Addendum: Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana

Draft Environmental Impact Statement

Introduction

The Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation) have prepared this addendum to the Lower Yellowstone Intake Diversion Dam Fish Passage Project Draft Environmental Impact Statement (EIS) to provide the public with the opportunity to review and comment on the evaluation completed on scoping comments that were inadvertently overlooked during the preparation of the Draft EIS.

Following the public release of the Draft EIS, it was realized that 12 comment letters submitted during the scoping period were not forwarded to the interdisciplinary team responsible for analysis in the Draft EIS. The majority of substantive comments (i.e., suggested alternatives, studies, and data) in the 12 comment letters were also identified in other comment letters and are already addressed in the Draft EIS. However, the comments did include additional variations on alternatives not previously considered. This addendum provides the evaluation of substantive comments not considered or analyzed in the Draft EIS.

Information and evaluation of substantive comments not considered in the publicly available Draft EIS has been shared with the interdisciplinary team and is being considered as part of the decision-making for the proposed fish passage project. Reclamation and the Corps have determined that the substantive comments in the 12 comment letters do not represent either substantial changes in the proposed action relevant to environmental concerns or significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR 1502.9 (c)). As such, this information does not require preparation of a supplement to the Draft EIS. The evaluation provided in the following pages will be incorporated into the Final EIS anticipated for release in fall 2016. Finally, the following evaluation specifically appends the text in DEIS section 2.3.1.

Alternatives proposed in scoping

Short weir- One commenter suggested that a short weir could prolong the ability to divert irrigation water through the current headworks, thereby reducing pumping demands while still allowing fish passage. There is no data to indicate at what height a weir may impede to pallid sturgeon fish passage. Turbulence and velocities, which can discourage pallid sturgeon passage, would be a concern for any weir of sufficient height to substantively prolong gravity water diversions at the current headworks. This issue could be addressed through a ramp to the weir crest. This approach is similar to Alternative Theme C which included a lower weir elevation and has been previously evaluated (Reclamation and Corps, 2015). For the above reasons and those identified by Reclamation and the Corps in the 2015 EA, this proposal has not been carried forward as an alternative for detailed analysis.

Retractable or Inflatable Gates- One commenter proposed that retractable or inflatable gates should be re-evaluated as a means to keep the river open most of the year. The author stated that there are many designs of gated weirs that may work at Intake. A similar comment was made during Independent External Peer Review of the 2015 Supplemental Environmental Assessment and the rationale for not carrying this option forward as an alternative has not changed from past analysis.

The June 2002 Alternatives Analysis Study considered using Obermeyer or other types of collapsible gates to replace the existing dam. Concerns were identified with likely Yellowstone River ice and sediment damage contributing to high long-term operation and maintenance (O&M) costs for this type of structure.

In addition, computations were performed with a hydraulic model (HEC-RAS) to evaluate flow velocities through the gates. With the primary goal of fish passage, the same Biological Review Team (BRT) criteria was employed related to turbulence, velocity, and flow depth. Evaluation was conducted for a normal annual migration flow in the range of 35,000 to 40,000 cubic feet per second (cfs) down to low flows of 5,000 cfs. Various combinations and number of gates open were examined with HEC-RAS modeling to determine gate passage flow velocity. Although the 2002 study concluded that collapsible gates were technically feasible, subsequent evaluation and refined fish passage criteria identified several flaws. The 2002 study results determined that impacts to the irrigation diversion would occur at low flow rates with a lessened impact at higher main river flows. Limiting the number of lowered gates to prevent irrigation withdrawal impacts resulted in very high velocities through the gate openings for some flows, in the range of 8 feet/sec or greater at 15,000 cfs and over 6 feet/sec at 40,000 cfs. Velocities drop just below the desired 6 feet/second and indicate that passage may be feasible for short durations during the peak spring runoff period (i.e. at flows greater than 40,000 cfs) but passage is not likely during lower flow periods. In addition, other species may also not be able to pass with the gates lowered. Turbulence would also likely be high through the gates at these velocities, further discouraging fish passage.

Therefore, considering the high velocities that could still create a pallid sturgeon passage barrier, potential adverse impacts to other species during low to normal flow periods, and O&M difficulties and high costs related to ice and sediment impacts, collapsible gates were not carried forward as an alternative. Fish biologists also expressed concerns that steel plates used for the gates, which emit a weak electrical field, may discourage electrosensitive fish such as sturgeon from swimming upstream based on studies such as Wilkens and Hofman (2007).

Supplement Natural Flows- One commenter recommended that under the Crow Tribe Water Rights Settlement Act of 2010 there are 50,000 acre-feet of water in Bighorn Reservoir available for purchase. The recommendation was to enter into a water service contract with the Crow Tribe and release that water over 2-3 weeks during the peak of the Yellowstone hydrograph to support pallid sturgeon passage at Intake Diversion Dam via the existing side channel.

The recommendation to release 50,000 acre-feet could increase river flows by various amounts dependent on the duration of the release. For example, a uniform pattern of release of 50,000 acre-feet over a one week period could increase flow by 3,600 cubic feet per second (cfs). If released over a two-week period, flow in the Yellowstone could increase by 1,800 cfs. A similar three-week release could provide an additional 1,200 cfs. Pallid Sturgeon have been observed passing upstream through the existing side channel at discharges between 45,000 and 64,000 cfs Yellowstone River main channel flow. The existing side channel only conveys flows when the river flows are greater than 20,000 to 25,000 cfs. Based on flow duration curves at Sidney, June is the highest flow month and the month when pallid sturgeon are most likely to migrate. As suggested in the comment, a two week period was considered, which would produce 1,800 cfs additional flow.

Table 1 shows the flow duration values for the month of June, and an example showing the added flow. Travel times from Yellowtail dam to Sidney are estimated as approximately 3-3.5 days (Corps, 1974). The travel time from was not factored into developing the example below, although it would be an important consideration if this recommendation were to be implemented. The two week period was selected by including flow duration discharges for approximately 14 days of flows above the starting flow but summing the days each interval would represent (eg the number of days highlighted in Table 1 is 14.4 days between 30,700-59,900 cfs). The approximate two-week period then includes flows up to 59,900 cfs.

Since pallid sturgeon have been observed in the existing side channel at higher discharges, flows could be released when the Yellowstone River is flowing at higher flows (such as greater than 45,000 cfs). This would affect flows up to 59,900 in the two-week period. In this example the current flow duration values of 30,700 to 59,900 cfs would increase to 32,500 to 61,700 cfs.

Table 1 Flow Duration Values for June with 50,000 acre feet added over approximate 2-week period

Percent of time	Days in Interval	June Discharge, cfs	June Discharges with 1,800 cfs added when flows exceed 30,700 cfs
0.01	0.0	142,000	142,000
0.05	0.0	134,000	134,000
0.1	0.0	127,000	127,000
0.2	0.0	121,000	121,000
0.5	0.1	108,000	108,000
1	0.2	93,000	93,000
2	0.3	84,600	84,600
5	0.9	59,900	61,700
10	1.5	54,700	56,500
15	1.5	49,900	51,700
20	1.5	46,200	48,000
30	3.0	40,500	42,300
40	3.0	35,400	37,200
50	3.0	30,700	32,500
60	3.0	26,800	26,800
70	3.0	22,700	22,700
80	3.0	18,700	18,700
85	1.5	16,900	16,900
90	1.5	14,900	14,900
95	1.5	12,400	12,400
98	0.9	10,000	10,000
99	0.3	8,570	8,570
99.5	0.2	7,730	7,730
99.8	0.1	7,090	7,090
99.9	0.0	6,530	6,530
99.95	0.0	6,500	6,500
99.99	0.0	6,480	6,480

The 1,800 cfs increases the river flows by between 3 and 7 percent. This would also increase flows in the existing side channel by approximately the same percent. For example at a total discharge of 63,000 cfs, the existing side channel conveys 4,470 cfs (7.1 percent) and increasing to 64,800 would increase the side channel discharge to approximately 4,600 cfs (7.1 percent). The percent of flow through the existing side channel is still much less than the BRT criteria has proposed (13-15 percent). Because the percent flow down the existing side channel is lower (4 to 6 percent) for lower total discharge, the amount of increase would be less. This analysis was highly idealized in that it would be unlikely that flows within the desired ranges would occur during a specific 2-week range and that the ideal period to release flows could be predicted each year. Timing additional releases correctly could be very difficult. One other constraint is that increased releases from Bighorn Reservoir may affect channel stability and other infrastructure along the Bighorn River.

Another comparison was performed to determine the number of years a release of 1,800 cfs could increase peak flows into the 45,000 cfs or greater range. Table 2 includes 56 years of peak flows at Sidney gage sorted from lowest to highest.

Table 2 Sidney Gage Peak Discharges from 1960 to 2015 (56 years) Sorted from Lowest to Highest

Year	Discharge	Year	Discharge
1987	23,000	2013	54,300
2001	24,900	2010	56,600
2004	25,800	2008	56,700
1966	28,000	1981	56,800
1977	28,100	1995	57,600
1985	29,700	1960	58,000
1961	30,700	1972	59,400
1988	33,000	1986	59,900
2006	33,700	2015	60,500
1980	35,300	1969	61,000
2000	36,000	1991	62,700
1989	37,600	1970	62,900
2012	40,300	1971	62,900
1992	40,500	1982	62,900
1990	40,700	1996	65,300
1983	41,900	1962	68,800
2007	41,900	2014	69,800
2002	43,600	1968	71,300
1984	44,200	1964	72,200
1998	44,300	1994	75,000
1979	47,000	1974	76,400
1973	47,700	1975	77,000
2005	48,100	1967	82,600
2003	49,100	1997	85,300
1976	49,900	1963	86,000
1993	51,100	1965	100,000
2009	51,800	1978	111,000
1999	54,300	2011	124,000

As shown in Table 2 there were 36 years where flows exceed 45,000 cfs. There are three years (2002, 1984, and 1998 that are highlighted) where 1,800 cfs additional flow would have increased flows above the 45,000 cfs value. There are an additional 5 years (2012, 1992, 1990, 1983, and 2007) that the 1,800 cfs addition could produce peaks a little lower than 45,000 cfs. This indicates that the addition of 1,800 cfs provides relatively little opportunity to increase the frequency of years when flows could be moved into the higher range that may allow pallid sturgeon passage via the side channel.

Therefore, considering the low percentage of fish that have been documented to use the existing side channel, the small increase in flows and limited number of years when this increase in flows could be high enough for pallid sturgeon passage, potential impacts to the Bighorn River, and the feasibility of timing the additional releases when they would be most beneficial, this recommendation was not carried forward as an alternative.

Hydraulic Ram Pumps- A commenter suggested that dam removal and pumping alternatives considered during scoping do not include reference to what the commenter considers the best practicable technology. It was recommended that hydraulic ram pumps requiring low hydraulic head pressure, no electrical supply, and minimal maintenance should be considered as an alternative pump technology.

The basic principle behind hydraulic ram pumps is to use a large amount of water falling a short distance to pump a small amount of water to a higher elevation. Typically, only 2% to 20% of the water flowing through a ram pump system will actually be delivered to the storage tank or trough. The remainder is overflow and directed back into the stream, as shown in Figure 1, below. (USDA, 2007)

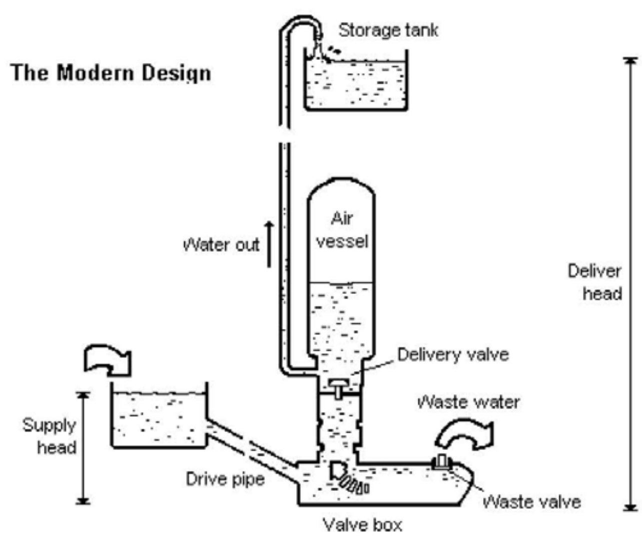

Figure 1 Hydraulic Ram Pump Schematic Layout

A hydraulic ram pump does not require electrical energy to operate, however energy must still be provided to lift water up to the desired height (shown in Figure 1 as the Supply Head). The design references reflect this requirement by recommending that the stream have a minimum gradient of 2 percent (2 feet of fall in a 100 feet reach) and that a minimum of 6.6 feet of head be provided to the hydraulic ram pump (USDA, 2007).

The Yellowstone River has a gradient of approximately 2.0 – 2.5 feet per mile within the project area, or approximately 0.04 percent. This slope is approximately 50 times flatter than the 2 percent minimum recommended in the design guide, therefore hydraulic ram pumps do not appear to be a feasible solution to providing the necessary lift. The slope is important, because additional water to drive the ram would need to be diverted from the Yellowstone River along with the water being pumped into a feeder canal. The canal would have to be approximately three miles long to gain the minimum recommended head of 6.6 feet, which does not account for friction losses within the feeder canal.

As stated earlier, a maximum of 20 percent of the water diverted to the ram pump can actually be lifted and the rest would overflow back to the Yellowstone River. Therefore, to deliver 50 cfs to the canal by a hydraulic ram would require diverting 250 cfs from the Yellowstone with the other 200 cfs being overflow. Note that we have not identified applications of ram pumps with this capacity, all are over an order of magnitude smaller.

Needing to divert the full 1,374 cfs during low summer flows also needs to be accounted for when looking at pump designs, as maintaining the viable and effective operation of the Lower Yellowstone Project is part of the Purpose and Need of the Project. Annually the Yellowstone River discharge reduces to 7,000 to 8,000 cfs during the months of August, September, and October. Taking into account the low efficiency of this pump system, the equivalent of the entire river would need to be diverted through the pump system to get the full 1,374 cfs needed to maintain current crop demands (7,000 cfs in the Yellowstone River would produce a diversion of 1,400 cfs).

Therefore, considering the lack of necessary head in the project area, low efficiencies of the pumps, and the need to divert almost the entire Yellowstone River during low summer flows to get the required 1,374 cfs, this alternative will not be carried forward for further analysis.

References

Corps, 1974. Bighorn River Basin. Yellowtail Dam and Bighorn Lake, Montana. Bureau of Reclamation. Report on Reservoir Regulations for Flood Control. U.S. Army Corps of Engineers, Omaha, Nebraska. January 1974.

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U.S. Department of Agriculture (USDA), “Technical Note No. 26, Hydraulic Ram Pumps”, 2007.

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