Bonneville) decision on the Wapatox proposal, a copy of a report titled "Wapatox Power Plant Review" was included. This report has a very small amount of information that was shared with Bonneville but protected by a confidentiality agreement between the Bureau of Reclamation and PacifiCorp. If you have not done so already, please forward the original copy of the report without copying or reading it.

Please find enclosed a revised final Wapatox report by the Montgomery Water Group. The confidential information has been removed and those affected portions of the report revised. The report is substantively the same as before. The facts and conclusions have not changed. We appreciate your assistance in the matter and apologize for the inconvenience.

Sincerely

Sarah R, McNary
Director for Fish & Wildlife

Enclosure

cc:
Mr. Jim Esget, U.S. Bureau of Reclamation
Mr. Eric Glover, U.S. Bureau of Reclamation
Mr. Doug Marker, Northwest Power Planning Council
Mr. Larry Cassidy, Northwest Power Planning Council
Mr. Rod Sando, Columbia Basin Fish and Wildlife Authority
Mr. John Palensky, National Marine Fisheries Service

WAPATOX POWER PLANT REVIEW

July 25, 2002

Prepared for:
Department of Energy
Bonneville Power Administration
P.O. Box 3621
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Water Resources Engineering

1.0 INTRODUCTION

Bonneville Power Administration (BPA) retained Montgomery Water Group, Inc. (MWG) to review the potential improvements to instream flow and fisheries habitat from purchase and retirement of the Wapatox Power Canal located on the Naches River and to review potential alternatives to purchasing the water right associated with the Wapatox Power Plant. The following report is divided into four sections; the first is an overview of the existing operations of the power plant, the second a review of the hydrologic changes from retirement of the plant, the third a review and summary of the potential improvements to fisheries from retirement of the plant and the fourth section a discussion of potential alternative strategies to purchasing the Wapatox plant.

2.0 OVERVIEW OF OPERATIONS OF WAPATOX POWER PLANT

The Wapatox Power Plant currently diverts between 300 cfs and 450 cfs year-around from the Naches River upstream of the Town of Naches at River Mile 17.1. The Wapatox diversion consists of a low concrete dam spanning the Naches River with a side diversion with fish screens. The Wapatox plant has a senior water right (1904 priority date) for natural flow in the Naches River that predates Yakima Project water rights. The Wapatox plant does not have storage water rights that are associated with the Yakima Project. If Naches River flows are not sufficient to maintain a 300 cfs diversion, inflow may be bypassed through the two upstream U.S. Bureau of Reclamation (USBR) reservoirs (Rimrock and Bumping Reservoirs) to attempt to satisfy the Wapatox water right. However the diversions into the power canal are informally subordinated by PacifiCorp (the plant's owner) during low flow periods in the wintertime to maintain 125 cfs in the Naches River over the diversion dam. Flow returns to the Naches River at River Mile 9.7. An irrigation water user withdraws 50 cfs from the Wapatox Canal during the irrigation season (April – October) and the City of Yakima diverts water from the canal tailrace when the canal is operating. Other irrigation diversions occur in the reach of Naches River bypassed by the Wapatox Canal; those diversions have been estimated to be as much as 100 cfs.

3.0 HYDROLOGIC CHANGES FROM RETIREMENT OF WAPATOX POWER PLANT

An analysis of the current diversions into the Wapatox Plant and the current stream flow regime in the Naches River was performed to review the potential changes in streamflow from retirement of the Wapatox Power Plant. Figures 1-3 show streamflow in the Naches River at the Naches gage with the flow diverted into the Wapatox Canal superimposed over the river flow. Each figure shows three water years starting in water year 1991. The Naches River at Naches gage is located downstream of the Wapatox diversion dam in the reach affected by the plant. The figures illustrate that two periods of low flow generally occur each year. During the irrigation season between July and September when natural flows decline, flows in the Wapatox Reach also decline, with minimum flows reaching 125 – 150 cfs in most years. During wintertime, flows also decline to low levels and may reach summertime lows in dry years. The Wapatox Power Plant diverts up to 300-400 cfs during those time periods. Discussions of the impacts for each season are contained in the following sections.

3.1 Hydrologic Impacts During Late Summer

Table 3-1 presents an analysis of the number of days that flows are less than a range of flows between 125 and 400 cfs during the summer period (July – September) for existing conditions and with retirement of the Wapatox Plant. The flows contained in the table are average daily flows. Also included in Table 1 is the Total Water Supply Available (TWSA) for April 1 of each year. The TWSA is a measure of the water supply available for water use and instream flow from the Yakima Project. The long-term average TWSA is approximately 2.9 million acre-feet (maf), and shortfalls in water supply can occur when TWSA volumes are less than approximately 2.6 maf.

Table 3-1
Number Of Days Flows Are Not Exceeded
Both With And Without Wapatox Power Plant
During July – September
Naches River At Naches Gage

	Water Year								
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Total Water Supply Available (million acre-feet)	2.82	2.35	2.00	2.02	3.04	2.87	4.54	2.98	4.20
# Days in Period	92	92	92	92	92	92	92	90[1]	92
Naches River Flowrate	(Number of days below flow in existing conditions/number of days below flow with retirement of Wapatox Plant)								
400 cfs	23/0	56/4	48/0	64/0	0/0	25/0	0/0	45/0	4/0
300 cfs	20/0	52/0	41/0	61/0	0/0	8/0	0/0	41/0	0/0
200 cfs	0/0	49/0	14/0	51/0	0/0	2/0	0/0	33/0	0/0
125 cfs	0/0	26/0	0/0	9/0	0/0	0/0	0/0	5/0	0/0

[1]Data not available for two days that year

For existing conditions and in water years with average water supply conditions such as 1991, 1996 and 1998 the number of days stream flow was less than 400 cfs at the Naches gage ranged from 23 to 45 days (25% to 49% of the time), the number of days less than 300 cfs ranged from 8 to 41 days (9% to 45% of the time). For dry years such as the period of 1992 – 1994, the number of days streamflow was less than 300 cfs ranged from 41 to 61 days (44% to 66% of the time) and the number of days streamflow was less than 400 cfs ranged from 56 to 64 days (61% to 70% of the time). For the scenario of the Wapatox Project retired, the number of days flows are less than 400 cfs would reduce to zero for average water years and to zero to four days (zero to 4% of the time) for dry water years. The number of days flows are less than 300 cfs would reduce to zero for all water years. The retirement of the Wapatox Power Plant could provide a

flow in the Wapatox Reach during the July – September time period exceeding 400 cfs for all but a few days in dry years.

The Yakima Project creates an artificial flow regime with storage and releases for irrigation water supply and instream flow. Prior to construction of the Yakima Project, streamflow in the Naches River also declined in the late summer. The USBR has prepared estimates of unregulated flow in the Naches River during average, dry and wet years. A copy of a comparison of regulated and unregulated flows is contained in Appendix A (USBR, 2002). During dry years such as 1994, the unregulated flow in the Naches River would have declined to a level similar to that experienced with regulation and with operation of the Wapatox Power Plant. Unregulated flows in average to wet years appear to be higher than flows experienced with regulation (combined with operation of the Wapatox Power Plant).

The flow regime is complicated by the "flip-flop" operation of the Yakima Project when reservoirs on the Naches River arm of the Yakima system are drafted heavily starting in early September to provide water supply to water users downstream of the confluence of the Yakima and Naches River. The "flip-flop" operation was conceived to reduce flows in the upper Yakima River basin and reduce impacts to spawning salmon in that reach when flows are suddenly reduced at the end of the irrigation season. During the "flip-flop" operation the Wapatox Canal diverts its full capacity to bypass as much flow as possible around the Wapatox Reach. The peak flow at the Naches River at Naches gage during "flip-flop" usually ranges between 1,500-2,000 cfs during most years and is less than 1,000 cfs during dry years. Figures 1-3 also illustrate the Naches River and Wapatox Canal flow during "flip-flop" periods.

3.2 Hydrologic Impacts During Winter Season

Table 3-2 presents an analysis of the number of days that flows are less than a range of flows between 125 and 400 cfs during the winter period (November - March) for existing conditions and with retirement of the Wapatox Plant. For years with average water supplies, the number of days stream flow was less than 400 cfs at the Naches gage ranged from 26 to 46 days (14% to 25% of the time), the number of days less than 300 cfs ranged from 11 to 21 days (6% to 11% of the time). For dry years such as the period of 1992 – 1994, the number of days streamflow was less than 300 cfs ranged from 75 to 125 days (41% to 68% of the time) and the number of days streamflow was less than 400 cfs ranged from 98 to 154 days (54% to 84% of the time). For the scenario of the Wapatox Project retired, the number of days flows are less than 400 cfs would reduce to 11 days (6% of the time) for average water years and 34 to 151 days (19% to 83% of the time) for dry water years. The number of days flows are less than 300 cfs would reduce to zero for average water years and 16 to 117 days (9% to 64%) during dry water years. The retirement of the Wapatox Power Plant could reduce the occurrence of flows below 400 cfs for average water years but flows would continue to remain below both 300 and 400 cfs for a significant period of time in dry years during the winter season.

Streamflow outside the periods shown in Tables 3-1 and 3-2 is generally adequate because of natural, unregulated runoff that greatly exceeds the Wapatox Plant water right.

Table 3-2
Number Of Days Flows Are Not Exceeded
Both With And Without Wapatox Power Plant
During November – March
Naches River At Naches Gage

	Water Year								
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
# Days in Period	183	183	183	183	183	183	183	183	183
Naches River Flowrate	(Number of days below flow in existing conditions/number of days below flow with retirement of Wapatox Plant)								
400 cfs	43/0	98/34	154/151	150/127	49/34	26/11	68/0	46/0	63/28
300 cfs	38/0	75/16	125/117	117/97	31/15	24/0	61/0	21/0	52/26
200 cfs	30/0	40/0	19/17	65/51	17/4	14/0	41/0	10/0	23/9
125 cfs	2/0	18/0	0/0	4/1	0/0	10/0	11/0	0/0	2/0

3.3 Review Of Potential Impacts From Flow Fluctuations In Wapatox Reach

A review of the potential effect from fluctuations in water levels was performed to determine if the current operation of the hydroelectric project causes fluctuations in water levels in the Naches River that may be harmful to fisheries. Figure 4 shows a plot of the rate of change in stage or depth at the Naches River at Naches gage for 2000, which is used as an example year. A guideline used by the USBR in the operation of the Yakima Project is to control the change in depth to less than two inches per hour to prevent stranding of fish. The fluctuations in water levels are generally less than two inches per hour except in the time of "flip-flop" when flow rates are ramped up in the Naches River arm of the Yakima Project. The operation of the Wapatox Plant alone does not appear to cause a problem of excessive changes in flow and water levels, based upon the year examined.

4.0 REVIEW OF IMPROVEMENT TO FISHERIES FROM RETIREMENT OF WAPATOX POWER PLANT

A number of reports that describe fisheries issues relating to the Naches River and Wapatox Reach were reviewed. Those reports included the *Salmon and Steelhead Habitat Limiting Factors WRIAs 37-39* report prepared by the Washington State Conservation Commission (2001), the *Draft Interim Comprehensive Basin Operating Plan for the Yakima Project* by the U.S. Bureau of Reclamation (2002), *The effects of various flow levels on the connectivity of floodplain habitats in the Wapatox Reach of the Lower Naches River, Washington* by U.S. Fish and Wildlife Service (2002) and *The Review And Synthesis Of River Ecological Studies In The Yakima River, Washington, With Emphasis On Flow And Salmon Habitat Interactions, Final Report* (Snyder and Stanford, 2001). Summaries of those documents follow.

4.1 Salmon and Steelhead Habitat Limiting Factors Report

The following is a description of Naches River fisheries issues that is excerpted directly from the *Salmon and Steelhead Habitat Limiting Factors WRIAs 37-39* report (Washington State Conservation Commission, 2001).

> *"The Naches River supports spring chinook, fall chinook (presumed presence), coho, summer steelhead, and bulltrout, as well as a number of other salmonid and non-salmonid species (WDFW 1998). The lower extent of spring chinook spawning in the Naches River is generally considered to be Horseshoe Bend, located approximately 2 miles upstream of the Tieton River confluence (B. Watson). Spring chinook fry emerging from the American River move into the middle Naches by late summer; fry from the upper Naches move into the lower Naches or Yakima River (CBSP 1990). The Naches River and tributaries have been thought to produce a significant percentage of the overall steelhead production in the Yakima watershed. Steelhead production from the Naches has not been directly assessed and has been estimated by subtracting the sum of Satus, Toppenish, and upper Yakima steelhead counts from total counts at Prosser Dam. Expanded counts in the upper Toppenish Creek watershed since 1998 indicate a much higher production from that system than previously thought, which would result in a corresponding decrease in estimated steelhead production from the Naches watershed (YSS 2001 DRAFT). Impeded upstream passage of adult salmonids by low flows downstream of Wapatox Diversion Dam (the largest diversion on the Naches River) was identified as a concern in the 1990 Subbasin Plan (CBSP 1990). Impaired passage may not be directly lethal, but it may delay and exhaust adult salmonids to such a degree that they are subject to increased pre-spawning mortality. The dam was rebuilt in 1978 with a new fishway (a modified pool and step-type passage facility)(BOR 2000). Possible spring chinook passage delays have been observed at the dam, particularly during low stream flows. A steelhead radio-telemetry study conducted by NMFS, did not indicate any passage problems at this site (Hockersmith et al. 1995, as cited in BOR 2000). A large number of unscreened/poorly screened Phase II diversions were located on the middle and lower Naches, resulting in a disproportionate impact on American River spring chinook smolt survival rates (CBSP 1990). These were replaced with louvered screens in the early 1990s, which should improve survival (Perala). One of the larger diversions that remains unscreened is the City of Yakima Water Treatment Plant (WTP), just downstream of the outlet of the Wapatox powerplant. The water right for this diversion is ~39 cfs. The City of Yakima Municipal Water intake is located in the tailrace of the Wapatox powerplant, when it is operating. However, the powerplant has not been operating for ~60 days/year in recent years; during these shutdowns, water is diverted through an unscreened auxiliary water intake from the Naches River. The BOR is negotiating with involved parties to buy out the Wapatox Powerplant to benefit salmon and steelhead by increasing instream flows in the Naches River (YSS 2001 DRAFT). Retirement of the Wapatox powerplant would result in unscreened water intake to the WTP year round. In addition, the WTP diversion is separated from the main flow of the Naches River only by a low concrete wall running down the left bank of the river. During spring runoff, flows may top this wall, entraining downstream migrants into the WTP. Returning adult spring chinook or summer steelhead may also access the WTP canal*

during high water, where they are blocked from returning to the Naches River (two adult summer steelhead were observed in the upper end of the water intake canal on May 14, 2000). Juvenile and adult salmonids, including ESA-listed species that enter the WTP canal, are likely entrained and lost to production. The reach from the mouth to Wapatox Dam is 60% braided with many good gravel bars (CBSP 1990). Side channels that would provide important rearing habitat are dried up from early July until flip-flop (mid-September). Passage up the Naches River is also impaired. Downstream passage for spring chinook juveniles is feasible only until July 4th; thereafter, migrants are lost due to impassable conditions and stranding (WDFW 1998).

Low flows during the winter and early spring, and prolonged high and fluctuating flows in the summer are the major factors affecting anadromous salmonid production in the mainstem Naches River. Poor instream flows in the winter in the lower Naches River significantly impact natural reproduction of spring chinook, steelhead, and coho (WDFW 1997a).

The lower Naches River is plagued by extremes in flows. Sudden increases in flow cause fish to vacate feeding territories and migrate to new areas, increasing competition and stress, reducing growth, and increasing the likelihood of mortality, either through predation or being displaced to unsuitable downriver habitat (CBSP 1990). Sudden decreases in flow result in the stranding or death of salmonids that are unable to relocate to nearby pools or runs. Irrigation diversions dry up side-channel habitat prior to mid-July, which is critical for rearing spring chinook (WDFW 1998). Water temperature and quality are excellent, but instream flows between the Wapatox diversion and outfall frequently are too low for optimal rearing and adult passage from mid-July to mid-September (CBSP 1990). Wapatox canal diverts 300-500 cfs from the Naches River, while four smaller diversions downstream take an additional 100 cfs. From mid-July through mid-September, these diversions leave about 150 cfs in the reach from the mouth to Wapatox, which had a mean unregulated discharge of 1,800 cfs (CBSP 1990). Flows upstream of Wapatox Diversion Dam are seldom too low to cause problems (WDFW 1998).

The braided channels of the Naches River downstream of Wapatox Dam (RM 9.7-17.1) are substantially dewatered at flows of 125 cfs and below. Higher flows in the Wapatox reach are necessary to maintain the high-quality rearing habitat for steelhead and salmon and to support the food organisms that sustain those fish. Researchers have hypothesized that most or all of the 30% estimated loss of smolts between Wapatox Dam and Sunnyside Dam occurs between Wapatox Dam and the powerplant outfall, and that the proximate cause is stranding in braids of the lower Naches, and especially predation exacerbated by low flows (CBSP 1990). Power subordination at Wapatox, and transfer of the savings to instream flow, would increase smolt capacity in the reach by an estimated 314,700 smolts, approximately three times the estimated benefit of restoring riparian condition throughout the entire Yakima River watershed (CBSP 1990).

Although instream flows in the Naches River would be significantly improved if the Wapatox buyout occurred, the diversion dam may need to be retained to provide water

delivery to these other entities. Although spring chinook redds are saved in the upper Yakima as a result of flip-flop management, there has been little or no effort to understand or monitor the effects of this flow regime on either the upper Yakima or on the lower Naches (Snyder and Stanford 2000 DRAFT). In the upper Yakima, significant stranding of benthic invertebrates may occur and numerous side-channel habitats critical to the completion of many different species life histories, including juvenile salmon, are disconnected as a result of the extensive instream flow variation associated with flip-flop. In the Naches River, flows capable of transporting bedload likely result in rapid rates of cut and fill avulsion, as well as generating a spectacular annual disturbance event, the magnitude and duration of which is well beyond that occurring historically. In both the upper Yakima and the lower Naches, organisms specifically adapted to the natural and predictable disturbance regime would likely be unable to adapt to the anthropogenic regime and would suffer declines in density and productivity (Resh et al. 1988, as cited in Snyder and Stanford 2000 DRAFT). This applies to the post-reservoir flow regime and particularly to the alteration of that regime via flip-flop. Snyder and Stanford (2000 DRAFT) strongly recommend that the flip-flop regime be re-examined carefully, although recognizing this as difficult due to the lack of quantitative data on resource impacts".

The report contained the flowing action recommendations for the Naches River that pertain to the Wapatox Reach:

- Protect/preserve ecological integrity of critical floodplain reaches
- Eliminate hydropower diversions whenever instream flows downstream of Wapatox dam cannot otherwise be maintained at 400 cfs (500 cfs in Sept.-Oct.)
- Acquire Wapatox Power Plant and diversion; restore water diverted for power to instream flow
- Screen City of Yakima water intake

4.2 The Effects Of Various Flow Levels On The Connectivity Of Floodplain Habitats In The Wapatox Reach Of The Lower Naches River, Washington

This report, prepared by Steve Croci of the USFWS, presents a study of the effects of various flow levels in the Naches River on the connectivity of side channels in the Wapatox Reach. The complexity of channel connectivity is a key component to a healthy and functioning system. The findings of the study were that channel separations become severely impaired or disconnected as flows are reduced in the Wapatox Reach. Side channels were more impacted than mainstem splits. This was of concern because the side channels appear to be preferred habitat for rearing anadromous salmonids. The work performed indicates the greatest loss in side channel habitat between flows of 311 cfs and 240 cfs. A flow of 240 cfs or less measured at the Naches River at Naches gage equates to loss of one-half of the preferred rearing habitat type. Croci note that up to 37% of the flow measured at the gage is diverted or goes subsurface downstream of the gage. Table 4-1 presents the channel connectivity found by Croci.

Table 4-1
Channel Connectivity, Side Channel And Mainstem Splits

Channel Connectivity	Flowrate at Naches gage, cfs					
	630	**497**	**311**	**240**	**189**	**147**
% Connected	95	95	84	68	68	68
% Severely impaired	5	0	11	26	21	21
% Disconnected	0	5	5	5	11	11

Table from Croci (USFWS, 2002)

Croci did not make recommendations for a minimum instream flow for the Wapatox Reach based upon his study, but it appears that a flow of 311 cfs would greatly improve the channel connectivity from existing levels in July and August and during wintertime operations. At a flow of 311 cfs, the percentage connected increases from 68% (at flows between 147 and 240 cfs) to 84%, the percentage severely impaired decreases from a range of 21-26% to 11% and the percentage disconnected decreases from a range of 5-11% to 5%. An additional 180 cfs (total of 497 cfs) improves connectivity by 11%, reduces the number of channels severely impaired by 11% but did not change the percentage disconnected. The most loss in channel connectivity occurs below a flow of 311 cfs, with less improvement above that flow relative to the total flow in the Naches River.

A more recent draft report titled *Wapatox Project Fishery Benefits* (Croci, undated) was also reviewed. The draft report appeared to have been prepared in June 2002. The conclusion reached in the new report is an additional 350 cfs to 400 cfs in the Wapatox Reach is needed to allow properly functioning habitat. The same conclusion was not contained in his January 2002 report although it appears no additional study of the benefits of increased flow was performed.

4.3 The Review And Synthesis Of River Ecological Studies In The Yakima River, Washington, With Emphasis On Flow And Salmon Habitat Interactions, Final Report

This report prepared by Snyder and Stanford (Flathead Lake Biological Station, 2001) concludes that the long-term success of salmon restoration in the Yakima Basin is largely dependent upon permanent provision of a normative flow regime for the entire river system and enhancement of anadromous salmonid habitat throughout the river system. It is stated that normative flows can potentially be achieved by rescheduling dam releases, providing alternative water sources, purchasing instream flow rights and removing revetments. Work is on-going by Stanford to better define each reach's need in terms of normative flows. The issues identified for the Wapatox Reach are low flows in summer and high flows and changes in flows during the flip-flop operation in September.

4.4 Draft Interim Comprehensive Basin Operating Plan for the Yakima Project

This document prepared by the U.S. Bureau of Reclamation (2002) provides an overview of Yakima Project operations and contains a discussion of the issues relating to the Wapatox Reach.

The Plan uses the information developed by Croci and discussed in the previous section to describe the flow impacts to the reach from operation of the Wapatox Plant.

The Plan contains discharge hydrographs for unregulated (without the Yakima Project) and regulated (current) conditions for the Naches River. A copy of those flow hydrographs is contained in Appendix A and was discussed in Section 3 of this report.

The Plan also developed recommendations for the U.S.B.R. to implement. The recommendations are quite broad and contain recommendations such as measuring the effectiveness of target flows and reviewing alternatives to "flip-flop" operation. No specific changes to operations of the Yakima Project reservoirs or rivers appear to result from the Plan.

5.0 ALTERNATIVE STRATEGIES

There are a number of potential strategies that may achieve the same or similar instream flow and/or fisheries benefits in the Wapatox Reach as purchasing the Wapatox Plant. Those strategies may include the following:

- Changing the operation of the Yakima Project to increase instream flow in the Wapatox Reach in some or all years.
- Lease water from PacifiCorp during water short years or during periods of low flow to improve instream flow in the Wapatox Reach.
- Implement Water Conservation or Water Storage Projects that would provide additional flow for instream use in the Wapatox Reach.
- Determine if the operation of the Plant will come under the jurisdiction of FERC with the potential for minimum instream flows imposed as a new operating condition.
- Determine if administrative or judicial actions may occur which would require maintenance of higher instream flow or change to a more normative hydrologic regime. This alternative may have the same actions as the first alternative listed above.
- A combination of two of more of the above strategies.

A short discussion of each alternative follows.

5.1 Change the Operations of the Yakima Project

To increase streamflow in the Wapatox Reach additional flow would need to be released from Yakima Project reservoirs. An estimate of the volume of water required from Yakima Project reservoirs was made by plotting Naches River at Naches flow versus a selected minimum instream flow for that location. Figures 5-8 illustrate that analysis. A minimum instream flow of 300 cfs was selected for the analysis. That instream flow is close to one of the flows (311 cfs) measured in the USFWS study (Croci, 2002). Below that flow, a large decrease in channel connectivity occurs. There will be disagreement on an appropriate minimum instream flow to use; the use of 300 cfs is not meant to endorse a particular minimum instream flow but to analyze the storage volume needs to meet a flow that may be minimally acceptable.

Figures 5 and 6 contain plots for water years 1993 and 1994, both of which were water short years. The instream flow needs are plotted as a cumulative volume over the water year to allow an analysis of flow needs both during the winter and late summer periods. The instream flow needs are 22,000 acre-feet in 1993 and about 40,000 acre-feet in 1994. The late summer needs are less; in 1993 they are approximately 8,000 acre-feet and in 1994 approximately 17,000 acre-feet.

Figure 7 contains a plot for water year 1997, which is a wet year (see Section 3.1). All of the instream flow needs occurred in the winter period and totaled approximately 15,000 acre-feet.

Figure 8 contains a plot for water year 1998, which is an average year (see Section 3.1). The instream flow needs also total 15,000 acre-feet for the whole water year. For the late summer period, the instream flow needs are approximately 11,000 acre-feet.

Additional flow releases from Yakima Project reservoirs may be possible during average to wet years as water supply needs are met during those types of water years. As described in Section 3.1, the average TWSA for the Yakima Project is 2.9 million acre-feet. Reduction (proration) in water supplies typically occurs only when TWSA volumes are less than about 2.6 million acre-feet. The USBR can review a potential change in operations to supply additional instream flow in the Wapatox Reach with a hydrologic model they have available for that type of analysis.

During water short years, additional volume from Yakima Project reservoirs would likely not be available to provide additional instream flow. However it is worthwhile to examine if the schedule of flow releases from the Naches arm reservoirs can be changed to increase flow in the Wapatox Reach during the July-September time period while decreasing flow during the "flip-flop" operations time period. We understand the USBR is currently analyzing their operations to determine if they can operate the system differently and more closely mimic a normative flow regime. If that were possible, higher flows may result in the Wapatox Reach during the July-September time period and "flip-flop" operations reduced.

The figure contained in Appendix A shows an unregulated flow regime in the Naches River for a dry year (water year 1994), a wet year (water year 1997) and a typical or average year (water year 1990). The unregulated flow regime for a dry year shows low flows that approximate the flows that occurred in 1994 in the Wapatox Reach even with diversion into the power plant. This indicates that additional flow provided in a dry year may increase flows above naturally occurring conditions.

The cost of this alternative could be minimal to the USBR if it is found that the Yakima Project operations could change without affecting water deliveries. If water supplies are affected, costs to water users could result from reduced farm income and other socio-economic costs. Power production at the Wapatox Plant would not be affected with this alternative.

5.2 Lease Water From PacifiCorp During Water Short Periods

For this alternative an agreement with PacifiCorp would be needed to lease flow during water short periods or during dry years to supplement flow in the Wapatox Reach. This alternative

would result in a reduction in power production at the plant and may create operational problems (unknown at this time) in the canal and power plant. This alternative may be less expensive than purchasing the power plant as the annual value of power produced is likely in the range of $700,000 to $750,000 using a value of $20 per mwh and 36,264 mwh of marketable power produced (USBR, 2002). Sections 3.1 and 3.2 provide an estimate of the number of days Naches River stream flow is less than 300 cfs with current operations of the Wapatox Plant. For an average year, stream flow is less than 300 cfs for about two months out of a year. If power production were suspended for two months each year on average, the lost production would be approximately 17% of $750,000, or $127,500 per year on average. The costs of lost production should approximate the lease costs as the water right is non-consumptive and the value is dependant on its use to generate power. The costs of leasing may be much higher in dry years but lower in wet years. For example, in a dry year such as 1994, the Naches River stream flow was less than 300 cfs for 178 days during the year. However with the plant retired, a 300 cfs target could only be met for an additional 81 days during the year because natural flows were too low. A lease for 81 days (22% of the year) may cost $166,000. This is a simplified analysis that does not account for a number of factors but the magnitude of annual average leasing costs provide an indication that more analysis of this alternative is warranted. The present value of an annual lease with costs of approximately $127,500 to $166,500 per year is much less than the proposed purchase price or BPA's proposed contribution to the purchase price.

5.3 Implement Water Conservation Or Water Storage Projects That Would Provide Additional Flow For Instream Use In The Wapatox Reach

For this alternative, structural changes in the storage or delivery of water would be needed to provide water that can be used to increase instream flow in the Wapatox Reach. The structural changes could entail constructing improvements to irrigation district canals and laterals to achieve water savings or constructing additional storage reservoirs to provide flow. A discussion of each follows.

Implement Water Conservation Measures

The USBR is implementing the Yakima River Basin Water Enhancement Program (YRBWEP) that contains as an element, water conservation projects in irrigation districts served by the Yakima Project. We reviewed a number of Water Conservation Plans prepared by Irrigation Districts and identified Districts where water conservation savings may be used to supplement instream flows in the Wapatox Reach, depending on the timing of the water savings. The cost of the water savings vary between $400 and $2,700 per acre-foot saved, with a median cost in the range of $1,300 per acre-foot saved. Section 5.1 contains an analysis of instream flow volume needs. For an average year, the instream flow volume required was 11,000 acre-feet during the July-September time period. That is the same time period that water savings from irrigation district water conservation projects would be available. The approximate cost of obtaining 11,000 acre-feet is $14,300,000 using a cost of $1,300 per acre-foot. The cost may be higher than described as the USBR wants to split the water saved through irrigation water conservation projects with irrigation districts; two-thirds of the water saved would go towards increased instream flow and one-third would be reserved for the irrigation district for its own use. If a split occurs, the cost would be one-third higher than described, or $19 million.

That cost is much higher than the cost of purchasing the Wapatox Power Plant.

Construct Additional Storage
The USBR is also reviewing the potential for adding storage to the Yakima Project. The costs of providing additional storage are greater than the costs of implementing water conservation measures in irrigation districts. For example, the cost of a project that would provide about 15,000 acre-feet of additional storage in Cle Elum Lake has been estimated by the USBR at $15 million. That cost is also much higher than the cost of purchasing the Wapatox Power Plant.

5.4 Determine If The Operation Of The Plant Will Come Under The Jurisdiction Of FERC With The Potential For Minimum Instream Flows Imposed As A New Operating Condition

It appears likely now that the Wapatox Power Plant will need to be licensed through FERC. The FERC licensing process is an expensive and time-consuming process, which will expose PacifiCorp to potential changes in the operations of the power plant to increase instream flow in the Wapatox Reach. The process of preparing relicensing documents and negotiating agreements with interested parties would take years, perhaps a decade. The outcome may be higher instream flows obviating the need to purchase the power plant. A disadvantage in waiting is the time frame for which the relicensing occurs and the lost opportunities for fisheries enhancement during that time period.

5.5 Determine If Administrative Or Judicial Actions May Occur Which Would Require Maintenance Of Higher Instream Flow Or Change To A More Normative Hydrologic Regime

This administrative or judicial action that may occur in the near future refers to a Biological Opinion on the operations of the Yakima Project that is forthcoming from National Marine Fisheries Service (NMFS) as a result of the Endangered Species Act (ESA). The content of the Biological Opinion is not known at this time. One result of the ESA consultation process may be a change in the operations of the Yakima Project to provide a flow regime that more closely matches a normative flow regime. That would likely increase instream flow in the Wapatox Reach and decrease the effects of "flip-flop" operations. If the USBR owned the Wapatox Plant it would provide them more flexibility in their system operations and may reduce the effect and cost of potential required changes in the system on water users. For that reason, the Wapatox Plant is a valuable acquisition for the USBR.

5.6 Implement Two or More of Alternative Strategies Described in Sections 5.1 to 5.5

Two or more of the alternative strategies described in Sections 5.1 through 5.5 could be implemented to reduce the cost of providing additional streamflow in the Wapatox Reach. Those strategies could include leasing water from PacifiCorp during water short periods or dry years to improve instream flow, requesting the USBR study the potential to provide additional instream flow during average to wet years and waiting to determine if actions by FERC or NMFS will require additional instream flow to be provided in the Wapatox Reach. These actions may result in the least cost to BPA and possibly the USBR, but increased costs (through reduced

water supply) for Yakima Project water users and PacifiCorp. Disadvantages of this alternative would be additional instream flow may not be available at all times due to constraints on USBR and PacifiCorp operations and the time frame to determine if increased instream flow will be required by FERC or NMFS may be long. That would reduce the fisheries enhancement benefit during that time period. In addition, PacifiCorp would need to willingly lease water to the USBR.

6.0 SUMMARY

The purchase of the Wapatox Power Plant would improve instream flow conditions in the Wapatox Reach by 300 to 450 cfs for most of the year. The increase in flow will greatly improve fish passage for adult salmon and steelhead in the July-September time period and improve rearing conditions for juvenile salmon in low water times in July-September and during winter months. An increase in instream flow in this reach would greatly increase smolt capacity and is a priority for fisheries interests.

An instream or target flow for this reach has not been recently set and the work by Croci indicates the greatest loss in side channel connectivity (a measure of a healthy and functioning system) occurs when flows at the Naches River at Naches gage drop below 311 cfs.

Alternatives to purchasing the Wapatox Plant were reviewed. The first alternative is to change the operations of the Yakima Project to release water from storage and provide additional instream flow. The estimated volume of storage required to provide an instream flow of 300 cfs at the Naches gage during average years is approximately 11,000 acre-feet during the July-September time period and 15,000 acre-feet for the entire year. It is possible that the USBR has sufficient storage during average to wet years to provide that additional flow from storage. During dry years additional volume from Yakima Project reservoirs would likely not be available, as water supply needs for irrigation are not currently met. It is recommended the USBR perform operational studies to determine if additional instream flow can be provided. The costs of this alternative may be minimal if it is feasible without affecting water supplies. If water supplies were found to be affected, costs to farmers may result from reduced farm income and other socio-economic costs.

The second alternative is to lease water from PacifiCorp during water short periods. We estimate a lease for two months of the year during an average year and less than three months during dry years would be required to provide 300 cfs instream flow when sufficient natural flow is available. The costs of leasing are estimated to be in the range of $127,500 to $166,000 per year based upon the estimated value of power produced by the plant. The present value of those costs is likely much less than the purchase cost or BPA's contribution.

The third alternative is to implement structural changes in irrigation water delivery or storage facilities through water conservation and increased storage. The costs of this alternative are higher than the purchase price of the power plant.

The fourth and fifth alternatives are to wait and determine if FERC relicensing or other administrative or judicial action (such as ESA consultation with NMFS) occurs which result in

increased instream flows. The time frame for these alternatives is longer and increased instream flow may not result for a number of years. The costs to USBR and BPA may be minimal if the power plant comes under FERC jurisdiction however the costs to USBR may be much greater if the operations of the Yakima Project are changed to increase instream flow in the Wapatox Reach and reduce the impacts of "flip-flop" operations. For that reason the Wapatox Plant is a valuable acquisition for the USBR as its purchase would provide more flexibility in operations of the Yakima Project and may reduce impacts on water users.

The last alternative is to lease water from PacifiCorp during water short periods or dry years to increase instream flow, request the USBR study a change in operations to provide additional instream flow during average to wet years and wait for administrative or judicial actions such as FERC licensing and NMFS consultation that may require PacifiCorp and/or the USBR to increase instream flow in the Wapatox Reach. This alternative is the least cost alternative for the BPA and possibly the USBR. However it could affect Yakima Project water users and PacifiCorp by reducing their water supply. Disadvantages of this alternative would be the increased flow may not be available at all times due to operational constraints of the USBR and PacifiCorp (until changes required by FERC or NMFS), there may be effects on Yakima Project water users and the time frame to implement would be longer than just purchasing the water right.

Respectfully submitted,

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