Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana

APPENDIX C – SECTION 404(b)(1)

Lower Yellowstone Intake Fish Passage EIS Draft Section 404(b)(1) Analysis

MAY 2016

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List of Acronyms and Terms

AAHUs – Average annual habitat units
Anthropogenic—Related to human activities
ARM—Administrative Rules of Montana
BRT – Biological Review Team
CEA—Cumulative Effects Assessment
CE/ICA – Cost effectiveness and incremental cost analysis
CFR—Code of Federal Regulations
cfs—cubic feet per second
CWA—Clean Water Act
dBA—A-weighted decibels; an expression of the relative loudness of sounds in air as perceived by the human ear
EA—Environmental Assessment
EPA— U.S. Environmental Protection Agency
ESA—Endangered Species Act
fps—feet per second
GIS—Geographic information system
HEC-RAS—Hydrologic Engineering Center River Analysis System
ITA—Indian trust assets
IWR – U.S. Army Corps of Engineers Institute for Water Resources
LYP—Lower Yellowstone Irrigation Project
MFWP—Montana Fish, Wildlife and Parks
MTDEQ—Montana Department of Environmental Quality
NHPA—National Historic Preservation Act
NRCS—Natural Resources Conservation Service
NRHP—National Register of Historic Places
O&M – Operation and maintenance
PED/CM – Planning, engineering and design/construction management
ppm—parts per million
Reclamation—Bureau of Reclamation
Service – U.S. Fish and Wildlife Service
SHPO— State Historic Preservation Office
TDS— Total dissolved solids
Corps—U.S. Army Corps of Engineers
USGS—U.S. Geological Survey
YRCDC—Yellowstone River Conservation District Council

1.0 Introduction

This Draft Clean Water Act Section 404(b)(1) Analysis has been prepared to evaluate compliance with the Section 404(b)(1) Guidelines for the Lower Yellowstone Intake Diversion Dam Fish Passage Project.

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged and fill material into waters of the United States per 40 Code of Federal Regulations (CFR) Parts 230 and 232. The Yellowstone River is a navigable waterbody and a water of the U.S. Section 404(b)(1) requires that alternatives be considered that could avoid or minimize adverse impacts to aquatic resources and waters of the U.S. for any project that results in the discharge of dredged or fill material. This document evaluates practicable alternatives that have been considered and documents the potential effects on characteristics of the aquatic ecosystem.

The purpose of the proposed action is to improve fish passage for pallid sturgeon and other native fish at Intake Diversion Dam, continue the viable and effective operation of the Lower Yellowstone Project (LYP), and contribute to ecosystem restoration. The proposed project is located between the communities of Glendive and Sidney in Section 36, Township 18 North, Range 56 East in Dawson County, Montana (Figure 1-1).

The U.S. Army Corps of Engineers (Corps) and the U.S. Bureau of Reclamation (Reclamation) have prepared a Draft Environmental Impact Statement (EIS) to analyze direct, indirect, and cumulative effects associated with alternative actions to improve fish passage at the Lower Yellowstone Intake Diversion Dam, in Dawson County, Montana.

1.1 BACKGROUND

The LYP was authorized by the Secretary of the Interior on May 10, 1904. Construction of the LYP began in 1905 and included Intake Diversion Dam, which is a wood and stone diversion weir that spans the Yellowstone River and diverts water into the main irrigation canal. The LYP was authorized to provide a dependable water supply sufficient to irrigate over 58,000 acres of land on the west bank of the Yellowstone River.

The U.S. Fish and Wildlife Service (Service) listed the pallid sturgeon as endangered under the Endangered Species Act (ESA) in 1990. The best available science suggests that Intake Diversion Dam impedes upstream migration of pallid sturgeon and their access to spawning and larval drift habitats. The lower Yellowstone River is considered by the Service to provide one of the best opportunities for recovery of pallid sturgeon. Both Reclamation and the Corps have general responsibility under section 7(a)(1) of the ESA to use their authorities to conserve and recover federally listed species and ecosystems upon which they depend. In addition, both agencies also need to avoid jeopardizing the pallid sturgeon in funding or carrying out any agency action per 7(a)(2) of the Act.

Section 7(a)(2) requires each Federal agency to consult on any action authorized, funded, or carried out by the agency to ensure it does not jeopardize the continued existence of any endangered or threatened species. The Pallid Sturgeon Recovery Plan (USFWS 2014a) specifically identifies providing passage at Intake Diversion Dam as important to protect and restore pallid sturgeon populations. By improving passage at Intake Diversion Dam, approximately 165 river miles of spawning and larval drift habitat would become accessible in the Yellowstone River and and additional miles in major tributaries such as the Powder River.

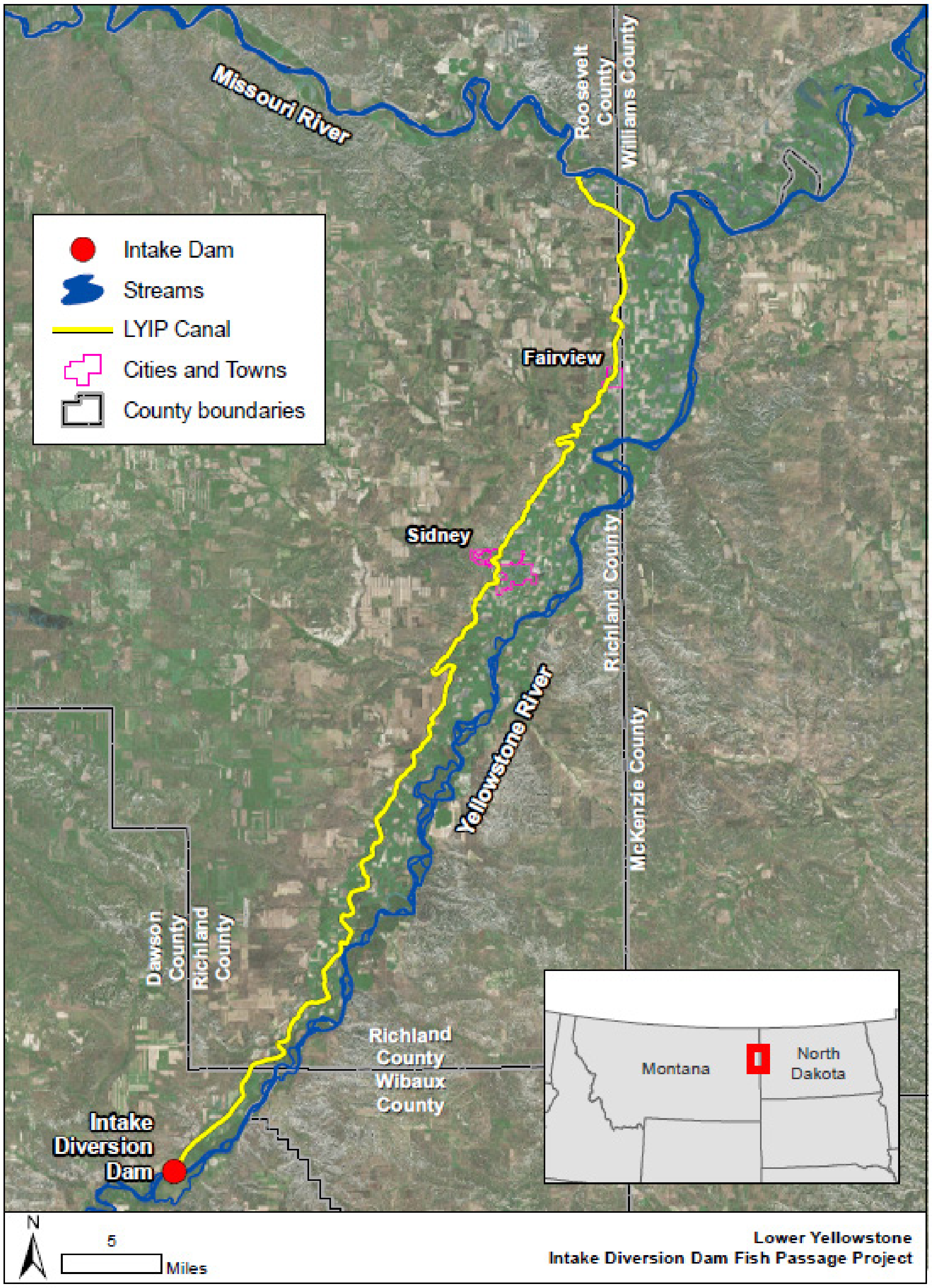


Figure 1-1 Overview of the Study Area

Section 3109 of the 2007 Water Resources Development Act authorized the Corps to use funding from the Missouri River Recovery and Mitigation Program to assist Reclamation in the design and construction of fish passage improvements at Intake Diversion Dam for the purpose of ecosystem restoration.

The Reclamation Act/Newlands Act of 1902 (Pub. L. 161) authorized Reclamation to construct and maintain the facilities associated with the LYP, which includes actions or modifications necessary to comply with Federal law such as the ESA.

1.2 PROBLEMS, OPPORTUNITIES, CONSTRAINTS AND OBJECTIVES

It is important to identify up front the planning goals, objectives, and constraints for the project in order to formulate a range of alternatives that can meet the goals and objectives. When identifying and evaluating alternatives it is also important to obtain input from Federal and state agencies, Tribes, cooperating entities, and the public.

This section summarizes the problems and opportunities assessed during the plan formulation process. The existing and expected future without-project conditions in the study area were evaluated using data and information from on-going research on pallid sturgeon being conducted by a variety of agencies and from information developed for the Missouri River Management Plan and overall pallid sturgeon recovery program. In the planning setting, a problem can be thought of as an undesirable condition, while the objective is the statement of overcoming the problem, and the opportunity is the means for overcoming that problem. Identification of problems and opportunities gives focus to the planning effort. Problems and opportunities can also be viewed as local and regional resource conditions that could be modified in response to public concerns.

1.2.1 Problems and Opportunities

1. *Intake Diversion Dam is a barrier to upstream fish passage.*

Intake Diversion Dam has impeded upstream migration of pallid sturgeon and other native fish for more than 100 years. The best available science suggests that the weir is likely a total barrier to the endangered pallid sturgeon, due to turbulence and high velocities at the existing weir and and in the reach immediately downstream from the weir (Helfrich et al. 1999, White and Mefford 2002, Bramblett and White 2001, Fuller et al. 2008; Delonay et al. 2014). Modifications to the existing weir and/or construction of a fish passage project would provide the opportunity for pallid sturgeon and other fish species to pass upstream of the Intake Diversion Dam.

2. *Fish passage is only intermittently provided by the existing side channel.*

During high flows occurring in 2014 and 2015, several pallid sturgeon utilized the existing side channel around Joe's Island to successfully bypass the weir (Rugg 2014, 2015). While this evidence suggests that pallid sturgeon can use this side channel to bypass the weir, the side channel only conveys flows when river flows exceed 20,000 cfs, which does not occur every year, and passage in 2014 and 2015 only occurred at flows greater than 40,000 cfs in the river, which is approaching a 2-year flood (50% probability of occurrence in any given year). Tracking of radio-tagged pallid sturgeon over several years indicates that pallid sturgeon migrate up to Intake Diversion Dam, but do not pass the weir and return downstream to spawn in the lower Yellowstone River, such as near river mile (RM) 10 (Bramblett 1996; Allen et al. 2015, Elliott et al. 2015).

Modifying the existing side channel or existing weir or constructing another type of fishway would provide the opportunity for pallid sturgeon and other fish to pass upstream of Intake Diversion Dam on an annual basis.

3. *Larval drift distances are insufficient for survival when spawning occurs below the Intake Diversion Dam.*

If spawning occurs below Intake Diversion Dam, newly-hatched pallid sturgeon (free embryos and larvae) likely drift into Lake Sakakawea before they are able to settle into suitable habitat. Biologists believe that like other river spawning species, pallid sturgeon need a river environment to survive (Braaten et al. 2008). The model developed by Kynard et al. (2007) indicates that total drift distance is a limitation on natural recruitment. If these young fish reach the lake environment, their survival rate is believed to be very low because of unsuitable habitat (Kynard et al. 2007). Biologists also suspect that pallid sturgeon larvae are intolerant of sediments in the river-reservoir transition zone (Wildhaber et al. 2008). The cause of free embryo and larval deaths in the reservoir is unknown but could be due to multiple factors: lack of food, predation, or sedimentation (Bergman et al. 2008). However, recent research indicates oxygen levels in the headwaters of reservoirs such as Fort Peck and Lake Sakakawea are too low for free embryos or larval pallid sturgeon to survive (Guy et al. 2015; Bramblett et al. 2016).

Improvements to fish passage at Intake Diversion Dam would provide the opportunity for pallid sturgeon to spawn in potentially suitable habitats for 165 additional miles of the Yellowstone River upstream of the weir. The distance between the next upstream barrier on the Yellowstone River, Cartersville Diversion Dam, and Lake Sakakawea is about 317 miles. This substantial increase in free-flowing river habitat likely would provide adequate drift distance for at least a portion of the larvae to settle out and rear prior to reaching Lake Sakakawea. Access to tributaries, such as the Tongue and Powder Rivers, would provide additional spawning habitat and could increase larval drift distance even further. Five wild adult pallid sturgeon were documented in the Powder River in 2014 and spawning appeared to have occurred (Rugg 2014).

1.2.2 Constraints and Other Considerations

1. *Provide water to the Lower Yellowstone Project through a viable and effective operation.*

Reclamation has contractual obligations to deliver the water right to continue viable and effective operation of the LYP. The Lower Yellowstone Irrigation Districts operate and maintain the facility and will inherit that responsibility for the modified facility, so consideration of long-term operation and maintenance costs and feasibility was a critical constraint during project formulation.

2. *Provide adequate passage to endangered pallid sturgeon through proper engineering.*

Any passageway recommended would be designed to meet criteria developed by the Service's Biological Review Team (BRT) to maximize the potential for effective upstream passage of pallid sturgeon, including appropriate depths, velocities, and attraction flows.

1.2.3 Objectives

1. *Improve Fish Passage*

Since Intake Diversion Dam is an impediment to successful upstream and downstream movement of pallid sturgeon and other native fishes, the proposed project is needed to allow fish passage at this structure.

2. *Continue Viable and Effective Operation of the Lower Yellowstone Project*

The LYP diverts water from the Yellowstone River into the main irrigation canal on the north side of the river immediately upstream of the Intake Diversion Dam. The system conveys water to irrigate over 58,000 acres within the LYP. Water rights for water delivered to these districts are jointly held by the districts and Reclamation. The proposed project is needed to maintain the viable and effective operation of the LYP by meeting the full water right obligation to the irrigation districts in a manner that is affordable and sutainable over the long-term.

3. *Ecosystem Restoration*

Improvements to fish passage at Intake Diversion Dam will support migration for numerous fish species and contribute to the sustainability of fish populations in the Yellowstone River. This project will support ecosystem functions by restoring access to a large area of suitable habitat throughout the Lower Yellowstone River ecosystem.

1.3 DEVELOPMENT AND EVALUATION OF ALTERNATIVES

This section presents the plan formulation process used in the development and screening of alternatives to meet the project objectives. Alternatives screened out earlier in the study are described in the Draft Lower Yellowstone Intake Diversion Dam Fish Passage Project EIS (Corps and Reclamation 2016).

1.3.1 No Action

Under the No Action Alternative, Reclamation would continue present operation of Intake Diversion Dam and headworks to divert water from the Yellowstone River for irrigation purposes, as authorized. Under this scenario it is likely that Reclamation would be obligated to reinitiate consultation with the Service under Section 7(a)(2) of the ESA, to evaluate the impacts to pallid sturgeon from the LYP. Continued O&M would include annual placement of rock on the existing weir crest and maintenance of irrigation canals, pipes, and pumps. In addition, the trolley system that is used to place rock on the weir crest will likely require repair or replacement in 5-10 years. The continued annual placement of rock on the existing weir crest would require a Section 10 permit under the Rivers and Harbors Act.

1.3.2 Rock Ramp Alternative

The Rock Ramp Alternative would leave the existing rock and timber crib structure at Intake Diversion Dam in place, but incorporate it into a replacement concrete weir and bury it under a shallow-sloped, un-grouted boulder and cobble rock ramp. The rock ramp would be designed to mimic natural river function and would have reduced velocities compared to existing conditions so that migrating fish could swim up the ramp and pass over the weir, thereby improving fish passage.

The replacement concrete weir would be located approximately 28 feet upstream of the existing weir, and would be constructed to an elevation of 1991.0 feet. A low-flow notch would be constructed at an elevation of 1989 feet and would have an 85 foot bottom width and an approximately 125 foot top width to concentrate flows during low flows. The downstream side of the weir would tie directly into the rock ramp to provide a seamless transition and unimpeded fish passage as fish migrate upstream.

The rock ramp would be constructed downstream of the replacement weir by placing large rock and cobble over a length of 1,200 feet with a slope ranging from 0.2 to 0.7 percent with a deeper low-flow channel designed into the ramp that would connect to the low-flow notch on the concrete weir.

1.3.3 Bypass Channel Alternative

The Bypass Channel Alternative includes constructing a 11,150 foot long bypass channel with a slope of 0.07 percent on Joe's Island from the inlet of the existing high flow channel to just downstream of the dam. It would also leave the existing Intake Diversion Dam in place, but incorporate it into the replacement concrete weir and rock/cobble fill as described for the Rock Ramp Alternative to ensure sufficient head to divert the full water right through the headworks and screens. Construction work and the primary elements of this alternative would be located on Joe's Island and at the weir location. Additional features in this alternative include rock grade controls at the upstream and downstream ends of the bypass channel to maintain desired flow splits and channel elevations, placement of fill along the bank at the downstream outlet to reduce the eddy that forms below the weir, and two additional grade controls and bank armoring in select locations in the channel. This alternative is designed to meet the Service's BRT criteria for flow volumes, depths, and velocities at all but very low flows in the river (Table 1-1).

Table 1-1 Service's BRT Design Criteria for a Bypass Channel

Criteria	7,000 – 14,999 cfs	15,000 – 63,000 cfs
Bypass Channel Flow Split	≥12%	13% to ≥15%
Bypass Channel Cross-sectional Velocities (measured as mean column velocity)	2.0 – 6.0 ft/s	2.4 – 6.0 ft/s
Bypass Channel Depth (minimum cross-sectional depth for 30 contiguous feet at measured cross-section)	≥4.0 ft	≥6.0 ft
Bypass Channel Fish Entrance (measured as mean column velocity)	2.0 – 6.0 ft/s	2.4 – 6.0 ft/s
Bypass Channel Fish Exit (measured as mean column velocity)	≤6.0 ft/s	≤6.0 ft/s

This alternative also includes continued O&M of the LYP irrigation system.

1.3.4 Modified Side Channel Alternative

The Modified Side Channel Alternative is intended to improve passage for pallid sturgeon around Intake Diversion Dam by modifying the existing side channel around Joe's Island. Pallid sturgeon were documented to have passed upstream of Intake Diversion Dam through the side channel during both the 2014 and 2015 spring runoff seasons (Rugg 2014, 2015) at flows greater than 40,000 cfs (approximately a 2-year flood event). The intent behind this alternative is that with more frequent flow in the side channel, the side channel would have sufficient attraction flows and would be passable during all years as well as providing year-round fish habitat.

The major proposed features for the High Flow Channel Alternative are summarized as follows:

- 6,000 feet of new channel at three bend cutoffs,
- 14,600 feet of channel modification to lower the existing high flow channel,
- Three backwater areas,
- 4,500 feet of bank protection,
- Five grade control structures,
- One 150 foot single span bridge, and
- Placement of 50,000 cubic yards of channel cobble substrate to simulate a natural channel bed and bed/bank edges.

Required water surface elevations for diversions into the irrigation canal would be met through continued routine rock placement on the existing weir as outlined in the No Action alternative. Note that the continued placement of rock on the existing weir will likely require repair or replacement of the trolley system by the LYP, similar to the No Action Alternative. This alternative also includes continued O&M of the LYP irrigation system. Rock for the existing weir is quarried on private land located south and east of Joe's Island and transported to the site by driving across Joe's Island. Because the Modified Side Channel Alternative would result in a deeper channel with consistently more water, a bridge would be constructed to provide for vehicle and equipment access to Joe's Island. This alternative includes a 150-foot prefabricated clear span truss bridge with abutments set outside of the main channel banks to minimize encroachment into the high flow channel. The new bridge would be set with a low chord elevation two feet above the 100-year water surface in accordance with the State of Montana and the National Flood Insurance Program criteria.

1.3.5 Multiple Pump Alternative

The Multiple Pump Alternative would remove the Intake Diversion Dam and the rock/rubble field downstream of the weir and construct five pumping stations on the Yellowstone River to deliver water to the LYP. The pumping stations would be designed to fully meet the LYP's water right with a total diversion capacity of 1,374 cfs. The pumping stations would be constructed at various locations along the Lower Yellowstone River between the headworks and about 20 miles downstream.

The five sites should be located on the outside of meander bends to minimize the chances they would be blocked by bar formation and maximize the depth of flow from the Yellowstone River towards the pumps. Both of these factors contribute to the reliability of the diversion and reduce maintenance associated with sediment removal. The downside is that the outside of the bends are also the most likely areas to erode in the immediate future. To minimize this potential two additional factors were accounted for in siting the pumping stations; the bends were evaluated and the stations were sited at bends that have been relatively stable over many years and the pumping stations were set back approximately 1,000 feet from the channel bank where possible. This placed them at or just inside the outer edge of the channel migration zone (CMZ) (DTM Consulting and AGI 2009). The five potential locations have been numbered from upstream to downstream along the river and are generally located as described in Table 1.2 below.

Table 1-2 Pump Station Locations

Site	Approximate Location
Site 1	Just downstream of Intake Diversion Dam
Site 2	8 miles downstream from Site 1, near Idiom Island
Site 3	3 miles downstream from Site 2, near Mary's Island
Site 4	0.2 miles upstream of Savage
Site 5	0.3 miles downstream of Savage

Each of the five pumping stations would be designed for a capacity of 275 cfs. Water would be drawn from the river through a feeder canal to a fish screen structure. The motors and electrical equipment in both the fish screen structure and the pump station would be located above the 100-year flood elevation. Fish not screened out would be returned to the river through a fish-friendly return pump at the end of the canal, while irrigation water would pass through the fish screen and flow into the pumping station. Discharge pipes would convey the irrigation water to the main irrigation canal.

1.3.6 Multiple Pumps with Conservation Measures Alternative

The Multiple Pumps with Conservation Measures Alternative includes four primary components including removal of Intake Diversion Dam and removal of the rock/rubble field downstream of the weir, implementation of water conservation measures, supplemental irrigation water supply using Ranney wells, and use of wind energy to more affordably provide electricity for Ranney well pumping. The removal of the weir would allow natural fish passage on the Yellowstone River, and the other components would provide a continued, but reduced, water supply to the LYP of only approximately 600 cfs. This reduced volume of water is not likely to meet the crop irrigation needs during peak demand times (i.e. August and September). The components of this alternative are described in the subsections below.

1.3.6.1 Conservation Measures

Installing water conservation measures throughout the system is proposed to reduce the amount of water needed by the project; both by reducing inefficiency and losses in the delivery system and on individual farms. Table 1-3 below includes a proposed list of conservation measures and the estimated amount of water that could be conserved. These were proposed by Defenders of Wildlife (Defenders) and Natural Resources Defense Council (NRDC) by letter dated February 17, 2016 (Defenders and NRDC 2016). Although these values are proposed based upon a conservation plan (LYIP 2009) and a value planning study (Reclamation 2005, 2013), the estimates included in those documents were not field verified. In fact, the value planning study noted that "cost and demand reduction estimates are currently at a low level of confidence and need to be field evaluated and refined."

The concept as proposed has been further developed into a conceptual design and cost estimate to allow alternative comparison.

Table 1-3 Water Conservation Measures and Estimated Savings (cfs)

Component	Description	Estimated conservation (cfs)
Check Structures	Installation of check structures in the canal for water control	61.5
Flow measuring devices	Measuring devices installed on the canals	18.5
Laterals to pipe	Convert laterals to pipe	255.8
Sprinklers	Install center pivot sprinklers	160
Lining main canal/laterals	Line main canal and laterals with concrete	200
Control over checking	Operational change to water levels in the canals	20.6
Groundwater pumping	Install groundwater pumps	49.5
	Total Savings	**765.9 cfs**

The conceptual alternative proposes that diversion requirements could be reduced by 766 cfs by the conservation measures described above. This would leave the required water delivery to the project of 608 cfs. The alternative proposes that this 608 cfs be accomplished through gravity diversions during high flows and then supplemented with pumping during most of the irrigation season. It is proposed that 7 pumping stations using Ranney Well technology, which pump shallow groundwater, could provide up to 608 cfs when gravity diversions are insufficient to provide this volume. Due to the significant electricity needed to use these pumping stations, an alternate source of energy using a wind farm is proposed.

1.3.7 Alternatives Analysis

For an ecosystem restoration project such as this fish passage project, there is no monetary measure of benefits to compare alternatives in a traditional cost-benefit ratio. However, if benefits can be quantified in some dimension, cost effectiveness and incremental cost analysis can be used to assist in selecting a preferred plan. For this purpose, the potential benefits of the alternatives have been quantified using the Fish Passage Connectivity Index (FPCI), which is described below.

Cost effectiveness analysis evaluates which alternatives are the least-costly way of attaining the project objectives. Incremental analysis is then used to evaluate the change in cost from each measure or alternative to the next to determine their incremental costs and incremental benefits.

This type of analysis helps identify which measures or alternatives provide the most benefit for the lowest cost and can be used as one element in selecting a preferred plan.

Following completion of the cost effectiveness analysis, all of the alternatives were further compared and ranked using a number of factors including cost, constructability, sustainability, effects to the LYP, cost effectiveness, and the range of potential environmental impacts.

1.3.7.1 Fish Passage Connectivity Index

The FPCI was developed to evaluate ecosystem outputs (i.e. benefits) of alternative measures for fish passage improvements on the Upper Mississippi River for cost effectiveness and incremental analysis (Corps 2010). The model has subsequently been approved for use in the Corps planning context for fish passage projects on other river systems. The FPCI is a simple arithmetic index that is calculated as:

$$\text{€} = \frac{\Sigma\, i \ldots n\, [(E_i \times U_i \times D_i)/25]}{n}$$

Where,

- € = Fish Passage Connectivity Index.
- i = a migratory fish species that occurs in the reach below the dam.
- n = number of fish species included in the index.
- E_i = Chance of encountering the fishway entrance is a calculated value ranging from 1 to 5, where 5 = highly likely; 3 = moderate probability; 1 = unlikely.
- U_i = Potential for species i to use the fish passage pathway or fishway (5 = Good, 3 = Moderate, 1 = Poor, 0 = None) considering adult fish swimming performance and behavior (i.e. bottom oriented, shoreline oriented) and hydraulic conditions within the fish passageway.
- D_i = Duration of availability for fish passage is an estimation of the fraction of the time during the typical upriver migration period for fish species i that the passage pathway is available. This is based on the anticipated depths and velocities available in the passage pathway during the typical flows in the migration season.

Although the model was developed to measure benefits of fish passage in the Upper Mississippi River, the model is applicable (with slight adjustments) to fish passage projects on other large river systems, especially those with very similar fish communities. This model, with minor adjustment, was used as a planning tool for comparing benefits of alternative measures for providing fish passage at Intake Diversion Dam. Additional background and data used for this calculation is provided in Appendix D of the Intake EIS.

A total of fourteen native fish species were included in the FPCI for the Intake Diversion Dam project including shovelnose sturgeon, pallid sturgeon, paddlefish, goldeye, smallmouth buffalo, blue sucker, white sucker, river carpsucker, shorthead redhorse, channel catfish, smallmouth bass, walleye, sauger, and freshwater drum. The FPCI is calculated as an index value (between 0 and 1) for each species. The index value is then multiplied by the potential acres of suitable habitat upstream of Intake Diversion Dam for each species to yield habitat units. The habitat units are then averaged across all 14 species to yield average annual habitat units (AAHUs) for each alternative, which are used in the cost effectiveness and incremental cost analysis described below.

1.3.7.2 Cost Effectiveness, Incremental Cost Analysis (CE/ICA)

The CE/ICA analysis utilized the Corps IWR Planning Suite model. The Corps-certified model provides a systematic method for testing all possible combinations of ecosystem restoration measures to identify combinations of measures (alternative plans) which are cost effective, and then ranks cost effective plans according to their efficiency to identify "best buy" plans. Because this analysis considered six complete alternatives which were mutually exclusive, no alternatives were created from the combination of measures in the model. Instead, the software identified which plans were cost effective, and then ranked the cost effective plans by efficiency to identify "best buy" plans. The CE/ICA model required the following inputs:

- <u>Average annual habitat units for each alternative</u>: Because habitat benefits are non-monetary, the outputs are referred to as "units" of output. In order to compare action alternatives to the No Action Alternative, AAHUs are typically converted to "net AAHUs," which is the change in habitat units as compared to no action. Thus, the No Action Alternative is always entered as zero net AAHUs, and each alternative is entered as the additional AAHUs that would be generated compared to no action. AAHUs were developed using the FPCI Model.
- <u>Average annual cost for each alternative</u>: Costs used in the analysis included construction, Planning, Engineering , and Design/Construction Management (PED/CM), real estate, monitoring and adaptive management, interest during construction, and Operations and Maintenance (O&M). Annualized costs are presented at an FY16 price level, amortized over a 50-year period of analysis using the FY16 Federal interest rate for Corps of Engineers projects of 3.125%.

Cost Effectiveness Analysis

Cost effectiveness analysis is a form of economic analysis designed to compare costs and outcomes (or effects) of two or more courses of action. This type of analysis is useful for environmental restoration projects where the benefits are not measured in monetary terms but in environmental output units such as the AAHUs developed in this study. The purpose of the cost effectiveness analysis is to ensure that the least cost alternative is identified for each possible level of environmental output; and that for any level of investment, the maximum level of output is identified. Per IWR 95-R-01, an alternative is <u>*not*</u> to be considered cost effective if any of the following rules are met:

- The same output level could be produced by another plan at least cost;
- A larger output level could be produced at the same cost; or
- A larger output level could be produced at less cost.

Table 1-4 provides the results of the cost effectiveness analysis sorted by increasing output.

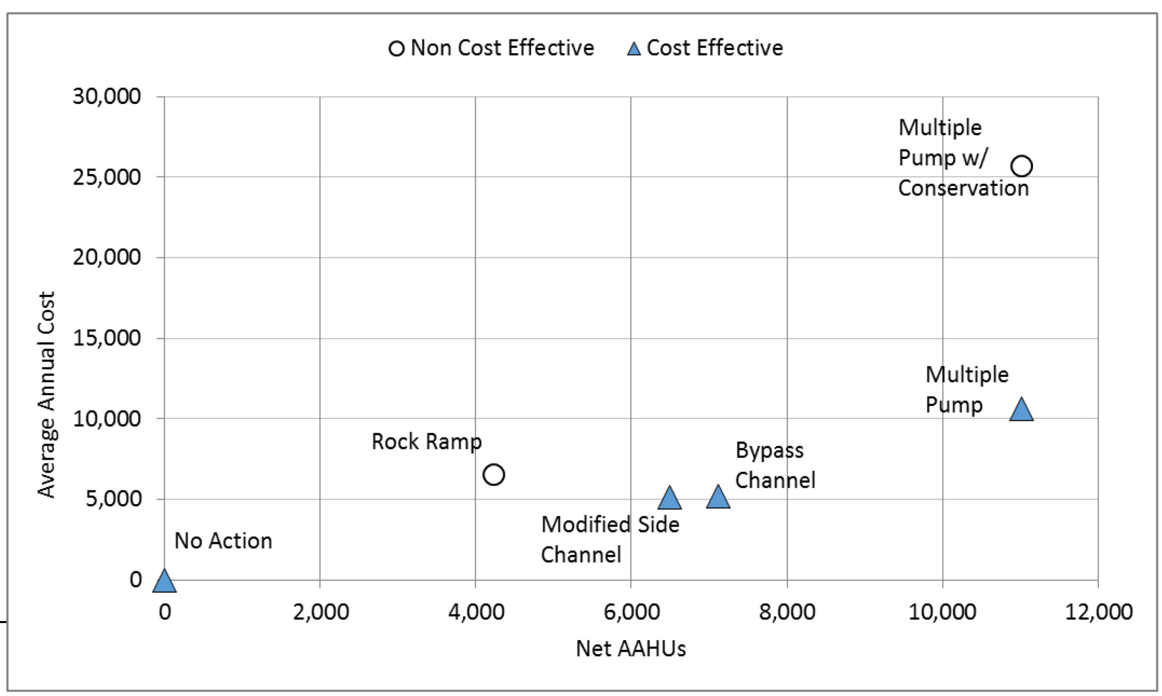
Table 1-4 Cost Effectiveness by Alternative

Alternative	Total First Cost[1] ($1,000s)	Annual Cost ($1,000s)	Net AAHUs	Cost per AAHU ($)	Cost Effective?
No Action	$0	$0	0	$0	Yes
Rock Ramp	$91,250	$6,546	4,220	$1,551	No
Bypass Channel	$57,582	$5,170	7,116	$727	Yes
Modified Side Channel	$54,917	$5,137	6,494	$791	Yes
Multiple Pump	$133,171	$10,594	11,011	$962	Yes
Multiple Pumps with Conservation Measures	$482,069	$25,709	11,011	$2,335	No

1 – Includes construction, design, construction management and real estate costs

As shown in the table, alternatives were identified as cost effective only when no other alternative provided *the same output* for less cost, and no other alternative provided *larger output* at the same or less cost. The No Action, Bypass Channel, Modified Side Channel, and Multiple Pump alternatives were identified as cost effective. The Rock Ramp Alternative is not cost effective because the bypass channel alternative provides greater output for less cost. The Multiple Pumps with Conservation Measures Alternative is not cost effective because the Multiple Pump Alternative provides the same level of output for less cost.

Figure 1-2 provides a graph of the total output and annualized costs for each of the alternatives while differentiating the cost effective plans from the non-cost effective ones. Per IWR 95-R-01, any alternatives that are not found to be cost effective "should be dropped from further analysis" in the CE/ICA process. Therefore the Rock Ramp, Modified Side Channel, and Multiple Pumps with Conservation Measures alternatives were dropped from further analysis and are not included in the ICA analysis that follows.



Incremental Cost Analysis

Subsequent incremental cost analysis of the cost effective plans is conducted to reveal changes in costs as output levels are increased. Only plans that were deemed as cost effective in the CE analysis have been advanced to ICA. These cost effective plans are the No Action, Bypass Channel, Modified Side Channel, and Multiple Pump alternatives. During the ICA, the cost effective plans are examined sequentially (by increasing scale in terms of net AAHUs produced) to ascertain which plans are most efficient in the production of additional environmental benefits.

The first step, is to "smooth out fluctuations in incremental costs per unit as project scale increases such that incremental cost per habitat unit are continuously increasing." This is first completed by calculating the incremental cost per unit for each plan over the "baseline condition," which is the No Action Alternative. Once the incremental costs per unit are calculated and sorted by increasing output, the alternative with the lowest incremental cost per unit will be selected as the first "best buy" alternative. Table 1-5 shows the calculation of the incremental costs per unit with the no action alternative set as the baseline for the cost effective alternatives.

Table 1-5 Identification of the First Best Buy Plan

Alternative	Annual Cost ($1000)	Net AAHUs	Incremental Output	Incremental Cost	Incremental Cost per Unit Output
No Action	$0	0	0	n/a	n/a
Modified Side Channel	$5,137	6,494	6,494	$5,137	$791
Bypass Channel	$5,170	7,116	7,116	$5,170	$727
Multiple Pump	$10,594	$11,011	$11,011	$10,594	$962

Table 1-5 indicates that the Bypass Channel Alternative is the first best buy alternative because it has the lowest incremental cost per unit of output. At this step of the ICA the incremental cost per unit is equal to the average annual cost per unit values calculated in Table 1-4 because the complete alternatives are being compared, not combinations of measures.

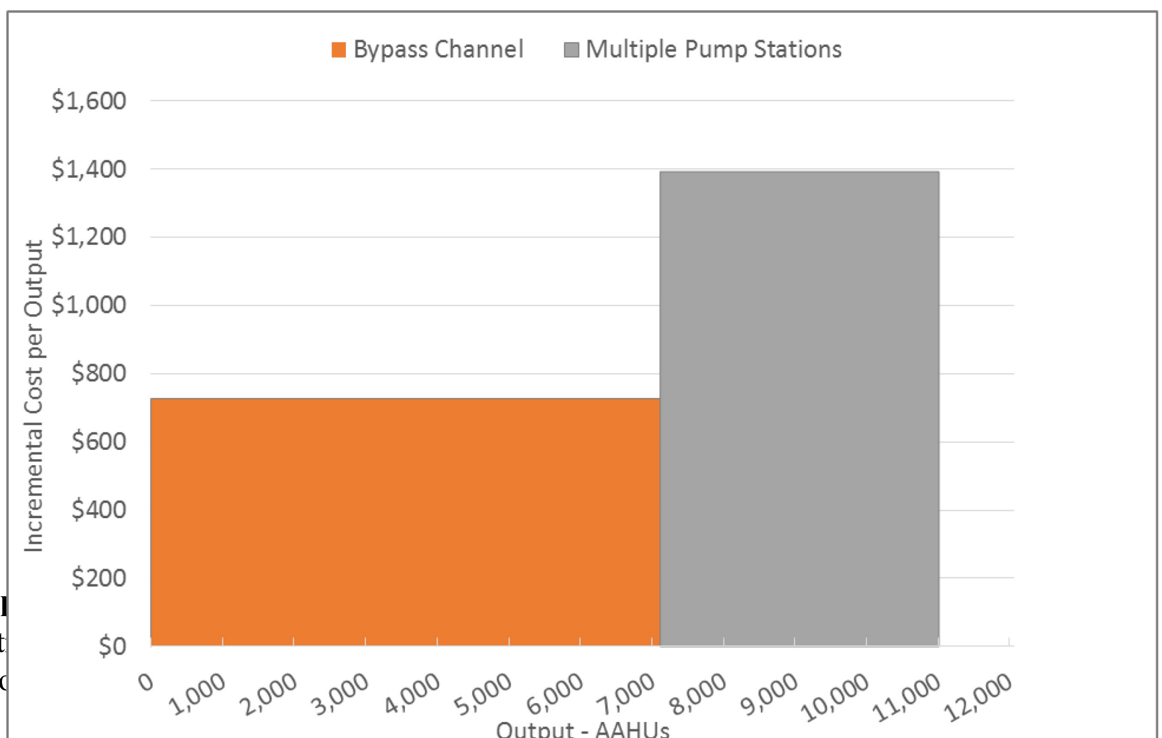
After selection of this best buy alternative, all alternatives with lower average annual output are removed from further iterations of the incremental cost analysis. Thus the No Action and Modified Side Channel alternatives are removed from further analysis and are not considered best buy plans.

Next, the incremental process should be started anew by comparing the next alternative with the first best buy plan. Thus the Bypass Channel Alternative is set as the new baseline. However, for this study only the Multiple Pump Alternative is remaining, and it is therefore a best buy plan as well since, no other plans can produce more output for lower incremental cost per unit. Thus the calculations and values in Table 1-6 show the incremental cost per unit output between the Bypass Channel and No Action, and then between the Multiple Pump Alternative and the Bypass Channel Alternative.

Table 1-6 Incremental cost analysis summary

Best Buy Alternative	Annual Cost ($1000)	Net AAHUs	Incremental Output	Incremental Cost	Incremental Cost per Unit Output
No Action	$0	0	0	n/a	n/a
Bypass Channel	$5,170	7,116	7,116	$5,170	$727
Multiple Pump	$10,5594	11,011	3,895	$5,424	$1,393

This table shows that the most efficient plan above no action is the Bypass Channel Alternative that provides 7,116 additional habitat units at a cost of $727 each. If more output is desired, the next most efficient plan available is the Multiple Pump Alternative that provides an additional 3,895 habitat units, at a cost of $1,393 dollars for each additional unit. Figure 1-3 provides a visual representation of this increase in incremental cost. The figure graphically illustrates the incremental cost and output differences between the two best buy action alternatives. The width of each box in the chart represents the incremental output of that plan, and the height of each box shows the incremental cost per unit of that output. The relatively wide box for the Bypass Channel Alternative shows that it provides about 65% of the total output possible at a cost of approximately $699 per unit. The box for the Multiple Pump Alternative shows that to achieve the remaining 35% of total possible output would be nearly twice as expensive per unit as the first 65%. Such breakpoints in incremental cost per unit typically require a higher level of justification based upon benefits or other considerations not accounted for with the fish passage index if the study team is to recommend the larger output plan that has much higher costs.



Summary of Concl

Following complet
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constructability, risk, total costs, and overall environmental impacts. The results of this comparison were:

- The No Action Alternative ranked lowest as it does not meet the project purpose and need and maintains the fish passage barrier, although it requires no construction and maintains the existing operation of the LYP.
- The Rock Ramp Alternative ranked and is tied for the second lowest as it has very difficult construction and future O&M as it may not withstand ice damage. While it maintains the existing operation of the LYP, it is not cost effective with a high total cost ($83.6 million), requires relocation of the fishing access and has the largest adverse changes to the river channel and substrate by placing such a large quantity of very large rock in the river.
- The Bypass Channel Alternative ranked highest as it is fairly easily constructed, would have reduced O&M with a replacement weir that will maintain the existing operation of the LYP, is cost effective and a best buy with the lowest incremental cost and low total cost (~$56 million), meets the Service's BRT criteria for pallid sturgeon passage and is designed using the best available science regarding pallid sturgeon passage. It has adverse impacts to the existing side channel and wetlands from placement of fill, but results in a net increase of 39 acres of side channel habitat and maintains 30 acres of the existing side channel as backwater habitat, providing more diversity of riverine habitat and reducing future placement of rock in the river.
- The Modified Side Channel Alternative ranked in the middle as it is easily constructed, would have the same O&M as the No Action Alternative and maintain the existing operation of the LYP. It is cost effective with a relatively low total cost (~$55 million), meets the Service's BRT criteria for pallid sturgeon passage but is located where pallid sturgeon may have difficulty finding it, would change the existing function of the side channel and would have continued rock placement at the weir.
- The Multiple Pump Alternative ranked second highest as it is easily constructed, would remove the weir and rock rubble field, thus restoring natural channel conditions and fish passage to the river. It was considered both a cost effective and a best buy plan as it provided more benefits at a lower cost than the Multiple Pumps with Conservation Measures Alternative. But it has a very high total cost (~$133 million) and would have very high O&M costs and effort required for operating and maintaining large pumps and requiring over 10 gigawatts of electricity. While it would deliver the full water right for the LYP it may be too costly for some farmers to remain viable. Further, it also has the potential for substantial adverse cultural resources impacts and would have the highest potential for entrainment of fish because of the multiple surface water pumps.
- The Multiple Pumps with Conservation Measures Alternative ranked and is tied for the second lowest as it has difficult and complex construction that could take approximately 8 years to construct. While it would remove the weir and rock rubble field returning natural channel conditions and fish passage to the river, these elements could not be constructed until the other features are complete, possibly too late for recovery of the wild pallid sturgeon population. It would have high O&M costs, is not cost effective with very high total cost (~$482 million), would not deliver the full water right for the LYP and thus, would not likely meet crop needs even with water conservation. This alternatives has the potential for substantial cultural resources impacts, would

substantially reduce wetlands that exist from irrigation seeps or surface flows, and would have the most adverse effects to existing farmland, incomes, and cropping patterns.

Specific to the analysis required under the Section 404(b)(1) guidelines, a comparison of effects to waters of the U.S. is shown in Table 1-7.

Table 1-7 Effects on Waters of the U.S. from each Alternative

Alternative	Temporary Impacts	Permanent Impacts
No Action	• No effect	• ~ 5 acres of river would continue to have increased quantities of riprap
Rock Ramp	• 57 acres of river disturbed during construction	• 20 acres of river filled with riprap and cobbles and concrete for replacement weir and ramp; would remain riverine
Bypass Channel	• 3 acres of river disturbed/filled during construction for replacement weir	• 3 acres of river filled with riprap and cobbles and concrete for replacement weir; would remain riverine • 1 acre of river filled to reduce downstream eddy; converted to uplands • 20 acres of existing side channel filled; converted to uplands • 1 acre of palustrine emergent filled; converted to uplands • 64 acres of new side channel created (bypass channel) • ~30 acres of existing side channel converted to backwater channel with fringing palustrine emergent wetland
Modified Side Channel	• ~50 acres of existing channel disturbed/excavated during construction	• 0.75 acre palustrine emergent filled • 0.75 acre palustrine emergent converted to channel • 8 acres of new palustrine emergent created (backwaters)
Multiple Pump	• ~20 acres of river disturbed during construction for weir and rock removal	• 0.1 acre palustrine emergent converted to canal • 0.5 acre palustrine scrub/shrub converted to canal • 0.6 acre of river filled for bank protection
Multiple Pumps with Conservation Measures	• ~20 acres of river disturbed during construction for weir and rock removal	• 0.5 acre riverine (lateral canals) filled for access roads • Unidentified loss of wetland acres from >50% reduction in irrigation canal flows

All of the alternatives have temporary and permanent effects on the Yellowstone River and wetlands. The Bypass Channel Alternative results in the largest increase in waters of the U.S. with 64 acres of new side channel created, although 25 acres of existing river/channel/wetlands would also be filled, resulting in a net increase of 39 acres of waters of the U.S. and conversion of 30 acres of high-flow side channel into backwater habitat. The evaluation of other factors indicates that the Bypass Channel Alternative balances all factors the best and is also highly cost effective with a much lower total cost than the other best buy alternative (Multiple Pump Alternative).

Therefore, the recommended plan is the Bypass Channel Alternative, since it meets the project objectives of improving fish passage and maintaining reliable irrigation diversions at a reasonable cost to maintain viable and effective operation of the LYP, and is constructable, operable, and has a similar scale of environmental impacts as the other alternatives.

2.0 Summary of Proposed Action

The proposed action is to construct a replacement concrete weir for the existing Intake Diversion Dam rock weir, to excavate a new bypass channel to provide fish passage upstream of the weir, and to fill portions of the existing side channel in order to meet the Service's BRT fish passage criteria to maximize potential fish use of the new bypass channel. Details are provided below in Sections 2.3-2.6.

2.1 PURPOSE AND NEED

The purpose of the proposed action is to improve passage of the endangered pallid sturgeon and other native fish at Intake Diversion Dam in the lower Yellowstone River while continuing a viable and effective operation of the Lower Yellowstone Project. Both Reclamation and the Corps have a general responsibility under Section 7(a)(1) of the ESA to use their authorities to conserve and recover federally listed species and ecosystems upon which they depend. Both agencies also need to avoid jeopardizing the pallid sturgeon in funding or carrying out any agency action per 7(a)(2) of the ESA.

2.2 WATER DEPENDENCY OF THE PROPOSED ACTION

As the purpose of the project is to provide fish passage, the project will necessarily occur in the Yellowstone River and its associated floodplain habitats, including wetlands. Measures of the proposed project that will occur within the waters of the U.S. include; 1) construction of a replacement concrete weir with cobble/rock fill, 2) connection of a constructed bypass channel to the Yellowstone River after a bypass channel is excavated in the dry, and 3) infill of the upper portion of the existing side channel.

Measures that will not require excavation or fill in waters of the U.S. include; 1) excavation of the new bypass channel, 2) relocation of the historic south rocking tower and boiler building on Joe's Island, 3) clearing and grubbing for staging areas and access, and 4) revegetation after construction completion.

2.3 DESCRIPTION OF PROPOSED PROJECT

The recommended restoration plan is presented in this section by key design element.

2.3.1 Replacement Concrete Weir

A replacement concrete weir is proposed approximately 28 feet upstream from the existing timber and rock weir with a crest elevation of 1991.0 feet (NAVD 88) in order to provide sufficient water surface elevations to divert the full irrigation diversion through the headworks and screens. A rendering of the replacement weir is shown in Figure 2-1.

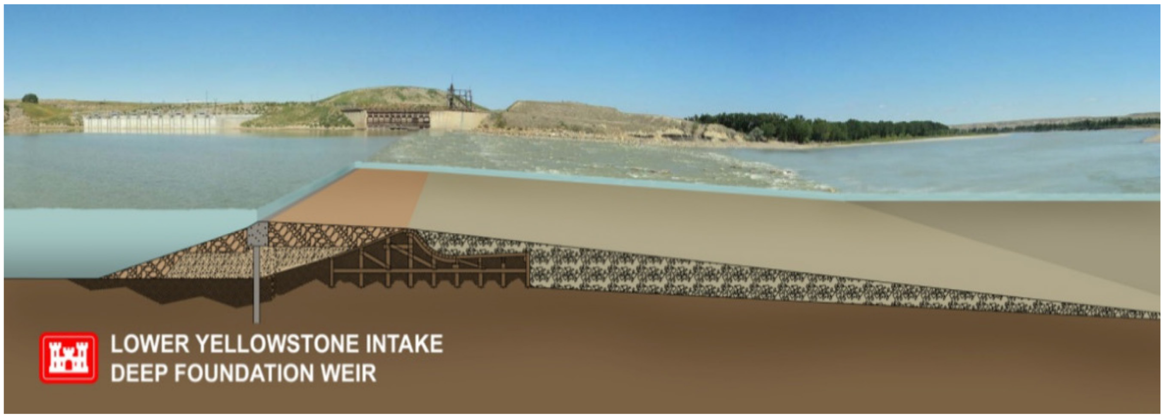

Figure 2-1 Rendering of replacement concrete weir

The weir structure would consist of a deep foundation of driven piles with a concrete cap. The concrete weir would require approximately 680 cubic yards of concrete, which would be trucked from Glendive and pumped to the site. The top of the structure would allow for a smooth crest surface for ice to pass over. Rock fill would be placed between the new weir and the existing weir to stabilize both structures. Cobble fill would also be placed upstream of the weir structure and sloped to pass flows and ice more smoothly over the weir crest. The weir crest will include a low-flow notch for fish passage at elevation 1889 feet with a bottom width of 85 feet and a top width of 125 feet. It is likely that occasional maintenance of the riprap between the old and new weirs would be necessary over the long term. However, the rock placed between weirs would not be subject to the same level of displacement experienced with the current weir since it will not be subject to direct impact from ice flows.

Construction of the new weir would begin on the north side of the river with up to one-half of the weir being constructed at a time. The immediate construction area would be dewatered, as needed, using a sheet pile coffer dam, with piles driven below grade into coarse alluvium material to reduce under seepage. Once the weir section is complete, the coffer dam sheet piles would be removed. Coffer dam installation and removal would occur during summer, but would not occur during the pallid sturgeon migration period (mid-April to July) to minimize fish impacts. During construction of the replacement weir and bypass channel, the LYP would need to maintain the existing weir. During construction, additional rock would continue to be placed on top of the existing weir to maintain diversions into the main canal. Rock would be placed on top of the existing weir as has occurred historically up to elevation 1991.0 ft. Once construction of the replacement weir is completed, there will be no need to place rock on the weir crest to maintain diversions into the main canal.

An access road and staging area would be constructed along the north side of the river to allow access for heavy equipment during construction. Following completion, the road would likely be left in place for long-term operation and maintenance use. In addition, the road between Highway 16 and Intake FAS will be resurfaced. Existing access roads to Joe's Island would be improved as needed to facilitate construction access. Access by motor vehicles across the newly constructed bypass channel would be limited at most flows.

2.3.2 Excavation of New Bypass Channel

The bypass channel would be designed to meet criteria developed by the Service's Biological Review Team (BRT) to divert 13-15% of total Yellowstone River flows (Table 1-1). As shown in the table, the bypass will be designed for cross-sectional velocities between 2 and 6 feet/second and minimum depths of 4 to 6 feet, depending on the flow.

While the channel will typically divert 13% of the total flow from the main channel during typical spring and summer discharges, diversion percentages would vary from 10% at extreme low flows (below 7,000 cfs) on the Yellowstone River to 16% at extreme high flows (Table 2-1). The geometry of natural side channels on the Yellowstone River near Intake varies greatly. The geometry of the proposed bypass channel falls within the range of all parameters evaluated for observed natural side channels.

Table 2-1 Analysis of Bypass Channel Flow Splits

Discharge at Sidney, Montana USGS Gage (return period) cfs	Split Flows			
	Flow into the bypass channel cfs	Flow remaining in the Yellowstone River cfs	Percent of flow in the bypass channel versus Yellowstone River percent	USFWS and BRT criteria percent
7,000	1,100	5,900	16	≥12
15,000	2,200	12,800	15	13 to ≥ 15
30,000	4,100	25,900	14	13 to ≥ 15
54,200 (2-yr)	7,500	46,700	14	13 to ≥ 15
63,000	8,700	54,300	14	13 to ≥ 15
74,400 (5 yr)	10,700	53,700	14	-
87,600 (10 yr)	12,900	74,700	15	-
128,300 (100 yr)	20,000	108,300	16	-

The excavation of the bypass channel would remove approximately 869,000 cubic yards of earthen material from Joe's Island. The proposed bypass channel alignment extends approximately 11,150 feet in length at a slope of approximately 0.07 percent. The channel cross section would have a bottom width of 40 feet, a top width of 150-250 feet, and side slopes varying from 1V:8H to 1V:4H. The excavated material would be disposed of in the upstream portion of the existing side channel.

The construction work zone would be isolated by coffer dams at the upstream and downstream ends of the proposed bypass channel, which would be constructed early in the construction sequence. The coffer dams will consist of sheet piles driven below grade into the coarse alluvium material to prevent under seepage. Some of the rock placement on the new channel side slopes will be placed after the coffer dam removal. Grade control structures are included at the downstream and upstream ends of the bypass channel as well as at two intermediate locations to prevent channel bed erosion that could impact passage success. The proposed grade control structures would be composed of buried riprap covered with gravel/cobble.

Additionally, bank riprap is proposed at four outside bends where velocities are higher to minimize the risk of major changes in the bypass channel planform that might reduce the capability to meet the Service's BRT criteria. Approximately 110,000 CY of riprap would be required for the bypass channel.

Modeling indicates the bypass channel could be subject to bed erosion. Therefore, construction of an armor layer is proposed. The armor layer would consist of large gravel to cobbles, similar in size to the naturally occurring coarse channel material found on Yellowstone River point and mid-channel bars and similar to what would be expected to occur naturally over time. Approximately 28,000 cubic yards of armor layer material would be screened from the alluvial material excavated from the bypass channel and placed in the channel bottom to achieve final design grade.

To ensure the desired13-15% split of flows into the constructed bypass channel the placement of fill in the upstream end of the existing side channel is required. Material excavated from the bypass channel would be placed as fill in approximately the first 1.5 miles of the existing side channel. This fill material would be compacted, sloped and reseeded for stability. This plug would not allow any water to be diverted into the upstream end of and flow through the existing side channel under most flow conditions. It is possible that under extreme flood conditions water could flow overland into the lower part of the side channel;,however, the only water that would regularly enter the high flow channel would be via a backwater effect at the downstream end. This would maintain similar backwater conditions as currently occurs in the lower portion of the side channel when river flows are below 20,000 cfs.

2.4 CONSTRUCTION METHODS

Both in-water and upland construction would be required for the various actions. Specific equipment used would depend on contractor preferences and experience. Equipment may include, but is not limited to, the following:

- Cranes: for lifting and placing materials
- Pile installation equipment: vibratory driving of piles
- Excavators: long-reach excavators for excavating channel and placing rock
- Dozers: for grading of slopes and access routes

2.4.1 General Construction Sequencing

The likely sequencing of construction elements will be:

a) Site Preparation
   a. Close Joe's Island and provide detours, signage, fencing, etc.
   b. Conduct pre-construction biological surveys and relocate fish and wildlife from the construction work zones
   c. Establish erosion controls in channel and spoils area

d. Prep haul roads and staging areas

b) Weir Construction
   a. Establish haul roads, access ramp, and barge inlet
   b. Install sheetpile coffer dam
   c. Install support pilings for new weir
   d. Pour concrete for new weir
   e. Place rock and cobble fill upstream and downstream of new weir
   f. Remove sheetpile

c) Bypass Channel Inlet Structure
   a. Install coffer dam around upstream inlet
   b. Excavation and riprap placement

d) Bypass Channel Outlet Structure
   a. Install coffer dam around outlet
   b. Excavate outlet
   c. Import and place outlet riprap

e) Channel Excavation
   a. Excavate channel from outlet to downstream outer bend protection
   b. Excavate channel between inlet and outlet
   c. Screening and placement of channel bottom armor
   d. Haul and place excavated material in existing side channel
   e. Place instream bypass channel protection and grade controls

f) Site Restoration
   a. Mulch, seed, and revegetate all disturbed areas
   b. Remove north side access crossings and culverts
   c. Demobilization of equipment, fencing, signage, etc.

2.4.2 Sediment Quality

In 2009, when the initial alternatives were evaluated for fish passage at the Intake Dam, a series of representative sediment samples were collected at points upstream and downstream of the Intake Diversion Dam to determine if the proposed soils and sediment disturbance would introduce contaminants into the water column (Corps 2009). This analysis was conducted in accordance with the guidance prepared jointly by EPA and the Corps for the evaluation of dredged material proposed for discharge into inland waters of the United States (1998). A total of eight locations were sampled and evaluated for potential contamination via an elutriate analysis. Three samples were taken downstream of the weir and five were taken from upstream of the weir. Two of the upstream samples came from an island and the rest were from the river bed.

Results showed that no pesticides or PCBs were in the samples and that, in general, nutrient concentrations in the samples were similar to ambient concentrations in the river. This means that sediment disturbance under any proposed alternative would not be likely to introduce pesticides, PCBs, or nutrients into the water (Corps 2009).

Arsenic, lead, zinc, iron, manganese, aluminum, and ammonia were detected in one or more samples; although at levels below Montana water quality standards, except for iron and manganese, which were present at levels well above state standards. However, in the case of iron, manganese, and aluminum, these minerals likely represent a natural condition associated with the geology and soils in the basin (Corps 2009). Similarly, for arsenic, lead and zinc, the levels detected appear to be associated with the geology and soils in the basin (Corps 2009).

2.5 TIMING OF DISCHARGE AND FILL

In-water work would be minimized through the use of coffer dams, which will allow the construction of the weir and bypass channel to occur isolated from the river. The placement of fill into waters of the U.S. would occur at the existing Intake Diversion Dam to create the replacement weir, as well as at the upstream end of the existing side channel. This work would largely occur during summer low flows or other periods outside of the spring runoff and fish migratory period (mid-April to July).

2.6 SOURCES AND GENERAL CHARACTERISTICS OF DREDGE/FILL MATERIALS

All fill material will come from two sources: 1) on-site reuse of materials excavated from the new bypass channel; or 2) a commercial source that meets the standards for suitability of clean material. This would generally mean that any materials imported to the project area would have low or non-detectable levels of contaminants that are not expected to have significant adverse impacts on water quality or biota in the short or long term.

3.0 Evaluation Criteria

The 404(b)(1) Guidelines require evaluation of the aquatic impacts associated with the discharge of dredged or fill material. The purpose of the CWA Section 404 as per 40 CFR Section 230.1(a) "is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." Specifically, 40 CFR Section 230.1(c) states that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact."

Section 230.11 of Subpart B of the Guidelines provides the following four conditions that must be satisfied in order to make a finding that a proposed discharge complies with the requirements described in 40 CFR Section 230:

1. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental impacts (see Sections 4, 5, and 6).
2. No discharge of dredged or fill material shall be permitted if it violates any water quality standards, jeopardizes any endangered or threatened species, or disturbs any marine sanctuaries (see Sections 4, 5, and 6).
3. No discharge of dredged or fill material shall be permitted that would result in significant degradation of any waters of the United States, including adverse effects on human health or welfare, effects on municipal water supplies, aquatic organisms, wildlife, or special aquatic sites (see Sections 4, 5, 6 and 7).
4. No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that would minimize potential adverse impacts (see Sections 8, 9, and 10).

The potential impacts of the proposed actions are evaluated based on conditions set forth in 40 CFR Subpart B Section 230.11, and the factual determination and discussion of conditions for compliance are provided in Sections 11 and 12. Findings of compliance or non-compliance with the restrictions on discharge, pursuant to 40 CFR 230.12, are provided in Section 13.

Sections 4, 5, 6, and 7 below describe the potential effects of the selected Bypass Channel Alternative on aquatic habitats, and fish and wildlife. The Intake EIS describes the potential impacts of each of the alternatives, but specifies the selected alternative as the most cost effective, practicable, and beneficial. In the following sections, the effects of the selected alternative are compared to the potential effects of taking no action.

4.0 Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

4.1 SUBSTRATE

4.1.1 Existing Conditions

The Yellowstone River channel boundaries are generally within alluvium consisting primarily of sand and gravel. Channel bed materials consist of gravel, cobble, and sand. The channel migrates within the alluvial materials and occasionally comes in contact with bedrock.

4.1.2 Potential Impacts

4.1.2.1 No Action Alternative

The No Action Alternative would not have any new construction elements and would therefore have no impact on substrate. The continued operation of the existing weir requires annual placement of rock on the weir crest. This activity would continue for the No Action Alternative and would thus, continue increasing the volume of rock present in the river, causing a larger rock/rubble field over time.

4.1.2.2 Proposed Bypass Channel Alternative

There would likely be some minor erosion and scour of the channel substrate and/or banks due to the placement of coffer dams around the weir construction area. The coffer dam could temporarily cause a rise in water surface elevations, primarily along the right bank on Joe's Island as a result of confining the flows, including for the 100-year and other flood flows. The coffer dam could also cause additional head for the Intake Canal. It is likely that velocities at the intake and screens could decrease when the coffer dam is on the north half of the river, but could increase velocities when the coffer dam is on the south half of the river.

The coffer dams at the proposed bypass channel location would not affect any river flows unless there was a flow higher than a 2-year event during construction, which could overtop the coffer dams and could cause some minor erosion/scouring at the coffer dam locations.

The new weir will include the placement of riprap and cobbles both upstream and downstream of the new weir to stabilize the structure. This will be a permanent addition of coarser substrate to the river channel. This material will be far more stable than the rock that is currently placed on the weir crest, so will not likely move downstream.

The placement of fill into the existing side channel would change its substrate to a mix of both coarse and fine materials placed to match the surrounding elevation on Joe's Island. Conversely, the excavation of the new bypass channel would change the current island surface to a coarse cobble/gravel channel.The following actions are recommended to minimize effects to surface water during construction and during the long-term operation and maintenance:

- Design coffer dams to obstruct the least amount of the channel or floodway to minimize the potential for affecting flood flows or ice jams or causing scour.

4.2 SUSPENDED PARTICULATES/ TURBIDITY

4.2.1 Existing Conditions

Based on measurements at the Sidney gage (USGS Gage No. 06329500) and at the study area, silt and clay are the predominant suspended load. Bed material loads (sediment sizes found in appreciable quantities in the channel bed) are predominantly sand with small amounts of gravel. Near Sidney, the median suspended sediment concentration is 82 mg/L, but the concentration varies greatly from 1 mg/L to over 4,700 mg/L. Suspended sediment concentration is generally highest in the spring and early summer, corresponding with runoff. Streambank erosion and runoff from adjacent agricultural lands also affect suspended sediment concentrations. Nearly a third of the annual sediment load in the Yellowstone River near Sidney comes from the Powder River Basin (though it contributes less than 5% of the annual Yellowstone stream flow).

The lower Yellowstone River is a naturally turbid, or highly sediment-laden, system, and the warmwater fishery has adapted to these conditions. Sedimentation or siltation has occurred behind the weir, however, which may be reducing the natural turbidity in downstream reaches. Turbidity data collected at the Sidney gage between 1998 and 2001 ranged from to 2.8 to 1,600 nephelometric turbidity units. The median value was 65. (USGS 2016)

4.2.2 Potential Impacts

4.2.2.1 No Action Alternative

Under the No Action Alternative, there would be no changes to the existing Intake Diversion Dam configuration, and there would be negligible effects to suspended particulates or turbidity from continued annual placement of rock on the crest of the weir.

4.2.2.2 Proposed Bypass Channel Alternative

Construction of the replacement concrete weir, excavation of the new bypass channel, and installation of a temporary bridge or culverts spanning the main irrigation canal all have the potential to re-suspend or release sediment into the water column. Excavation of a new bypass channel will be isolated from the river, with coffer dams used at the upstream and downstream ends of the bypass to keep flows from entering the channel throughout the construction period, ensuring that only negligible effects will result to water quality. Construction staging and access would be located on Joe’s Island adjacent to the proposed Bypass Channel. Silt fences and other erosion control measures would ensure that sediment and contaminants did not wash into the water from staging and access zones. Stockpile areas will not be located in wetlands and will be covered as appropriate during construction to prevent erosion and reseeded at the completion of construction to prevent wind and water erosion.

Measures to minimize effects include:

- Conduct all filling activities while isolated from the river (i.e. behind coffer dams) to the maximum extent practicable.
- Implement erosion control measures to reduce the potential for sediment-laden stormwater runoff during construction.

4.3 WATER QUALITY

4.3.1 Existing Conditions

The Administrative Rules of Montana designate the main stem Yellowstone River as Class B-3 waters (ARM 17.30.611). Water quality standards for Class B-3 waters (ARM 17.30.625) include Montana numeric water quality standards from Circular DEQ-7 (MTDEQ 2012). Class B-3 waters are suitable for the following beneficial uses:

- Drinking water, including culinary use and food processing purposes after conventional treatment.
- Primary contact recreation, including bathing, swimming, and recreation
- Aquatic life, including the growth and propagation of nonsalmonid fishes and associated aquatic life, waterfowl, and furbearers
- Agricultural use, including industrial water supply.

The river currently supports the beneficial uses for agriculture, drinking water, and recreation, while not fully supporting beneficial uses for aquatic life (MTDEQ 2014). Causes for non-support of aquatic life result from the presence of the Intake Diversion Dam, which is a fish passage barrier, the alteration in streamside vegetation cover, presence of chromium, copper, lead, and high levels of nitrogen, phosphorous, sediment, TDS, and pH. Many of these are currently listed as 303(d) impairments, shown in Table 4-1.

The Yellowstone River is designated water quality Category 5, defined as waters where one or more applicable beneficial uses have been assessed as being impaired or threatened. The Yellowstone River between the Intake Diversion Dam and the North Dakota border has eight water quality parameters that are consistently not meeting regulatory state water quality standards: chromium, copper, lead, nitrogen, phosphorous, sedimentation or siltation, TDS, and pH. Each of these has been reported as a separate 303(d) listing under the CWA.

Table 4-1 CWA Section 303(d) listed impairments and causes in the Yellowstone River study area

Impairment	Probable Source	Total Maximum Daily Load Study Completed
Chromium (total)	Sources are unknown	No
Copper	Natural or unknown sources	No
Fish Passage Barrier	Impacts from hydrostructure flow regulation and modification	No
Lead	Sources are unknown	No
Sedimentation/Siltation	Rangeland grazing, irrigated crop production, streambank modifications and destabilization, hydrostructure flow regulation and modification, and unknown sources	No
Total Dissolved Solids	Natural or unknown sources	No
pH	Natural or unknown sources	No
Nitrogen (Total)	Irrigated crop production, streambank modification and destabilization, and unknown sources	No
Phosphorous (Total)	Irrigated crop production, rangeland grazing, streambank modifications and destabilization, and unknown sources	No
Alteration in Streamside or Littoral Vegetative Covers	Irrigated crop production, rangeland grazing, streambank modifications and destabilization	No

4.3.2 Potential Impacts

4.3.2.1 No Action Alternative

No construction activities or changes in operation and maintenance would occur under this alternative and therefore, no impacts would result. Continued rocking maintenance of the weir would result in temporary slight increases in turbidity each year, which would not be a significant effect on water quality.

4.3.2.2 Proposed Bypass Channel Alternative

No substantial changes in water quality are anticipated to result from construction, aside from minor increases in turbidity, which are discussed above. Measures to avoid contamination of water during construction would be employed and only clean fill materials used. Since placement of rock on the weir crest would no longer be necessary, minor turbidity increases associated with maintenance of the weir would be reduced as compared to no action.

The proposed Bypass Channel Alternative will create a fish passable channel around Intake Diversion Dam, thus reducing the impediment caused by the existing weir, and thus greatly reducing the fish passage barrier that is one of the 303(d) listings for the lower Yellowstone River.

Measures to minimize effects to water quality include:

- Implementation of a pollutant prevention plan during construction addressing all potential contaminants that may be present on site.

4.4 CURRENT PATTERNS, WATER CIRCULATION, AND FLUCTUATIONS

4.4.1 Existing Conditions

The Yellowstone River is one of the longest free-flowing rivers in the lower 48 states, draining about 70,000 square miles as it flows more than 600 miles from its origin east of Yellowstone National Park, Wyoming, through Montana to the confluence with the Missouri River in North Dakota (Chase 2014). At the Missouri River confluence, the Yellowstone River contributes more than 50% of the average annual flow (Corps 2010).

The Intake Diversion Dam is located near the town of Intake in Dawson County, Montana. Built over 100 years ago, it is the most downstream and largest in a series of six diversion structures on the Yellowstone River downstream of Billings, Montana.

The Corps analyzed the flow records at the Sidney Montana gage (USGS Gage No. 06329500) located 36 miles downstream of the Intake Diversion Dam, and at the Glendive Montana gage (USGS Gage No. 06327500) located 18 miles upstream of the Intake Diversion Dam. Flows at the Sidney gage are affected by operations at Yellowtail Dam, which is located on the Bighorn River in south central Montana, approximately 90 miles upstream of the confluence with the Yellowstone River. Yellowtail Dam regulates 28% of the base flows upstream of Sidney, and reservoir operations can alter the flow regime (Corps 2006). Thus two periods were assessed:

- The full period of record—Water years 1911 – 2005
- The period following the construction of Yellowtail Dam—Water years 1967 – 2005.

USGS analyzed the Yellowstone River flow records for two scenarios:

- Unregulated stream flow, representing flow conditions that might have occurred if there had been no water-resources development in the basin
- Regulated stream flow, representing flow conditions if the level of water resources development that existed in 2002 was in place during the entire study period.

The period of study was water years 1928 – 2002. Daily stream flows were modified to represent unregulated and regulated stream flow conditions. Statistical summaries were calculated for each set of conditions.

The Corps recommended using the flow frequency and flow duration values for the regulated conditions developed by USGS for the design and evaluation of the proposed bypass channel (Corps 2015a). The regulated flow frequency values are provided in Table 4-2 (highlighted in green) and the flow duration values are provided in Table 4-3. Table 4-2 also provides discharges developed by the Corps using post-Yellowtail Dam data through 2005 for use in the evaluation of construction timelines.

Table 4-2 Flow Frequency

Percent Chance Exceedance	Return Period (yrs)	Discharges (cfs) for various scenarios. Recommended values are Annual Post Yellowtail Dam; seasonal values used in evaluation of various construction timelines to lower risk. Study was conducted using data through 2005.						2013 USGS Study **	
		Seasonal: Aug-Feb	Seasonal: Aug-Mar	Annual (period of record)	Annual-Post Yellowtail Dam	Winter (1Jan-15Apr) Post Yellowtail Bulletin 17b	Winter (1Jan-15Apr) Post Yellowtail Top Half	Unregulated	**Regulated**
0.2	500	128,507	192,400*	192,400	114000	249000	213000	174800	**156200**
0.5	200	96,637	172,300*	172,300	105000			157600	**140200**
1	100	77,223	148,907	156,900	97200	128000	123000	144900	**128300**
2	50	61,117	114,710	141,400	89400	94600	94100	132300	**116200**
5	20	43,967	78,968	120,600	78700	61500	62800		
10	10	33,515	57,696	104,200	70100	43100	43800	103000	**87600**
20	5	24,764	40,334	86,900	60600			89800	**74400**
50	2	14,982	21,709	60,400	45300	14900	12300	69600	**54200**
80	1.25	9,961	12,688	41,200	33300				
90	1.11	8,334	9,886	33,400	28200				
95	1.05	7,314	8,171	28,000	24500				
99	1.01	5,949	5,925	19,800	18600				

* Discharges reduced to not exceed annual discharges

** "Streamflow Statistics for Unregulated and Regulated Streamflow Conditions for Selected Locations on the Yellowstone, Tongue, and Powder Rivers, Montana and Wyoming 1928-2002" (USGS)

Source: Corps 2015a

Table 4-3 Flow Duration

Regulated Data from "Streamflow Statistics for Unregulated and Regulated Streamflow Conditions for Selected Locations on the Yellowstone, Tongue, and Powder Rivers, Montana and Wyoming 1928-2002" (USGS 2013)					
	Discharge (cfs)				
Percent Time Flow Equaled or Exceeded	Annual	Fall (OCT-DEC)	Winter (JAN-MAR)	Spring (APR-JUN)	Summer (JUL-SEP)
1	56,800	13,700	35,300	66,600	55,500
2	49,500	12,500	25,000	60,500	46,200
5	36,900	11,300	17,000	52,000	35,300
10	25,800	10,400	12,400	43,500	26,900
15	18,700	97,400	10,500	36,800	21,100
20	14,500	9,230	9,500	31,600	16,600
25	12,200	8,840	8,800	27,500	13,700
30	10,700	8,510	8,250	23,800	12,000
40	9,030	7,890	7,500	18,000	9,700
50	7,990	7,300	6,810	14,300	8,230
60	7,070	6,730	6,130	11,500	6,860
70	6,210	6,050	5,560	9,110	5,680
75	5,780	5,660	5,250	8,230	5,150
80	5,350	5,300	4,970	7,500	4,600
85	4,880	4,850	4,560	6,640	4,010
90	4,270	4,320	4,120	5,860	3,460
95	3,440	3,490	3,510	5,220	2,550
98	2,520	2,610	2,830	4,530	1,940
99	2,060	2,200	2,560	3,620	1,550

Source: Corps 2015a

Daily flows were also calculated by the Corps for the period of record at Sidney, Montana for the 5th, 10th, 25th, 75th, 90th, and 95th percentiles. The resulting hydrographs show a spring time pulse in mid-March through mid-April, which occurs in about 50% of the years, and a larger rise starting in early May, peaking in late June and receding by early August (Figure 4.1 5th, 10th, 25th, 50th, 75th, 90th, and 95th, Daily flow Percentiles for Period of Record Water Years 1911 1934, and Water Years 1934-2005, Sidney, MT (USGS Gage No. 06329500) (Corps 2006)).

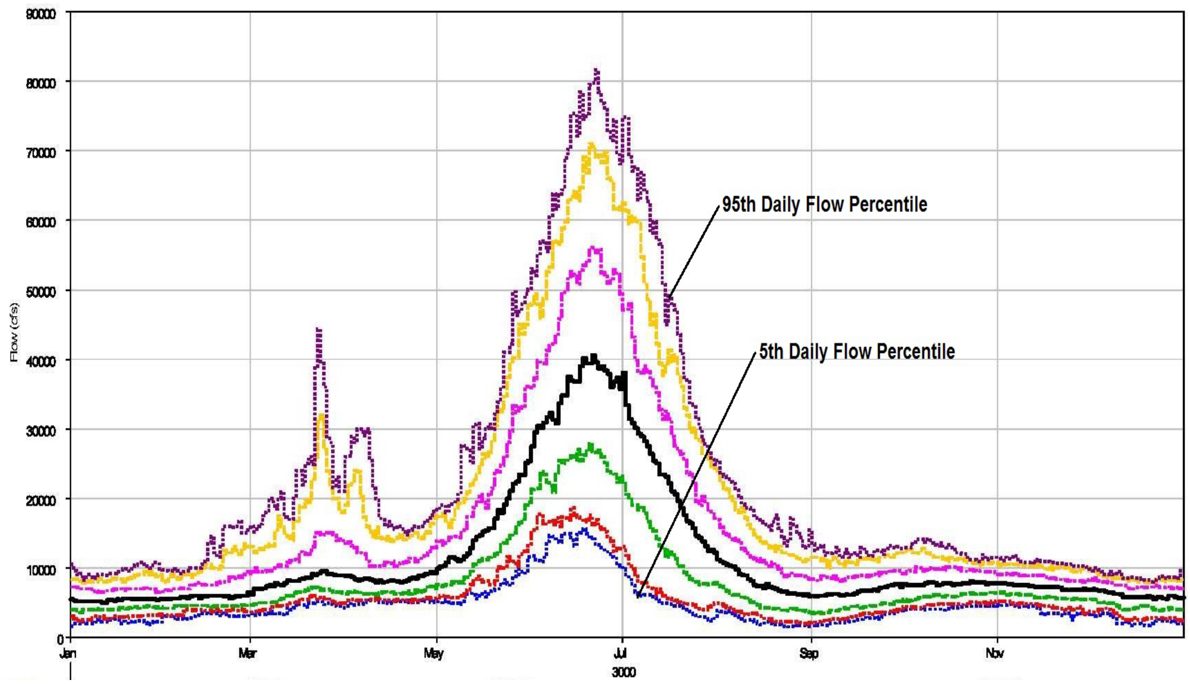

Figure 4-1 5th, 10th, 25th, 50th, 75th, 90th, and 95th, Daily flow Percentiles for Period of Record Water Years 1911 1934, and Water Years 1934-2005, Sidney, MT (USGS Gage No. 06329500) (Corps 2006)

The first rise is generally driven by snowmelt and rain in the plains region of the watershed. The second rise is primarily driven by mountain snowmelt (Corps 2006).

In 2011 and 2012 the Corps Engineering Research and Development Center/Cold Regions Research and Engineering Laboratory provided an assessment of ice impacts and design guidance on the Intake Diversion Dam and headworks structure and the proposed bypass channel (Tuthill and Carr 2012; Reclamation and Corps 2015). The report notes that ice breakup on the Lower Yellowstone River typically progresses downstream from warmer to colder climates (southwest to northeast) in a series of ice jams and releases. These jams tend to increase in severity as the breaking front encounters stronger, thicker ice. Jams in the main channel push flow and ice into side channels and onto the overbanks, leaving behind ice pieces. Historically when these jams form, the wide floodplains in the lower Yellowstone River system serve as a relief mechanism for collecting and storing ice. The overbank velocities of the ice pieces are low, (typically less than 2 feet/second at 40,000 cfs as calculated using HEC-RAS).

The main canal was constructed in 1909. The canal is 71.6 miles long and conveys water along the north side of the Yellowstone River until it discharges to the Missouri River near the confluence of the Yellowstone and Missouri Rivers (Reclamation 2013). The canal has a design capacity of 1,400 cfs. The canal slope is 0.0002 feet/foot. The channel has a bottom width of 30 feet and 1.5H:1V side slopes. The canal is approximately 10 feet deep at the design capacity. Diversions are made into the canal typically from May through the end of September. Water diverted at the Intake Diversion Dam is measured daily at a bridge on the main canal, 2.8 miles downstream of the headworks. The annual diversions range from approximately 234,000 acre-feet to 378,000 acre-feet, with an average of 327,000 acre-feet.

The hydrologic assessment prepared by the Corps (Corps 2006) included the development of a 5-year moving average of flow. The analysis indicates an overall increase in flows during the winter but an overall annual decrease in flow. The report notes that while this may intuitively seem to be due to irrigation diversions and reservoir operation—with higher summer flows diverted or held in storage and winter flows augmented with reservoir releases—the trends are not pronounced enough to determine if these trends are due to irrigation and reservoir operations or other factors such as climatic trends. More recent analysis in the CEA indicate a similar pattern of hydrologic trends, with decreasing August flows over the period of record (Corps and YRCDC 2015). The CEA also notes that there is strong evidence of decreasing annual flow, decreasing annual minimum discharge, and decreasing peak discharge.

4.4.2 Potential Impacts

4.4.2.1 No Action Alternative

Under the No Action Alternative, river flows are not impeded by the Intake Diversion Dam. High flow events would overtop the banks and flows would occur through the existing side channel. The No Action Alternative would maintain the continued barrier of upstream passage of pallid sturgeon due to factors such as high velocities, turbulent flows, and low depths over the weir.

Climate change effects that may occur for the No Action Alternative include declines in snowpack in the mountains, potential increases in precipitation falling as rain, and increased air temperatures (Reclamation 2016). In addition, more extreme weather events such as floods and droughts are likely to occur more frequently. These factors would likely continue the trend of earlier and lower peak flows from snowmelt and potentially higher peak flows in winter and early spring from rainfall.

4.4.2.2 Proposed Bypass Channel Alternative

During construction of the proposed Bypass Channel Alternative, when the coffer dams are in place, the river flow would have roughly half the width, and approaching double the depth, with increased velocities through the reach. For example, during a flow of 15,000 cfs, the existing depth and velocity over the weir is 2.6 feet and 7.6 feet/second; if the width were reduced by 300-350 feet, the depth could potentially be 4 feet and the velocity could be 9.9 feet/second (similar to depths and velocities at a doubled flow, 30,000 cfs under existing conditions) during the two years of constructing the new weir. There could likely be some erosion and scour of the channel substrate and/or banks, primarily along the right bank on Joe's Island as a result of confining the flows and it could temporarily cause a rise in water surface elevations, including for flood flows. The coffer dam could also cause additional head for the Intake Canal. It is likely that velocities at the intake and screens could decrease when the coffer dam is on the north half of the river, but could increase velocities when the coffer dam is on the south half of the river.

During ice break-up, the presence of the various coffer dams would likely affect where ice would flow and deposit in the floodplain and could cause the potential for an ice damming effect at the weir as there would be a reduced width for flow, temporarily raising water surface elevations upstream of the weir. This effect could extend for up to 1.8 miles to the first side channel, which is the existing side channel, where ice is often pushed out of the main channel as the ice dam moves upstream.

Once the replacement weir is completed, it would create sufficient head at the main canal headworks to fully divert the 1,374 cfs without additional placement of rock. There would not be any effects to flood water surface elevations from the replacement weir. Modeling of the low-flow notch in the weir indicates that there would be increased depths of flow through this notch as compared to the existing weir and slightly reduced velocities. This may facilitate passage by fish that currently occasionally pass upstream of the weir.

The completed bypass channel would divert 13-15% of the river flow, thus reducing flow slightly in the main channel over the approximately half-mile distance between the upstream and downstream ends of the channel. Further, the bypass channel is designed to provide optimal depths and velocities for pallid sturgeon migration over the range of flows in the river from 7,000 to 63,000 cfs. Depths will range from 4 to 10 feet and velocities will range from 2 to 6 feet/second.

A long-term advantage of a bypass channel that functions over a wide range of flows is that even with projected climate change effects on flows, the bypass channel would likely convey appropriate percentages of the river's flow and provide suitable depths and velocities for fish passage.

4.5 SALINITY

Salinity is not applicable for the Yellowstone River.

5.0 Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

5.1 THREATENED AND ENDANGERED SPECIES

5.1.1 Existing Conditions

Based on letters from the U.S. Fish and Wildlife Service, nine species that are listed under the Endangered Species Act (ESA) may occur within the proposed study area (USFWS 2016a, USFWS 2016b, Table 5-1). Of those species, only four are known or likely to be present, including the least tern, piping plover, whooping crane, and pallid sturgeon.

Table 5-1 Federally Listed Species or candidate Species in Montana and North Dakota and likelihood of presence in Study Area

Common Name	Scientific Name	MT[b]	ND[b]	ESA Status	Likely Presence in Study Area
Mammals					
Black-footed ferret	*Mustela nigripes*		X	Endangered	Not present
Gray wolf[a]	*Canis lupus*		X	Endangered	Not likely to be present
Northern long-eared bat	*Myotis septentrionalis*		X	Threatened	Not likely to be present
Birds					
Least tern	*Sternula antillarum*	X	X	Endangered	Likely to be present
Piping plover	*Charadrius melodus*	X	X	Threatened	Likely to be present
Rufa Red knot	*Calidris canutus rufa*		X	Threatened	Not present
Whooping crane	*Grus americana*	X	X	Endangered	Likely to be present
Fish					
Pallid sturgeon	*Scaphirhynchus albus*	X	X	Endangered	Present
Insects					
Dakota skipper	*Hesperia dacotae*		X	Threatened	Not present

a. Gray wolf has been delisted in Montana and is considered in recovery; it remains endangered in North Dakota.
b. Checked boxes indicate the species is federally listed for protection within that state, according to USFWS 2016a and USFWS 2016b.

5.1.2 Potential Impacts

5.1.2.1 No Action Alternative

Operation of the existing Intake Diversion Dam maintains a fish passage barrier to federally protected pallid sturgeon, as well as at least a partial fish barrier for several state fish species of concern, including blue sucker, Iowa darter, Northern redbelly dace, paddlefish, pearl dace, sauger, shortnose gar, sicklefin chub, and sturgeon chub. Under the No Action Alternative, the presence of the Intake Diversion Dam blocks access to an extensive area of potential spawning habitat that may also be far enough upstream to allow suitable drift distance for sturgeon larvae to settle out before reaching Lake Sakakawea, thus continuing to prevent recruitment of pallid sturgeon. This would be a major on-going effect to listed and sensitive fish species. There would be no effect on other federally listed or candidate species.

5.1.2.2 Proposed Bypass Channel Alternative

Under the proposed Bypass Channel Alternative, construction would have minor effects on a variety of protected fish and wildlife. This would primarily be due to construction equipment, disturbance, and personnel onsite, as well as the alterations of the instream conditions of the Yellowstone River during construction. However, because the site is already relatively well used by recreationists, visitors, and maintenance personnel, the occurrence of rare terrestrial species around the Intake Diversion Dam is unlikely. Effects to protected fish and wildlife will primarily be to aquatic species known to be present in this reach of the Yellowstone River, particularly pallid sturgeon and other state fish species of concern.

Federally protected terrestrial species that may occur in the project area include the least tern, piping plover, and whooping crane. It is unlikely that northern long-eared bats would be present, since they are very rare and hibernacula are not known to occur in the area. There is no known permanent population of terns, plovers, or cranes within the proposed project footprint for the selected alternative, but each have been observed in the area regularly and recently. If these species did arrive in the area during construction, they would be expected to naturally relocate to avoid disturbance. The construction of this alternative does not occur in areas considered critical habitat for any of the federally protected terrestrial species. Furthermore, though the general area of this reach has been known to support migrating and/or nesting of least tern, piping plover, and whooping crane, the construction and access footprint of the proposed project is very small in comparison to the surrounding available habitat and generally not located in potentially suitable habitats for these species (i.e. most of the construction footprint is main channel, river banks, and grassy or disturbed uplands, including existing dirt roads). Therefore, only minor effects to any of these species would occur, limited to temporary disturbance from noise and human presence.

Actions that could be taken to avoid and minimize effects to each of these protected species include:

Northern Long-eared Bat. Construction of the proposed bypass channel would only have the potential to disturb this bat species if it were found roosting under the existing canal bridge or in trees to be cleared during construction, which is considered highly unlikely. Pre-construction surveys would be conducted to document if this bat is present. If found onsite, Corps and Reclamation environmental staff will notify the USFWS and MFWP and determine appropriate actions to protect individuals.

Least Tern. Interior least terns have been regularly reported to use the sandy shorelines of the Yellowstone River for nesting and foraging. Pre-construction surveys for tern nests will be conducted. If active nests are found, they should be protected during the nesting season with temporary fencing or flagging for a quarter mile buffer around the nest to prevent access and disturbance.

Piping Plover. As with the least tern, piping plovers have been regularly reported to use the sandy shorelines of the Yellowstone River, including areas near the Intake Diversion Dam.Effects to plovers could be minimized by conducting pre-construction surveys and by protecting nests with temporary fencing or flagging for a quarter mile buffer around any active plover nests during the nesting season.

Whooping Crane. Whooping cranes are rare visitors to the Yellowstone River corridor and would be unlikely to occur. However, whooping crane sighting reports will be monitored before and during construction to determine if cranes are in the construction area. If any are sighted, Corps and Reclamation environmental staff will notify USFWS to determine if any actions to minimize effects are warranted.

Pallid Sturgeon. The existing Intake Diversion Dam is already impassable to pallid sturgeon so the blocking of a portion of the river channel by coffer dams during construction does not represent a loss of habitat or change in accessibility to habitat. The existing side channel willbe blocked off and not accessible for fish passage as soon as construction of the bypass channel begins and will be partially filled and not accessible after construction is complete. Pallid sturgeon passage has only been documented through the side channel during May or June when flows exceeded 40,000 cfs (Rugg 2014, 2015), which is approaching a 2-year flood. Thus, it is possible that during one of the approximate 2 years of construction, that pallid sturgeon might be blocked from passing around the weir. However, even in 2014 and 2015 when pallid sturgeon were documented to pass upstream, there is currently no evidence that any recruitment of fish occurred (no eggs, free embryos, or larvae were documented). Thus, even if passage is blocked for one season, this will not likely affect recruitment. Once the bypass channel is complete, the channel should provide pallid sturgeon passage during all years under nearly all flow conditions.

There will likely be temporary and minor increases in turbidity on multiple occasions over the 2-3 year construction period, but this should rapidly mix and be diluted, and pallid sturgeon are adapted to high turbidity environments.

Noise from sheet pile driving may affect pallid sturgeon and other fish species. Noise attenuates through water in a straight line and dissipates when it encounters land. Thus, in a meandering river, the distance that noise would propogate is limited to the first bend upstream and downstream of the project area. Vibratory driving of the steel sheet pile coffer dams is unlikely to cause injury to fish. However, it is anticipated that any fish present within close proximity to the work zone would immediately flee the area once activities such as moving rocks or pile driving began to occur, thus reducing localized foraging habitat. Thus, the installation and removal of coffer dams will occur outside of the time period of migration for pallid sturgeon (mid-April to July) to avoid potential effects to pallid sturgeon. Further, as there has been no documented recruitment of larvae from the one recorded instance of spawning upstream of Intake Diversion Dam there are unlikely to be any larval pallid sturgeon near Intake Diversion Dam during construction.

Once completed, the bypass channel would improve passage for pallid sturgeon and other aquatic species. The bypass channel is designed to meet the Service's BRT criteria for optimal pallid sturgeon passage and would be accessible over a much wider range of flows than the existing side channel that only has flowing water when flows exceed 20,000 cfs. It is anticipated that a majority of pallid sturgeon that swim up to the weir would encounter the bypass channel as its entrance will be located close to the weir, thus a likely majority of pallid sturgeon would use the channel. Passage upstream would extend the available spawning habitat to pallid sturgeon, potentially up to the Cartersville Diversion Dam, adding over 165 miles of potential spawning habitat and the lower 20 plus miles of tributaries such as the Powder River. Currently, a small number of pallid sturgeon in the Yellowstone River have been documented to use the existing side channel to pass above the Intake Diversion Dam (total of 6 fish in 2014 and 2015; Rugg, 2014, 2015). The fish passage benefits are intended to provide a major benefit to pallid sturgeon for both spawning and from the much longer drift distance that would allow at least a portion of the larvae to settle out and will likely increase recruitment. The existing side channel would be filled at the upstream end and would no longer be accessible for upstream passage, but the much greater likelihood of passage in the bypass channel would likely far outweigh the loss of flow through the side channel that a small percentage of fish used.

A number of measures can be employed to minimize effects to listed and sensitive fish and wildlife species, including:

- Conduct pre-construction surveys within the construction footprint for listed and sensitive wildlife and plant species and fence and protect any listed plant species observed.
- All surface-disturbing and construction activities will be prohibited from occurring within 0.25 mile of any existing and active least tern or piping plover nest within the dates of May 15 to August 15.
- If any whooping cranes are sighted during the project construction, the on-site manager will immediately notify Corps/Reclamation environmental staff to consult with the USFWS regarding appropriate actions.
- Construction activities within the wetted perimeter of the active channel will be observed and monitored by a qualified fisheries biologist during the first day of in-water work for each activity to determine if there is potential for direct harm or harassment of pallid sturgeon. This will include coordination with MFWP to make sure radio-tagged pallid sturgeon and other monitored native fish continue to be monitored, especially during the construction season.
- All pumps used in the river during construction will use intakes screened with no greater than 0.25 inch mesh when dewatering coffer dam areas in the river channel. Pumping will continue until water levels within the contained areas are suitable for salvage of any juvenile or adult fish occupying these areas. All fish will be removed by methods approved by the USFWS and MFWP prior to final dewatering.
- Care will be taken to prevent any petroleum products, chemicals, or other harmful materials from entering the water.
- All work in the waterway will be performed in such a manner to minimize increases in suspended solids and turbidity that could degrade water quality and damage aquatic life outside the immediate area of operation.
- All areas along the bank disturbed or newly created by the construction activity will be seeded with vegetation native to the area for protection against subsequent erosion and the establishment of noxious weeds.

- Clearing vegetation will be limited to that which is absolutely necessary for construction of the project.
- Any in-stream construction activity will be conducted during periods least likely to impact the pallid sturgeon or other sensitive fish species.
- Sheetpiles will be installed using vibratory equipment to the maximum extent practicable to minimize noise levels and potential effects to fish.
- At the start of pile driving each day, conduct a low-energy ramp up with reduced noise levels to allow fish the opportunity to move from the area.
- A monitoring and adaptive management plan will be implemented for the preferred alternative to document fish passage, entrainment, and success of the project in meeting physical and biological objectives (see Appendix E).

5.2 AQUATIC FOOD WEB

5.2.1 Existing Conditions

The aquatic community includes fish, mussels, macroinvertebrates, and aquatic vegetation. The Yellowstone River still has relatively pristine character (Jaeger et al. 2006). However, several anthropogenic factors influence the aquatic ecosystem, including alterations to the hydrograph, geomorphology, riparian vegetation and wetlands, river and tributary connectivity, and water quality, as well as introduction of non-native species and pressure from recreational fishing (Corps 2015b).

5.2.2 Potential Impacts

5.2.2.1 No Action Alternative

No changes to the existing aquatic food web would occur under the No Action Alternative.

5.2.2.2 Proposed Bypass Channel Alternative

Excavation and dewatering, along with the installation of coffer dams, and concentrated river flows around the coffer dam, would likely release sediment into the water. Increases in sedimentation and turbidity could cause a temporary adverse effect on aquatic species, if fine silts infill intersticial spaces or cover aquatic plants. However, the Yellowstone River is a naturally high turbidity system, and construction impacts would be minor and temporary. Increased velocities and depths resulting from the placement of coffer dams could also temporarily impact species, however, this would only occur for a short time and would not be higher than typical seasonal runoff conditions. Fish and macroinvertebrates will move through the area as in any high flow event. Mussels or plants anchored into the shoreline will sustain minor effects, as the areas affected will be small and localized to the Intake Diversion Dam area.

Measures to minimize effect would include:

- All work in the river will be performed in a manner to minimize increased suspended solids and turbidity including the use of coffer dams to isolate in-water work zones and taking appropriate erosion control measures.

- All areas along the bank disturbed by construction will be seeded with native vegetation to minimize erosion.
- All contractors will be required to inspect, clean and dry all machinery, equipment, materials and supplies to prevent spread of Aquatic Nuisance Species.
- Construction activities will be conducted in accordance with permit conditions, including water quality monitoring, if required.All pumps will have intakes screened with no greater than 0.25-inch mesh when dewatering coffer dam areas in the river channel. Pumping will continue until water levels within the contained areas are suitable for salvage of juvenile or adult fish occupying these areas. Fish will be removed by methods approved by the Service and MFWP prior to final dewatering.
- Reclamation will implement a monitoring and adaptive management plan that will include measures to take if project objectives are not met (see Appendix E).

5.3 WILDLIFE

5.3.1 Existing Conditions

Five general habitat types in the study area provide productive ecological support for native terrestrial wildlife: wetland, woody riparian, barren land, shrubland, and grassland. These habitats are utilized by frogs, toads, snakes, lizards, bats, large and small mammals, songbirds, waterfowl, wading birds, shorebirds, and insects.

5.3.2 Potential Impacts

5.3.2.1 No Action Alternative

No impacts to wildlife would occur from the No Action Alternative.

5.3.2.2 Proposed Bypass Channel Alternative

Loss of a diversity of high-quality habitat patches would occur and potentially affect wildlife under the Bypass Channel Alternative, while disturbance from construction activities, which would last approximately 28 months, would also result in moderate temporary impacts.

Joe's Islandwould be fundamentally altered by the Bypass Channel Alternative. Joe's Island and adjacent mainland include all wildlife habitats found in the greater study area. Because they are relatively high in quality, and are anticipated to be subjected to both short-term and long-term impacts from this action, the resulting effects on wildlife may be locally widespread and substantial, but scaled-down when considering their regional impact.

All anticipated impacts to wildlife from the Bypass Channel Alternative would be concentrated in Dawson County, Montana, and likely cause the degradation of County-regulated and protected wildlife resources, including big game winter range, waterfowl nesting areas, habitat for rare or endangered species, and wetlands (Dawson County, Unknown year; MFWP 2012). Big game winter range for mule deer, white-tailed deer, and pronghorn all occur in the project area and would be degraded by the Bypass Channel Alternative, and are also protected by the State of Montana (MFWP 2012).

Actions to minimize effects would include:

- Conducte pre-construction survey for wildlife prior to the start of each year's work. If wildlife are observed, identify the type and timing of use, and important biological information important to minimize impacts.
- If appropriate, establish construction buffers around sensitive wildlife, such as an active bird nests.
- At the start of construction, a wildlife biologist would provide awareness training to the construction crew to educate them on sensitive wildlife resources they may encounter during construction, and provide a protocol and contacts to call if any listed species or other sensitive wildlife are observed on site during construction.
- Areas potentially hazardous to wildlife will be adequately protected (e.g., fenced, netted) to prevent access that could lead to their harm.
- To protect wildlife and their habitats, project-related travel will be restricted to existing roads and easements. No off-road travel would occur, except with prior approval. Speed limits will be followed at all times and drivers should be cognizant of safely avoiding vehicle strikes. Species at particular risk to vehicle strikes include ungulates during crepuscular hours, various bird species, snakes, and small and mid-sized mammals. Driver safety remains paramount, and would be maximized by following this guidance for minimizing vehicle strikes of wildlife.
- Removal and/or degradation of specific habitat features identified as important to wildlife would minimized to the extent possible. Examples include large snags, patches of mature riparian forest, and native grassland and shrubland habitat.
- Wildlife-proof fencing will be used on reclaimed areas, if it is determined that wildlife species and/or livestock are impeding successful vegetation establishment.
- All riverbank disturbance areas will be inventoried for potential turtle nesting habitat. If turtle nesting habitat or evidence of turtle nesting is found in construction areas, construction in these areas will be restricted during June and July, or approved mitigation measures will be implemented.
- Effort would be made to reestablish native vegetation and habitat comparable to that disturbed and/or destroyed by construction activities. This would include minimizing the establishment of invasive plant species, which greatly degrade the quality of native habitats.

6.0 Potential Impacts on Special Aquatic Sites (Subpart E)

6.1 SANCTUARIES AND REFUGES

6.1.1 Existing Conditions

There are no sanctuaries or refuges in the study area.

6.2 WETLANDS

6.2.1 Existing Conditions

A diversity of wetland types are found within the study area, and are classified according to Cowardin et al. (1979). Floodplain and depressional wetlands have formed primarily from alluvial processes. Willow shrublands are found in floodplains, around beaver ponds and lakes, and non-willow shrublands are found in springs and seeps along streams (Jean and Crispin 2001).

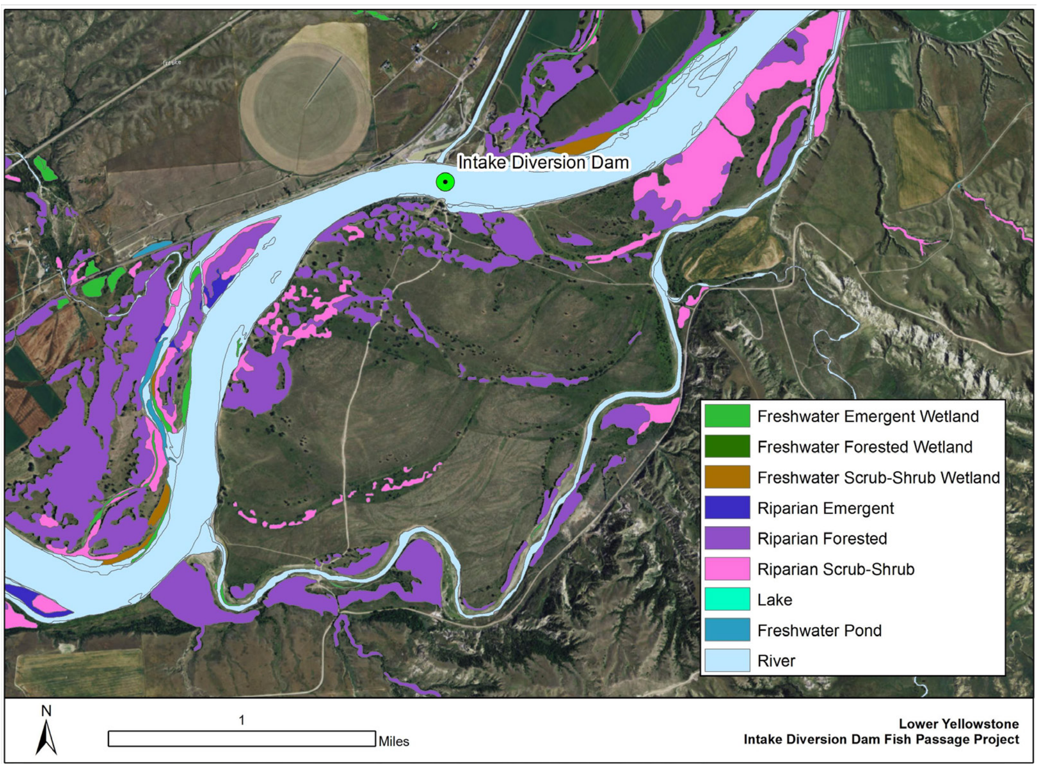

Figure 6-1 Riparian land and Wetlands in the Study Area

Palustrine emergent wetlands are the most common type of wetlands in the study area and typically contain persistent erect, rooted herbaceous vegetation. Depressional wetland can be either open or closed, depending on whether the water source is connected to groundwater or surface draining systems or completely isolated from drainage systems (McIntyre et al. 2010). Dominant graminoids found in these types of wetlands include foxtail barley (*Hordeum jubatum*) and western wheatgrass (*Pascopyrum smithii*) on drier sites; and bulrush (*Schoenoplectus* spp.), sedges (*Carex* spp.), cattails (*Typha* spp.), and bluejoint reedgrass (*Calamagrostis canadensis*) on wetter sites (Corps and YRCDC 2015). Halophytic species such as saltgrass (*Distichlis spicata*) and Nuttall's alkaligrass (*Puccinellia nuttalliana*) occur on sites with saline soils.

Palustrine scrub-shrub wetlands are associated with streams and rivers within the study area. These types of wetlands are dominated by woody vegetation less than 20 feet tall. Native species in scrub/shrub wetlands are red-osier dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana*), western snowberry (*Symphoricarpos occidentalis*), silver buffaloberry (*Shepherdia argentea*), silverberry (*Elaeagnus commutata*), sandbar willow (*Salix exigua*), peach-leaf willow (*Salix amygdaloides*), several cottonwood species (*Populus* spp.), and Rocky Mountain juniper (*Juniperus scopulorum*) (Corps and YRCDC 2015). In many cases, this wetland type represents transitional plant communities of younger age classes of forest communities.

Palustrine forested wetlands are dominated by trees taller than 20 feet and are typically classified as seasonally flooded. Cottonwood species are the tallest and most visible native woody species, Great Plains cottonwood (*Populus deltoides*) being the dominant species. Other native woody species such as peach-leaf willow, sandbar willow, yellow willow (*Salix lutea*) and green ash (*Fraxinus pennsylvanica*) are present throughout (Corps and YRCDC 2015).

Riverine wetlands include lower perennial unconsolidated bottom wetlands which are low gradient and have a slow water velocity. Substrates in this system are predominantly sand and mud and floodplains are usually well developed. Also present are lower perennial unconsolidated shore wetlands which are the shorelines to low gradient rivers that have less than 75% areal cover of stones, cobbles, boulders or bedrock and less than 30% vegetative cover. These shorelines are also irregularly exposed due to flooding and drying.

Mountain alder (*Alnus incana*), water birch (*Betula occidentalis*), and Western snowberry (*Symphoricarpos occidentalis*), silver sagebrush (*Artemisia cana*), chokecherry, and red-osier dogwood are common along riverine floodplains (Corps and YRCDC 2015).

The Corps conducted a wetland delineation in the study area in 2012 (Corps 2015c). This field investigation confirmed the presence of a seep spring, wetlands, and intermittent waterway near the western boundary of the waste pile site in a drainage way that connects to a side channel of the Yellowstone River. The side channel of the Yellowstone River that flows around Joe's Island had a gravel/cobble bed that was intermittently exposed and contained patchy emergent wetlands. Flow was not apparent during the investigation.

6.2.2 Potential Impacts

6.2.2.1 No Action Alternative

There would be no effects on wetlands resulting from the No Action Alternative.

6.2.2.2 Proposed Bypass Channel Alternative

Impacts to wetlands adjacent to the Yellowstone River would include the construction of the weir upstream of the existing weir, excavation of the bypass channel, bank modifications near the downstream entrance to the bypass channel, and filling of upstream portions of the existing side channel.

Weir construction would result in disturbance of approximately 3 acres of the river with riprap and cobble fill being placed in the river to stabilize the existing and new weirs. This impact on the riverine habitat will be minimal, as there is already large rock present in the low quality riverine habitat at the existing weir area, which would be converted to a shallower smaller rock substrate. There will be temporary effects on velocities and depths as the river is diverted from one side to the other with coffer dams.

Bank modifications by the weir and near the downstream entrance of the bypass channel would result in approximately 1 acre of fill being placed in the Yellowstone River where the current eddy forms on the south bank. The placement of fill in the existing high flow channel would eliminate 21 acres of existing seasonal channel habitat. These acres will be offset by the creation of approximately 64 acres of year-round riverine habitat that will be created by the excavation of the new channel.

Approximately 1 acre of palustrine emergent wetlands would be permanently filled by the proposed plug of the upstream portion of the existing side channel. This acre of palustrine emergent wetlands will be offset by the development of new wetland habitat along the proposed new bypass channel.

The existing high flow channel below the proposed channel plug would not be directly affected by construction activities but could be indirectly affected by the elimination of upstream flows due to the channel plug. Although the channel will no longer convey water it will still be backwatered from the Yellowstone River during spring runoff. The channel in these back water areas will have little to no velocity, which should encourage the growth of wetland vegetation. For operation and maintenance actions on the new weir and bypass channel, temporary access would occur on existing access routes, thus effects on wetlands would be negligible. The impacts would be minor to riverine habitat associated with temporary disturbance by placing rock. The need for rock replenishment would be substantially reduced from the existing condition resulting in less frequent maintenance activities.

Periodic replacement of riprap along the banks and bottom of the bypass channel could have temporary impacts on riverine habitat and adjacent wetlands by placement of riprap. The area of impact would be minimal and infrequent as the rock is designed to withstand expected velocities. Bypass channel maintenance may require a temporary coffer dam for removal of accumulated sediment. Temporary coffer dams could temporarily impact riverine habitat and wetlands, but the impact would be minor.

Actions taken to minimize effects would include:

- The disposal of waste material, topsoil, debris, excavated material or other construction related materials within any wetland, drainage way, stream or aquatic system would be minimized to the extent possible.
- Discharges of fill material associated with unavoidable crossings of wetlands or intermittent streams will be minimized to the maximum extent practicable.
- Low pressure equipment or pressure-spreading mats will be used as feasible to minimize compaction of wetland soils during construction.
- Rock quarry materials will come from approved upland sites.

6.3 MUDFLATS

There are no mudflats within the study area as defined in 40 CFR §230.42 as "broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems."

6.4 VEGETATED SHALLOWS

Vegetated shallows are defined in 40 CFR §230.43 as "permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number freshwater species in rivers and lakes." All existing vegetation in the study area would be considered emergent rather than rooted aquatic vegetation.

6.5 CORAL REEFS

There are no coral reefs in the study area.

6.6 RIFFLE AND POOL COMPLEXES

6.6.1 Existing Conditions

The Yellowstone River has naturally wide, shallow flows over sand and gravel substrate. Pools and riffles are formed by the natural hydrograph of high velocity spring flows interacting with the channel bed and shoreline. The presence of the Intake Diversion Dam alters that natural pool and riffle formation process, creating one large backwater pool behind the weir and one long riffle extending 300 feet downstream and spanning the 700 foot width of the river.

6.6.2 Potential Impacts

6.6.2.1 No Action Alternative

Under the No Action Alternative, the existing Intake Dam would continue to create a backwater pool behind the weir. The annual placement of rock along the weir crest would ensure continued presence of the rock/rubble field riffle.

6.6.2.2 Proposed Intake Project

Replacement of the existing weir with a concrete weir would not change the configuration of pools and riffles in the main channel.

Placement of fill in the existing side channel would eliminate side channel habitat and therefore any riffle and pool complexes present in this channel. However, this channel only conveys flows occasionally (at or above 20,000 cfs in the river), so if any riffle and pool complexes are present, they are likely to be of low quality due to sediment deposition and only occasional inundation. Construction of the new bypass channel would generally be similar to substrate and channel configurations present in natural side channels in the Yellowstone River. However, the cobble substrate is intended to be stable, so the formation of pools is unlikely.

7.0 Potential Effects on Human Use Characteristics (Subpart F)

7.1 MUNICIPAL AND PRIVATE WATER SUPPLIES

7.1.1 Existing Conditions

7.1.1.1 Lower Yellowstone Irrigation Project (LYP)

These districts and Reclamation jointly hold the following unadjudicated irrigation water rights in the state of Montana totaling 1,374 cubic feet of water per second (cfs):

- 1,000 cfs (Water Right No. 42M 40806-00)
- 300 cfs (Water Right No. 42M 40807-00)
- 18 cfs (Water Right No. 42M 40808-00)
- 42 cfs (Water Right No. 42M 40809-00)
- 14 cfs Provisional Permit (Savage Irrigation District only; Permit No. 97792-42M)

The period of use on the LYP water right is April 15 - Oct. 15, and Savage Irrigation District from April 1 - Oct. 31 (MDNRC, 2016). The oldest of these claims has a Priority Date of 1905 and a flow rate of 1,000 cfs. In addition to the 1,374 cfs claimed, LYP claims an additional 62.49 cfs for other water rights at Intake that include Stock watering and Domestic and Industrial Use.

The Intake Diversion Dam is maintained and operated by the Board of Control of the LYP. The LYP provides irrigation to about 58,000 acres of farmland along the Lower Yellowstone River. Acreage irrigated by the LYP is generally located between the main canal and the river in the Montana counties of Dawson and Richland, we well as in McKenzie County, North Dakota. The majority of the water is diverted between April 15 and October 15 each year.

The LYP facilities are owned by the Bureau of Reclamation but are operated and maintained by the water users via irrigation districts and the Board of Control of the LYP. The members of the Board of Control include Intake Project (Intake Irrigation District), Savage Unit of the Pick-Sloan Missouri Basin Program (Savage Irrigation District), and the Lower Yellowstone Irrigation Project Divisions One and Two (Lower Yellowstone Irrigation Districts One and Two). All of the irrigation districts obtain water from the LYP's main canal.

Most of the land that can by irrigated by the LYP is between the canal and the river. Since the early 1950s, both the agricultural economy and lands served by the LYP have remained relatively stable. In contrast to a dry-land farming trend towards larger, consolidated farms, the number of farm units on the LYP has dropped only slightly. Until recently, the primary irrigated crop was sugar beets with some small grains, alfalfa, and corn. Recently commodity prices have caused a shift to more corn and small grain production, with a corresponding decline in sugar beet acreage, though sugar beets are still the highest value crop, accounting for over half the total crop revenue in 2014 (Lower Yellowstone Project Board of Control 2009).

7.1.1.2 Tribal Water Rights

The United States government has recognized through the Winters Doctrine that tribes in the western United States (west of the Mississippi) may hold rights to water in streams running through or alongside the boundaries of their reservations (U. S. Supreme Court decision *Winters v. United States,* 1908). The Winters Doctrine will apply to any Indian water rights in Montana or along the Missouri River. When a reservation is established with expressed or implicit purposes beyond agriculture, such as to preserve fishing, then water may also be reserved in quantities to sustain use (U.S. Supreme Court *Arizona v. California* 1963). The Court held that tribes need not confine the actual use of water to agricultural pursuits, regardless of the wording in the document establishing the reservation. However, the amount of water quantified was still determined by the amount of water necessary to irrigate the "practicably irrigable acreage" on a reservation. The Court also held that the water allocated should be sufficient to meet both present and future needs of the reservation to assure the viability of the reservation as a homeland. Case law also supports the premise that Indian reserved water rights are not lost through non-use.

7.1.2 Potential Impacts

Under either the No Action or Bypass Channel Alternatives, Tribal water rights and irrigation needs would be protected as required.

7.2 RECREATIONAL AND COMMERCIAL FISHERIES

7.2.1 Existing Conditions

Recreation in the vicinity of Intake Diversion Dam and downstream to the Missouri River includes hunting, fishing, boating, camping, picnicking, walking/hiking, and scenic and wildlife viewing within recreation areas located along the river. Recreation facilities range from open space with no amenities to established camping areas water and vault toilets.

Game fish in the Lower Yellowstone River include paddlefish, shovelnose sturgeon, walleye, sauger, catfish, bass, and trout. The protected pallid sturgeon must be released if caught. Fishing is a popular activity on the river along the whole length between Intake and the state line. The City of Sidney has two annual catfish tournaments, and two additional tournaments were proposed in 2015, one at Miles City, and one at Savage (Corps and YRCDC 2015).

The most popular game fish is the paddlefish, with nearly half of the annual visitation to the site occurring during the paddlefish season, which occurs during May and June. Visitors enjoy paddlefish snagging as a family tradition, and visitors come from all over, including other states, to participate in paddlefish snagging.

Paddlefish anglers come from all over the state to participate in the sport at Intake. Paddlefish congregate on the downstream side of the Intake Diversion Dam, presenting a very accessible location for paddlefish snagging. Fishing by boat is prohibited within a quarter-mile downstream of the weir during paddlefish season.

The MFWP monitors the number of paddlefish caught and closes the season when the quota is met. In 2015, the total quota was 1,000 paddlefish caught in the Missouri River downstream of Fort Peck Dam and the Yellowstone River. Intake FAS has its own annual limit of 800 fish. In 2015, the harvest season lasted from May 15 through June 3, with catch-and-release closing on June 13 (Stuart 2015). The 2015 season was atypically long at Intake. In some years, the quota is met in a week (Reclamation and Corps 2015).

Montana law prohibits commercialization of fish and wildlife; however, special state legislation authorizes a MFWP-designated Montana non-profit corporation to accept paddlefish roe donations and process and market the roe as caviar. The MFWP issues a yearly memorandum of understanding to one non-profit corporation for this opportunity, which has been the Glendive Chamber of Commerce and Agriculture since the inception of the program in 1990.

7.2.2 Potential Impacts

7.2.2.1 No Action Alternative

Future recreational fishing activities will remain the same without the proposed project.

7.2.2.2 Proposed Bypass Channel Alternative

The Bypass Channel alternative would have a variety of adverse effects on recreation resources in the study area during construction, most of which are concentrated at Intake FAS and Joe's Island. Temporary effects on the quantity and quality of recreation from the presence of construction activities are judged to minor to moderate, and less than significant. To the extent possible, construction activities will be minimized within, or occur outside of, the Intake FAS area during the paddlefish season.

From the perspective of effects on recreation, the operation of the Bypass Channel would result in mostly beneficial effects. Beneficial effects on recreation from the Bypass Channel include the creation of additional channel area that would be open for recreation use, including boating. A navigable bypass channel would also provide boaters easier access to the upstream side of the Intake Diversion Dam from the Intake FAS boat ramp. Visitation to Joe's Island may also increase in the short term as visitors explore the new channel.

The bypass channel could also improve fishing opportunities upstream of the Intake Diversion Dam. Paddlefish would still be expected to stack up downstream of the Intake Diversion Dam, but would also have the opportunity to move further upstream. Paddlefish could potentially travel as far upstream as the Cartersville irrigation dam, at Forsythe (RM 238.6). Upstream spawning by paddlefish could result in an increase in paddlefishing opportunities upstream of Intake over the long term, which would in turn increase visitation and use of upstream fishing access sites. In the short term, beneficial effects may be minor to moderate as anglers monitor and adapt to changes in the recreational fishery.

With changes in the location of fishing opportunities, and a potential reduction in the availability of fish at the downstream end of the Intake Diversion Dam, use of the Intake FAS may be reduced. Overall, the adverse operational effects of the selected alternative on recreation would be minor and less than significant, while there would be moderate beneficial effects.

Additional actions to minimize effects identified for the Bypass Channel alternative include:

- Reclamation and MFWP would meet to evaluate and coordinate closures at the FAS and Joe's Island to recreational use, including closure of construction zones to swimming, fishing, boating, hiking, camping, hunting, etc. on one or both sides of the river.

7.3 WATER RELATED RECREATION

7.3.1 Existing Conditions

Boating is allowed on the lower Yellowstone River, and access is provided via boat ramps at the various fishing access sites on the river. The Intake FAS provides a concrete boat ramp below the weir. The nearest upstream access is at the Black Bridge FAS, in Glendive, which has a concrete boat ramp. Downstream of Intake, the Elk Island FAS provides a gravel boat ramp at the downstream end of the site, and an older concrete ramp at the upstream end of the site that may not be usable except during high flows.

Boaters occasionally pass downstream over Intake Diversion Dam. Most boaters launching from the Intake FAS are heading downstream for fishing, hunting, boat touring, or pulling persons on inner tubes or other flotation devices. Waterskiing is not a popular recreational activity at Intake FAS. Intake FAS may also be used by boaters to access Joe's Island.

Activities other than fishing and boating that visitors may engage in at the study area include swimming, wildlife viewing, ice fishing, picnicking, and other general day uses, such as nature appreciation, that are dependent or enhanced by the river's presence. Swimming may be dangerous near Intake due to rough water and submerged obstacles, and is discouraged by posted signs. Picnicking and day use facilities are open to the public at no cost, and may be used throughout the year. While most fishing visitation occurs during the spring, summer, and fall, anglers do engage in ice fishing during the winter. Because of the weir, the river does typically freeze over at Intake FAS, and anglers typically fish upstream or downstream of the weir.

7.3.2 Potential Impacts

7.3.2.1 No Action Alternative

No changes to boating opportunities will result from the No Action Alternative.

7.3.2.2 Proposed Bypass Channel Alternative

During construction, the Intake FAS will remain open to boaters. Following construction, there will be no change in the availability of boat access from the Intake FAS. Navigation above the

Intake Diversion Dam will remain available as it is now and safety may be slightly improved with the replacement concrete weir. During construction, Joe's Island will be closed to visitors, but will reopen after the project is completed.

7.4 AESTHETICS

7.4.1 Existing Conditions

From points on and near the Intake Diversion Dam, views would include the wide, turbid stretch of the Yellowstone River, industrial headworks at the entrance of the main canal and the canal itself, a network of unpaved roadways, lands with exposed dirt, rock and sand shoreline along the river, agricultural lands and sparse cottonwood gallery and other vegetation communities. In winter, snow and ice may cover the area, creating a white expanse dotted by defoliated trees. In summer, the study area has a dichotomy of aesthetics, with areas around the canal and headworks having a barren and industrial appearance in contrast to the river and green cottonwood galleries providing a more natural look. On the south shore of the river, sandy shorelines, grasslands, shrublands, and cottonwood gallery comprise the visual environment. Distant views from higher points within the site are of the low elevation bluffs that are part of the Great Plains Badlands. Joe's Island is directly south of the Intake Diversion Dam and is an approximately 1,400 acre island formed by a side channel to the Yellowstone River. The island topography is shaped by overbank flooding and formation of side channels. Cottonwoods and other riparian trees and vegetation occupy the depressions where these old side channels once flowed, while a combination of native and non-native prairie and shrub steppe occupy the remaining areas. There are no homes, but a modest network of dirt roads provides access to most of the island, including the right bank cableway tower. Distant views of low badlands bluffs can be seen to the south. Visitors to this area would primarily and most often include recreationists.

7.4.2 Potential Impacts

7.4.2.1 No Action Alternative

There would be no changes to the study area under the No Action Alternative, and therefore, no changes to visual resources.

7.4.2.2 Proposed Bypass Channel Alternative

Construction of the new weir for the Bypass Channel Alternative would result in changes to visual conditions during and after construction. These include the temporary presence of mobile and fixed construction equipment onsite at Intake FAS and Joe's Island, for an estimated three years, which would vary with season and would be experienced by a a variety of viewer groups. Once construction is complete, most areas disturbed for weir construction would be returned to pre-construction conditions via reseeding and equipment removal. Overall, construction of the Bypass Channel Alternative is expected to have a moderate and less than significant effect on visual conditions.

New permanent features would include the bypass channel with armoring, infill of the existing side channel, placement of spoils, and access roads. The new bypass channel would receive a portion of the Yellowstone River flow on a year round basis. The existing side channel only conveys water during higher flows. In general, the overall visual condition would not change, since one high flow channel is replaced with another, with the new one operating similarly to the old one. Over time, revegetation would obscure traces of channel construction, eventually approaching a more natural appearance.

Measures taken to minimize effects at the project site would include:

- Minimize footprints of construction as much as possible to limit areas of effect.
- Restrict construction or staging from using areas that are subject to erosion.
- Minimize haul and access road use and improve those roads that would become permanent.
- Strategize construction schedule to minimize truck, equipment, and personnel presence.
- Minimize footprint of clearing and grubbing to protect as much existing vegetation as possible.
- Minimize stream crossings and restore shoreline or instream habitat that are damaged.
- Mulch and reseed areas that are cleared after construction is complete to facilitate return to vegetated conditions.
- Limit operation and maintenance to annual or emergency basis to reduce onsite equipment and personnel.

7.5 PARKS, NATURAL AND HISTORIC MONUMENTS, NATIONAL SEASHORES, WILDERNESS AREAS, RESEARCH SITES, AND SIMILAR PRESERVES

7.5.1 Existing Conditions

There are no parks, natural or historic monuments, national seashores, wilderness areas, research sites or other similar preserves within the study area or vicinity.

7.6 OTHER FACTORS IN THE PUBLIC INTEREST

7.6.1 Cultural Resources

7.6.1.1 Existing Conditions

A total of 27 sites have been previously recorded within the study area (Table 7-1), three of which are within the APE of the Proposed Project: 24DW287, 24DW443, and 24DW447. (24DW287 and 24RL204 are both portions of the Lower Yellowstone Irrigation Project main canal in Dawson and Richland counties; however sections in different counties are given different identifying site trinomials.) All three resources are NRHP-eligible and considered historic properties for this analysis. It is unclear at this time if any of the resources recorded within the study area are within the alternatives.

- 24DW287 is the main canal of the Lower Yellowstone Irrigation Project, described above. The site is a contributing element to the Lower

Yellowstone Irrigation Project Historic District and is considered an NRHP-eligible historic property.

- 24DW443 is the Lower Yellowstone Irrigation Project Diversion Dam, described above. The site is a contributing element to the Lower Yellowstone Irrigation Project Historic District and is considered an NRHP-eligible historic property.
- 24DW447 is the site of the Lower Yellowstone Irrigation Project Headworks Camp/Gate Tender Residence, described above. The site is a contributing element to the Lower Yellowstone Irrigation Project Historic District and is considered an NRHP-eligible historic property.

Table 7-1 Previously conducted surveys in study area

SHPO Document Number	Author	Date	Title
DW 6 2401	Herbort, Dale P.	1980	Cultural Resource Evaluation Belle Prairie and Box Elder Reservoir
DW 4 2348	Huppe, Katherine M.	1981	Cultural Resource Reconnaissance of a Portion of Montana Department of Highways Project FR20-1(1)19, Glendive-Sidney, and associated Materials Sources
DW 6 2406	Pearson, Jay, et al.	1981	A Class III Intensive Inventory for all Cultural Resources along the Proposed Route of the Montana -Dakota Utilities Cabin Creek to Williston Pipeline From the Sacomorgan Creek Line to the Richland-Dawson County Line
DW 6 2411	Aaberg, Stephen A.	1984	Intake State Recreation Area
RL 6 20052	Davis, Leslie B.	1984	1983 Effort, Nollmeyer (Letter Report to Dr. Ann Johnson, NPS)
RL 4 8931	Wood, Garvey C.	1985	Hilde Construction – Molly Eidness Pit (Pit 136-3)
DW 4 2352	Rossillon, Mitzi	1987	A Cultural Resources Inventory at the Bridge Over the Diversion Canal at Intake
RL 4 30084	Vinson, Edrie L.	1988	Lower Yellowstone Project Main Canal Bridge U.S. Reclamation Service 1907-1908
RL 6 13050	Coutant, Brad A.	1991	Fifteen Assorted Structures on the Lower Yellowstone Irrigation District, Richland County, Montana
DW 6 15872	Tingwall, Douglas, et al.	1994	Intake Fishing Access Site Class III Cultural Resource Survey Results
RL 4 15917	Platt, Steve	1994	District 4 MCS Sites
DW 6 23072a	Kordecki, Cynthia, et al.	2000	Lower Yellowstone Irrigation Project, 1996 and 1997 Cultural Resources Inventory, Dawson and Richland Counties, Montana and McKenzie County, North Dakota
RL 6 23550	Brumley, John H.	2000	A Cultural Inventory of 14 Bridge Projects Areas within Richland County, Montana
ZZ 6 23753a	Kordecki, Cynthia, et al.	2001b	Lower Yellowstone Irrigation Project, 1996 and 1997 Cultural Resources Inventory, Dawson and Richland Counties, Montana and McKenzie County in North Dakota
DW 4 24430	Aaberg, Stephen A. and Chris Crofutt	2002	30 KM Northeast of Glendive Northeast Class III Cultural Resource Survey Results In Dawson County and Richland County Montana
RL 6 24567	Vincent, William B.	2002	Notification of Undertaking – Proposed Replacement of a Deteriorated Chute at the Savage Spillway Structure and Associated Bridge in

SHPO Document Number	Author	Date	Title
			Richland County Montana
RL 6 30349	Boughton, John, et al.	2008	Williston Basin Interstate Pipeline Company: A Cultural Resource Inventory Along the Cabin Creek-Williston Pipeline, in Richland County, Montana
DW 6 34023a	Vincent, William B.	2009	Test Drilling Near the Lower Yellowstone Diversion Dam and Canal, Dawson County, Montana
DW 6 34030a	Vincent, William B.	2009	Intake Diversion Dam Modification, Lower Yellowstone Project
DW 6 34186a	Toom, Dennis, et al.	2011	Headworks Camp (24DW0447) Historic Site archaeological Excavations, Dawson County, Montana
RL 2 35413	Brooks, Brittany A.	2013	Weber 24-30-1H, 2H, 3H & 4H Well Pad and Access Road: A Class III Cultural Resource Inventory in Richland County, Montana
RL 6 34235	O'Dell, Kevin C.	2013	A Class III Cultural Resource Survey for Mercury Towers' Mt46467 Savage Communications Tower in Richland County, Montana
RL 6 36650	Person, Amanda C. and Wade K. Burns	2013	Lower Yellowstone Irrigation Canal/Drain Crossings: A Class III Intensive Cultural Resource Inventory in Richland County, Montana
RL 6 36909	Littlestrand, Eric and Wade K. Burns	2013	Balducki, Yellowstone Farms, and Oberfall Borehole Locations: A Class III Intensive Cultural Resource Inventory in Richland County, Montana
RL 6 37204	Livers, Michael C.	2013	Lower Yellowstone Irrigation Project PW # 1442 DR 1996: A Cultural Resource Survey for the Lateral HH Replacement Project, Richland County, Montana
ZZ 5 34260	Rennie, Patrick	2013	Cultural and Paleontologic Resources Inventory of Six Parcels of State Land in Custer, Garfield and Richland Counties
RL 2 37039	Brooks, Brittany A.	2014	Asbeck 12-31-1H, Asbeck Federal 13-31-2H, 13-31-3H, and 13-31-4H Well Pad and Access Road: A Class III Intensive Cultural Resource Inventory in Richland County, Montana

a. Survey conducted within APE of Proposed Project.
b. Survey ZZ 6 23753 is listed in SHPO's database with a date of 2001. However, the report title page indicates a date of 2000. Therefore, the report is referenced in this document as Kordecki, et al. (2000).

Kordecki, et al. (2000; Survey Report ZZ 6 23753) documents a survey of the Lower Yellowstone Irrigation Project completed in 1996 and 1997 as part of compliance efforts ahead of the 2010 EA. Kordecki, et al. (2000; Survey Report DW 6 23072), Vincent (Test Drilling Near the Lower Yellowstone Diversion Dam and Canal, Dawson County, Montana 2009), and Vincent (Intake Diversion Dam Modification, Lower Yellowstone Project 2009) are Section 106 consultations that were based on the work of Kordecki, et al. (2000; Survey Report ZZ 6 23753).

The systematic pedestrian survey of Kordecki, et al. (2000; Survey Report DW 6 23072) covered all linear features (i.e. canals and laterals) of the irrigation system as well as all Reclamation-owned and administered lands along the system that had not been previously surveyed. Survey of the system's linear features totaled 288 miles: 71.6 miles of main canal and 202 miles of laterals. The Reclamation-owned and administered lands were surveyed in 12 blocks totaling 3,082 acres. The survey identified a total 12 historic engineering and architectural sites directly related to the Lower Yellowstone Irrigation Project (in addition to several bridges associated with the initial construction of the system) and 25 prehistoric archaeological sites (20 newly recorded and five previously recorded sites that were updated by the survey). The historic sites include the Lower

Yellowstone Diversion Dam (24DW443), the Lower Yellowstone Main Canal and Lateral System (24DW287/24RL204/32MZ1174), the Savage Sluiceway (24RL142), the Intake Pumping Plant (24DW446), the Thomas Point Pumping Plant (24RL231), the Savage Irrigation Unit (24RL275), the Headworks Camp/Gate Tender Residence (24DW447), the Crane Canal Rider Residence (24RL277), the Savage Headquarters Camp (24RL209), the Ridgelawn Camp (24RL80), the Fairview Canal Rider Residence (24RL208), and the Lateral LL Reclamation Building (24RL283). These sites represent a NRHP-eligible historic district, although the pumping plant component of the Savage Irrigation Unit and the Crane Canal Rider Residence are not considered contributing elements to the district.

Toom, et al. (2011; Survey Report DW 6 34186) documents a large-scale data recovery archaeological excavation at the Headworks Camp (24DW447). The excavations were conducted as mitigation for impacts related to the Project as proposed in the 2010 EA and 2015 Supplemental EA and as required by the 2010 memorandum of agreement discussed above. The excavation sought to examine the relationships between structural features, status-diagnostic artifacts, and social stratification within the camp, as reflected in the archaeological record. Although many period artifacts of interest were recovered, very few structural features of original camp buildings, such as foundations, were found, making it impossible for the researchers to achieve their primary goal of answering questions of social stratification.

7.6.1.2 Potential Impacts

No Action Alternative

No changes would result to cultural resources under the No Action Alternative.

Proposed Bypass Channel Alternative

Direct, major impacts are anticipated during construction under this alternative as a result of the excavation of the bypass channel and use of the stockpile area and haul roads. The alignment of the bypass channel would require relocation of the historic south rocking tower and boiler building on Joe's Island, both of which are features of 24DW0443. Although the structure and building would not be destroyed, their removal from their historic location and setting would be considered adverse effects under Section 106 of the NHPA. This impact was considered under the previous Draft and Supplemental EAs in 2010 and 2013. Mitigation for the impact was agreed upon in the June 2010 Memorandum of Agreement, which resulted in documentation of the buildings and structures. The parties to the Memorandum were to consult and determine if any additional or different mitigation was warranted. Until the Memorandum is re-initiated and the additional consultations completed, the potential for direct, major impacts remains.

The proposed locations of the coffer dams at the upstream entrance and downstream exit of the bypass channel as well as the around the new weir is unclear at this time. Although impacts at the upstream entrance are not anticipated due to a lack of recorded cultural resources there, impacts at the downstream exit may occur if the coffer dam is placed over and into the existing weir. One of the haul/access roads to be improved passes through the northern boundary of 24DW0296. Although the road is existing, widening of it within the site boundaries may result in adverse effects under Section 106 of the NHPA. Sites 24DW0430, 24DW0431, and 24DW0442 are within the footprint of the stockpile area. Site 24DW0431 is also partially within the staging area, however impacts to this NRHP-ineligible resource would not be considered adverse under Section 106. While capping of sites 24DW0430 and 24DW0442 could be considered beneficial and protective impacts, it also makes access to the resources difficult for future study or traditional use. Further, if construction equipment were to drive across the sites while depositing materials or otherwise disturb the sites, it would be considered an adverse effect under Section 106 of the NHPA. The above described adverse effects would also be considered direct, major impacts under NEPA.

Excavation of the channel would be extensive. Although the entirety of the construction footprint has been surveyed for cultural resources (outside of active river channels), there is potential for intact subsurface archaeological resources to exist within this alluvial island. Disturbance of these potential historic properties would be considered an adverse effect under Section 106 of the NHPA and a direct, major impact under NEPA.

Measures taken to minimize effects to cultural resources would include:

- MM-CR-01: Impacts on Intake Diversion Dam (24DW0443) may be mitigated to minor or moderate through detailed recording of the structure. Engineering drawings and photographs of the dam would be filed with the SHPO and National Archives. If engineering drawings and photographs are unavailable, the dam would be recorded in accordance with the Historic American Buildings Survey and the Historic American Engineering Record.
- MM-CR-02: Impacts on the Old Cameron and Brailey Sub Camp (24DW0298) may be mitigated to no effect through avoidance. If avoidance is infeasible, impacts may be mitigated to moderate through data recovery of the archaeological site under an approved research design.
- MM-CR-03: Potential impacts on unidentified cultural resources in unsurveyed portions of the APE may be reduced to no effect through avoidance of unsurveyed areas. If avoidance is infeasible, impacts may be mitigated to minor or moderate by surveying such areas within the APE. Additional mitigation measures may be necessary to avoid impacts on newly identified resources/potential historic properties as a result of the survey.

7.6.2 Activities Affecting Coastal Zones

There are no coastal zones within the study area.

7.6.3 Navigation

7.6.3.1 Existing Conditions

Recreational boating is allowed on the Yellowstone River. There is no commercial use of the river.

7.6.3.2 Potential Impacts

No Action Alternative

No changes to boating opportunities will result from the No Action Alternative.

Proposed Bypass Channel Alternative

During construction, the Intake FAS will remain open to boaters. Following construction, there will be no change in the availability of boat access from the Intake FAS. Navigation above the Intake Diversion Dam will remain available as it is now. Actions taken to minimize effects would be the same as those for Section 7.2 Recreational and Commercial Fisheries.

8.0 Evaluation and Testing of Discharge or Fill Material (Subpart G)

The evaluation procedures and testing sequences outlined in Subpart G are intended to support the determinations concerning the suitability of the material proposed for discharge into waters of the United States.

8.1 GENERAL EVALUATION OF DREDGED OR FILL MATERIAL

All materials discharged as fill would be obtained from on-site or a source that meets the standards for suitability of material. This would generally mean that any materials imported to the project area would have low or non-detectable levels of contaminants that are not expected to have significant adverse impacts on water quality or biota in the short or long term.

9.0 Actions to Minimize Adverse Effects to the Aquatic Environment (Subpart H)

9.1 GENERAL

The overall outcome of the proposed Bypass Channel Alternative is beneficial to the endangered pallid sturgeon, as well as other fish species that would benefit from providing upstream passage above the Intake Diversion Dam. However, there may be adverse effects resulting to aquatic resources as a result of construction or operation. General conservation recommendations include a variety of measures intended to minimize the adverse effects to each of the aquatic environment. Specific measures to avoid or reduce the effects of construction have been included above for each applicable resource area, as described in Sections 4, 5, 6, and 7. General or additional details are provided below.

a. Work Window. To minimize effects to pallid sturgeon or other sensitive fish species, construction shall primarily occur during summer low flows or other low flow periods outside of the migration period (mid April to July).

b. Notice to Contractors. Before beginning work, all contractors working on site shall be provided with a complete list of permit conditions, reasonable and prudent measures, and terms and conditions intended to minimize the amount and extent of take resulting from in-water work.

c. Minimize Impact Area. The applicant will confine construction impacts to the minimum area necessary to complete the project.

d. Fish Capture and Removal. Whenever work isolation is required and ESA-listed fish are likely to be present, the applicant must attempt to capture and remove the fish as follows:

   i. A fishery biologist experienced with work area isolation and competent to ensure the safe capture, handling and release of all fish will supervise this part of the action.

   ii. Any fish trapped within the isolated work area must be captured and released using methods prudent to minimize the risk of injury, then released at a safe release site.

e. Pile Driving. Vibratory pile driving shall be used to the maximum extent practicable.

f. Pollution Control Plan. The applicant will implement a pollution control plan (PCP) to prevent pollution caused by construction activities from entering the river. The PCP must have the following components:

   i. The name and address of the party responsible for accomplishment of the PCP.

   ii. Practices to prevent contaminant releases associated with equipment and material storage sites and fueling staging areas.

iii. A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
iv. A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
v. Practices to prevent debris from dropping into any stream or waterbody, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.
vi. During construction activities, monitoring will be done as often as necessary to ensure the controls discussed above are working properly. If monitoring or inspection shows that the controls are ineffective, work crews will be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.

g. The applicant will maintain an absorptive boom during all in-water activities to capture contaminants that may be floating on the water surface as a consequence of construction activities.

9.2 MONITORING, ADAPTIVE MANAGEMENT, AND MAINTENANCE

In order to ensure the effectiveness of the proposed bypass channel, Reclamation will implement a long-term monitoring and adaptive management plan. A plan was developed in 2015 (Reclamation 2015) and is being implemented to determine the effectiveness of the headworks and screens that were designed to reduce entrainment into the main irrigation canal. The plan developed in 2015 was designed to evaluate key project uncertainties related to the design, performance, and biological response of pallid sturgeon and other fish species. The Service has developed further biological criteria that would indicate success of the proposed bypass channel (Service 2016) based upon the overall goal of unimpeded movement by pallid sturgeon through the free-flowing Lower Yellowstone River. Thus, a revised monitoring and adaptive management plan has been prepared to address both the physical and the biological criteria that would indicate success of the project and are summarized below.

Bypass Channel Design and Performance

- Document whether the bypass channel consistently meets the physical and biological criteria currently recommended.

Pallid Sturgeon

- Document whether motivated adult pallid sturgeon pass upstream of Intake Diversion Dam during the spawning migration time period (April 1 – June 15). If ≥ 85% of telemetered fish passed upstream without substantial delay the passage way would be considered successful (Service 2016).

- Conduct field and laboratory swimming capability studies of juvenile pallid sturgeon to determine if upstream juvenile passage is reasonably expected to occur and if upstream passage would benefit condition, growth, and survival of juveniles. Develop decision criteria to trigger adaptive management options to improve passage for juveniles if the lack of juvenile passage is demonstrate to result in negative population level effects.
- Monitor adult sturgeon passing downstream of Intake Diversion Dam for injury or evidence of adverse stress to ensure that mortality of adults passing downstream does not exceed 1% during the first 10 years of project implementation.
- Monitor the irrigation canal below the screens and the river immediately downstream of the boulder field below Intake Diversion Dam to assess potential injury and mortality to free-embryo, larvae and young-of-year sturgeon. Experiments could be undertaken including the release of free-embryo pallid or shovelnose sturgeon upstream of the weir to assess entrainment or impingement at the screens and injury from drift over the weir crest and through the rock rubble field.

Native Fish

- Document if other native fish are able to migrate upstream and downstream of the proposed weir and bypass channel.

10.0 Analysis of Practicable Alternatives

The Yellowstone Intake Diversion Dam Fish Passage Project Environmental Impact Statement provides an analysis of alternatives considered. The purpose of the project is to restore access to pallid sturgeon of upstream habitat for population recovery. The Intake Diversion Dam prevents upstream passage of endangered pallid sturgeon. Necessarily, the project must be designed for modifications that occur within and adjacent to the waters of the Yellowstone River at the Intake Diversion Dam. Reclamation has determined that the proposed restoration plan is the most cost effective and feasible alternative to achieve the project purpose in a manner that is designed to avoid unacceptable adverse impacts to the aquatic ecosystem. Sections 10.1 through 10.6 summarize the findings per the CWA Section 404(b)(1) alternatives analysis criteria.

10.1 SITE AVAILABILITY

Pursuant to the CWA Section 404(b)(1) regulations, an alternative is practicable if it is available to meet and capable of meeting the project purpose, among other considerations. The regulations at 40 CFR 230.1(a)(2) state "an area not presently owned by the applicant, which could be reasonably obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered." The project area includes the Intake Diversion Dam and surrounding areas and could not be accomplished at any other location.

10.2 COST EFFECTIVENESS

Pursuant to the CWA Section 404(b)(1) regulations, a determination of practicability must consider if fill or disposal can be accomplished at a reasonable cost (§230.10(a)(2)). All alternatives evaluated in the feasibility study require excavation, fill, and grading work in and adjacent to the Yellowstone River. To determine cost effectiveness, a cost effectiveness and incremental cost analysis (CE/ICA) was conducted to compare the costs and habitat benefits for each alternative. The proposed restoration plan is the most cost effective alternative to achieve all of the project objectives in a manner that is designed to avoid unacceptable adverse impacts to the aquatic ecosystem and other elements of the environment. The No Action Alternative does not itself provide an option for avoidance of all effects, as failure to provide fish passage upstream of the Intake Diversion Dam for pallid sturgeon may result in further endangerment of the species.

10.3 FEASIBILITY

The preferred alternative was determined to be the most practicable alternative considering cost, existing technology, and construction feasibility in light of the overall project purpose and need.

10.3.1 Technical Feasibility

The preferred alternative is constructable using common, existing technology and equipment. A construction contract had been let by the Corps for project construction in 2015, which is currently on hold until the overall project is approved.

10.3.2 Administrative Feasibility

Administrative feasibility refers to the requirements associated with coordinating with other offices and agencies, including statutory limits, waivers, and requirements for off-site actions. Overall, the administrative logistics increase as the project area and potential construction duration increases. Reclamation believes that the proposed restoration plan is the most administratively feasible alternative to achieve the project purpose in a manner that is designed to avoid unacceptable adverse impacts to the aquatic ecosystem.

10.4 AQUATIC IMPACTS FROM DISPOSAL

Potential aquatic impacts are discussed in Section 4 of this analysis. The No Action Alternative would have a substantial continuing adverse effect on pallid sturgeon populations by preventing passage upstream of the Intake Diversion Dam. The proposed restoration plan provides an alternative bypass channel for upstream passage that is a technically sound solution, which reasonably minimizes the discharge of dredged or fill material into waters of the U.S. Reclamation believes that the proposed restoration plan minimizes discharge to the maximum extent practicable and most effectively meets all of the project objectives.

10.5 CONSERVATION AND RECOVERY

Section 9 of this document provides a detailed set of potential avoidance and minimization measures as well as conservation measures that will reduce effects to any ESA-listed species and their critical habitat. Section 9 also includes a description of proposed monitoring actions that would be implemented post-construction.

10.6 LIMIT NUMBER OF SITES

The project area comprises the minimum area required to feasibly build a technically sound bypass channel for upstream passage of pallid sturgeon around the Intake Diversion Dam. The size and location of sites selected for discharge of fill material included in the proposed plan were determined in coordination with other resource agencies and stakeholders to assess a number of possible alternatives through the application of the cost, effectiveness, and implementability criteria. The proposed project results in a net removal of material from the floodplain and floodway and waters of the U.S.

11.0 Factual Determination

This section provides a summary of the detemrinations made for each component of the aquatic ecosystem evaluated in previous sections.

11.1 PHYSICAL SUBSTRATE DETERMINATIONS

The physical and chemical substrate conditions are described in Section 2 and Section 4. Potential impacts to the physical and chemical properties of the substrate are discussed in Section 4.1.2. The proposed project would result in temporary impacts to the existing substrate during construction. Measures to reduce effects would be implemented during construction to minimize disturbance to substrate as described in Section 9.

11.2 SUSPENDED PARTICULATES AND TURBIDITY DETERMINATIONS

Suspended particulates and turbidity existing conditions and potential impacts are described in Section 4.2. The proposed project would result in minor temporary and localized increases in suspended particulates in the project area. Measures to reduce effects would be implemented during construction to minimize suspended particulate materials and turbidity, as described in Section 9.

11.3 WATER QUALITY DETERMINATIONS

Water quality existing conditions are described in Sections 2 and 4. Potential impacts to water quality are described in Section 4.3.2. The proposed project would result in minor increases in turbidity and the potential for spills/leaks from construction equipment. Long-term beneficial effects include improvements to beneficial uses for Aquatic Life, specifically through providing upstream fish passage. There are no long-term adverse impacts identified. Measures to reduce effects would be implemented during construction to minimize potential water quality impacts as described in Section 9.

11.4 CURRENT PATTERNS, WATER CIRCULATION, AND FLUCTUATION DETERMINATIONS

Current patterns, water circulation, and fluctuation existing conditions and potential impacts are described in Section 4.4. The proposed project would have minor short-term effects on current patterns or water circulation in the project area due to coffer damming during concrete weir construction. The effects of these actions are anticipated to be negligible because they would be insignificant localized and temporary impacts. The project will result in much improved passage of endangered pallid sturgeon upstream of the Intake Diversion Dam.

11.5 SALINITY DETERMINATIONS

Salinity considerations are not applicable to the Yellowstone River.

11.6 AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

The aquatic ecosystem and organism existing conditions within the project area are described in Section 5. The proposed construction activities associated with the proposed restoration plan may have short-term impacts on primary and secondary productivity, benthic and epibenthic organisms, from short-term increases in turbidity, excavation and disturbance, foraging disruption, and fish handling and removal. Short-term upland impacts on terrestrial mammals and birds may result from potential increased noise and grading, which may result in disruption of foraging. Long-term effects include the opening of 165 miles of spawning habitat for endangered pallid sturgeon and other Yellowstone River fish. Impacts would be temporary and less than significant and upstream passage above the Intake Diversion Dam would represent a long-term benefit. Measures to reduce effects would be implemented during construction to minimize impacts to the aquatic ecosystem and organisms as described in Section 9.

11.7 RECREATIONAL, AESTHETIC, AND ECONOMIC VALUES DETERMINATIONS

Recreational, aesthetic, and economic existing conditions and potential impacts are described in Section 7. Potential effects of the proposed project on human use characteristics would occur during construction and would be temporary. Impacts to historic and cultural resources are not likely. Recreation in the project area would be temporarily affected during construction on Joe's Island, but the Intake FAS would not be closed. Construction would be minimized or avoided, as possible, during paddlefish season. Impacts would be temporary and localized during construction. The completed project would not interfere with future recreation or navigation within the project area. Therefore, these impacts would be less than significant. Measures to reduce effects would be implemented during construction to minimize construction-related impacts as described in Section 9.

11.8 DETERMINATION OF CUMULATIVE IMPACTS ON THE AQUATIC ECOSYSTEM

Cumulative impacts are impacts on the environment that result from the incremental impact of actions when added to other past, present, and reasonably foreseeable future actions. The implementation of the proposed project would incrementally reverse the cumulative adverse impacts that have occurred to pallid sturgeon and the Lower Yellowstone River by allowing fish passage around the weir that has been a fish passage barrier for 100 years. Impacts from construction are short-term and minor and would not contribute substantially to cumulative effects.

11.9 DETERMINATION OF SECONDARY IMPACTS ON THE AQUATIC ECOSYSTEM

Secondary effects are "associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material" (40 CFR 230.11(h)(1)). Under CWA, secondary impacts are generally interpreted as indirect impacts. Therefore, secondary effects are limited to effects in the aquatic environment that are indirectly related to implementation of the action, such as minor erosion or downstream sedimentation.

12.0 Review of Conditions for Compliance

According to the guidance, "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 CFR 230.10 [a]). The potential for significant adverse impacts on the aquatic ecosystems resulting from implementation of the preferred alternative would be mitigated to the extent possible through the application of avoidance and minimization measures described in Section 9. The following subsections contain a review of conditions for compliance for the practicable alternatives assessed under the Yellowstone Intake Diversion Dam Fish Passage Project EIS.

12.1 AVAILABILITY OF PRACTICABLE ALTERNATIVES

Section 230.10 of Subpart B of the Section 404(b)(1) Guidelines further specifies four general conditions that must be met for compliance. These include consideration of practicability, compliance with the ESA, protections for water quality and human uses, and compliance with the avoidance, minimization, and compensatory mitigation requirements. The results of the analyses are summarized below.

12.1.1 Practicability (40 CFR Section 230.10(a))

A practicable alternative according to 40 CFR 230.10 is one that has a reasonable expectation of success in achieving the overall purpose and need, and is feasible to implement in consideration of cost, existing technology, and logistics. The alternatives are evaluated for compliance with the definition of practicability in the EIS and each were found to be practicable. However, the proposed alternative is the most cost effective, constructable, and sustainable.

12.1.2 Compliance with Water Quality Standards, ESA, and Protection of Habitat (40 CFR Section 2301.10(b))

Based on the evaluation of impacts in Sections 4, 5, and 6 of this document, the alternatives have been assessed for any cause of, or contribution to significant degradation to, waters of the U.S. Under 40 CFR 230.10(c), special emphasis on the persistence and permanence of the effects is considered in making the significant degradation determination. The potential impacts to the chemical and biological characteristics from the proposed restoration plan are generally low. The potential to release pollutants arises from the use of construction equipment (i.e. fuels and oils). Evaluation of the alternatives has indicated that implementation of the proposed project would not result in substantial water quality exceedances, and therefore would not result in significant degradation. The long-term result of the project would be improved fish passage, thus, improving a current 303(d) listing.

The analysis in the Biological Assessment prepared for this project (Appendix D) indicates that the proposed project will not result in jeopardy to any listed species or result in the destruction or adverse modification of critical habitat.

12.1.3 Protections for Water Quality, Special Aquatic Sites, and Human Uses (40 CFR Section 130.10(c))

This criteria involves prevention of significant degradation or significant adverse effects resulting from the discharge of pollutants on water supplies, fish and wildlife, aquatic organisms, and special aquatic sites; significant adverse effects on ecosystem diversity, productivity, or stability through the transfer of pollutants outside of the disposal site; and/or significant adverse effects on human use values (40 CFR 230.10 (c)(1) – (4)).

Based on this analysis, the proposed restoration plan would meet all applicable state water quality standards within appropriate compliance distances and durations and are not expected to violate any toxic effluent standard or prohibition under CWA Section 307.

12.2 COMPLIANCE WITH PERTINENT LEGISLATION

All of the practicable alternatives are expected to comply with pertinent legislation and treaty rights as described below.

- ESA: Formal consultation in process under Section 7 of the ESA.
- Section 106 of the National Historic Preservation Act: Section 106 consultations with the Montana State Historic Preservation Officer is in process.
- Section 401 of the CWA: A water quality certification would be obtained from the State of Montana

12.2.1 Treaty Rights

The proposed work would not affect treaty fishing rights or Indian Trust Assets and may have beneficial effects on overall fish populations.

12.3 POTENTIAL FOR SIGNIFICANT DEGRADATION OF WATERS OF THE UNITED STATES AS A RESULT OF THE DISCHARGE OF POLLUTED MATERIALS

As described in Section 8, any materials imported to the project area would have low or non-detectable levels of contaminants that are not expected to have significant adverse impacts on water quality or biota in the short or long term.

12.4 STEPS TO MINIMIZE POTENTIAL ADVERSE IMPACTS ON THE AQUATIC ECOSYSTEM

Finally, no discharge of fill shall be allowed unless all appropriate and practicable measures have been taken to minimize and avoid and then compensate for potential adverse impacts. Section 9 details the avoidance, minimization and conservation measures that would be applied to the proposed project.

13.0 Findings

This section describes findings of compliance or non-compliance with the restrictions on discharge per 40 CFR Section 230.12. These findings are supported by the factual determinations and conditions for compliance included in Sections 11 and 12.

13.1 ALTERNATIVES TEST

Based on the discussion above, are there available, practicable alternatives having less adverse impact on the aquatic ecosystem?

Yes ☐ No ☒ Not Applicable ☐

Based on the discussion above, if the project is in a special aquatic site and is not water-dependent, has the applicant demonstrated there are no practicable alternative sites available?

Yes ☐ No ☐ Not Applicable ☒

13.2 SPECIAL RESTRICTIONS

Would the project:

Violate state water quality standards?

Yes ☐ No ☒ Not Applicable ☐

Violate toxic effluent standards (under Section 307 of the CWA)?

Yes ☐ No ☒ Not Applicable ☐

Jeopardize endangered or threatened species or their critical habitat?

Yes ☐ No ☒ Not Applicable ☐

Violate standards set by the Department of Commerce to protect marine sanctuaries?

Yes ☐ No ☐ Not Applicable ☒

Evaluation of the information above indicates that the proposed discharge material meets testing exclusions criteria for the following reason(s):

☐ based on the above information, the material is not a carrier of contaminants

☒ the levels of contamination are substantially similar at the extraction and disposal sites and the discharge is not likely to result in degradation of the disposal site and pollutants would not be transported to less contaminated areas

☒ acceptable constraints are available and would be implemented to reduce contamination to acceptable levels within the disposal site and prevent contaminants from being transported beyond the boundaries of the disposal site

13.3 OTHER RESTRICTIONS

Would the discharge contribute to significant degradation of waters of the U.S. through adverse impacts to:

Human health or welfare, pollution of municipal water supplies, fish, shellfish, wildlife, and special aquatic sites?

Yes ☐ No ☒ Not Applicable ☐

Life stages of aquatic life and other wildlife?

Yes ☐ No ☒ Not Applicable ☐

Diversity, productivity, and stability of the aquatic ecosystem, such as the loss of fish or wildlife habitat, or loss of the capacity to assimilate nutrients, purify water or reduce wave energy?

Yes ☐ No ☒ Not Applicable ☐

Recreational, aesthetic, and economic values?

Yes ☐ No ☒ Not Applicable ☐

13.4 ACTIONS TO MINIMIZE POTENTIAL ADVERSE IMPACTS (MITIGATION)

Would all appropriate and practicable steps (40 CFR 23.70-77) be taken to minimize the potential adverse impacts of the discharge on the aquatic ecosystem?

Yes ☒ No ☐ Not Applicable ☐

Based upon this Section 404(b)(1) analysis, I have determined that the proposed action is in compliance with the Section 404(b)(1) guidelines and would not have a significant adverse effect on waters of the U.S.

Date: ______________________

John W. Henderson
Colonel, Corps of Engineers
District Commander

14.0 References

Bergman, H. I., A.M. Boelter, and K. Parady. 2008. Research needs and management strategies for Pallid sturgeon recovery. Rept. to US Army COE, Proc. of a Workshop, 31 July-2 August, St. Louis, MO.

Braaten, P.J., D.B Fuller, L.D. Holte, R.D. Lott, W. Viste, T.F. Brandt, and R.G. Legare. 2008. Drift Dynamics of Larval Pallid Sturgeon and Shovelnose Sturgeon in a Natural Side Channel of the Upper Missouri River, Montana. North American Journal of Fisheries Management 808–826.

Bramblett, R.G. and E.A. Scholl. 2016. The spatial and temporal extent of the suspected hypoxic zone in the headwaters of Lake Sakakawea. Annual report 2015. Prepared for Montana Fish, Wildlife, and Parks.

Bramblett, R.G. and R.G. White. 2001. Habitat use and movements of pallid and shovelnose sturgeon in the Yellowstone and Missouri Rivers, Montana and North Dakota. Trans. Am. Fish Soc. 130: 1006-1025.

California Department of Transportation (CalTrans). 2007. Compendium of Pile Driving Sound Data. Available at: http://www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf.

California Department of Transportation (CalTrans). 2009. Final technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish. Sacramento, California. February.

Chase, K.J. 2014. Streamflow Statistics for Unregulated and Regulated Conditions for Selected Locations on the Yellowstone, Tongue, and Powder Rivers, Montana, 1928-2002. Scientific Investigations Report 2013-5173, Version 1.1, U.S. Geological Survey.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Dawson County. Unknown year. Part III; Information Required For Environmental Assessment under the Subdivision and Platting Act. Dawson County, Montana; Subdivisions/Certificate of Surveys, Subdivision Regulations. Available at www.dawsoncountymontana.com/departments/ planning/docs/EA_Joint_form.pdf.

Defenders of Wildlife and Natural Resources Defense Council (Defenders and NRDC). 2016. Letter dated February 17, 2016.

Delonay, A.J., R.B. Jacobson, M.L. Annis, P.J. Braaten, K.A. Chojnacki, C.M. Elliott, D.B. Fuller, J.D. Haas, T.M. Haddix, B.J. McElroy, G.E. Mestl, D.M. Papoulias, J.C. Rhoten, and M.L. Wildhaber. 2014. Ecological requirements for pallid sturgeon reproduction and recruitment in the Missouri River: annual report 2011. U.S.G.S. Open-file report 2014-1106.

DTM Consulting and Applied Geomorphology, Inc. (DTM Consulting and AGI). 2009. Yellowstone River Channel Migration Zone Mapping, Final Report. Prepared for the Yellowstone River Conservation District Council. Bozeman, MT.

DTM Consulting, Inc. (2009). Banks and Flow Lines of the Yellowstone River, 1950-2001. ESRI personal geodatabase, Montana State Library.

Elliot, C., R. Jacobson, and C. Hickcox. 2015. Habitat surveys of 2015 pallid sturgeon spawning patches on the Yellowstone River. USGS Blog. Comprehensive Sturgeon Research Project. Pp. 5.

Fuller, D.B., M. Jaeger, and M. Webb. 2008. Spawning and associated movement patterns of pallid sturgeon in the lower Yellowstone River. Report submitted to the Western Area Power Administration, upper basin pallid sturgeon work group: Montana Fish, Wildlife and Parks.

Guy, C.S., H.B. Treanor, K.M. Kappenman, E.A. Scholl, J.E. Ilgen and M.A.H. Webb. 2015. Broadening the regulated-river management paradigm: a case study of the forgotten dead zone hindering pallid sturgeon recovery. Fisheries 40(1): 6-14.

Helfrich, L.A., C. Liston, S. Hiebert, M. Albers, K. Frazer. 1999. Influence of Low-head Diversion dams on Fish Passage, Community Composition, and Abundance in the Yellowstone River, Montana. Rivers. Vol 7 Number 1.

Jaeger, M., M. Nelson, G. Jordan, and S. Camp. 2005. Assessment of the Yellowstone River for Pallid Sturgeon Restoration Efforts. Annual Report for 2005.

Jaeger, M., T. Watson, and M. Nelson. 2006. Assessment of the Yellowstone River For Pallid Sturgeon Restoration Efforts Annual Report for 2006. Montana Fish, Wildlife & Parks.

Kordecki, C., M. McCormick, C.F. Jackson and J. Bales. 2000. Lower Yellowstone Irrigation Project, 1996 and 1997 Cultural Resources Inventory, Dawson and Richland Counties, Montana and McKenzie County, North Dakota. Contract, University of North Dakota, Department of Anthropology, Anthropology Research and Renewable Technologies, Inc., Billings, Montana: U.S. Bureau of Reclamation, Montana Area Office.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2007. Use of laboratory studies to develop a dispersal model for Missouri River pallid sturgeon early life intervals. J. Appl. Ichthyol. 23:365-374.

Lower Yellowstone Project Board of Control. 2009. Conservation Plan – Lower Yellowstone Irrigation Project. Electronic, Bureau of Reclamation (BOR-0017430).

Montana Department of Environmental Quality (MTDEQ). 2012. Circular DEQ-7 Montana Numeric Water Quality Standards. Water Quality Planning Bureau, Water Quality Standards Section, October. Available at pubs.usgs.gov/sir/2004/5113/.

Montana Department of Environmental Quality (MTDEQ). 2014. Final Water Quality Integrated Report. 305(b) and 303(d) Documents Final Integrated Reports. Available at deq.mt.gov/wqinfo/cwaic/ reports.mcpx.

Montana Department of Natural Resources and Conservation. 2016. General Abstract, Water Right Number 42M 97792-00 Provisional Permit.

Montana Department of Natural Resources and Conservation (MDNRC). 2016a. Water Rights Bureau – Controlled Ground Water Areas webpage. dnrc.mt.gov/divisions/water/water-rights/controlled-groundwater-areas. Accessed January 2016.

Montana Fish, Wildlife and Parks (MFWP). 2012. Subdivision Recommendations for Subdivision Development in Montana; Appendix C.2. Big Game Winter Range. Available at fwp.mt.gov/ fishAndWildlife/livingWithWildlife/buildingWithWildlife/subdivisionRecommendations /.

Rugg, M. 2014. Lower Yellowstone River Pallid Sturgeon Progress Report. Montana Fish, Wildlife and Parks. Glendive, MT.

Rugg, M. 2015. Lower Yellowstone River Pallid Sturgeon Progress Report. Montana Fish, Wildlife and Parks. Glendive, MT.

Stuart, J. 2015. Paddlefish Season Comes to a Close. Glendive Ranger Review. June 03. Accessed January 20, 2016. www.rangerreview.com/news/paddlefish-season-comes-close.

Toom, D. L., M. Rossillon, M. McCormick, and M.A. Jackson. 2011. Headworks Camp (24DW447) Historic Site Archeological Excavations, Dawson County, Montana. Contract, Anthropology Research, University of North Dakota and Renewable Technologies, Inc., Billings, MT: U.S. Bureau of Reclamation, Great Plains Regional Office.

Tuthill, A.M., M.L. Carr. 2012. Evaluation of Ice Impacts on Bypass Channel at Intake Dam on Lower Yellowstone River. U. S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory. Hanover, NH.

U.S. Army Corps of Engineers (Corps) and Yellowstone River Conservation District Council (YRCDC). 2015. Yellowstone River Cumulative Effects Analysis and Appendices. U.S. Army Corps of engineers Omaha District, NE.

U.S. Army Corps of Engineers (Corps). 2006. Final Report, Lower Yellowstone Project Fish Passage and Screening, Preliminary Design Report, Intake Diversion Dam, Appendix B, Hydrology. Final Report.

U.S. Army Corps of Engineers (Corps). 2009. Results of Elutriate Sampling Conducted Along the Yellowstone River at Intake Dam, Montana on April 29-30, 2009. Omaha District, Omaha, Nebraska.

U.S. Army Corps of Engineers (Corps). 2010. Lower Yellowstone Irrigation Project-Intake Dam, Rating Curves, Intake Screens/Gate. Design Report.

U.S. Army Corps of Engineers (Corps). 2015a. Lower Yellowstone Intake Dam-Model Calibration Report.

U.S. Army Corps of Engineers (Corps). 2015b. *Yellowstone River Cumulative Effects Analysis.* CORPS Omaha District.

U.S. Army Corps of Engineers (Corps). 2015c. Intake Diversion Dam Modification. Lower Yellowstone Project, Montana. Final Supplemental to the 2010 Final Environmental Assessment, including Appendices.

U.S. Bureau of Reclamation (Reclamation) and U.S. Army Corps of Engineers (Corps). 2015. Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Final Supplement to the 2010 Environmental Assessment. Including all attachments.

U.S. Bureau of Reclamation (Reclamation). 2005. Final Report, Lower Yellowstone Fish Passage Alternative Value Planning Study. August 10, 2015.

U.S. Bureau of Reclamation (Reclamation). 2013. Lower Yellowstone Fish Passage Alternatives Planning Study.

U.S. Fish and Wildlife Service (USFWS). 2000. Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River System. Denver, Colorado and Ft. Snelling, Minnesota.

U.S. Fish and Wildlife Service (USFWS). 2003. Amendment to Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization And Navigation Project and Operation of the Kansas River reservoir system. U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service (USFWS). 2014a. U.S. Fish & Wildlife Service Revised Recovery Plan for the Pallid Sturgeon (Scaphiryhnchus albus). Billings, Montana: Pallid Sturgeon Recovery Coordinator, U.S. Fish and Wildlife Service, Montana Fish and Wildlife Conservation Office.

U.S. Fish and Wildlife Service (USFWS). 2016a. List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project (Montana). Letter from Montana Ecological Field Office, Helena, Received January 19, 2016.

U.S. Fish and Wildlife Service (USFWS). 2016b. List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project (North Dakota). Letter from North Dakota Ecological Field Office, Bismarck, Received January 19, 2016.

U.S. Geological Survey (USGS). 2007. Sturgeon research update: confirmed pallid sturgeon spawning in the Missouri River in 2007.

White, R.G. and B. Mefford. 2002. Assessment of Behavior and Swimming Ability of Yellowstone River Sturgeon for Design of Fish Passage Devices. Montana State

University-Bozeman: Montana Cooperative Fishery Research Unit, and Water Resources Research Laboratory.

Wildhaber, M.L., A.J. DeLonay, D.M. Papoulias, D.L. Galat, R.B. Jacobsen, D.G. Simpkins, P.J. Braaten, C.E. Korschgen, and M.J. Mac. 2007. A Conceptual Life History Model for Pallid Shovelnose Sturgeon; U.S. Geological Survey Circular 1315, 18 p.