# Intake Diversion Dam Modification Lower Yellowstone Project, Montana, Final Environmental Assessment

April 2010

U.S. Department of the Interior
Bureau of Reclamation

US Army Corps of Engineers

## Common Acronyms

| | |
|---|---|
| BA | Biological Assessment |
| BRT | Biological Review Team |
| Board of Control | Lower Yellowstone Project Board of Control |
| Corps | U.S. Army Corps of Engineers |
| Council | Yellowstone River Conservation District Council |
| DEQ | Department of Environmental Quality |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| FAS | Fishing Access Site |
| FONSI | Finding of No Significant Impact |
| FWCA | Fish and Wildlife Coordination Act |
| FWP | Fish, Wildlife & Parks |
| GIS | Geographical Information System |
| HCP | Habitat Conservation Plan |
| IMPLAN | IMpact anlaysis for PLANning |
| Intake Draft EA | Intake Draft Environmental Assessment |
| Intake Project | Intake Diversion Dam Modification Project |
| IPCC | Intergovernmental Panel on Climate Change |
| ITA | Indian Trust Assets |
| MEPA | Montana Environmental Policy Act |
| MOU | Memorandum of Understanding |
| ND Health Department | North Dakota Department of Health |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| O&M | Operation and Maintenance |
| Reclamation | Bureau of Reclamation |
| RMPA2 | Recovery-Priority Management Area 2 |
| Service | U.S. Fish and Wildlife Service |
| TDS | Total Dissolved Solids |
| USGS | U.S. Geological Survey |

## Technical Acronyms

| | |
|---|---|
| cfs | cubic feet per second |
| F | Fahrenheit |
| ft | feet |
| in or ” | inch |
| Mcf | 1,000 cubic feet |
| mg/L | milligrams per liter |
| µg/L | micrograms per liter |

# Table of Contents

## List of Tables

## List of Figures

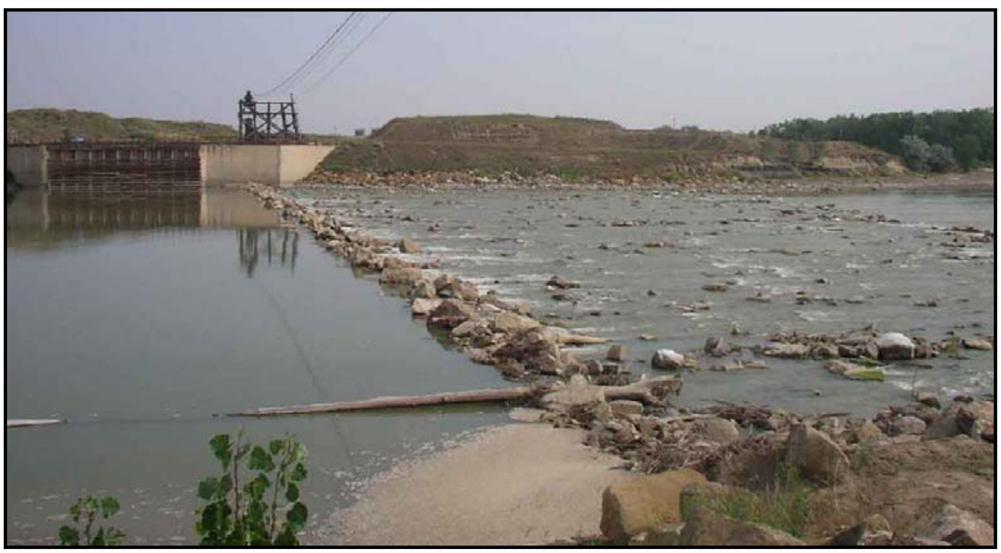
# Chapter One
# *Purpose and Need*

## Introduction

**Entrainment** means to carry along in a current.  In this case fish are involuntarily carried by water flowing into the irrigation canal system through an unscreened intake.

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (Corps) are proposing to modify Intake Diversion Dam, a feature of the Lower Yellowstone Project, to improve passage for the endangered pallid sturgeon and other native fish and to reduce entrainment of fish into the Lower Yellowstone Project's main canal (figure 1.1).  The Lower Yellowstone Project furnishes a dependable supply of irrigation water for approximately 54,000 acres of fertile land along the west bank of the Yellowstone River in Montana and North Dakota.

Reclamation and the Corps jointly prepared this final environmental assessment (Intake Final EA) for the Intake Diversion Dam Modification, Lower Yellowstone Project.  The Intake Final EA analyzes and discloses effects associated with proposed modifications to the Intake Diversion Dam and Lower Yellowstone Project's main canal headworks.  Reclamation and the Corps are joint lead agencies for preparation of the Final Intake EA.  Reclamation is the administrative lead agency for the National Environmental Policy Act (NEPA) activities associated with the proposed Intake Diversion Dam Modification Project (Intake Project).



**Intake Diversion Dam impedes fish passage on the Lower Yellowstone River, and the canal headworks (upper left) entrains fish In the Lower Yellowstone Project main canal**

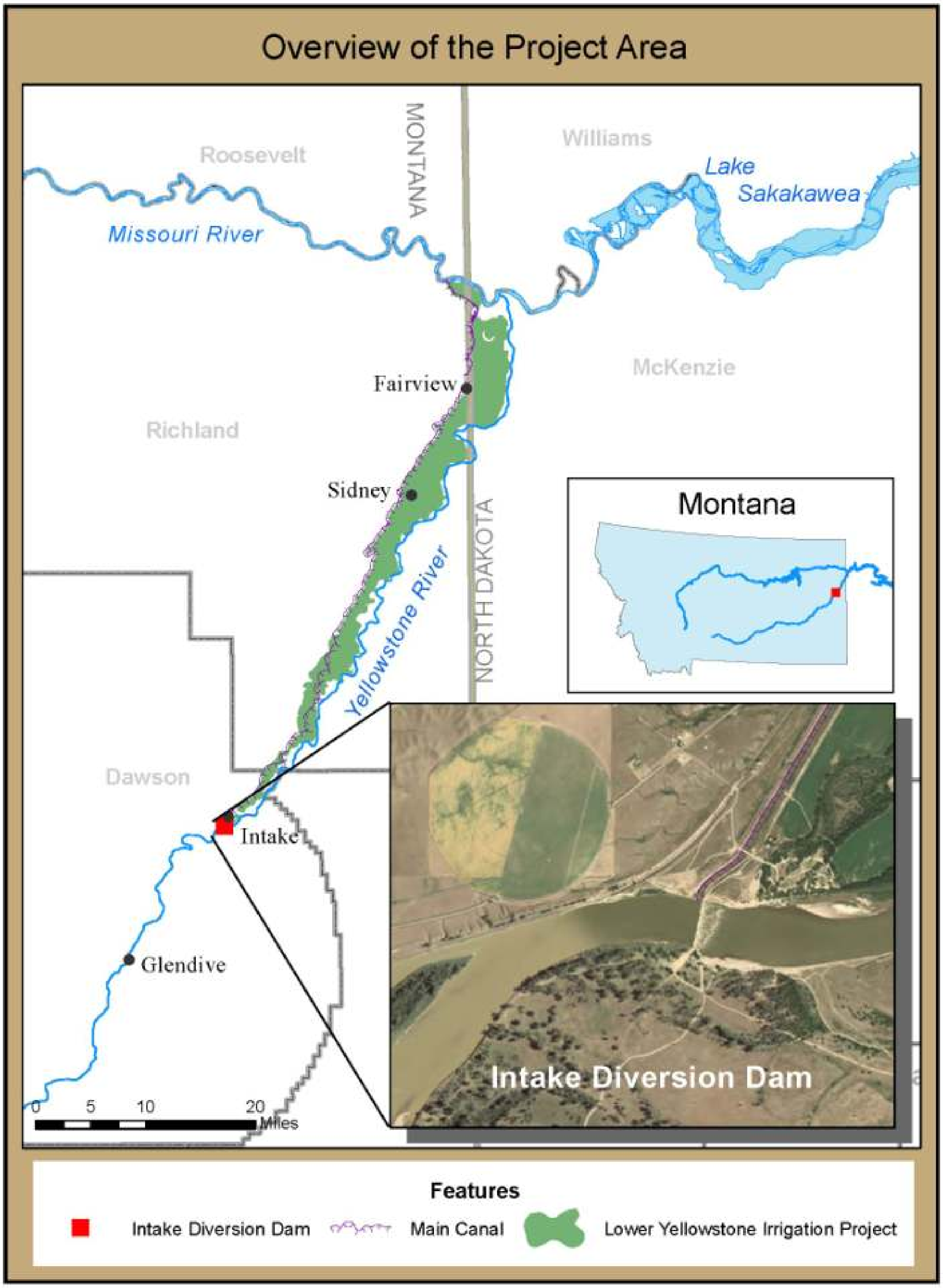
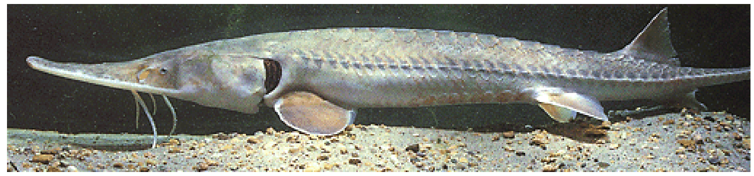



**Figure 1.1. Intake EA General Project Area.**

## Proposed Action

The proposed federal action would modify Intake Diversion Dam and main canal headworks to improve passage for endangered pallid sturgeon and other native fish in the lower Yellowstone River and reduce entrainment of fish into the Lower Yellowstone Project main canal.



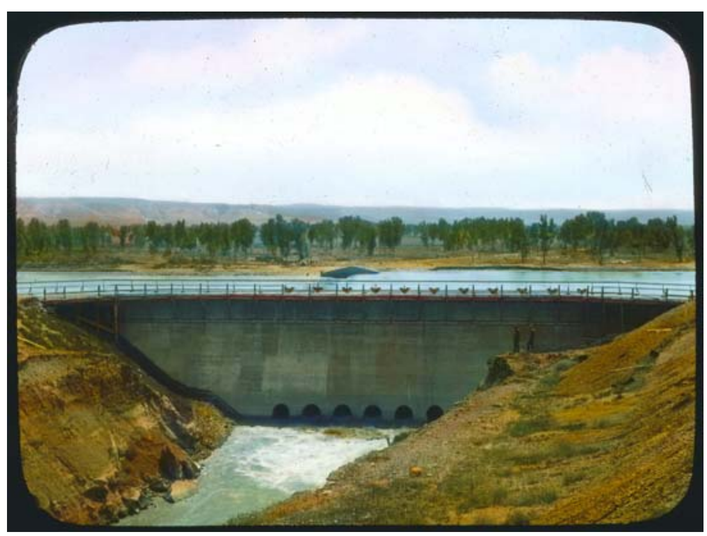
**Pallid sturgeon (photograph courtesy Nebraska Game and Parks Commission)**

## Purpose and Need for Proposed Action

The purpose of the proposed action is to improve upstream and downstream fish passage for adult pallid sturgeon and other native fish in the lower Yellowstone River and minimize entrainment of pallid sturgeon and other native fish into the Lower Yellowstone Project main canal.

### Purpose – Improve Fish Passage

Construction of the Lower Yellowstone Project began in 1905 under the Reclamation Act of 1902 and included Intake Diversion Dam – a 12-foot high wood and stone structure that spans the Yellowstone River and raises the water level for diversion of water into the main canal. Intake Diversion Dam likely has impeded upstream migration of pallid sturgeon and other native fish for more than 100 years. The best available science suggests that the diversion dam is a partial barrier to some fish species (Helfrich et al. 1999; Jaeger et al. 2004; Backes et al. 1994; Stewart 1986, 1988, 1990, 1991). It is likely a total barrier to other fish species, such as pallid sturgeon, due to increased turbulence and velocities associated with the rocks at the dam and downstream (Jaeger et al. 2005; Fuller et al. 2008; Helfrich et al. 1999; White and Mefford 2002; Bramblett and White 2001; U.S. Fish and Wildlife Service (Service) 2000a, 2003, 2007). Appendixes L and M address this issue in detail.



**Historic photograph showing the canal side of the headworks** (photo courtesy of Bancroft Library, BANC PIC 1960.010 ser. 2 :2079—LAN)

Monitoring of radio-tagged fish indicates that pallid sturgeon currently can move no further upstream than Intake Diversion Dam and some attempt to spawn below the dam. If spawning occurs below the dam, newly-hatched pallid sturgeon (larvae) drift into Lake Sakakawea before they are able to swim. Biologists believe that like other river spawning species, pallid sturgeon need a river environment to survive (Jaeger et al. 2002; Braaten et al. 2008).

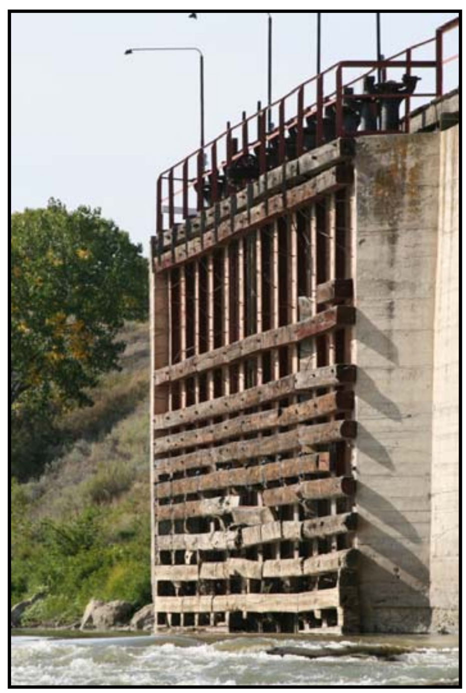
The model developed by Kynard et al. (2007) indicates that total drift distance is a limitation on natural recruitment. If these young fish reach the lake environment, their survival rate is believed to be very low because of unsuitable habitat (Kynard et al. 2007). Biologists also suspect that pallid sturgeon larvae are intolerant of sediments in the river-reservoir transition zone (Wildhaber et al. 2007). The cause of larval deaths in the reservoir is unknown but could be due to the lack of food, predation, or related to sedimentation in reservoirs (Bergman et. al. 2008).

**Recruitment**
The number of fish hatched in a given year that survive to a specified age.

The proposed Intake Project would aid in recovery of pallid sturgeon by providing an additional 165 miles of the Yellowstone River for migration, spawning, and development (see appendixes L and M). 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 (Upper Missouri River Basin Pallid Sturgeon Work Group 2009). Access to tributaries, such as the Tongue and Power Rivers, would provide additional spawning habitat and could increase larval drift distance.

## Purpose – Minimize Entrainment of Fish

Installation of a fish screen on the canal headworks would minimize entrainment of pallid sturgeon and other native fish into the main canal. Trapping and monitoring indicate that an average of 500,000 fish of 36 species are annually entrained at Intake Diversion (Hiebert et al. 2000). Many of these are native fish (Hiebert et al. 2000), and their death rate is high. For instance, about 86% of the sauger that are entrained in the main canal die compared to a mortality rate of 31% for un-entrained sauger that remain in the Yellowstone River. All radio-monitored sauger and pallid sturgeon that have entered the canal system died somewhere in the system (Jaeger et al. 2005).



**Existing unscreened main canal headworks**

The underlying need for the proposed action is that Reclamation needs to comply with the Endangered Species Act (ESA) by completing consultation under Section 7(a)(2) for operation of Intake Diversion Dam and the Lower Yellowstone Project. If Reclamation does not initiate and successfully complete consultation, then Reclamation's ability to operate the dam and headworks to deliver water to the Lower Yellowstone Project could be severely constrained or limited in the future. Reclamation has contractual obligations to deliver Project water needed to continue viable and effective operation of the Lower Yellowstone Project. The Corps has a need for the proposed action to comply with the 2003 Missouri River Amended Biological Opinion as amended on October 23, 2009. Fish passage and entrainment protection at Intake are now Corps requirements under the amended Biological Opinion.

The proposed action is needed to:

- Continue effective operation of the Lower Yellowstone Project in compliance with the ESA, and
- Contribute to restoration of the lower Yellowstone River ecosystem.

### Need – Continue Effective Operation of the Lower Yellowstone Project

The Lower Yellowstone Project diverts water from the Yellowstone River into the main irrigation canal on the north side of the river at a location 18 miles downstream of Glendive, Montana. The irrigation canal system roughly parallels the Yellowstone River to its confluence with the Missouri River (figure 1.1). The average annual water supply diverted for these projects is 327,046 acre-feet. Four irrigation districts are included in the Lower Yellowstone Project – Lower Yellowstone Irrigation Districts Numbers 1 and 2, Savage Irrigation District, and Intake Irrigation District. The Lower Yellowstone Irrigation District Number 2 is in North Dakota and represents about one-third of the irrigated lands. The system conveys water to irrigate approximately 54,300 acres on about 398 farms along the canal.

### Need – Contribute to Ecosystem Restoration

The Service listed the pallid sturgeon as endangered under the ESA in 1990. Section 7(a)(1) of the ESA authorizes all federal agencies to use their resources for the conservation and recovery of federally listed species and the ecosystems upon which they depend, and under Section 7(a)(2), requires federal agencies to consult with the Service to ensure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of any federally listed species or to modify designated critical habitat. The lower Yellowstone River has been identified by the Service as an area of priority for pallid sturgeon recovery because sturgeon are still in the area, and there is suitable habitat remaining in the river to assist in recovery, and the Yellowstone River exhibits a natural hydrograph (Service 1993; Service 2003).

Pallid sturgeon are one of the rarest native fish in the Missouri and Mississippi River basins (Service 1993). The declining population of mature pallid sturgeon in the Yellowstone River and Missouri River between Fort Peck Dam and Lake Sakakawea is expected to be locally extinct by 2018 if reproduction and survival of young fish does not improve (Kapuscinski 2003a; Kapuscinski 2003b). According to the Service (2003:27), “the value of restoring the Yellowstone River as a natural migratory route for sturgeon and making the middle Yellowstone function as the spawning and nursery grounds for pallids cannot be overstated.”

## Background Information

### Project Authorization

**Construction of the main canal just below the intake gates in November 27, 1908**

Reclamation constructed the Lower Yellowstone Project under the Reclamation Act/Newlands Act of 1902 (Public Law 161)(Act). The Act set aside money from the sale of lands to be used in the "examination and survey for and the construction and maintenance of irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands." The Act authorized construction of irrigation projects to establish farms in the western United States. As is the case for most authorized Reclamation projects, the long-term operation and maintenance (O&M) of project facilities is the responsibility of the Lower Yellowstone Project water users. Reclamation retains ownership of the Lower Yellowstone Project facilities, but the facilities are operated and maintained by the Board of Control of the Lower Yellowstone Project (Board of Control) under contract with Reclamation. The terms of that contract would likely need to be revisited, if the Intake Project is constructed, to accommodate the O&M needs and requirements for modified intake and diversion structures.

The Corps is a joint lead agency for the EA, because the Service suggested in their Missouri River Master Manual biological opinion (2000a and 2003 amendment) that the Corps work with Reclamation to provide passage for pallid sturgeon at Intake Diversion Dam as a conservation recommendation and as an adaptive management action for Missouri River recovery. On October 23, 2009, the Service amended the 2003 Missouri River Amended Biological Opinion and included fish passage and entrainment protection at Intake as a Reasonable and Prudent Alternative (RPA). As such, passage and entrainment protection at Intake are now Corps requirements under the amended Biological Opinion.

Section 3109 of the 2007 Water Resources Development Act authorizes the Corps to use funding from the Missouri River Recovery and Mitigation Program to assist Reclamation with compliance with federal laws, design, and construction of modifications to the Lower Yellowstone Project for the purpose of ecosystem restoration. Funding for future construction, if a decision is made to proceed with the preferred alternative, may be provided by the Corps subject to Congressional appropriation.

### Informal ESA Consultation History

Since 1993 Reclamation has been coordinating and consulting informally with the Service about modifications to the Intake Diversion Dam and main canal headworks. Montana Fish, Wildlife & Parks (FWP), Lower Yellowstone Project irrigation districts, and Upper Basin Pallid Sturgeon Working Group were also involved in these early discussions. Pallid sturgeon fish passage and entrainment were key issues identified by the Service early in ESA section 7 informal consultation and were included in the 1993 Pallid Sturgeon Recovery Plan (Service 1993).

> **Biological Assessment (BA)** - A BA is a report prepared by a federal agency that evaluates whether a federal action is likely to adversely affect federally listed species, proposed species, or designated or proposed critical habitat for those species. It is used by the agency to consult with the Service.

Since 1994 Reclamation and others have been collecting data and monitoring fish during investigations of diversions along the lower Yellowstone River. Reclamation funded or participated in a number of studies to evaluate the effects of the operation of the Lower Yellowstone Project on pallid sturgeon (FWP and Reclamation 1994; Corps and Reclamation 1996; FWP 1996; Reclamation 1991; Reclamation and FWP 1999; and Hiebert et al. 2000).

These studies culminated in Reclamation’s preparation of a preliminary draft biological assessment (BA) on the continued O&M of the Lower Yellowstone Project, which was reviewed by the Service in 1999. Comments provided by the Service stressed the need for fish passage and entrainment protection (Service 2000b). Reclamation decided to include fish passage and protection measures in a revised BA and began researching and evaluating fish passage and protection options (Mefford et al. 2000).

One option that initially appeared feasible was construction of a boulder fishway (or rock fishway) to enable fish to swim around Intake Diversion Dam. The proposal included a flat plate linear fish screen inside the canal with a bypass to return entrained fish to the river. But passage for pallid sturgeon was poorly understood at that time, and questions were raised regarding whether that design would provide adequate passage for these large, relatively weak, bottom-swimming fish. Resource agencies expressed concerns that pallid sturgeon would find it difficult to locate the entrance to a rock fishway because of the differences in flow volume and velocity between the diversion dam and fishway.

In 2001 the Corps funded engineering design of pallid sturgeon passage facilities at Intake Diversion Dam. The Corps also contracted for two studies of sturgeon swimming ability to help develop criteria for fish passage (White and Mefford 2002; U.S. Geological Survey 2002).

The Corps (2002) then evaluated the recommended alternatives. One alternative considered replacing the diversion dam with a new structure topped with inflatable gates (Obermeyer weirs) that could be lowered for fish passage when diversions were sufficiently high to be diverted without the gates. The Corps (2002) also completed a fish passage alternatives analysis document that responded to recommended alternatives. That same year Reclamation sponsored a value-engineering study to identify additional alternatives with the best potential for fish passage. This study and the process of developing alternatives are discussed in detail in appendix A.1.

In April 2005 Reclamation sent a draft BA to the Service that analyzed the continued operation of the Lower Yellowstone Project and included construction of a rock fishway for fish passage and a v-shaped screen structure in the main canal with a bypass pipe back to the river. The draft BA proposed monitoring the success of the fishway and screen, as well as monitoring during construction. This draft BA proposed a rock fishway instead of replacing the dam with inflatable weirs because of concerns with cost and technical challenges associated with weirs. In a meeting on May 16, 2005, the Service commented on the draft BA stating that the rock fishway did not appear to improve passage, and Reclamation agreed to continue informal consultation while further exploring other alternatives.

In June 2005 Reclamation sponsored a value planning study to identify potentially viable alternatives for passage and screening. This study and the process of developing alternatives are discussed in detail in appendix A.1. At the same time Reclamation began formalizing cooperative partnerships with the Corps, Service, FWP, and The Nature Conservancy.

In the early stages of project planning, an option of considering fish passage and entrainment protection as separate projects was explored, but the Service, EPA, and Montana state agencies were strongly opposed to fish passage occurring before proper screening at the canal intake because it could result pallid sturgeon being entrained. With less than 150 pallid sturgeon left in the population, the risk of losing even one adult fish to entrainment would be too harmful . The Service indicated that they would not approve a fish passage project that did not include concurrent entrainment protection.

On May 12, 2009, Reclamation, the Corps, and the Service reached an agreement that informal Section 7 consultation is appropriate for the construction of the proposed Intake Project, so long as concurrent formal Section 7 consultation continues on operations of the Lower Yellowstone Project. As a result, a separate BA was drafted, attached to the Intake Final EA as appendix D, to assess effects to listed species from construction of the proposed fish passage and entrainment protection structures. The 2005 draft BA remains in draft and is being updated to include operation of the new proposed Intake Project, in addition to operation of the overall Lower Yellowstone Project. Consultation on operation of the irrigation project is solely the responsibility of Reclamation.

### Memorandum of Understanding

In July 2005 Reclamation, the Corps, the Service, FWP, and The Nature Conservancy entered into a Memorandum of Understanding (MOU) and pledged to work together to aid in the recovery of pallid sturgeon through restoration of the lower Yellowstone River as a natural migratory route and to reduce fish loss to the irrigation canal (Jewel et al. 2005). The MOU identifies the roles, work objectives and responsibilities of each agency associated with modifications to the Lower Yellowstone Project.

The Yellowstone River Conservation District Council (Council), representing conservation districts on the Yellowstone River, Missouri River Basin Association, Missouri River Natural

Resources Committee, the Upper Basin Pallid Sturgeon Workgroup, and the Board of Control supported and encouraged these coordination efforts, although none of these groups signed the MOU.

### Biological Review Team

In 2006 the Service created a Biological Review Team (BRT) of fisheries biologists and engineers with expertise in fish passage and pallid sturgeon to review preliminary alternatives. The BRT includes representatives from the U.S. Geological Survey (USGS), Service, FWP, and Reclamation. Corps staff attended meetings of the BRT but did not serve on the BRT. Chapter five lists members of the BRT, and their role in development of alternatives is explained in appendix A.1.

## Cooperating Agencies

Reclamation and the Corps invited other agencies and local governments to assist with various aspects of the Intake Final EA, including developing and reviewing early drafts of the environmental document. Those that were invited to participate were chosen because they have jurisdiction by law or special expertise with respect to environmental issues. Cooperating agencies that assisted with preparation of the Intake Draft EA include the Montana Department of Environmental Quality, Montana Department of Natural Resources and Conservation, FWP, Board of Control, USGS, and the Service.

The Environmental Protection Agency (EPA) was invited to be a cooperating agency but declined the invitation due to lack of agency resources, workload, and other program commitments (Wardell 2008). However, EPA participated in scoping, attended meetings, and reviewed preliminary and draft documents.

## Relationship of the Proposed Action to Other Projects or Activities

There are six diversion dams on the mainstem Yellowstone River downstream from Billings, Montana. Intake Diversion Dam is the furthest downstream dam and therefore, the first barrier encountered by pallid sturgeon on their migration route. The upstream dam at Huntley is also federally owned, while the middle four (Waco, Rancher’s Ditch, Yellowstone, and Cartersville) are private dams managed by local irrigation districts. All six dams impede fish passage to some degree (Helfrich et al. 1999). While the purpose and need for this EA is to provide passage at Intake, there are other separate collaborative efforts in the planning stage to provide passage at Cartersville, Montana. If completed, this would open access to even more river habitat for pallid sturgeon and other native fish. There are also a number of ongoing projects to restore pallid sturgeon in the upper Missouri River.

## Nature of Decisions to be Made

Reclamation and the Corps will make the following decisions regarding the proposed federal action in a Finding of No Significant Impacts (FONSI) upon completion of the Final EA, provided any adverse impacts identified in the Final EA can be mitigated to insignificant levels:

- Reclamation will decide whether to proceed with the proposed action, or a reasonable alternative to it, to modify Intake Diversion Dam to improve fish passage for adult pallid sturgeon and other native fish, minimize entrainment of pallid sturgeon and other native fish into the main canal, and provide for continued operation of the Lower Yellowstone Project.

- The Corps will decide whether to assist Reclamation with the proposed action, or a reasonable alternative to it, and provide funding for design and construction activities needed to modify Intake Diversion Dam for the purpose of improving fish passage, minimizing entrainment, and assisting in restoration of the lower Yellowstone River ecosystem. Because this is Corps civil works action, the Omaha District will complete 404(b)(1) evaluation and obtain 401 Water Quality Certification from the State of Montana Department of Environmental Quality for modifications to Intake Diversion Dam and the main canal headworks (see appendix B).

## Scope of the EA

Scope consists of the range of actions, alternatives, and impacts to be considered. The scope of this Intake EA consists of the following:

1) types of actions,
2) types of alternatives, and
3) types of potential impacts to be considered.

### Scope – Types of Actions

Connected, cumulative, and similar actions within the geographic scope of the proposed Intake Project are considered in chapter four of this EA. In general, the geographic scope of this EA considers potential impacts on the Yellowstone River from just above the Intake Diversion Dam in Montana to the river's confluence with the Missouri River in North Dakota. It also includes lands within the boundaries of the Lower Yellowstone Project in Montana and North Dakota (figure 1.1). However, the scope of the affected environment may vary for each resource as explained in chapter three, Affected Environment.

**Connected Actions** automatically trigger other actions that cannot, or will not proceed unless other actions are taken first or at the same time.

**Cumulative Actions** are other past, present, and reasonably foreseeable actions by any other entity or individual within the area that could be affected by the proposed action.

**Similar Actions** are those reasonably foreseeable actions similar in timing or geography to the proposed action that they must be evaluated with the proposed federal action.

### Scope – Types of Alternatives

The Council on Environmental Quality regulations require federal agencies to consider three types of alternatives to the proposed action: 1) no action; 2) other reasonable courses of action; and 3) mitigation. Two action alternatives and a no action alternative are evaluated in this Intake Final EA. Appropriate actions to minimize effects have been incorporated into the two action alternatives. These alternatives are described in detail in chapter two and the actions to minimize effects are explained in chapter four and are compiled in appendix I. Appendix A.1 explains how alternatives were developed, the alternatives screening process, and identifies the alternatives that were considered but eliminated from detailed study and the reason(s) for doing so.

### Scope – Types of Potential Impacts to be Considered

The potential impacts and benefits that may result from the proposed action and alternatives are direct, indirect, and cumulative. Potential impacts and benefits of each alternative for specific resources are described in chapter four and summarized at the end of chapter two in a matrix table. In chapter four the environmental impacts and benefits of each action alternative are compared to the No Action Alternative (Continue Present Operation), as well as among alternatives. Comparative environmental impacts are summarized at the end of chapter two.

## Concerns and Issues Outside the Scope of the Proposed Action

Although scoping comments raised the issue of conserving water to reduce the irrigation districts' water demands, further analysis determined that conservation of water by the irrigation districts is an ongoing activity included in the No Action Alternative. This proposed federal action focuses on modifications to the Intake Diversion Dam and headworks to protect, benefit, and assist recovery of the endangered pallid sturgeon. The irrigation districts holds joint water right statements of claims with Reclamation for the diversion of 1,374 cubic feet per second (cfs), and alternatives are designed to meet that water right to continue effective operation of the Lower Yellowstone Project.

**Cubic Feet per Second (cfs) -** Represents the rate at which water flows. A cubic foot of water is equal to 7.48 gallons.

Each year when irrigation water demands exceed their water rights, water rationing is implemented in accordance with a water rationing plan (see chapter three, Lower Yellowstone Project Irrigation Districts section). In addition, canal seepage losses contribute substantially to groundwater recharge in the region, which may be adversely affected if widespread conversion to water conservation technologies were implemented. However, water conservation is an ongoing activity, as described in a water conservation plan (see chapter three, Lower Yellowstone Project Irrigation Districts section).

## Purpose of the Intake EA

The primary purpose of an EA is to determine whether proposed federal actions would have significant impacts on the human environment. If significant impacts are identified in an EA that cannot be mitigated, an EIS is prepared. An EA can also be used to inform decisionmakers and the public of proposed actions, reasonable alternatives, and their environmental impacts before decisions are made. It must be considered by officials, in conjunction with other relevant material, to plan actions and to make decisions. Reclamation and the Corps prepared this Intake EA to comply with the requirements of NEPA. It is intended to be responsive to issues relevant to the proposed action and substantive comments received. The Intake EA presents key issues of pallid sturgeon recovery, examines alternatives for passage and entrainment, and evaluates the environmental impacts of each of the proposed alternatives. A Finding of No Significant Impact (FONSI) will be signed after the Final EA is completed if no significant impacts are identified from the selected alternative that cannot be mitigated to insignificant levels. The FONSI explains the finding that no significant impacts would result from the selected alternative and the decision not to prepare an EIS. There is no requirement to formally publish the FONSI in the *Federal Register* or the media. However, the interested and affected public will be made aware that the FONSI is available. News releases and public service announcements would be distributed to the media announcing the availability of the FONSI. A copy of the FONSI would be available upon request, as well as posted on the project website (http://www.usbr.gov/gp/mtao/loweryellowstone).

## Relevant Concerns and Substantive Issues Related to the Proposed Action

### Public Involvement Process

**Open House and public meeting in Sidney, Montana**

Scoping is an important part of the NEPA process. It serves to focus the EA on the truly relevant issues and is an opportunity for the public to provide input to Reclamation and the Corps throughout preparation of the EA. Reclamation and the Corps developed a public involvement strategy that identified ways in which interested parties and the public could be informed of the proposed federal action, stay informed as the NEPA process progressed, and provide input and feedback throughout the NEPA process.

To achieve this Reclamation and the Corps published a Notice of Intent on September 12, 2008, in the *Federal Register* (Vol. 73 No. 178:52964) announcing their intent to prepare an environmental impact statement (EIS), hosted public scoping meetings, organized meetings with state and federal agencies, distributed newsletters, disseminated scoping information to agencies and the public, initiated contact with affected tribes, established a cooperating agency team, issued news releases announcing project-related events, made information available on a web site and produced and distributed a *Public Scoping Summary Report*. That report identified the substantive issues relevant to the proposal that are evaluated in the EA.

### Issue Identification

Reclamation and the Corps conducted a wide range of informal and formal scoping activities. These activities solicited and received comments from potentially affected or interested individuals, groups, organizations, tribes, and agencies. During public and agency scoping, a total of 46 letters and e-mails were received in addition to the oral comments presented at three public scoping meetings. All comments were carefully considered. A total of 222 comments were identified and grouped into the issue categories listed in table 1.1 . Other resources, issues, or concerns may be identified during the process of completing the NEPA process and will be considered and analyzed as appropriate.

## Overview of the Intake EA

This chapter describes the purpose of and need for the proposed Intake Project. Chapter two describes the process used to develop alternatives, discusses the alternatives considered in detail, lists the alternatives that were considered but eliminated from further consideration, and provides a summary comparison of alternatives and associated consequences or impacts. It also identifies the preferred alternative and incorporates by reference actions to minimize effects listed in chapter four and appendix I of this EA. Chapter three describes the current state of the environment and resources that could be affected by the proposed action and alternatives.

Chapter four analyzes and describes the impacts associated with each alternative considered in detail, and includes measures to mitigate environmental impacts. It also explains other considerations required by the NEPA. Chapter five includes consultation and coordination activities with other federal, tribal, and state agencies and describes applicable federal and state laws, regulations, and executive orders. EA appendixes are listed in table 1.1.

**Table 1.1 – Issues Identified During Public Scoping and Their Locations in the Intake EA.**

| Issue | Chapter | Section | Appendix |
|---|---|---|---|
| **Air Quality** | Chapter Three - Affected Environment | Air Quality | |
| | Chapter Four - Environmental Consequences | Air Quality | |
| **Alternatives** | Chapter Two - Alternatives | Alternatives Identified for Further Study | Appendix A.1 – Alternative Formulation<br>Appendix A.2 – Hydraulics |
| **Aquatic Communities** | Chapter Three - Affected Environment | Aquatic Communities | Appendix F – Species Common and Scientific Names |
| | Chapter Four - Environmental Consequences | Aquatic Communities | Appendix I – Actions to Minimize Effects |

| Issue | Chapter | Section | Appendix |
|---|---|---|---|
| **Clean Water Act Compliance** | Chapter Three - Affected Environment | Lands and Vegetation (Wetlands)<br><br>Water Quality | Appendix B – Clean Water Act (404)(b)1 |
| | Chapter Four - Environmental Consequences | Lands and Vegetation (Wetlands)<br><br>Water Quality | Appendix I – Actions to Minimize Effects<br>Appendix J – Adaptive Management Strategy |
| | Chapter Five - Coordination and Consultation | Clean Water Act | |
| **Climate Change** | Chapter Three - Affected Environment | Climate | |
| | Chapter Four - Environmental Consequences | Climate | |
| **Cumulative Impacts** | Chapter Four - Environmental Consequences | All Resource/Issue Sections (Cumulative Effects Subsections) | Appendix I – Actions to Minimize Effects<br>Appendix J – Adaptive Management Strategy |
| **Environmental Justice** | Chapter Three - Affected Environment | Environmental Justice | |
| | Chapter Four - Environmental Consequences | Environmental Justice | |
| **Endangered Species Act** | Chapter Three - Affected Environment | Federally-Listed Species and State Species of Special Concern | Appendix C – List of Federally Listed Species and Species of Special Concern<br>Appendix F – Species Common and Scientific Names |

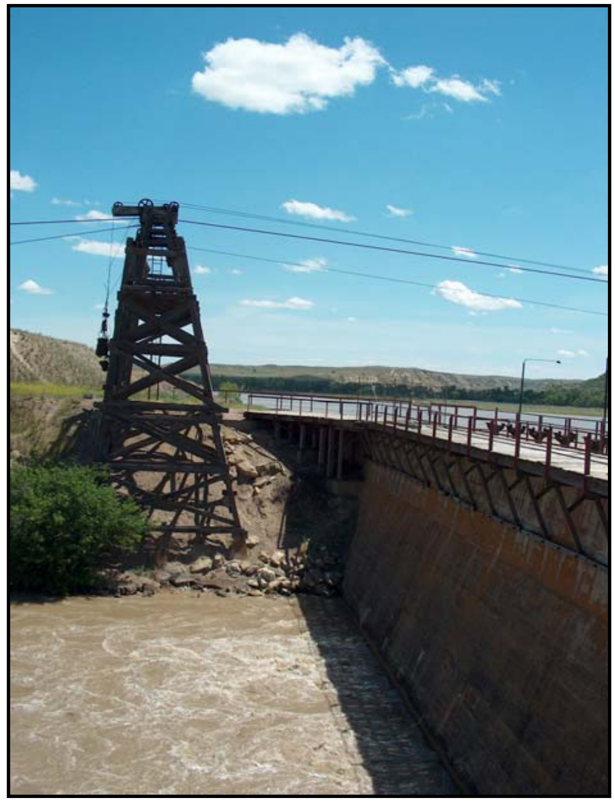
| Issue | Chapter | Section | Appendix |
|---|---|---|---|
| | Chapter Four - Environmental Consequences | Federally-Listed Species and State Species of Special Concern | Appendix D – Biological Assessment for the Intake Diversion Dam Modification, Lower Yellowstone Project and Letter of Concurrence from the Service<br>Appendix E – Hydraulic Analysis and Pallid Sturgeon Evaluation<br>Appendix F – Species Common and Scientific Names<br>Appendix I – Actions to Minimize Effects<br>Appendix J – Adaptive Management Strategy<br>Appendix L – Missouri River Recovery Implementation Committee Questions and Answers<br>Appendix M - Intake Diversion Dam Modification,<br>Lower Yellowstone Project, Science Review Report |
| **Historic Properties** | Chapter Three – Affected Environment | Historic Properties | Appendix G – Historic Properties |
| | Chapter Four - Environmental Consequences | Historic Properties | Appendix G – Historic Properties<br>Appendix I – Actions to Minimize Effects |
| **Hydrology** | Chapter Three - Affected Environment | Hydrology | Appendix A.2 – Hydraulics |
| | Four - Environmental Consequences | Hydrology | Appendix A.2 – Hydraulics |
| **Geomorphology** | Chapter Three - Affected Environment | Geomorphology | Appendix A.2 – Hydraulics |
| | Four - Environmental Consequences | Geomorphology | Appendix I – Actions to Minimize Effects |
| **Indian Trust Assets** | Chapter Three - Affected Environment | Indian Trust Assets | Appendix H – Indian Trust Assets Consultation |
| | Chapter Four - Environmental Consequences | Indian Trust Assets | Appendix H – Indian Trust Assets Consultation |
| **Natural Resources** | Chapter Three - Affected Environment | Aquatic Communities<br><br>Lands and Vegetation<br><br>Wildlife | Appendix F – Species Common and Scientific Names |

| Issue | Chapter | Section | Appendix |
|---|---|---|---|
| | Chapter Four - Environmental Consequences | Aquatic Communities Lands and<br><br>Vegetation<br><br>Wildlife | Appendix F – Species Common and Scientific Names<br>Appendix I – Actions to Minimize Effects |
| **NEPA** | Chapter One - Purpose and Need | | |
| | Chapter Five - Consultation and Coordination | Coordination and Compliance with Applicable Laws, Regulations, and Policies | |
| **Recreation** | Chapter Three - Affected Environment | Recreation | |
| | Chapter Four - Environmental Consequences | Recreation | Appendix I – Actions to Minimize Effects |
| **Social and Economic Conditions** | Chapter Three - Affected Environment | Lower Yellowstone Project Irrigation Districts<br><br>Social and Economic Conditions | |
| | Chapter Four - Environmental Consequences | Lower Yellowstone Project Irrigation Districts<br><br>Social and Economic Conditions | Appendix A.1 – Alternative Formulation<br>Appendix I – Actions to Minimize Effects |
| **Surface Water Quality** | Chapter Three - Affected Environment | Surface Water Quality | Appendix B – Clean Water Act (404)(b)1 |
| | Chapter Four - Environmental Consequences | Surface Water Quality | Appendix B – Clean Water Act (404)(b)1<br>Appendix I – Actions to Minimize Effects<br>Appendix K – Water Quality Tables |
| **Wildlife** | Chapter Three - Affected Environment | Wildlife<br><br>Federally Protected Species and Species of Special Concern | Appendix F – Species Common and Scientific Names |
| | Chapter Four - Environmental Consequences | Wildlife<br><br>Federally Protected Species and Species of Special Concern | Appendix F – Species Common and Scientific Names<br>Appendix I – Actions to Minimize Effects |

# Chapter Two
# *Alternatives*

## Introduction

This chapter describes reasonable alternatives developed to meet the purpose and need explained in the previous chapter. The No Action Alternative (Continue Present Operation), which is the future without the proposed Intake Project, is also explained. The No Action Alternative in this EA was developed in consultation with the Service and in coordination with the Lower Yellowstone Project irrigation districts. The alternatives that were considered but eliminated from further study are described in appendix A.1, Alternative Formulation. Hydraulic analysis is discussed in appendix A.2.



**No Action Alternative (Continue Present Operation) - Water flowing through unscreened main canal headworks**

## Alternatives Identified for Further Study

In 2005 a Reclamation Value Planning Study team initially brainstormed 110 ideas for alternatives and screened these down to 10 (Reclamation 2005). After conceptual development, the Value Planning Study used a "choosing by advantages" system to rank the alternatives and eliminated the 3 with the lowest scores. The Value Planning Study recommended that the Long, Low-Gradient Channel Alternative, Rock Ramp Alternative, Remove Dam and Build Single Pumping Plant Alternative, and the Widen Fishway Alternative be carried forward for further consideration. The Remove Dam and Move Diversion Upstream Alternative, Multiple Pump Stations Alternative, and Collapsible Gates Alternative also were identified for further study.

Later in 2005 Reclamation formed a Technical Team to apply three filters to these 10 alternatives and to recommend which were worthy of further consideration. Reclamation, the Lower Yellowstone Project, State of Montana, The Nature Conservancy, the Corps, and the Service representatives served on the team. The filters were biological, water delivery, and engineering/construction factors. Using these, the Technical Team identified the Rock Ramp, Single Pumping Plant, and Move Diversion Upstream as the most viable ways to provide fish passage. These were further developed from 2005 through 2009. A Biological Review Team of pallid sturgeon experts with the Service made specific recommendations to alternatives throughout development.

When the NEPA process began in 2008 with public scoping, two fish screen options and five alternatives were under consideration. The scoping alternatives included the three identified by the Technical Team plus No Action and Relocate Main Channel, including two types of fish screens. Public scoping identified a new alternative – Multiple Pumping Plants. Screening eliminated the Relocate Diversion Upstream, Single Pumping Plant, and Multiple Pumping Plants Alternatives, and the V-Shaped Screen Option. An Infiltration Gallery Alternative later suggested by EPA was found to be redundant with the Single Pumping Plant and was also eliminated. As a result of this alternative formulation process, the alternatives forwarded for evaluation in the Intake EA were No Action, Relocate Main Channel, and Rock Ramp (see appendix A.1, Alternative Formulation).

The alternatives evaluated in this EA are:

- **No Action (Continue Present Operation) –** Under this alternative, Reclamation would continue present operation of the dam and headworks to divert water from the Yellowstone River for irrigation purposes, as authorized. This means operating the irrigation project without any modifications to provide fish passage alternatives or reduce entrainment until Reclamation completes required ESA consultation activities with the Service and implements any ESA requirements regarding fish passage and entrainment resulting from that consultation.

- **Relocate Main Channel –** The primary features of this alternative would be to excavate a 2.4-mile long new main channel for the Yellowstone River through Joe's Island to improve fish passage and contribute to ecosystem restoration. In addition, this alternative would include construction of a new main canal headworks structure with removable rotating drum screens or other screens that meet the screening criteria to minimize entrainment, and re-engineering and backfilling the existing Yellowstone River channel to deliver water from the new headworks to the existing main canal.

- **Rock Ramp –** The primary features of this alternative would be replacing Intake Diversion Dam with a concrete weir and un-grouted boulder and cobble rock ramp. This would maintain the existing surface elevation of the river upstream of the weir for diversion into the main canal, while improving fish passage and contributing to ecosystem restoration. A new main canal headworks structure with removable rotating drum screens or other screens that meet the screening criteria to minimize entrainment also would be constructed.

## No Action Alternative (Continue Present Operation)

This alternative best fits the definition of a "no action" alternative described in the CEQ and Departmental of the Interior regulations (43 CFR 46.30). In this case, this alternative is considered to be no change from current management direction or level of management intensity. It is assumed that all ongoing management actions would continue under existing legislation and regulations and would comply with all legal requirements and contractual obligations in the future.

This alternative is the benchmark against which all other alternatives are compared. This alternative analyzes and discloses the effects of continuing to operate Intake Diversion Dam as it is presently operated and maintained. The effects of this alternative are evaluated in this EA as the future condition of the environment without the proposed action.

This alternative would involve the Board of Control, as Reclamation's authorized agent under the O&M transfer and repayment contracts Ilr-103 and Ilr-104. These are the contracts with Lower Yellowstone Irrigation District Number 1 and Number 2 that authorize them to operate, maintain, and repair the Intake Diversion Dam and headworks with no significant modification of either structure beyond normal maintenance. Individual elements or actions undertaken by this alternative, where they are known, include:

- Using the existing Intake Diversion Dam and headworks to continue authorized operation of the Lower Yellowstone Project;
- Replacing displaced rocks along the crest of the Intake Diversion Dam periodically;
- Removing and transporting rock from the existing quarry for dam maintenance;
- Operating and maintaining the unscreened headworks;
- Dewatering and maintaining the main canal; and
- Reclamation continuing to consult with the Service under Section 7(a)(2) of the ESA.

***Using the Existing Intake Diversion Dam and Headworks***

The Reclamation Service built the existing Intake Diversion Dam, a low rock-filled timber-crib structure, in 1906 – 1911 (figure 2.1). Its crest lies about 5 ft below the natural low water mark of the river and 9 ft above the riverbed. The dam extends 700 feet between the headworks of the main canal on the north side of the Yellowstone River to a concrete abutment on the south side. Steel sheet piles cover the downstream curtain wall, which were installed after ice destroyed the original wooden sheet piles during the first winter after construction. In the 1970s two-thirds of the timber deck was replaced with new timbers and metal straps. Extending about 300 feet downstream of the dam, loose rocks built up from nearly a hundred years of erosion control activities form a "a dam in and of itself" in the river (Rider 1998)."

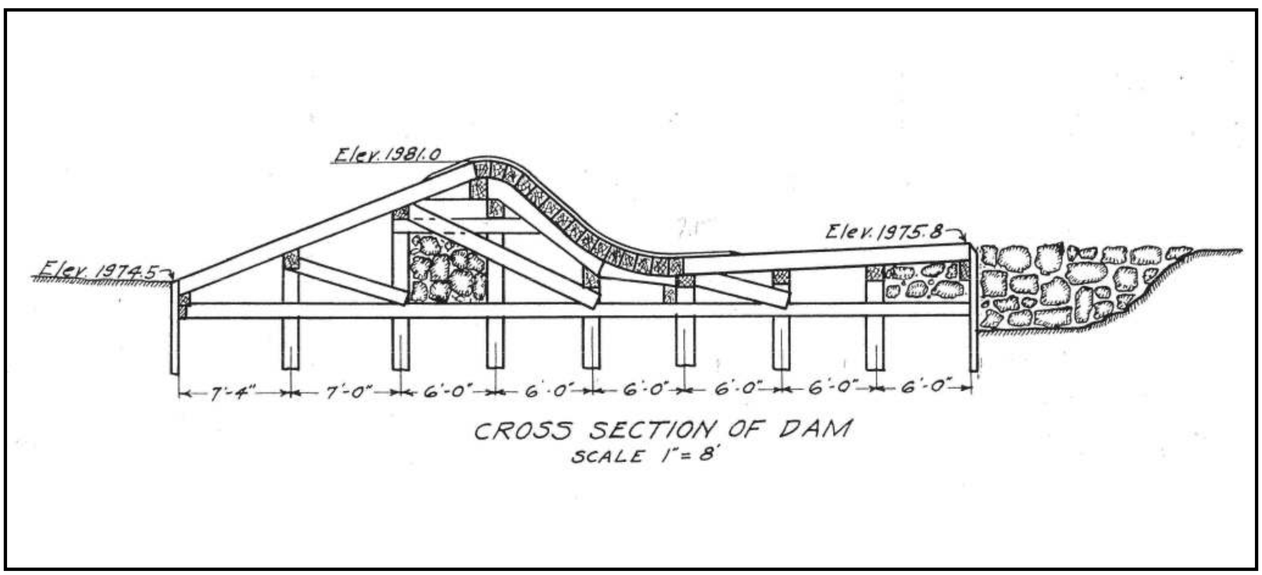
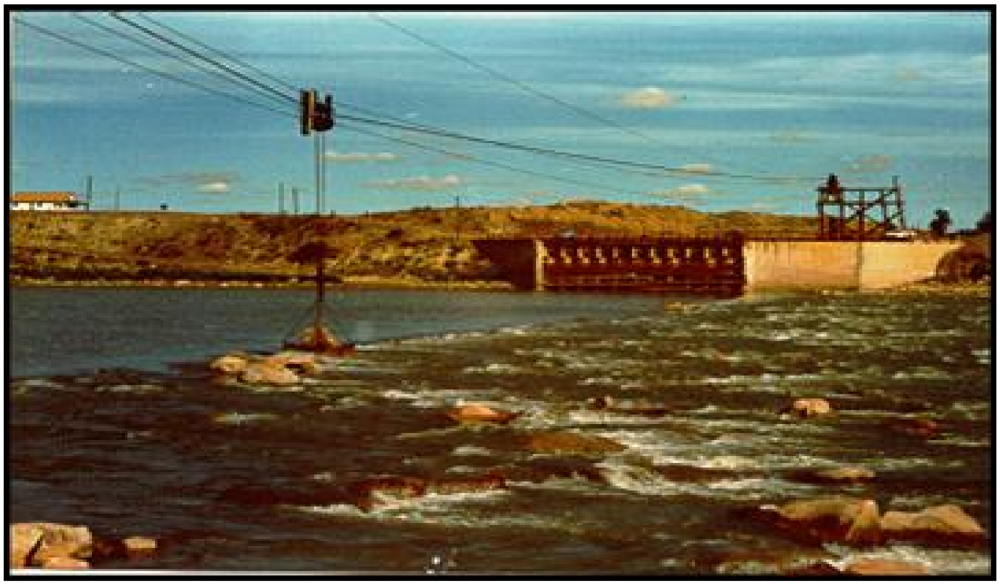



**Figure 2.1 – Historic Cross-section Drawing of Intake Diversion Dam.**

Routine O&M of the dam and headworks would continue (figure 2.2). The 12"x12" ice and trash deflectors would be replaced as needed, and the cableway would be maintained in good condition (see photograph below). Some accelerated maintenance and replacement likely would occur. The Board of Control expects to repair concrete at the entrance to the high-pressure gates and projecting piers and would attempt to repair three bays every other year until completed.



**Historic photograph showing replacement of rock on Intake Diversion Dam**

The north cableway tower probably would be renovated in the next 10 years. The south tower was renovated in 1999. It is anticipated that the cableway drums would be reconditioned or replaced in the next 5 years.

***Replacing Displaced Rocks along the Crest of the Intake Diversion Dam***

According to the Board of Control, rock has been added to the crest of the diversion dam nearly every year of the dam's existence. The reason rock is added is to elevate the water surface at least 12" above the existing crest, maintain a full canal, and protect the downstream face of the diversion dam from erosion. The annual quantity of rock added depends on river events, high water, and ice movement and varies from 500 - 7,000 tons, with the average being approximately 2,500 tons. It is estimated that 45,000 cubic yards of rock has been placed on the dam crest since construction. Approximately 22,000 cubic yards is located within 350 feet downstream of the dam. More rock has been moved further downstream by high flows and ice.

Rock is placed on the diversion dam usually in late July or early August when main canal flows are normally affected by seasonal low flow. Rock is stockpiled at the diversion dam, taken from the stockpile with a loader, dumped into a skid, and hauled across the river and dumped in the river by an overhead cableway (see photograph). A portable hydraulic pump unit provides power to operate the cableway. The cableway spans about 900 ft and is suspended between two wooden towers.

***Removing and Transporting Rock from the Existing Quarry for Dam Maintenance***

Rock is quarried from private land about 2 miles southeast of the diversion dam and hauled and stockpiled near the right abutment (figure 2.2). Rock is excavated from a sloping base below vertical rock outcrops. It is separated from other material with a hydraulic hoe, sorted, and placed on two small trucks and stockpiled at Intake Diversion Dam.

***O&M of the Unscreened Headworks***

Diversion of irrigation water traditionally starts May 1 and continues until October 1; however, climatic conditions can begin the season 2 weeks earlier or extend it by 2 weeks. Diversions range from 600 – 1,380 cfs. The higher diversions occur for about 50% of the irrigation season and continue as late as the first week of September. Diversions are regulated with 11 high pressure, unscreened gates. Gates are adjusted daily in response to fluctuations in river flow and irrigation demand.

Maintenance of the headworks structure includes repair and rehabilitation of gates and lifting devices, power unit, deck, wooden debris and ice deflector, concrete surfaces, and security features. A major maintenance activity involves removing lodged trees and limbs from the riverside of the high pressure gates. This maintenance is conducted every year prior to adding rock to the dam. A pontoon boat is positioned near the debris, and grab hooks are used to pull lodged materials from the debris and ice deflectors mounted on the gate bays. Workers use chain saws to cut debris into smaller pieces. A power winch on top of the structure assists in raising submerged trees and limbs to the surface.

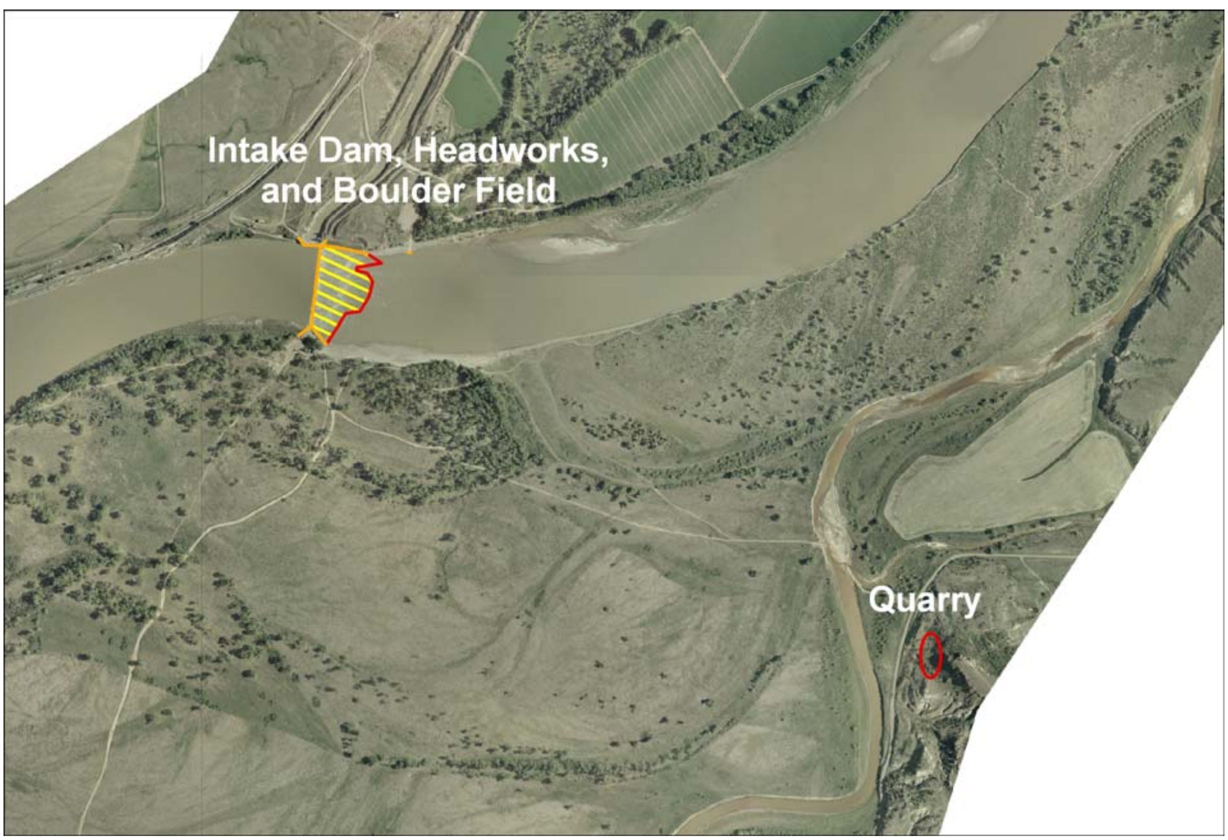



**Figure 2.2 – No Action Alternative (Continue Present Operation).**

The 12”x12" timbers covering the headworks are replaced about every 15 years. Deteriorating concrete which is subject to aging, freeze-thawing, and eroding, is repaired annually.

#### *Dewatering and Maintaining the Main Canal*

At the end of each irrigation season, the main canal is dewatered. Some of the entrained fish return to the river during the irrigation season or as the irrigation system is slowly dewatered in the fall. However, most entrained fish perish (Jaeger et al. 2005).

#### *Continuing Reclamation’s Consultation with the Service*

Under the No Action Alternative (Continue Present Operation), Reclamation would be obligated to continue consultation with the Service on the continued operation of the Lower Yellowstone Project under Section 7(a)(2) of the ESA and review O&M activities in accordance with the NEPA. The likely outcome of Section 7 consultation on the continued operation of the Lower Yellowstone Project would result in requirements for Reclamation to minimize entrainment and provide suitable upstream and downstream passage for larval, juvenile, and adult pallid sturgeon at Intake (Louis Hanebury, personal communication, 2009).

#### *O&M Cost Estimate*

The cost estimate for O&M of the existing Intake Diversion Dam, headworks, and first mile of the main canal would be $139,281 annually. This would include $40,875 for the diversion dam, $31,563 for the headworks, $1,133 for the main canal, and $65,710 for diversion dam rehabilitation. Both the main canal and dam would be repaired every 12 years.

### Relocate Main Channel Alternative

This alternative would move the main channel of the Yellowstone River from its current location to bypass the existing Intake Diversion Dam (figure 2.4). The relocated channel would have a steeper slope than the natural riverbed in order to reliably divert flow into the main canal without pumping. This newly excavated channel would provide relatively unimpeded fish passage, although there would be some erosion-control features. The relocated channel would be paired with new headworks and removable rotating drum screens or other screens that meet the screening criteria to prevent entrainment of fish into the main canal. It also would allow regulation of diversion flows into the Lower Yellowstone Project.

The main channel relocation alternative would have the following features:

- Excavated main channel;
- Concrete control structure;
- In-channel grade control structures (sills and rock riprap revetment);
- Irrigation canal extension;
- New headworks with screens; and
- Tieback levees.

#### *Excavated Main Channel Feature*

The primary component of this alternative is excavation of a new 12,500 ft (2.4 mile) long channel segment to provide fish passage. The existing channel would be partially filled and the existing Intake Diversion Dam buried. The new channel would diverge from the natural channel of the Yellowstone River approximately 8,000 ft upstream from the Intake Diversion Dam and would reconnect to the natural channel approximately 5,000 ft downstream. The longitudinal slope of the new channel would be approximately .085%, which is slightly steeper than the natural channel. For comparison purposes the natural slope of the Lower Yellowstone River is variable, but typically ranges from between .05% - .065%.

The new channel would simulate a natural channel with a compound cross-section (figure 2.3), and the banks would tie into existing ground. All channel sides would have a 4 to 1 slope. The new channel would have three components (figure 2.3):

1) Low flow channel 50 ft wide by 2 ft deep,
2) Normal flow channel 600 ft wide by 6 ft deep, and
3) High flow channel 1,250 ft wide.

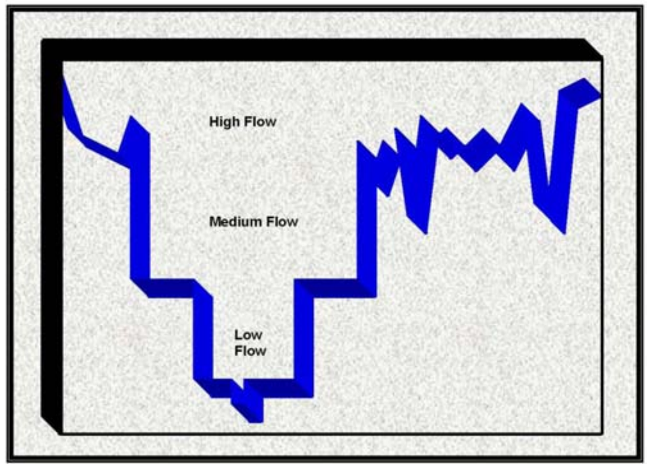



**Figure 2.3 –Channel Cross-section Showing Low, Average, and High Flow Area for the Relocate Main Channel Alternative.**

Fish would use the low-flow channel during low flows, while the wide, high-flow bench would minimize flood impacts that could result from a channel with a higher slope than the existing channel. The 100-year flood elevation at the upstream end of the proposed channel would be equal to or less than the existing 100-year flood elevation. Figure 2.3 shows a schematic of a typical channel cross-section with water surface elevations accommodating a range of flows.

Approximately 6.1 million cubic yards of soil would be excavated to construct the channel (figure 2.4). To minimize flood flow impacts, the entire channel probably would be constructed using either mechanical excavation or hydraulic dredging, as opposed to partially constructing the channel and allowing natural flows to finish it by eroding out the remaining material. Under both the mechanical excavation and hydraulic dredging scenarios, approximately 3.4 million cubic yards of material excavated from the new channel would be used to fill the existing channel of the river. The existing Intake Diversion Dam would be buried in place. In addition approximately 150,000 cubic yards of the excavated fill would be used to construct tieback levees. The remaining 2.5 million cubic yards of material would be hauled to an upland disposal site (see yellow slash area in figure 2.5).

The proposed disposal site for the leftover excavated material is located along the right bank (southeast) bluff line adjacent to an existing rock quarry (see figure 2.2). The leftover material would cover 33 acres and form a 40 ft high artificial hill shaped to blend with the surrounding topography (figure 2.5).

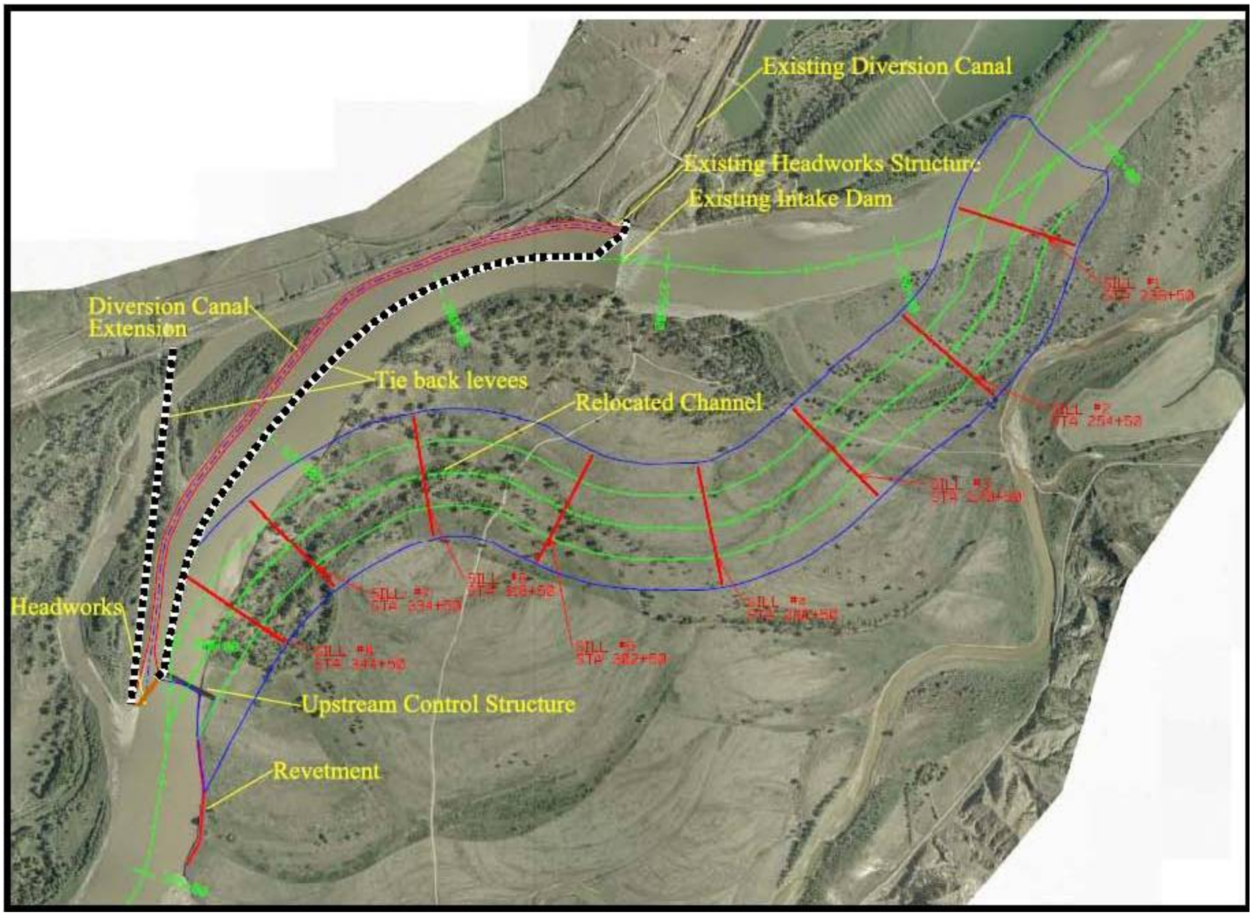



**Figure 2.4 – Relocate Main Channel Alternative.**

### *Concrete Control Structure*

Upstream from Intake a concrete control structure would stabilize the inlet to the new channel at an elevation high enough to divert 1,374 cfs into a new canal headworks (figure 2.4). The concrete control structure would hold the upstream end of the new main channel in place and protect it from ice gouging and erosion. This control structure would resemble a 600 ft wide concrete weir with a 10 ft crest width and a 2 to 1 slope on the front face. However, unlike a weir, the downstream side would tie directly into the bottom of the excavated main channel providing a seamless transition and unimpeded fish passage rather than sloping down to the riverbed like a typical weir. The concrete control structure would incorporate a 50 ft wide by 2 ft deep low flow channel to match the new low flow river channel (see figure 2.3). The crest elevation of the control structure would rise approximately 5 - 6 ft above the natural channel bottom.

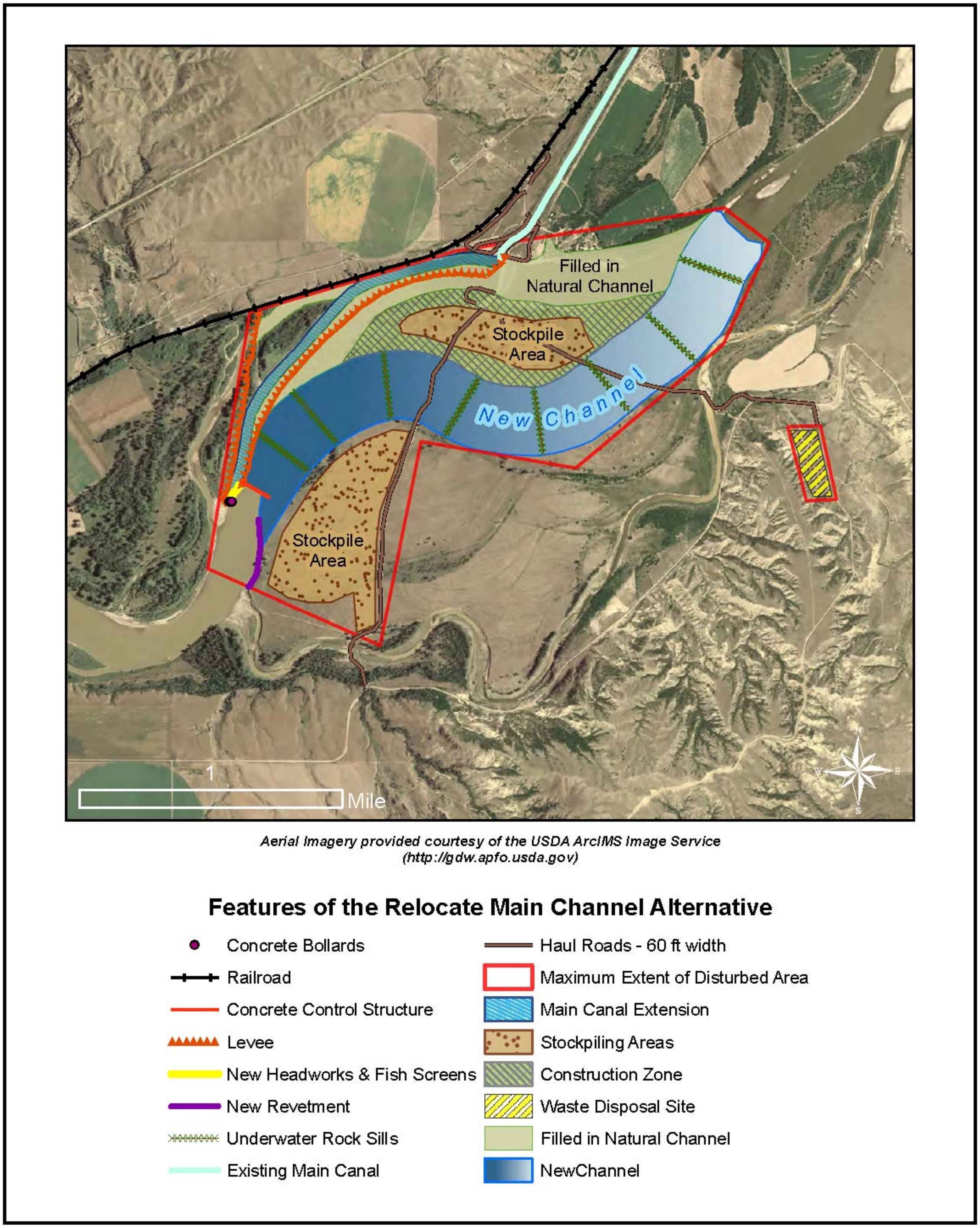



**Figure 2.5 – Relocate Main Channel Alternative Construction Impact Zones, Access Routes, and Preliminary Staging Areas.**

### *In-Channel Grade Control Structures*

Eight rock riprap sills would be constructed in the bed of the relocated channel to deter potential erosion headcutting and channel widening. Maintaining configuration of the relocated channel would ensure unimpeded fish passage and reliable diversions into the main canal. Spaced approximately 1,600 ft apart, each sill would be a keyed trench 10 ft wide by 4 ft deep filled with graded riprap. There would be a drop of about 1 ft at each sill with the crest set at the bottom of the excavated channel. The sills would extend through the high flow channel on either side of the channel centerline (see figure 2.3) and terminate at the edge of the excavation by tying into natural ground.

In addition, a rock riprap revetment would be constructed along the right bank of the existing channel extending from the right bank chute location downstream to the relocated main channel inlet (figure 2.3). This revetment would be 1,800 ft long and would prevent bank erosion and possible flanking of the Project by flood flows. The sills and revetment would use graded rock riprap with a median size of 24 inches and approximately 26,000 tons and 9,200 tons of rock riprap, respectively, for construction. The rock should be available from existing commercial quarries in Glendive or Limestone, Montana, and would be transported to the Project by truck or rail depending on the source.

### *Irrigation Canal Extension*

An extension of the main canal would be built behind the current headworks to the new headworks upstream location (figure 2.4). The canal extension would be shaped as fill is added to the existing river channel. Constructed to have a trapezoidal channel shape with a 50 ft bottom width, 4 to 1 side slopes, and a longitudinal slope of .1%, the canal extension would be approximately 7,400 ft long.

### *New Headworks with Screens*

A new headworks structure would control diversion of water into the canal extension and would have fish screens to minimize fish entrainment. Lacking screen design criteria specific to pallid sturgeon and other warm water species, the criteria used to design these screens meets standards developed by National Marine Fisheries Service and Service for salmonids. The Service has recommended using these criteria to minimize entrainment of pallid sturgeon and other native fish. The criteria are:

- Maximum screen size of 1.75 mm profile bar (2.38 mm woven wire)
- Maximum approach velocity of 0.4 ft per second in front of the screen.

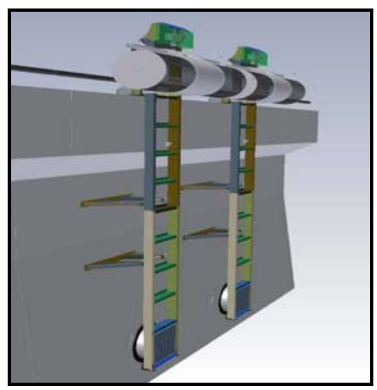


**Figure 2.6 – Removable Rotating Drum Screens Can be Raised to Avoid Ice and Flood Damage.**

Using these criteria, 17 removable rotating drum screens (figures 2.6 and 2.7) or other screens that meet the screening criteria would be installed on the riverside of the new headworks. These screens could be sized for a wide range of flow conditions and be adapted to the site based on head, debris load, etc. Each screen unit would roll on a track raising it above the river when not in use (figure 2.6). This feature would avoid damage from ice flows and jams during the winter.

The screens would have fixed brushes mounted on the inside and outside or some other form of cleaning system. The screen cylinder would rotate against the brushes to clean and remove algae build up that could impede flow through the screen. Each screen would be 6 ft in diameter and 19.5 ft long. Figure 2.7 is a schematic of the fish screen.

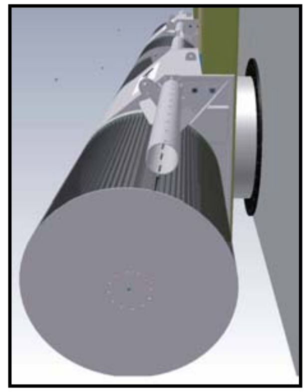


**Figure 2.7 – Schematic of the Removable Rotating Drum Screen.**

The new headworks structure with 17 gates and fish screens would be a reinforced concrete floodwall founded on steel piles built across the face of the extended main canal (figure 2.8). It would be 371.5 ft long and have reinforced concrete retaining walls positioned upstream and downstream tying into the adjacent banks. A steel sheet pile wall under the upstream end of the structure would protect against scour and reduce seepage. A bridge deck on one of the retaining walls would allow vehicle access to the top of the headworks structure for O&M of the screens. The top elevation of the headworks would be 5 ft above the 100 year ice-affected water surface.

Installed upstream and in front of the new headworks, a row of reinforced concrete bollards in the Yellowstone River would protect the structure and screens from debris and ice. The bollards would be elliptical in shape with a sloping face to break up ice sheets and would be on steel piles anchored to the channel bed. Figure 2.8 illustrates the new headworks structure with fish screens.

**Bollard** - a short, vertical post used to anchor a ship or to protect something from impact. In this case a line of bollards would protect the headworks from large floating objects, like trees or ice sheets.

### *Tieback Levees*

Tieback levees upstream and downstream from the new headworks structure would prevent overland flooding of the new diversion canal extension (figure 2.4). Constructed with a 4 to 1 side slope, the tieback levees would have a trapezoidal cross-section with a 10 ft crest width. The crest elevation would be 5 ft above 100-year ice-affected floodplain.

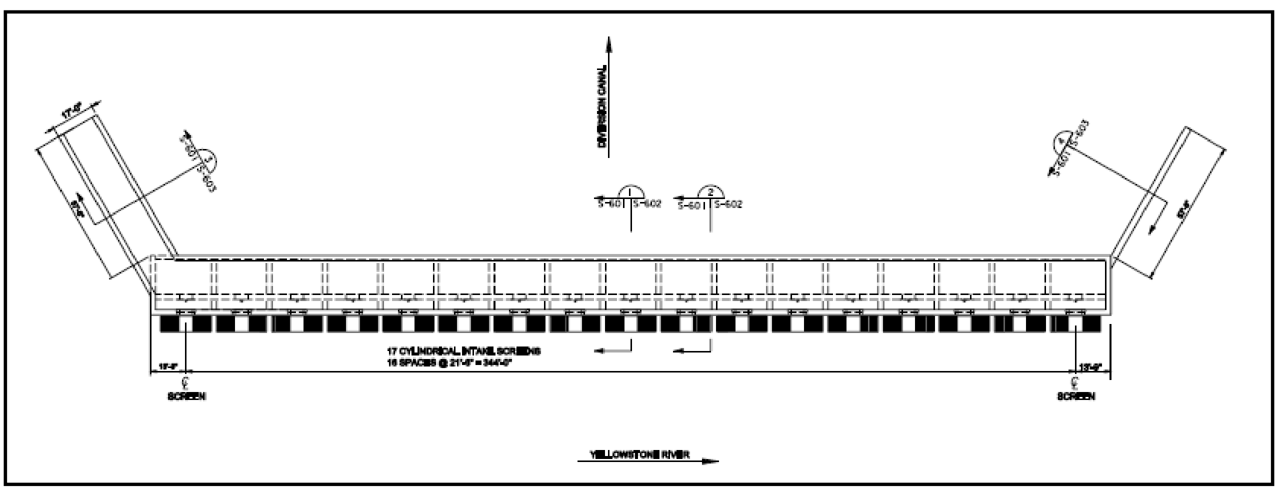



**Figure 2.8 – New Headworks With 17 Rotating Removable Drum Screens for the Relocate Main Channel Alternative.**

The upstream tieback levee would extend from the top of the new headworks north approximately 1,900 ft and tie into high ground near the railroad tracks. The downstream tieback levee would extend from the top of the new headwork along the backfilled former Yellowstone River channel down to the location of the current Intake Diversion Dam. It would tie into high ground just downstream from the existing headworks structure.

### *Real Estate Requirements*

The Relocate Main Channel Alternative features would be located primarily on Joe's Island, which is in the Yellowstone River floodplain. Some of this property was acquired by Reclamation during construction of the original Lower Yellowstone Project and is still administered by the agency. Other lands on Joe's Island are Montana State Trust lands or part of the old river channel. The ownership status of the old river channel has not been determined. Additional real estate interest (title or easement) would be acquired on approximately 33 acres for disposal of excess excavated material (figure 2.5). In addition, temporary rights-of-entry and/or easements might be necessary for construction staging areas. A pre-construction survey to determine land boundaries and subdivisions would be conducted to clarify ownership status so that real estate interests could be obtained.

### *Construction Considerations*

This would be a fairly large construction project, considering the volume of material to be excavated to construct a new channel. Because the Yellowstone River is large, construction access to either side would follow separate routes, since a temporary bridge would be infeasible. Access from the left bank would be used to construct the headworks and screening structure, canal extension, and tieback levees. Access from the right bank would be used to construct the concrete control structure, excavate the new channel, and construct sills and the upstream revetment. In addition, designated staging and stockpiling areas would be necessary to accommodate equipment, materials, and work crews during construction. Construction areas are identified on figure 2.5.

Construction of this alternative likely would take 3 years, if sufficient funding were available. It would begin with installation of a cofferdam around the site of the new headworks. By using a cofferdam, flow in the existing river channel could be maintained allowing uninterrupted operation of the Lower Yellowstone Project irrigation facilities. Concurrently, excavation of the new channel would proceed from the center of the channel outwards upstream and downstream. After the headworks and canal extension were completed, flows would be diverted through the new headworks, while finishing excavation of the channel and building the tie-back levees. Operation of the screens could be supplied by the existing local power grid.

### *Preliminary Cost Estimate*

**Construction Cost Estimate** The preliminary cost estimate for construction of the Relocate Main Channel Alternative is $68.9 million. This would include $38.6 million to excavate the main channel and build dikes; $4.7 million for the concrete control structure; $2.5 million for in-channel grade control structures (sills); $21.8 million for a new headworks, canal extension, and fish screens; and $1.4 million for revetment, clearing and grubbing, temporary improvements to haul roads, and seeding and mulching.

**O&M Cost Estimate** The preliminary cost estimate for O&M of the Relocate Main Channel Alternative is $333,755 annually. This would include $224,620 for the concrete weir and abutment bank protection, $108,002 for the headworks and screens, and $1,133 for the first mile of the main canal, which would be repaired every 12 years.

## Rock Ramp Alternative

This alternative would replace the existing timber and rock Intake Diversion Dam with a concrete weir that would have a shallow-sloped ramp to provide fish passage (figure 2.9). The rock ramp is designed to mimic natural river function and would lower velocities and turbulence so that migrating fish could seamlessly pass over the dam. The new dam and rock ramp would be paired with new headworks with screens, which would minimize entrainment of fish into the main canal and regulate irrigation diversions.

The Rock Ramp Alternative would have the following features:

- Concrete weir to replace the existing timber and rock dam;
- Rock ramp for fish passage;
- Irrigation canal extension; and
- New headworks with screens to minimize entrainment.


**Figure 2.9 – Rock Ramp Alternative** (concrete weir shown in green, rock ramp in light blue, canal extension in blue, new headworks in yellow, existing headworks in brown, and bollards in red).

During informal consultation with the Service in 2005, Reclamation submitted a draft Biological Assessment (BA) that identified a rock fishway as the preferred alternative. Resource agencies expressed concerns that pallid sturgeon would find it difficult to locate the entrance to a rock fishway because of concerns over attraction flows for a small fishway compared to the flow coming over the diversion dam which spans the entire width of the river. Since no fish passage structures have ever been designed or constructed specific to the needs of pallid sturgeon and uncertainties over fish utilization, several meetings were held to discuss alternative technologies and measures to address this issue. Consensus from the BRT, as well as other resource agencies, was that passage needs to be provided across the entire width of the river. This would provide the maximum opportunity for ensuring successful fish passage. During the initial evaluation of the rock ramp alternative, engineers indicated that a ramp spanning only a portion of the river channel would have a host of cross-currents and energy dissipation issues. This would likely reduce the actual effectiveness and area available for fish passage.

***Concrete Weir***

The replacement concrete weir would be located downstream of a new headworks to create sufficient water height to divert 1,374 cfs into the main canal. This concrete weir would replace an existing timber and rock-filled dam providing long-term durability lacking in the current structure. The concrete weir would be constructed as a cast-in-place reinforced concrete wedge spanning the entire width of the Yellowstone River channel. The upstream, sloping face of the concrete weir would be designed to withstand damage from blocks of ice moving up and over the dam in the spring. The historic headworks would be preserved in place to serve as a weir abutment on the north (left) bank of the river, while a new concrete weir abutment would be constructed on the south (right) bank at the lateral extent of the new weir. It would anchor into adjacent ground.

The weir crest would vary in elevation, including at least one low-flow channel for fish passage. The variable crest would offer an array of depth-velocity habitat zones for fish migration under a wide range of flows, which are typical on the Lower Yellowstone River. The channels in the weir crest would be designed to provide fish passage during late summer and early fall low flows and would be approximately 1 - 2 ft deep. 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. During final design, physical and hydraulic modeling would be used to optimize the crest configuration for fish passage and sediment transport (see appendix E).

***Rock Ramp***

A rock ramp would be constructed downstream of the replacement weir by placing rock and fill material in the river channel to shape the ramp without grout, and then it would be covered with rock riprap. The ramp would provide flow characteristics that meet the swimming abilities of the pallid sturgeon, so the endangered fish would have unimpeded access to habitat upstream of the weir. A wide range of slopes have been evaluated to simulate performance and predict reliability of fish passage (figure 2.10).

Because pallid sturgeon are sensitive to flow velocities and turbulence, the rock ramp would be constructed to be relatively flat (approximately 0.5% slope) over much of its width to keep flow velocities as low as possible. For comparison purposes, the natural slope of the Lower Yellowstone River varies, but typically ranges from between .05% - .065%. The final configuration of the rock ramp would be optimized for pallid sturgeon passage using ongoing computer and physical scale modeling. If selected, the Service's BRT would be consulted during design of this alternative, including but not limited to reviewing results and making recommendations on the physical model, hydraulic modeling, and final alternative design.

The new rock ramp would be constructed over the site of the existing Intake Diversion Dam, preserving most of the historic dam in place. Because the existing dam's rock field has washed downstream, part of the existing dam crest might be removed and rock moved to accommodate construction of a ramp. The rock ramp would include at least one low flow channel in conjunction with the low flow channel on the crest, which would allow fish migration during low flows. The rocks in the ramp would be sized to withstand high flows and ice jams and would range from 1 - 4 ft in diameter. The largest rocks would be placed near the crest to resist ice forces. Approximately 119,000 tons of rock riprap and 30,000 cubic yard of compacted fill would be needed to construct the ramp, but this volume might be reduced during final design. The rock should be available from existing commercial quarries in Glendive or Limestone, Montana, and would be transported to the Project by truck or rail depending on the source.

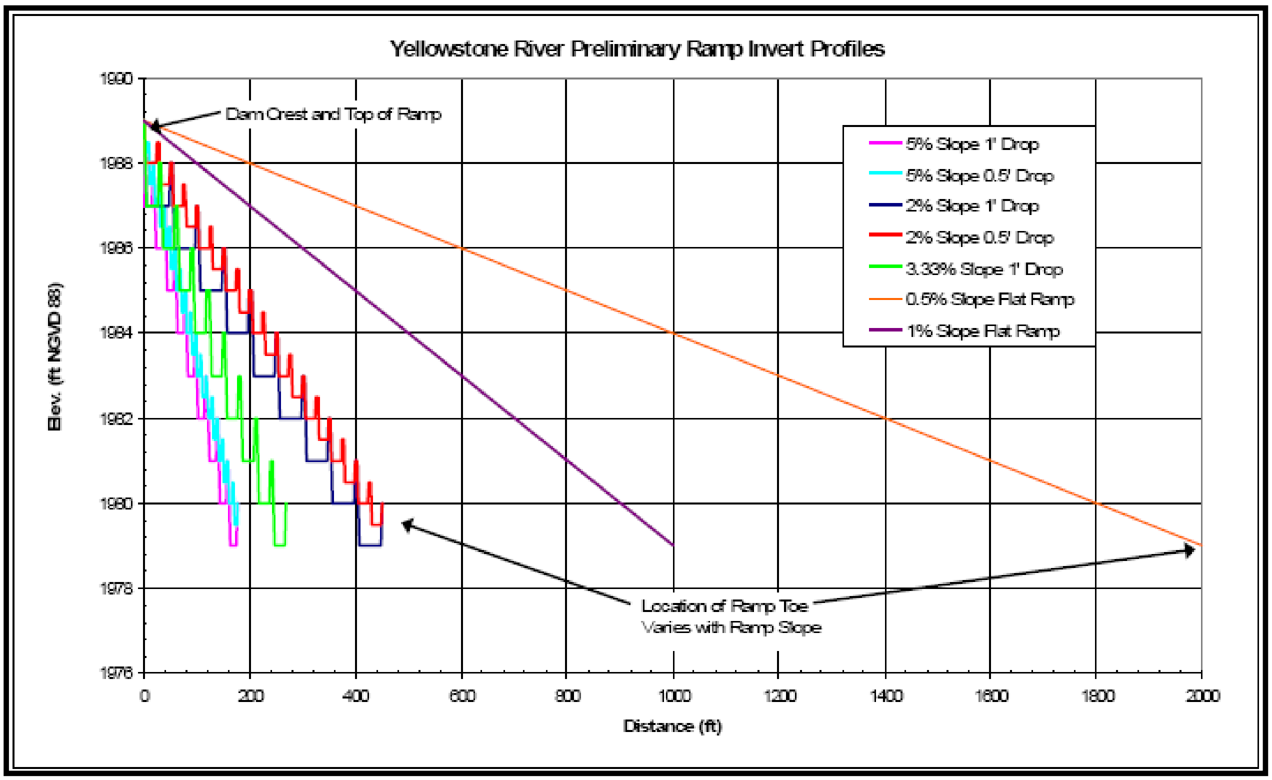



**Figure 2.10 – Graph Showing the Range of Ramp Slopes Evaluated for the Rock Ramp Alternative.**

### *Irrigation Canal Extension*

The Rock Ramp Alternative would include excavation of a new segment of the main canal to connect the new headworks structure to the existing canal. The new canal extension would mimic the existing main canal geometry. The existing canal has a trapezoidal channel with a 50 ft bottom and 1 to 3 slope sides. The location of the new canal extension would correspond with a relatively high bank and hillside along the north bank of the Yellowstone River. Material excavated during construction of the new canal would be used to fill the existing canal behind the current headworks, as fill for the rock ramp and/or to build cofferdams needed to control water during construction. Any excess material would be permanently stockpiled in the area shown on figure 2.12. The material would form a 35 ft artificial hill shaped to blend with the surrounding topography. The new canal embankments would include access roads along each side for maintenance purposes and for stabilization of the cut slope. The upstream end of the new canal would transition into a 300 ft wide section tied into the new headworks structure.

### *New Headworks with Screens*

A new headworks structure would control diversion of water into the canal extension, and screens, as described previously in the discussion of the Relocate Main Channel Alternative, would be installed in the new headworks to minimize entrainment of fish into the canal (figures 2.6 and 2.7). The new headworks and fish screen facility for this alternative would need 12 gates with screens, which is fewer than the other action alternative. Although the new headworks only would require 11 screens to divert the Districts' full water rights, an additional screen has been incorporated into the final design to provide increased reliability.

In the event that a screen needed repair or maintenance, the gate to that screen could be shut and a back-up screen put into operation to divert the full water right. Each individual screen would be 6.5 ft in diameter and 25.2 ft long, resulting in a total structure length of 310 ft (figure 2.11). The top elevation of the headworks would be 5 ft above the 100-year ice affected water surface. Bollards would be installed upstream of the new headworks. See pages 2-10 to 2-11 for a description of the new headworks structure.

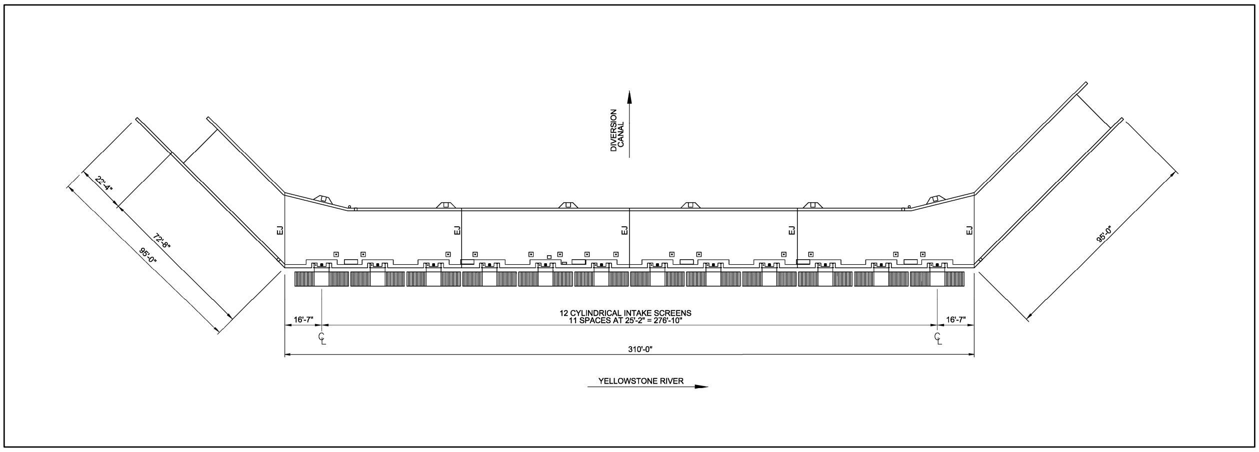



**Figure 2.11 - New Headworks With 12 Rotating Removable Drum Screens for the Rock Ramp Alternative.**

### *Real Estate Requirements*

The Rock Ramp Alternative features would be primarily within the channel and along the north bank of the Yellowstone River. Most of this property is currently held by Reclamation or by the State of Montana, with the exception of an irregularly-shaped private parcel north of the new headworks structure. There is also a parcel of railroad right-of-way in the construction zone, although the railroad would not be impacted. Approximately 12 acres of private real estate would be acquired from this parcel for the canal extension. In addition, temporary construction easements or rights-of-entry would be needed for proposed haul routes, staging areas, and material handling areas during the construction. Figure 2.12 shows the proposed construction access routes and staging areas anticipated for this project.

### *Construction Considerations*

The Rock Ramp Alternative would be a fairly large construction project, considering the volume of material that would be moved to the site to construct the rock ramp. Because the Yellowstone River is a large river, access to the left and right banks for construction would be needed to replace the existing dam.

It is anticipated that the overall construction would be conducted in three primary phases:

- Phase 1 - construct the new headworks, canal extension, and the south half of the concrete weir;
- Phase 2 - build the north half of the concrete weir and north half of the rock ramp; and
- Phase 3 - finish the rock ramp.

Construction of this alternative would take 2.5 years, if sufficient funding were available. It would begin by building the new headworks, while continuing to divert flows to the main canal through the existing headworks. A cofferdam along the north bank of the river would control water during construction. Concurrent with headworks construction, the southern half of the replacement concrete weir would be constructed using haul routes on the south side of the river across Joe's Island. A cofferdam would be constructed in the river channel extending downstream and tying into the existing dam to control water during dam reconstruction. Access to the south bank would be on existing dirt roads, but temporary culvert or low flow crossings would be needed to cross the existing high flow side channel (figure 2.12).

Material excavated during construction of the canal extension would be used to backfill the existing canal behind the existing headworks. If construction timing allows, this material would be excavated and placed during the non-irrigation season, but the material could be temporarily stockpiled at the rock stockpile area and then moved to backfill the existing canal after diversion operations cease in the fall.

Construction of the north half of the concrete weir and rock ramp would start after completing the headworks and canal extension, ensuring continued diversion of flows for uninterrupted operation of the irrigation districts. A cofferdam extending from the existing headworks across the end of the concrete weir would control water for this construction phase. After the north half of the concrete weir is in place, rock ramp construction would begin working from the north bank across the river in parallel segments.

Preliminary estimates of 119,000 tons of rock varying in size from 1 - 4 ft probably would be needed to build the ramp. It is anticipated that suitable rock would be purchased from existing Montana quarries, either in Glendive, Limestone, or Warren and be shipped to the Intake Project site by rail. Figure 2.12 identifies a section of track along the existing Yellowstone Valley Railroad short line where the rock would be unloaded from the railcars and temporarily stockpiled for ramp construction. Because many trucks would be needed to transport rock from the stockpile to the riverbank, a temporary crossing might be constructed across the current main canal to prevent damage to the existing county bridge. The new crossing would use six 10-ft by 10-ft box culverts with sufficient width and length to bridge the existing canal.

Construction of the remainder of the rock ramp would be the final phase of this alternative. It would be completed by working incrementally across the river from the north bank building sections of the ramp.

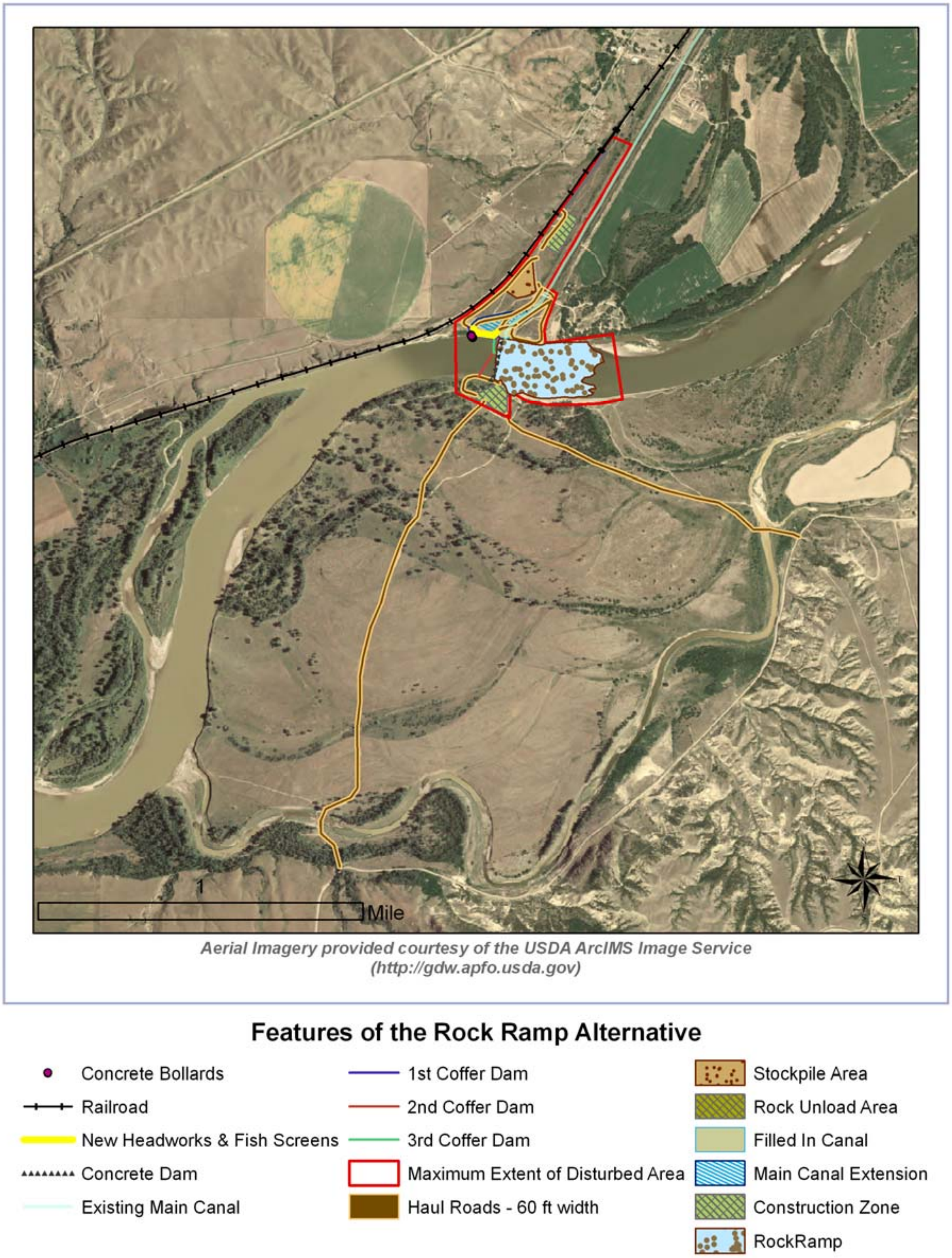



**Figure 2.12 – Rock Ramp Alternative Construction Access Routes and Preliminary Staging Areas.**

***Preliminary Cost Estimate***

**Construction Cost Estimate** The preliminary cost estimate for the Rock Ramp Alternative is $38.8 million. This would include $18.2 million for the new headworks, canal extension, and fish screens, $13.5 million for the rock ramp and $7.1 million for non-contract costs. Operation of the screens could be supported by the existing local power grid.

A physical model of this alternative is being used to optimize design of the rock ramp. The physical model demonstrates how the ramp structure would meet pallid sturgeon velocity needs, while minimizing the amount of rock fill to be placed in the Yellowstone River. Mininizing fill is a key component of Clean Water Act compliance.

During optimization of a full width rock ramp alternative, hydraulic modeling efforts focused primarily on meeting the swim criteria developed by the BRT as outlined in Appendix E. These criteria reflected the potential hydraulic needs of the pallid sturgeon to pass over the weir. Fourteen iterations of a rock ramp that spanned the width of the river were modeled. The first modeling effort used a 1-dimensional HEC-RAS model to develop the initial configuration. Then a 2-dimensional ADH model was used to refine and optimize the preliminary design. The preliminary design, as presented in this final EA, provides the best combination of depth and velocity results over a wide range of flow conditions. This conforms to the criteria set forth by the BRT while minimizing the footprint and fill in the river channel. Preliminary design refinement, which was on-going concurrent with the draft EA review, incorporates physical (1:20 scale) modeling of the diversion headworks and screens and the rock ramp. The goal is to further optimize performance of the Rock Ramp Alternative, while minimizing the construction footprint and associated costs.

**O&M Cost Estimate** The preliminary cost estimate for O&M of the Rock Ramp Alternative is $272,807 annually. This would include $163,671 for the concrete weir and ramp, $108,002 for the headworks and screens, and $1,133 for the first mile of the main canal, which would be repaired every 12 years.

## Summary of Environmental Consequences

Chapter four fully discloses the environmental impacts of the proposed alternatives, which are summarized in this section. Table 2.1 compares the impacts of the proposed action alternatives. Direct, indirect, and cumulative effects are discussed in detail in chapter four. When data were available, these effects are quantified. Actions to minimize effects are also described in the resource impact sections in chapter four and are summarized in appendix I.

The action alternatives are compared to the No Action Alternative (Continue Present Operation) to estimate the impacts on each resource in chapter four. Table 2.1 summarizes the effects to resources for each alternative, when compared to the No Action Alternative. The table identifies whether each alternative would have a long-term beneficial, long-term adverse, temporary effect, minimal effect or no effect on a resource when compared to No Action. The table takes into account implementation of the actions to minimize effects described in chapter four and appendix I.

**Table 2.1 – Summary of Environmental Impacts That Could Result From Construction and O&M of the Action Alternatives.**

| Resource | Rock Ramp Alternative | Relocate Main Channel Alternative |
|---|---|---|
| **B** – Beneficial Effect **A** – Adverse Effect **M** – Minimal Effect **T** – Temporary Effect **N** – No Effect | | |
| Climate | N | N |
| Air Quality | T | T |
| Hydrology | N | N |
| Geomorphology | M | M |
| Surface Water Quality | T N | T M |
| Aquatic Communities - Fish | B T | B T |
| Aquatic Communities - Mussels | T M | T M |
| Aquatic Communities - Macroinvertebrates | T M | T M |
| Federally-Listed Species and State Species of Special Concern | B T M N | B T M N |
| Lower Yellowstone Project Irrigation Districts | T | T |
| Recreation | T M | T M |
| Social and Economic Conditions - Regional | T B | T B |
| Social and Economic Conditions – Irrigation Districts | M | M |
| Environmental Justice | N | N |
| Natural Resource Lands | T M | T M |
| Wildlife | T M | T M |
| Historic Properties | M | M |
| Indian Trust Assets | N | N |

## Consequences of No Action Alternative (Continue Present Operation)

There would be consequences if Reclamation decides to continue present operation of the Lower Yellowstone Project. In general, incidental take of pallid sturgeon at Intake would continue. Permitting and minimization of incidental take of pallid sturgeon for operation of the Lower Yellowstone Project under No Action would require either a Board of Control-negotiated habitat conservation plan (HCP) under Section 10(a) of the ESA or completion of Section 7(a)(2) consultation by Reclamation. Either scenario to address incidental take would not diminish Reclamation's legal responsibility to comply with the ESA and correct the existing passage and entrainment impacts caused by the Intake Diversion Dam and headworks. In addition, passage and entrainment protection at Intake are now Corps requirements under the amended 2003 Missouri River Amended Biological Opinion.

For many resources, the No Action Alternative (Continue Present Operation) would have little or no effect. For those resources that would be affected, the consequences of No Action would be:

- ***Federally-Listed Species*** Section 11 of the ESA describes civil and criminal penalties that may result from incidental take in violation of Section 9. Criminal violations are subject to fines of no more than $50,000 and imprisonment for no more than one year, or both.

- ***Federally-Listed Species*** To remedy unauthorized incidental take at Intake associated with the operation of the Lower Yellowstone Project, the Board of Control could develop and implement a Service-approved HCP. Such a plan would authorize a prescribed level of incidental take of pallid sturgeon and include procedures for operating and maintaining the Lower Yellowstone Project in a manner that minimizes incidental take. It is likely that such a HCP would also include provisions to provide adequate upstream and downstream passage for pallid sturgeon during specified time frames and to minimize entrainment of pallid sturgeon in the main canal. The Board of Control would be responsible for funding such actions.

- ***Federally-Listed Species*** Reclamation would also need to complete consultation on the continued operation of the Lower Yellowstone Project with the Service under Section 7(a)(2) of the ESA. The biological assessment prepared by Reclamation to determine effects on listed species and initiate formal Section 7 consultation under this alternative would describe effects resulting from continued operations and may or may not include conservation measures to improve fish passage and/or reduce entrainment. The likely outcome of this Section 7 consultation would be a biological opinion from the Service concluding that continued operation of the Lower Yellowstone Project jeopardizes the continued existence of the pallid sturgeon.

- ***Federally-Listed Species*** Biological opinions that conclude actions are likely to jeopardize the continued existence of a listed species are required to develop reasonable and prudent alternatives (RPAs), if any, in consultation with the action (or consulting) agency (e.g., Reclamation). It is likely that such RPAs for the Lower Yellowstone Project would include requirements that Reclamation provide adequate upstream and downstream passage for pallid sturgeon during specified time frames and minimize entrainment of pallid sturgeon into the main canal. The RPAs could also specify a date by which the requirements must be fulfilled. Reclamation would be responsible for funding such actions.

- ***Federally-Listed Species*** The absence of a Service-approved HCP or lack of a completed Section 7 consultation by the Board of Control and/or Reclamation, respectively, would not be in compliance with the ESA. Based on Reclamation's experience with Section 7 consultation and ESA compliance on other projects and facilities, the Service would likely require that improved passage and entrainment minimization be in place by a certain date. Reclamation has undertaken similar modifications of project facilities on other Reclamation projects and has modified project facilities and operations to avoid jeopardizing listed species. Failure to achieve compliance with ESA has resulted in severe curtailment of project water deliveries from other Reclamation projects.

- ***Existing Uses of the Yellowstone River*** The No Action Alternative (Continue Present Operation) could impact use of water by the Lower Yellowstone Irrigation District. If Reclamation does not initiate and successfully complete consultation with the Service, then the Board of Control's ability to operate the dam and headworks to deliver project water to the Lower Yellowstone Project could be severely constrained or limited in the future.

- ***Water Quality*** The Board of Control's continued action of placing rocks along the crest of the dam and the subsequent movement of rocks downstream would result in minor disturbance of sediments, which could cause a temporary localized increase in turbidity. Disturbance of sediments would not increase concentrations of nutrients, trace elements, or organic compounds in the lower Yellowstone River.

- ***Aquatic Resources*** Intake Diversion Dam would continue to be a fish barrier, preventing or reducing upstream movement of many species. Entrainment into the main canal would continue to be a substantive source of mortality for sauger and many other fish species. Paddlefish would continue to congregate downstream of the dam during spawning season and would move upstream only during high flows when the side channel around Joe's Island is flowing. Continued fish entrainment reduces the number of fish to transport mussel larvae.

- ***Lower Yellowstone Project*** Under this alternative there would be no short-term impacts relative to the reliability of providing a full water supply or the O&M of the Intake Diversion Dam and headworks. Reclamation would continue consulting with the Service under Section 7(a)(2) of the ESA. Based on Reclamation's experience with Section 7 consultation and ESA compliance on other projects and facilities, the Service would likely require that improved fish passage and entrainment minimization be in place by a certain date. Failure to achieve compliance with ESA would result in severe curtailment of project water deliveries over the long-term.

- ***Wetlands*** The Board of Control's replacement rocks along the crest of the existing Intake Diversion Dam and subsequent movement of rocks downstream would continue to fill riverine wetlands. However, even with the current redistribution of rock, riverine wetlands remain. Current fill from this action is about 2 acres and would expand in subsequent years as additional rock is added.

- ***Historic Properties*** This alternative would have the fewest impacts to historic properties, except that ongoing neglect of the Headworks Gate Tender Residence and outbuildings (24DW447) would be considered an adverse effect under the National Historic Preservation Act (NHPA). In addition, continued removal of rocks from the historic Lower Yellowstone Quarry (24DW296) to use in O&M of the Intake Diversion Dam is an ongoing adverse effect.

## Comparison of the Alternatives

Although some resources would be affected in the same way by the two action alternatives, the degree or amount of effects would likely differ. To more clearly distinguish between the two action alternatives, the advantages and disadvantages of each in comparison to No Action are listed in tables 2.2 and 2.3. The tables take into account the actions to minimize effects listed in chapter four and in appendix I.

## Identification of the Preferred Alternative

Reclamation and the Corps have identified the Rock Ramp as the preferred alternative. It is the least cost alternative. Unlike the No Action Alternative, the Rock Ramp Alternative would meet the purpose and need of the proposed action and would improve fish passage and minimize entrainment. In comparison to the other alternatives considered in the Final Intake EA, it would improve fish passage by decreasing channel slope and have 52,044 fewer feet of bank stabilizing structures on the lower Yellowstone River than the Relocate Main Channel Alternative. Hydraulic modeling indicates that the Rock Ramp Alternative would be easier for pallid sturgeon to navigate than the other alternatives. Recreational resources would be less affected than with the other action alternative, because the river would stay beside the campground and day use area, and access would be improved to Joe's Island. Because the construction footprint is in the same location but smaller than the other action alternative, there would be fewer impacts to natural resources and wildlife, and fewer actions to minimize effects would be required. It would cost about $30.1 million less to construct than the other action alternative, would have lower annual O&M costs, and would take less time to build.

In a project where there is no monetary means of measuring benefits but project outcomes can be quantified, cost effectiveness analysis can be used. Given that the purpose and need of the proposed action is to provide fish passage and entrainment protection to endangered pallid sturgeon and give them access to an additional 165 river miles of habitat, both action alternatives meet the purpose and need. Appendix E presents a relative comparison of the action alternatives and their ability to facilitate pallid sturgeon passage. While the alternatives were compared against a set of criteria developed by the BRT based on pallid sturgeon swim capability, neither alternative provides more or less habitat output. Modeling results for the rock ramp alternative demonstrate that it meets the swimming abilities of pallid sturgeon better than the Relocated Main Channel Alternative. However, the BRT concluded that both alternatives provide adequate depth/velocities to successfully provide passage, and thus, access to the same amount of habitat (165 river miles). Given that both alternatives have the ability to equally meet the purpose and need of the proposed action and the quantity of habitat available for each alternative is the same, an incremental analysis of the alternatives simplifies to a least cost analysis.

**Table 2.2 - Advantages and Disadvantages of the Relocate Main Channel Alternative.**

| Relocate Main Channel Alternative | |
|---|---|
| **Advantages** | **Disadvantages** |
| • Would reconnect the lower Yellowstone River and contribute to ecological restoration by rerouting the river around a fish barrier.<br>• Would allow passage of the endangered pallid sturgeon and other native fish up and downstream at Intake, Montana, opening 165 miles of the Yellowstone River for migration, spawning, and rearing.<br>• Would minimize entrainment of pallid sturgeon and other native fish.<br>• Would improve the river channel slope near Intake, Montana.<br>• Access to Joe's Island would improve.<br>• Recreational boat traffic would improve on the Yellowstone River at Intake.<br>• Short-term positive regional economic benefits would result from construction.<br>• Fewer historic properties would be impacted by construction of this alternative, as compared to other action alternative. | • It would be the most expensive alternative, with an estimated cost of $68.9 million.<br>• Annual O&M costs would be more than the other action alternative.<br>• This would be a fairly large construction project requiring excavation of 6.1 million cubic yards of soil. Of this, 2.5 million cubic yards would be disposed of by building a 40 ft high artificial hill on private land.<br>• Construction would take 3 years, which is 6 months longer than the other action alternative.<br>• Would increase the length of stabilization features on the Lower Yellowstone River by about 20% in the reach from Cartersville Dam to the confluence of the Missouri River when compared to No Action, and 18.4% when compared to the Rock Ramp Alternative.<br>• More sediment would be disturbed during construction, but the effects on water quality and aquatic resources would be temporary.<br>• Has lower pallid sturgeon hydraulic modeling scores than the Rock Ramp Alternative, indicating that it would be more difficult for sturgeon to navigate than the rock ramp (appendix E).<br>• The new headworks, screens, and extended main canal would be more difficult and more costly to maintain by the irrigation districts.<br>• Temporary, periodic closure of the boat ramp, day use area, and campground during construction could reduce recreational use of Intake Fishing Access Site. After construction the boat ramp would be relocated.<br>• The river would be moved farther from the campground and day use area reducing audio and visual aesthetics.<br>• The undeveloped recreation area on Joe's Island would be smaller.<br>• The hunting area on Joe's Island would be reduced.<br>• Contractors, sub-contractors, and the Glendive Chamber of Commerce could lose money during the paddlefish season, as a result of temporary closure of the boat ramp during construction and long-term dispersal of paddlefish.<br>• The construction footprint is larger, thus impacts to natural resources and wildlife would be greater, and the costs of actions to minimize effects would be higher. |

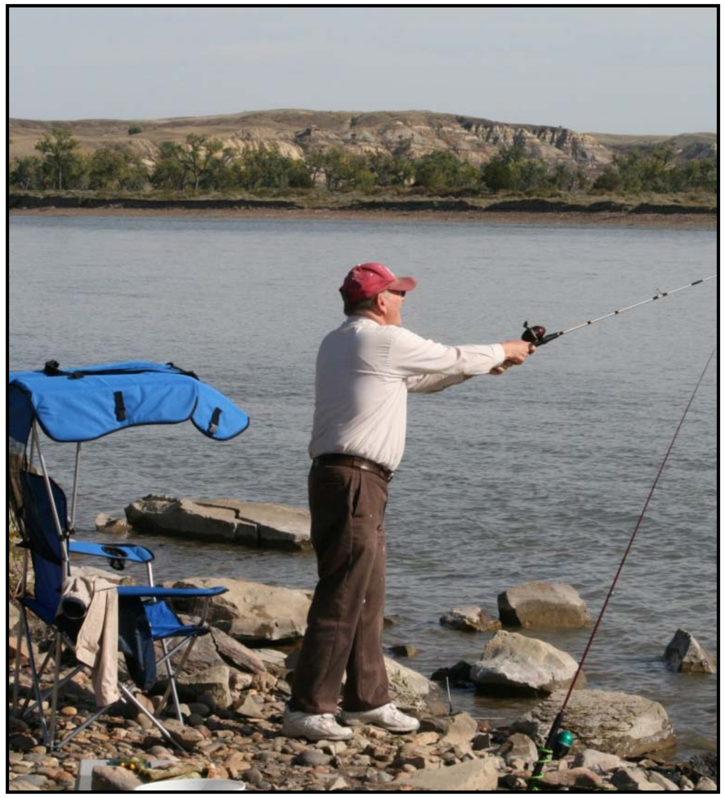
**Table 2.3 - Advantages and Disadvantages of the Rock Ramp Alternative.**

| Rock Ramp Alternative | |
|---|---|
| **Advantages** | **Disadvantages** |
| • Would reconnect the lower Yellowstone River and contribute to ecological restoration providing passage over a fish barrier.<br>• Would allow passage of the endangered pallid sturgeon up and downstream at Intake, Montana, opening 165 miles of the Yellowstone River for migration, spawning, and rearing.<br>• Would minimize entrainment of pallid sturgeon and other native fish.<br>• Would be less expensive than the other action alternative, with an estimated cost of $38.8 million. It is the least cost alternative.<br>• Annual O&M costs would be less than the other action alternative.<br>• Construction would take 2.5 years, which is 6 months less than the other action alternative.<br>• Would improve the channel slope and have 52,044 fewer feet of bank stabilizing structures on the lower Yellowstone River than the Relocate Main Channel Alternative.<br>• Less sediment would be temporarily disturbed during construction.<br>• This alternative has higher pallid sturgeon hydraulic modeling scores, indicating that it would be easier for pallid sturgeon to navigate than the other alternatives (appendix E).<br>• The river would remain beside the campground and day use area.<br>• The undeveloped recreation area on Joe's Island would stay the same, but access would improve.<br>• The hunting area on Joe's Island would be the same.<br>• Changing the grade of the dam could allow more boat traffic up and downstream at Intake.<br>• Short-term positive regional economic benefits would result from construction of this alternative.<br>• The construction footprint is smaller than the other action alternative, so there would be fewer impacts to natural resources and wildlife, and fewer actions to minimize effects would be required. | • This is a fairly large construction project requiring import of 119,000 tons of rock.<br>• The new headworks, screens, and rock ramp would be more difficult and more costly to maintain by the irrigation districts.<br>• Temporary, periodic closure of the boat ramp, day use area, and campground during construction could reduce recreational use of Intake Fishing Access Site. After construction the boat ramp would be relocated.<br>• Contractors, sub-contractors, and the Glendive Chamber of Commerce could lose money during the paddlefish season, as a result of temporary closure of the boat ramp during construction and of long-term dispersal of paddlefish.<br>• More historic properties would be impacted by construction of this alternative. |

# Chapter Three *Affected Environment*

## Introduction

The environment of the area to be affected by the alternatives is described in this chapter. The discussion focuses on the existing conditions of resources that could be affected by the proposed Intake Project. The results of the impact analyses are summarized in the next chapter (chapter four), and environmental commitments to avoid, minimize, or mitigate adverse effects to these resources are listed in that chapter and in appendix I. Common and scientific names of species referenced in both chapters are in appendix F.



**Fishing at Intake, Montana, is a popular activity that would be affected by the action alternatives.**

Resources that could be affected by the proposed alternatives are distributed throughout the geographic scope of the Intake Project, as generally defined in chapter one but more specifically described by resource in this chapter (figure 1.1).

Issues or resources identified during public scoping are:

- Climate
- Air Quality
- Hydrology
- Geomorphology
- Surface water quality
- Aquatic communities
- Federally-listed species and state species of special concern
- Lower Yellowstone Project irrigation districts
- Recreation
- Social and economic conditions
- Environmental justice
- Lands and vegetation – wetlands, grasslands, woodlands, riparian, and noxious and invasive plant areas
- Wildlife
- Historic properties
- Indian trust assets

Public scoping comments also suggested revisions to alternatives, requested analysis of cumulative effects, and asked questions regarding compliance with NEPA (Reclamation and

Corps 2009). Chapter two describes the revised alternatives and explains why some of the suggested alternatives were not feasible or reasonable.

## General Description of the Intake Project Area

**Ecoregions** are areas defined by environmental conditions and natural features. They denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. These resources include geology, vegetation, climate, soils, land use, wildlife, and hydrology.

The area of potential effect lies within one distinct ecoregion. Ecoregions are relevant in natural resource management and decisionmaking as each ecoregion's quality and integrity reflects specific environmental resources. Ecoregions also reflect biodiversity (Council on Environmental Quality 1993). The ecoregion represented in the Intake Project area is the Northwestern Great Plains (figure 3.1), as described by Omernik (1987) and including refinements of Omernik's framework for other projects (EPA 2005).

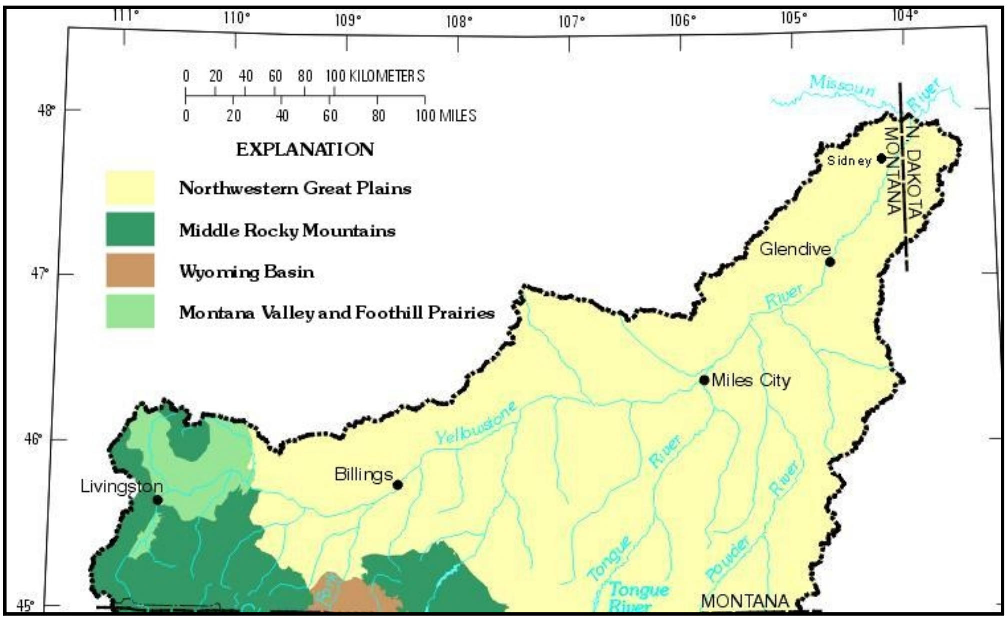



**Figure 3.1 – Northwestern Great Plains Ecoregion (modified from Zelt et al. 1999).**

The Northwestern Great Plains Ecoregion is largely an unglaciated, semiarid, and rolling plain underlain by shale, siltstone, and sandstone. It contains occasional buttes, badlands, ephemeral-intermittent streams, and a few perennial rivers. Low precipitation and high summer evapotranspiration restrict groundwater recharge rates. Rangeland is common, but spring wheat and alfalfa farming also occur; agriculture is affected by erratic precipitation with few opportunities for irrigation. Native grasslands persist, especially in areas of steep or broken topography. More specifically this Intake Project falls within an ecoregion subunit called the River Breaks, which is composed of very highly dissected terraces and uplands that descend to the Missouri and Yellowstone river systems.

# Climate

## Introduction

- What is the climate in the Project area that could be affected?

Climate of the lower Yellowstone River basin is temperate and semiarid. Because the basin is located near the center of the continent, the weather is characterized by fluctuations and extremes. Air masses originating in the arctic dominate in the winter, while air masses from the Gulf of Mexico influence the spring and early summer weather.

The mean annual temperature at Glendive is 45° F. July is normally the warmest month, with average daily highs of 89° F and an average monthly temperature of 74° F. January is the coldest month, with average daily lows of 4° F, and an average monthly temperature of 15° F.

The average annual precipitation at Glendive is 13.9". Annual precipitation is highly variable, with a maximum of 26.0" in 1916 and a minimum of 4.8" in 1934. On average, about 50% of the precipitation falls from May through July. The average annual snowfall is 29."

**Ice blocks removed from Yellowstone River during construction of Lower Yellowstone Project**

# Air Quality

## Introduction

- What is the existing air quality in the Project area that could be affected by the Intake Project?

The 1990 Clean Air Act is a federal law that covers the entire country, ensuring that all Americans have the same basic health and environmental protections. Under this law, EPA sets limits on how much of a particular pollutant can be in the air anywhere in the United States. Individual states are allowed to have more protective ambient air standards, but they are not allowed to have less stringent standards than those set by EPA.

The air quality in the project area meets the national and state standards for the criteria pollutants of carbon monoxide, lead, particulate matter, and sulfur dioxide. There are few industries located in the area, with the exception of a recent expansion in oil production which has the potential to affect air quality. There is one air quality monitoring station in Sidney, Montana. This monitoring station monitors nitrogen oxide, ozone, particulate matter, and meteorological data. Air quality is generally regarded as good (http://todaysair.mt.gov/AirMonitoring/AirDataMap.aspx).

**Overview of the Project area – looking north from the Intake headworks**

# Hydrology

## Introduction

- What are the hydrologic characteristics of the Lower Yellowstone River that could be affected by the Intake Project?

This section describes the existing conditions of the Yellowstone River that could be affected by the proposed alternatives. Hydrologic characteristics that may be affected are:

- Hydrologic connectivity
- Timing of flow
- Flooding and ice jams
- Existing Uses

**View of the Yellowstone River near Intake, Montana**

## Methods

A literature review collected information on the hydrologic and geomorphic characteristics of the Lower Yellowstone River in the area of the proposed Intake Project. Flow conditions of the affected environment were assessed using daily flow records from the Sidney, Montana, gage (USGS Station ID 6329500). This gage is the closest to the Intake Project site and has the most complete record of daily flows. The Sidney gage is located approximately 42 river miles downstream of the Intake Diversion Dam. Flow at Intake Diversion Dam is expected to be similar in timing and magnitude to this gage. The gage reflects the diversions at Intake, which may be substantial during low flows.

## Hydrologic Setting

The Yellowstone River is a principal tributary of the Missouri River (figure 3.2). The Yellowstone River drains a large basin that extends from the Rocky Mountains in Yellowstone National Park through the plains of southern Montana and northern Wyoming. It flows into the Missouri River near Buford, North Dakota just upstream from Lake Sakakawea. At its confluence with the Missouri River, the Yellowstone River is the larger river contributing more than 50% of the average annual flow. Two major tributaries, the Powder and Tongue rivers, join the Yellowstone River between the Intake Diversion Dam site and the next low head dam diversion at Cartersville, Montana.

### *Hydrologic Connectivity*

Intake Diversion Dam, located at river mile 73, is the first and largest in a series of six diversion dams on the Yellowstone River downstream of Billings, Montana. The locations of the diversion dams and river miles are shown in figure 3.3.

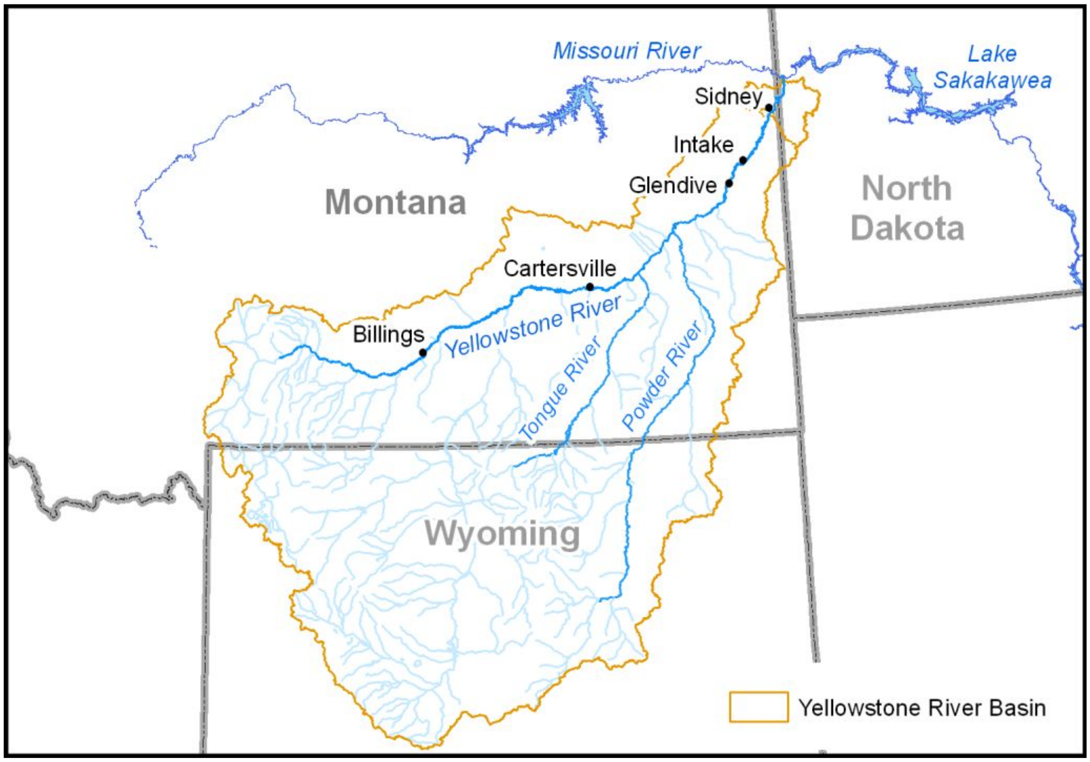



**Figure 3.2 - Overview of the Yellowstone River Basin.**

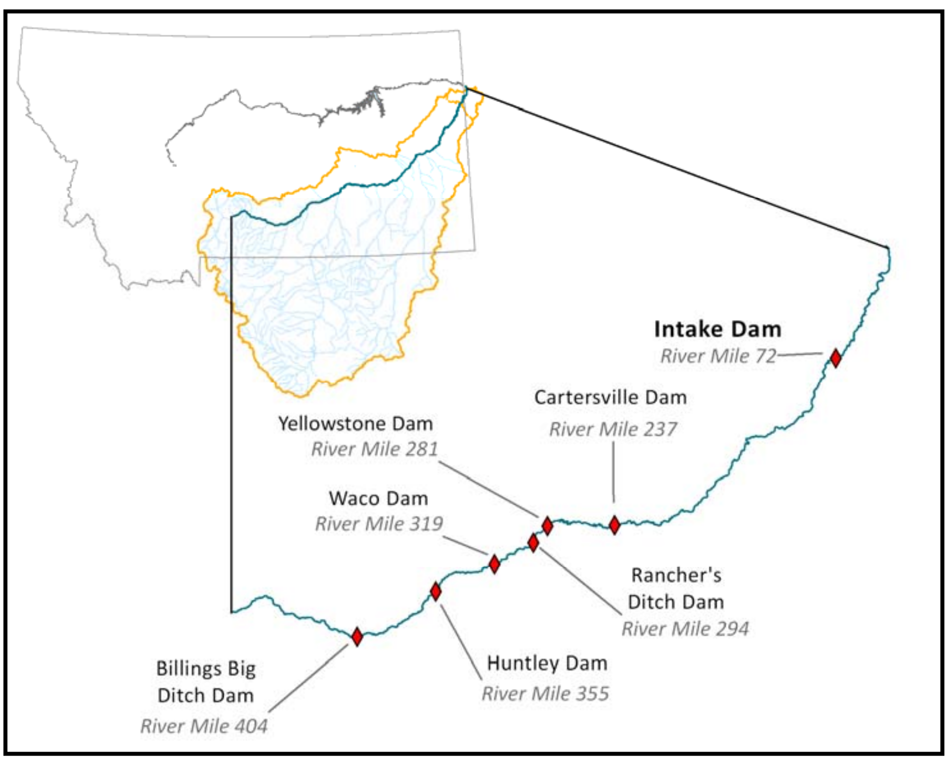



**Figure 3.3 - Diversion Dams Along the Yellowstone River (adapted from Jenkins 2007).**

Diversion dams such as these, often called low-head dams or run-of-river dams, extend across the entire width of the river, but do not create impoundments or reservoirs that regulate flow. For this reason, the lower Yellowstone River is considered hydrologically connected with its watershed. While low head dams do not regulate flow; they can create partial or complete barriers to fish passage, depending on species and flows (Helfrich et al. 1999; Bramblet and White 2001). This can ecologically isolate segments of the river.

***Timing of Flow: Seasonal Variation***

Flow at the Sidney gage has two regular peaks, shown in figure 3.4. A short-duration peak is in the late winter/early spring because of localized snowmelt on the plains, and a second, larger and longer peak occurs in late spring through summer when the mountain snowmelt reaches the lower reaches of the Yellowstone River. Most of the flow in the lower Yellowstone River is due to the melting snowpack in the mountains of the Yellowstone Basin (Zelt et al. 1999).

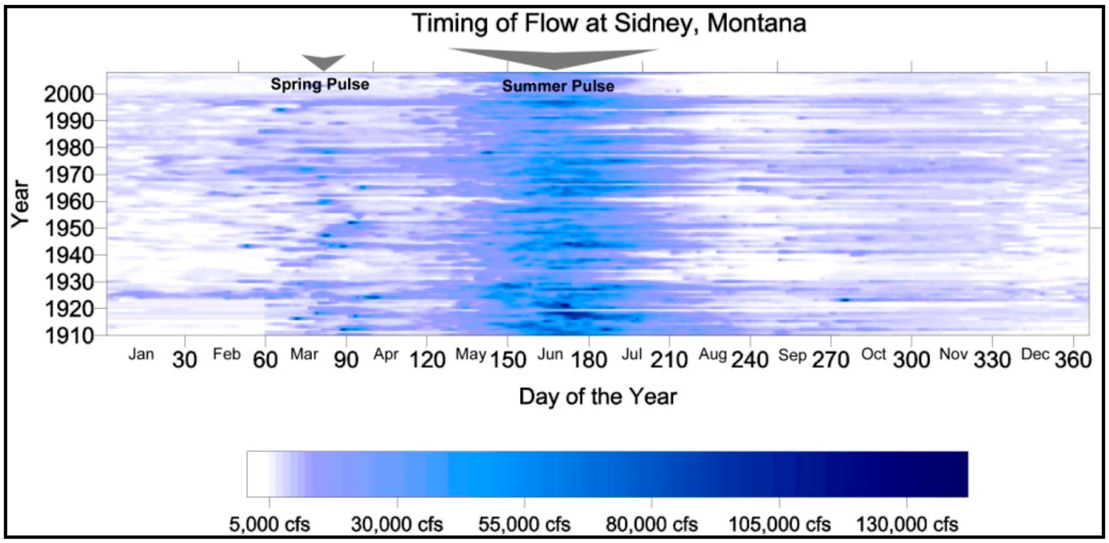



**Figure 3.4 - Daily Flow Values at Sidney, Montana, Show Two Consistent Pulses Of High Flow; a Short Pulse in Late Winter/Early Spring, and a Longer One Throughout Summer Months.**

***Flooding and Ice Jams***

The estimated bankfull discharge near the Intake Dam site is 52,000 cfs. Bankfull discharge is the 1.5-year flood frequency flow and is associated with channel-forming properties (Koch and Curry 1977).

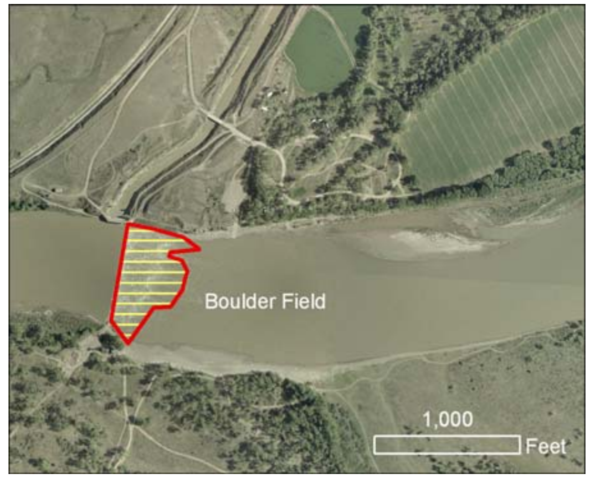
In the spring sometimes heavy rain precedes ice melt in the lower Yellowstone River and can cause ice jams. Ice jams may result in extreme backwater flooding in the area above and below the Intake Diversion Dam site.

High flows, flowing ice and ice jams have damaged the Intake Diversion Dam structure by moving large boulders off the crest of the dam as far as several hundred feet downstream (see aerial photo). The downstream movement of rock requires periodic replacement of rock at the dam crest during low flow conditions. The Board of Control is responsible for replacement of the rock (see chapter two, No Action Alternative).

## Existing Uses of the Yellowstone River

The lower Yellowstone River has been used extensively for irrigation since the early 1900s. Irrigation accounts for Montana's largest water withdrawals and consumptive use in the lower reaches of the Yellowstone River (Cannon and Johnson 2004; PBS&J 2009). The Lower Yellowstone Project has a statement of claims and provisional permits to divert 1,374 cfs for irrigation (Montana Department of Natural Resources and Conservation on-line Water Rights Query System).

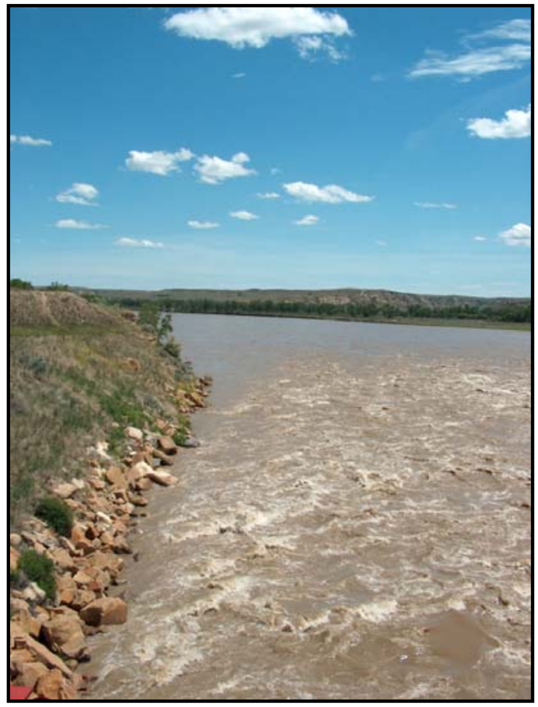
A geographic information system (GIS) dataset developed by the Natural Resource and Conservation Service (2003), was used to identify water diversion structures located downstream of the Lower Yellowstone Project diversion. This inventory listed 1 municipal and 1 industrial intake, 12 permanent irrigation pumps, and 12 portable irrigation pumps downstream of the Intake headworks. The FWP has been granted an instream flow reservation for the Yellowstone River at Sidney of approximately 5.5 million acre-ft of water per year (Peterman and Nelson 1986).




**Aerial photo showing the boulder field below Intake Diversion Dam created by ice and high flows pushing rock off the crest of the dam.**

**Portable irrigation pump in the Yellowstone River**

## Geomorphology



Yellowstone River flow along a riprapped bank downstream from Intake

### Introduction

- What are the geomorphologic characteristics of the lower Yellowstone River that could be affected by the Intake Project?

This section describes the existing conditions of the Yellowstone River that could be affected by the proposed alternatives. Geomorphologic characteristics that may be affected are:

- Channel characteristics
- Channel migration zone
- Channel modifications

### Methods

A literature review and GIS data was used to assess existing conditions of the geomorphology of the lower Yellowstone River in the area of the proposed Intake Project. Corps' bathymetry data that measure the depth of the river were analyzed in ArcGIS to determine streambed geomorphology in the Intake Project area.

### Channel Characteristics

**Anabranching** describes a river reach that splits around mid-channel islands and then rejoins the main channel downstream.

Koch and Curry (1977) concluded that the Yellowstone River main stem is very similar to that observed during the William Clark expedition of 1806. This characterization is consistent with more recent studies. The lower Yellowstone River throughout its course to the confluence of the Missouri River is classified as having anabranching reaches with abundant side channels and braided reaches with gravel bars (Jenkins 2007; Koch and Curry 1977). Koch and Curry (1977) specifically described the geomorphic characteristics of the lower Yellowstone River in a 17-mile reach from Intake to Savage, Montana, and this stretch represents that section of the river from Intake to the confluence. In most reaches, the river is on the east side of the river valley periodically in contact with the valley wall.

The Yellowstone River is similar to many large river systems in that sediment particle size generally decreases downstream. Both the average and the range of particle sizes as well as their arrangement in the streambed are ecologically important. Data are most readily available for the median particle size. Near Intake, the surface pebble counts show the median particle size is 22 mm. Downstream from Sidney, the bed material changes from gravel to predominantly sand. Data on bed material near Sidney show that, except during the highest discharges, the bed material has a much smaller median particle size of about 0.250 mm (Koch and Curry 1977). In the area immediately downstream of Intake Diversion Dam, the channel bed is covered with large boulders that have been moved downstream off the crest of the dam during high flows.

The slope of the Yellowstone River is also similar to other larger river systems, and generally decreases in the downstream direction. This reach of the river has an average natural slope of 0.045% - 0.050% (Koch and Curry 1977; Applied Geomorphology, Inc and DTM Consulting 2004). If the slope of the dam crest and boulder field is taken into consideration, the slope at Intake Diversion Dam ranges between 0.7% - 4.2% , with an average slope of 2.0% (Curtis Miller, Corps, personal communication 2009).

## Channel Migration Zone

The channel migration zone of the Yellowstone River identifies areas prone to lateral channel shift over the next 100 years (Thatcher et al. 2008). River corridor classifications near Intake Diversion Dam site are shown in figure 3.5. Most of the river corridor in this area on Joe's Island is classified as the historic migration zone. Thatcher et al. (2008) defines the historic migration zone as the combined portion of the river corridor that represents a zone of historic channel occupation over approximately the past 50 years.

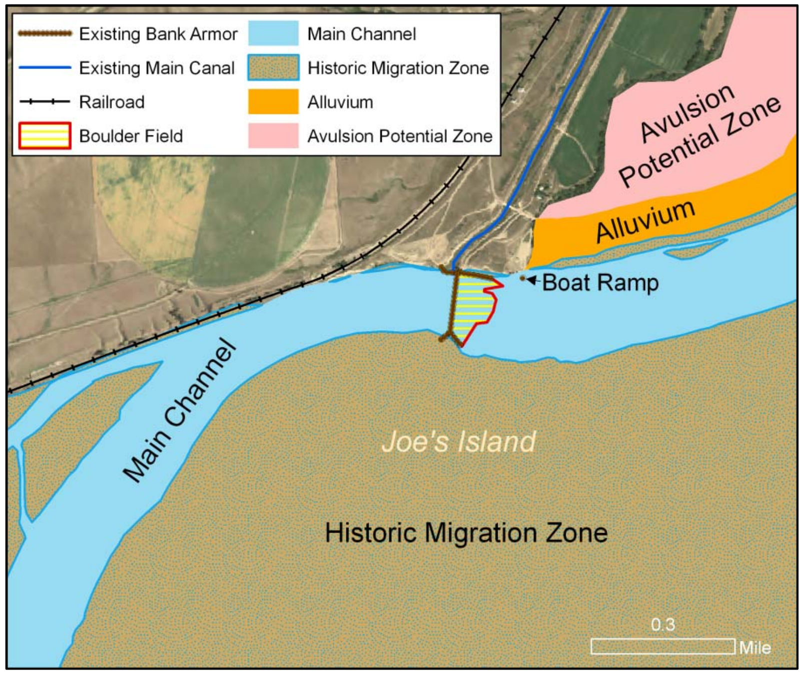



**Figure 3.5 – Existing Channel Migration Zones Near Intake Diversion Dam (Thatcher et al. 2008).**

To a lesser extent alluvium and avulsion potential zones are located upstream and downstream of the existing dam (Thatcher et al. 2008). Alluvium is the most common material in the river channel and is frequently reworked by the river. Avulsion potential zones are places where the river has historically "jumped" channels (avulsed) due to a range of processes, including natural erosion, flood events, and ice jamming. This process may be natural or driven by human activities and creates an additional risk of erosion within the river corridor. The Intake Diversion Dam and downstream boulder field occupies approximately 6 acres in the channel migration zone.

Another structure located in the vicinity of the Intake Project is a section of railroad that runs adjacent to the main channel on top of the valley wall. The section of rail adjacent to the river has not been stabilized.

While typically these natural and manmade activities may increase the risk of avulsion, it should be noted that the river channel and avulsion potential zones upstream and downstream of the

Intake Diversion Dam site have been stable for more than 100 years. The channel has not avulsed into the downstream Avulsion Potential Zone during the entire history of the Intake Project.

## Channel Modifications

Although channel forms and processes are mostly natural, a number of man-made structures have affected the geomorphic character of the river. Artificial alteration of the river and riparian areas includes bank armoring (riprapping), diversions, closing side channels, and clearing bank vegetation. Riprapping to stabilize banks and reduce erosion is the most common alteration along the lower Yellowstone River. It is common at locations where railroads, highways, bridges, pumping plants, and other structures are built on or near the river bank (Koch and Curry 1977). Although bank stabilization reduces sideways (lateral) erosion, it may degrade the streambed in some areas. The existing environment has a total of four man-made structures that stabilize the river channel near the Project area. These bank stabilizing structures, shown in figure 3.5, are:

- the existing headworks which stabilizes about 285 linear feet on the left bank;
- Intake Diversion Dam which is approximately 665 linear feet across the river;
- structure along the south bank stabilizing approximately 327 feet;
- structure along the north bank stabilizing approximately 367 feet;
- the boulder field which covers approximately 6 acres of the river bed and
- the boat ramp which stabilizes another 25 feet along the left river bank.

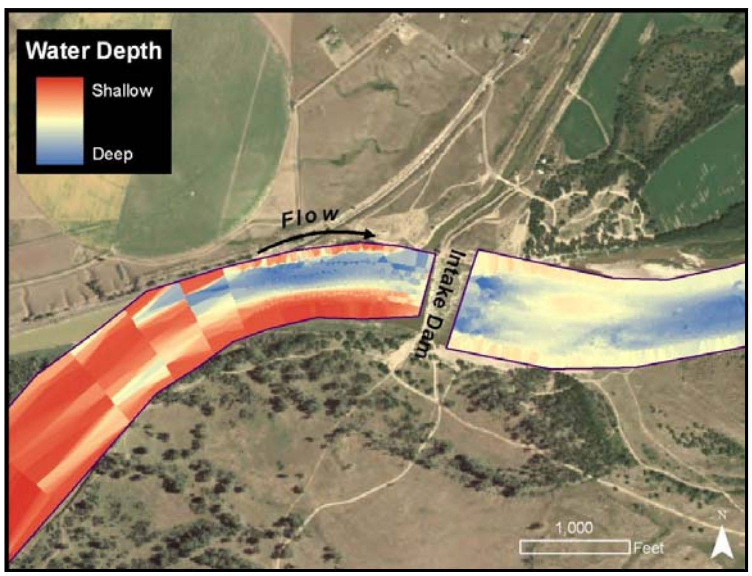



**Figure 3.6 - Water Depth Indicates Zones of Deposition and Erosion in the Streambed Near Intake Diversion Dam.**

In figure 3.6 red areas depict shallow water with sediment deposits, and blue areas are deep water where sediments have been removed. Immediately upstream of the dam deposition is occurring on the south riverbank. This is a pattern of sediment deposition called a point bar. The north bank of the river is the cut bank, an area where erosion is likely taking place and is the deepest part of the channel. The bathymetry data also indicate there is not a characteristic wedge of sediment deposited directly upstream of the dam structure, as often occurs with such structures. Sediment deposition in the canal is a continual problem. Sediment in the Yellowstone River is very fine and stays suspended for a long time which is why the irrigation districts clean the main canal on a 10-year cycle and the lateral canals, which have more check structures, on a 5-year cycle. The high pressure gates of the canal intake structure are at the bottom of the river, which contributes to removing sediment from in front of the Dam.

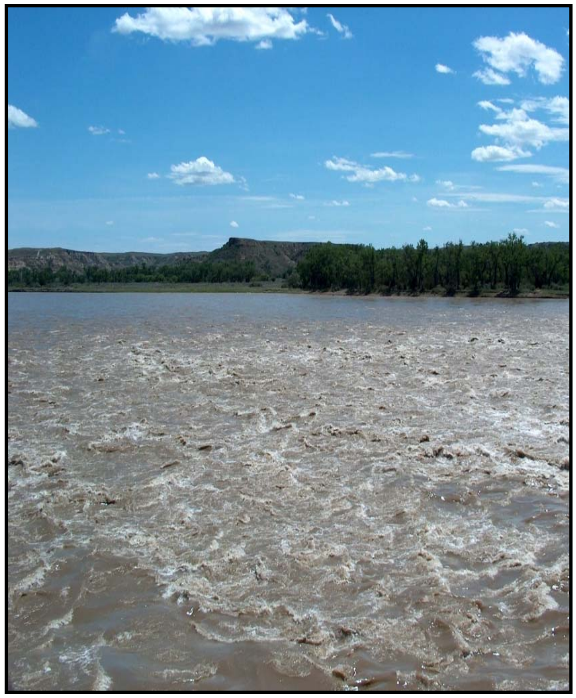
On the downstream side of the dam and immediately downstream of the boulder field, there is a pool of deep water indicating erosion immediately followed by an underwater island where sediments are being deposited.

## Surface Water Quality

### Introduction

- What is the existing water quality of the Lower Yellowstone River?

In general, the waters of the lower Yellowstone River are suitable for most designated uses. The water quality of the lower Yellowstone River is determined by interaction of water with the landscape, including upstream reaches and tributaries as well as human activities. Water moving across the landscape is exposed to different minerals in soils and rocks of different geomorphic regions, as well as plant and animal materials in other ecoregions. Additionally, geothermal activity in the headwaters affects downstream water quality. Human activities that alter the land surface, such as conversion to agriculture, or that consume water, such as irrigation, further modify water quality.



**Turbid water downstream of Intake Diversion Dam on the Yellowstone River**

Several local, state, and federal agencies are responsible for evaluating, describing and ensuring that the quality of surface waters is sufficient to meet the beneficial uses of society. The Montana Department of Environmental Quality (DEQ) and the North Dakota Department of Health (ND Health Department) monitor and assess the condition of surface waters within their respective states. Some oversight is provided by the EPA. The USGS is also an active participant in assessing water quality in the Yellowstone River Basin.

Surface waters within Montana and North Dakota are categorized according to their anticipated and desired societal uses. The State of Montana identifies the following beneficial uses:

- **Drinking, culinary use, and food processing**
- **Aquatic life support for fishes and associated aquatic life, waterfowl, and furbearers**
- **Bathing, swimming, recreation, and aesthetics**
- **Agricultural water supply**
- **Industrial water supply**

Montana's surface waters are classified based primarily on water temperature, fish, and associated aquatic life. The lower Yellowstone River is classified "B-3." Waters classified B-3 are suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply (Montana DEQ 2006).

**Exceedances of most water quality standards are uncommon**

Not all surface waters can be used for their intended purpose, usually because of poorer than expected water quality, some physical modification of the habitat or a biological problem. There are three types of standards used to establish a regulatory limit that supports a designated use:

1) a numeric standard;
2) a narrative standard; and
3) anti-degradation standard.

A numeric standard represents a "safe" concentration for a particular contaminant intended to protect a designated use. Narrative standards involve keeping waters free of unwanted conditions, such as oil sheens, floating solids, or algae blooms. A narrative standard may also be interpreted as the physical condition necessary to achieve a designated use. The anti-degradation standard pertains to waters that currently have water quality better than the applicable numeric or narrative standards for the designated use. The anti-degradation standard does not allow further degradation of the resource to the numeric standard.

Lakes and rivers are evaluated according to the "degree" that each beneficial use is achieved by placing them in one of four categories:

1) fully supporting;
2) partially supporting;
3) threatened; or
4) not supporting.

Generally, a water body is considered "partially supporting" or "threatened" if water quality standards are occasionally exceeded, or if trends are expected to continue to degrade the current condition into the future. "Not supporting" typically means the frequency and severity of the problem is greater than "threatened" and a documented problem exists. For instance, observed fish kills would usually indicate waters that do not support aquatic life beneficial use.

Between Intake and the North Dakota border, the river is classified as "fully supporting" water use for agriculture, drinking water, industry, and primary contact recreation (Montana DEQ 2006). Beneficial use for aquatic life and warmwater fisheries are classified as "partially supporting," with impairments related to concentrations of some trace elements, nutrients, pH, sedimentation, and total dissolved solids (TDS) (Montana DEQ 2006). Exceedances of most water quality standards are uncommon, and are often naturally caused. In addition, Intake Diversion Dam is listed as a probable source of impairment for warmwater fisheries and aquatic life related to fish passage. The Yellowstone River reach from the mouth of the Powder River to Intake is also listed as 'partially supporting" for warmwater fisheries due to impaired fish passage at Intake. Other beneficial uses were not assessed for this reach (Montana DEQ 2006).

### Existing Conditions

The physical and chemical data for the lower Yellowstone River indicate that the water is suitable for most designated uses. The following discussion is based largely on evaluation of data collected by the USGS for the Yellowstone River near Sidney, Montana, between 1959 and 2008. These data are available online at www.nwis.waterdata.usgs. The water of the lower Yellowstone River is alkaline, with a median pH of 8.1 and a maximum of 9.0 at Sidney. In the State of Montana, the pH standard for Class B-3 waters is 6.5 to 9.0, with induced variation of less than 0.5 units. Within the Yellowstone River Basin, pH generally increases from upstream to downstream (USGS 2004). This increase reflects the soils and rocks in the basin that naturally buffer the water.

**Intake Diversion Dam is listed as a probable source of impairment related to fish passage. Flow is 2,000 cfs in this photograph.**

Dissolved oxygen concentrations in the Yellowstone River near Sidney, Montana, are generally near saturation, with a median concentration of 9.2 mg/L. Virtually all samples collected are within an acceptable range based on aquatic life criteria established by the State of Montana.

Suspended sediment concentrations generally increase from upstream to downstream on the Yellowstone River. Near Sidney, the median suspended sediment concentration is 82 mg/L, but the concentration varies greatly from 1 mg/L to over 4700 mg/L. Suspended sediment concentration is generally highest in the spring and early summer during runoff (USGS 2004). Streambank erosion and runoff from adjacent agricultural lands also affect suspended sediment concentrations.

**Water Quality Measurements**
**µg/L** is micrograms per liter, which roughly translates to parts per billion.

**mg/L** is milligrams per liter or roughly parts per million.

The general water chemistry of the lower Yellowstone River is characterized as a mixed cation/anion type, dominated by sodium, calcium, sulfate, and bicarbonate ions. About 25% of samples taken between 1959 and 2008 in the Yellowstone River near Sidney had sulfate levels above the secondary drinking water standard of 250 mg/L.

TDS ranges from 119 to 874 mg/L, with a median of 506 mg/L. Samples collected from 1999-2001 as part of the National Water Quality Assessment program had slightly lower TDS, with a median concentration of about 450 mg/L. TDS varies seasonally, and is generally lowest in the spring and early summer when the water is diluted by snowmelt runoff (USGS 2004). Highest concentrations occur in the fall and winter when the stream chemistry is dominated by base flow (USGS 2004). TDS concentrations on the lower Yellowstone River are primarily attributed to natural factors, but irrigation return flow may also contribute to elevated TDS concentrations at some sites in the Yellowstone River basin (Lindner-Lunsford et al. 1992). The median TDS concentration for the Yellowstone River near Sidney slightly exceeds the national secondary drinking water standard of 500 mg/L. The lower Yellowstone River below Intake is classified as "partially supporting" for aquatic life and warmwater fisheries, with the occasionally elevated TDS concentrations listed as a probable cause of impairment (Montana DEQ 2006).

Total nitrogen concentrations in the lower Yellowstone River near Sidney ranged from 0.16 mg/L to 9.30 mg/L, with a median of 0.87 mg/L. Concentrations were generally larger than concentrations for EPA nutrient ecoregion reference conditions (EPA 2001). The ecoregion reference condition for total nitrogen (0.38 mg/L) was exceeded by about 95% of the samples. Total nitrogen varies seasonally, with highest concentrations typically in the spring and early summer. High concentrations during this period are likely related to suspended organic matter during snowmelt runoff (USGS 2004). Total nitrogen is listed as a probable cause of impairment for aquatic life and warmwater fisheries in the lower Yellowstone River below Intake Diversion Dam. The probable sources of impairment are irrigation, grazing, and streambank modification (Montana DEQ 2006).

Total phosphorus concentrations on the lower Yellowstone River near Sidney ranged from < 0.01 mg/L to 2.7 mg/L, with a median of 0.09 mg/L. Concentrations were generally larger than concentrations for EPA nutrient ecoregion reference conditions (EPA 2001). The ecoregion reference condition for total phosphorus (0.029 mg/L) was exceeded by about 75% of the samples. Like total nitrogen, highest total phosphorus concentrations typically occur in the spring and early summer during the snowmelt runoff when suspended sediment concentrations are high (USGS 2004). Total phosphorus is listed as a probable cause of impairment for aquatic life and warmwater fisheries in the lower Yellowstone River below Intake Diversion Dam. The probable sources of impairment are irrigation, grazing, and unknown sources (Montana DEQ 2006).

Trace element concentrations in waters of the lower Yellowstone River near Sidney are generally below established standards. Montana DEQ has identified impairments to aquatic life and warmwater fisheries related to copper, chromium, and lead (Montana DEQ 2006). Additionally, arsenic introduced from upstream geothermal activity is a concern because of its toxicity to sturgeon (Roderick McNeil, Montana DEQ, personal communication).

Arsenic concentrations range from 1 µg/L to 12 µg/L, with a median of 4 µg/L. About 1% of arsenic samples exceeded the EPA drinking water standard of 10 µg/L. Arsenic concentrations decrease from upstream to downstream in the Yellowstone River. Geothermal waters in Yellowstone National Park are a substantial source of arsenic, which is subsequently diluted by downstream inflows (USGS 2004). Copper was detected at concentration above 1.0 µg/L in about 90% of samples, chromium was detected in about 25% of samples, and lead was detected in about 5% of samples. None of the samples for arsenic, copper, chromium, or lead exceeded the aquatic life chronic standard.

Because trace elements are easily adsorbed onto bed sediments, concentrations in the water column may not be a good indicator of potential effects. USGS (2000) analyzed 44 trace elements in streambed sediments at sites in the Yellowstone River Basin. Four of these elements (arsenic, chromium, copper, and lead) were found in potentially toxic concentrations at one or more sites in the basin.

There are no state or U.S. federal standards for concentrations of trace elements in streambed sediments. The Canadian Council of Ministers of the Environment (2002) developed guidelines for sediment concentrations of trace elements that may be toxic to aquatic life. The Canadian guidelines have two levels. The lower level, termed an interim sediment quality guideline, represents a concentration below which adverse biological effects are not expected. The upper level, termed a probable effect level, represents a concentration above which frequent adverse effects are anticipated. In the lower Yellowstone River near Sidney, concentrations of arsenic and chromium exceeded the interim sediment quality guideline, indicating the potential for adverse effects on aquatic life. Copper and lead concentrations were below the guideline. Concentrations of all four elements were below the probable effect level (USGS 2004).

Because the Intake Diversion Dam is a popular paddlefish snagging location, it is assumed that fishing tackle, including lead sinkers, have been lost below the dam. Ingestion of lead sinkers can kill waterbirds (Goddard et al. 2008, Sidor et al. 2003, Scheuhammer and Norris 1996); however, the lead weights used for paddlefish snagging are relatively large (4-5 ounces), and ingestion of these weights by waterbirds likely would be very rare (Franson et al. 2003, Goddard et al. 2008). Under some environmental conditions, such as soft water with low pH, lead sinkers may dissolve over time (Goddard et al. 2008), although the rate of corrosion is generally low (Jacks et al. 2001).

Pesticides are frequently detected in the lower Yellowstone River, but are found at very low concentrations. Near Sidney, pesticides were detected in 42 of 44 water samples collected in 1999-2001. Sixteen pesticides (11 herbicides and 5 insecticides) were detected in one or more samples. Concentrations of all compounds were generally below 0.01 µg/L, and were substantially smaller than standards and guidelines for human health and aquatic life (USGS 2004). Concentrations of pesticides in bed sediments and fish tissue in the lower Yellowstone River were also very low (USGS 2000).

Concentrations of *E. coli*, an indicator of fecal contamination, are low. All samples collected by USGS in the Yellowstone River near Sidney were below the State of Montana limits (USGS 2004).

## Aquatic Communities

### Introduction

- What aquatic communities (fish, mussels, and macroinvertebrates) in the Intake Project area could be affected by the proposed alternatives?

This section identifies aquatic communities that may be affected either by construction activities or changes in geomorphology or water quality under the various alternatives (see also Hydrology and Geomorphology and Surface Water Quality Sections).

**Pallid sturgeon fingerlings**

### Methods

A literature search identified fish, mussels, and macroinvertebrates currently inhabiting areas that could be affected by the Intake Project. Lists of species were obtained from the FWP website and other sources. Consideration was also given to the types of habitats and how these habitats might be impacted, either from construction or alterations that could occur through geomorphologic changes by any of the alternatives.

### Existing Conditions

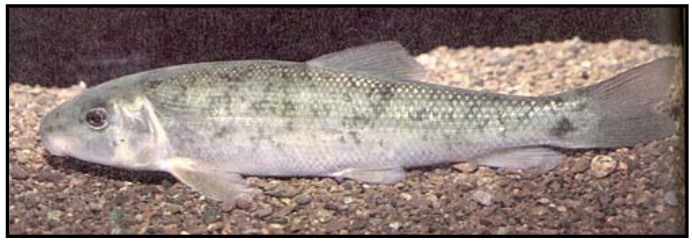
#### *Fish*

From its headwaters to its mouth, the Yellowstone River changes from a coldwater mountain stream to a warmwater prairie river. The river can be divided into three segments based on fish distribution:

1) An upper coldwater salmonid zone from the headwaters to the mouth of the Boulder River (river mile 456),
2) A transition zone from the mouth of the Boulder River to the mouth of the Bighorn River (river mile 296), and
3) A lower warmwater zone from the mouth of the Bighorn River to the confluence with the Missouri River (Peterman 1979).

In the Yellowstone River, fish species diversity and community complexity increases from upstream to downstream. For this EA, the affected environment for fish extends from the Cartersville Diversion Dam near Forsyth, Montana (river mile 237) downstream to the confluence with the Missouri River (figure 3.2). This reach lies entirely within the warmwater zone, also referred to as the lower Yellowstone River.

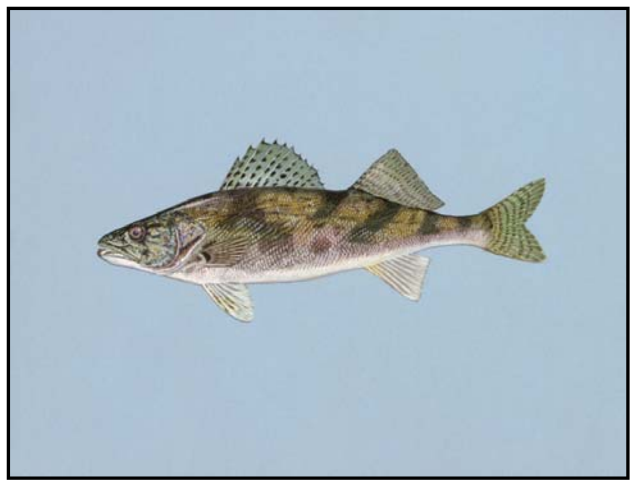
The most widespread species in the Yellowstone River is white sucker, which is abundant in all three river zones. Goldeye, common carp, longnose dace, shorthead redhorse, burbot, longnose sucker, mountain sucker, rainbow trout, and brown trout also occur in all river zones (White and Bramblett 1993). Rainbow trout and brown trout do not reproduce in the warmwater zone, and shorthead redhorse, carp, and goldeye do not reproduce in the coldwater zone (Peterman 1979).



**White sucker are abundant in all three river zones in the Yellowstone River** (photograph by William D. Schmid **www.hatch.cehd.umn.edu**)

Instream habitats of the lower Yellowstone River include main channel pools, runs and riffles, side channels, and backwaters. Most pools are 5 ft - 10 ft deep, although some are at least 18 ft. deep during summer flows. There are many islands and braided channels with associated backwaters, except in the reaches from Miles City to Cedar Creek and from Sidney to the confluence with the Missouri River (Penkal 1992). The lower Yellowstone River main channel riverbed upstream from Sidney is primarily gravel and cobble. Downstream from Sidney, the substrate is mainly sand and silt (Penkal 1992).

Fifty-two species of fish have been recorded in the lower Yellowstone River (Montana Fisheries Information System, http://fwp.mt.gov/fishing/mfish/default.aspx). Of these, 31 species are native and 21 species are introduced. Native species considered abundant include the blue sucker, channel catfish, emerald shiner, flathead chub, goldeye, longnose sucker, paddlefish, river carpsucker, sauger, shortnose redhorse, shovelnose sturgeon, smallmouth buffalo, stonecat, western silvery minnow, and white sucker (Montana Fisheries Information System, http://fwp.mt.gov/fishing/mfish/default.aspx).



**Adult sauger can move upstream at Intake, but passage of juveniles is restricted.**
(www.fws.images)

The stonecat prefers high-gradient reaches while the goldeye, flathead chub, western silvery minnow, and sauger all prefer more sluggish reaches. The channel catfish prefers larger rivers with turbid habitats. The shorthead redhorse and white sucker may be found in transition zones that generally have less turbidity, some vegetation, and gravel substrates (Zelt et al. 1999). Species of special concern include the pallid sturgeon (which is federally-listed as endangered), paddlefish, sturgeon chub, sicklefin chub, sauger, and blue sucker.

In the lower Yellowstone River, saugers spawn at numerous locations from the mouth of the Tongue River to below Intake (Jaeger et al. 2005). Elser et al. (1977) and Rehwinkel (1978) found spawning migrations of Yellowstone River sauger and walleye in the lower Tongue and Powder rivers. Jaeger et al. (2005), however, reported that the Powder River was rarely used for spawning by saugers, and no sauger spawning was documented in the Tongue River. Because of low flows in late summer and early fall, there are few resident game species in the lower reaches of the Tongue and Powder rivers (Penkal 1992).

Several fish species provide substantial angling opportunities in the lower Yellowstone River. The following discussion is summarized from White and Bramblett (1993). Saugers are native and are common to abundant, with abundance increasing from upstream to downstream. Walleye are introduced, and are most abundant below Intake Diversion Dam when fish migrate upstream to spawn. Paddlefish snagging at Intake Diversion Dam is a popular sport fishery, with a large spawning population moving upriver in the spring. Channel catfish are an important sportfish, but little is known about the population. Burbot fishing is popular in late winter and early spring.

**Successful burbot fisherman**
(www.reelflyfishing.com)

Intake Diversion Dam impedes upstream migration of fish to and from traditional spawning areas and other seasonal habitats, although the degree to which passage is prevented varies from species to species. Helfrich et al. (1999) collected and tagged 4,080 fish downstream of Intake Diversion Dam. Only 17 fish consisting of four species (goldeye, walleye, sauger, and smallmouth buffalo) were later collected upstream of the dam.

The lack of recaptured fish above the dam may reflect the low number of marked fish relative to the high abundance of unmarked fish, poor visibility due to turbidity, high river flows and velocities, and restricted sampling intensity and frequency (Helfrich et al. 1999). Furthermore, the fish that did migrate upstream of the Diversion Dam are considered to be stronger swimming species that may be better adapted for movement through swift, turbulent water (Helfrich et al. 1999). Graham et al. (1979) tagged 2,573 sauger and 697 walleye below Intake Diversion Dam. Of the 195 sauger that were recaptured above and below Intake, 57% moved upstream of the dam. Although walleye could negotiate the structure, nearly all movement was downstream after spawning. Jaeger et al. (2005) found that diversion dams on the lower Yellowstone River did not hinder the upstream movement of adult saugers, but passage by juveniles was clearly restricted. Substantial numbers of paddlefish move upstream of Intake only when May-June flows exceed 45,000 cfs (Peterman 1979).

Hiebert et al. (2000) estimated that about 500,000 fish of 36 species are annually entrained into the main canal at Intake Diversion, of which as many as 8% are sturgeon. Jaeger et al. (2005) estimated that 86% of the saugers that are entrained die, and up to 78% of annual non-fishing mortality of saugers in the lower Yellowstone River was related to entrainment into the main canal at Intake.

Pallid sturgeons migrate upstream to Intake Diversion Dam each year (Backes et al. 1994). However, very few pallid sturgeons have been documented above Intake. Watson and Stewart (1991) captured a pallid sturgeon near Fallon, Montana in 1991 in conjunction with studies associated with the Tongue River Project. Otherwise, the last recorded capture of a wild pallid sturgeon above the Intake Diversion Dam was in 1950 (Brown 1955) with five other reports from the 1920s and 1930s (Krentz, personal communication, 2009). All records of occurrence from above the Intake Diversion Dam have been in the vicinity of the Tongue River. There are unsubstantiated reports of pallid sturgeon historically being caught at the mouth of the Bighorn River.

**The last recorded capture of a pallid sturgeon above Intake Diversion Dam was in 1991.**

Thus, it appears that Intake Diversion Dam currently presents a nearly complete barrier to upstream movement of pallid sturgeon. Captures of juvenile pallid sturgeon above the Intake Diversion Dam have increased in recent years. However, this is due to targeted stocking efforts above the dam to quantify suitable habitat between Intake and the Bighorn River and to establish a connection to this stretch of the river for spawning when the stocked fish mature (Krentz, personal communication 2009).

Pallid sturgeons are not strong swimmers and are not as capable at navigating turbulent waters as some other species. Helfrich et al. (1999) tagged 29 shovelnose sturgeon on the lower Yellowstone River. No tagged shovelnose sturgeon were recaptured upstream of any of the low-head diversions. Although pallid sturgeon were not used in their study, the similarities of shovelnose and pallid sturgeon suggests that neither of these closely related species may be adapted to negotiate turbulent water over large rock river bottom with high slopes. The USGS (2002) found shovelnose and pallid sturgeon have similar swimming abilities but that shovelnose sturgeon are less motivated to move upstream. Radio telemetry studies have documented pallid sturgeon moving up to the Intake Diversion Dam, turning around, and moving downstream (Bramblett 1996).

The spawning strategy used by pallid sturgeon further illustrates the importance of passage at Intake Diversion Dam. The lower Yellowstone River upstream of Intake contains some of the best remaining habitat for successful spawning (Service 2000a, Service 2003). Depending on water temperature, eggs hatch from three to eight days after fertilization, and the sack fry are carried downstream (Service 2000a). The further upstream pallid sturgeon are able to spawn, the longer the time drifting larval fish have to develop and locate suitable habitat before entering Lake Sakakawea (Krentz, personal Communication, 1999). On the lower Yellowstone River, bluff pools and terrace pools, which have relatively coarse substrates, are presumed to be the preferred spawning habitat for pallid sturgeon. Table 3.1 shows the shows the number and acreage of these pools in the Yellowstone River below Cartersville Diversion Dam. Suitable spawning habitat is much more prevalent above Intake. The ability to spawn as far upstream as habitat and conditions permit may be critical to development and survival of larval and immature fish and to survival, recruitment, and recovery of the species. Providing passage at Intake

Diversion Dam would open approximately 165 miles of additional habitat in the Yellowstone River to pallid sturgeon, as well as providing access to the confluences of the Powder and Tongue rivers.

**Table 3.1. Summary of bluff pool and terrace pool habitats on the Lower Yellowstone River.**

| Reach | Bluff Pools | | Terrace Pools | |
|---|---|---|---|---|
| | number | acres | number | acres |
| Below Intake Dam | 7 | 453 | 3 | 182 |
| Between Cartersville Dam and Intake Dam | 17 | 1611 | 36 | 2319 |

***Mussels***

Although little is known about mussel populations in Montana, the best available information indicates that there are three native and three introduced mussel species; two were very recently introduced (Stagliano 2008). Species found in the Yellowstone River include the native fatmucket and the introduced mapleleaf. Fatmuckets have been located in the Intake Project area both above and below Intake Diversion Dam. Because mussel larvae can attach to a host fish for up to 3 months, mussels may be carried to new areas in a watershed many miles from their origin or even to different states. This is the case for the mapleleaf, which likely arrived with catfish or crappie stockings (Montana Field Guide 2008).

**Mapleleaf mussel (photo courtesy of U.S. Forest Service)**

***Macroinvertebrates***

The macroinvertebrates of the lower Yellowstone River are predominately tolerant of silt and are abundant (Newell 1977; Zelt et al. 1999). Within the lower Yellowstone River Basin, invertebrate fauna are likely dominated by 7 species of caddisflies and 17 species of mayflies (Zelt et al. 1999; Newell 1977). Newell (1977) reports 17 species of mayflies on the lower Yellowstone River from the Glendive area down to the confluence with the Missouri River.

**Caddisfly** (photo courtesy of www.insects.tamu.edu)

Other true flies, mostly non-biting midges and seven species of stoneflies generally prefer rapid currents and are diverse but not abundant (Newell, 1977). Four species of true bugs and two species of water beetles were also documented (Newell 1977). Deposition of organic sediment at slow current velocities in channel riparian and sandbar complexes may increase production of midges (Zelt et al. 1999).

***Aquatic Invasive Species***

Few aquatic invasive species have become established in the Lower Yellowstone River. Whirling disease was detected at the Miles City fish hatchery in 2002, but has not been subsequently documented at the hatchery or in the Lower Yellowstone River. It is not known whether the whirling disease spores were present in the Yellowstone River water used by the hatchery or were transferred through alternate pathways (e.g., fish-eating birds). New Zealand mudsnails are present in the Bighorn River, so eventual spread to the Lower Yellowstone River may be likely. Common carp are present in the Yellowstone River both upstream and downstream of Intake Diversion Dam. Carp are strong swimmers, and can probably pass upstream at Intake under most flows. Saltcedar is presently established at many riparian sites along the Bighorn and Lower Yellowstone rivers. Seeds of this invasive plant are transported by river flows, so additional infestations are likely to occur in the future.

## Federally-Listed Species and State Species of Special Concern

### Introduction

- What federally-listed species and state species of special concern in the Intake Project area could be affected by the proposed alternatives?

Information presented in this Intake Final EA was used to prepare a biological assessment under Section 7(c) of the ESA (appendix D). The assessment's purpose is to:

1. Assure that compliance with the ESA is incorporated into early planning decisions and alternative selection.
2. Establish and promote interagency cooperation and consultation in project decision-making, which may affect listed and proposed species.
3. Develop possible conservation and actions to avoid or reduce identified impacts.

**Pallid sturgeon protected by ESA (photo courtesy of Service)**

The Service, as required by the ESA, confirmed a list of federally-listed endangered, threatened, and proposed species that are or may be present in the Intake Project area (appendix C).

Species of special concern are:

- **Montana** - Species are considered at-risk or potentially at-risk due to rarity, restricted distribution, habitat loss, and/or other factors. Designation as a Montana Animal Species of Concern or Potential Animal Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to be proactive in species conservation.

- **North Dakota** - Species ranked by the North Dakota Natural Heritage Program as S1, S2, and S3 are considered species of special concern for this Intake Project. This not a statutory or regulatory classification but is a rank assigned according to a standardized procedure of the Natural Heritage Program. Ranking helps set priorities for both inventory and protection.

  S1, S2, and S3 species are all vulnerable to local extinction. S1 species are critically imperiled in the state, because they are extremely rare. S2 species are imperiled in the state because of rarity. S3 species are vulnerable in the state either because they are rare and uncommon, or restricted in range (even if abundant at some locations).

## Methods

Federal and state lists and Montana and North Dakota Natural Heritage Program databases were searched to determine if any of these species had been recorded in the Intake Project area. A literature search for life history information was completed for species recorded in the Intake Project area. State agencies with responsibilities for listed species and Service field offices were contacted for current information on locations, life histories, and current research information. Federally listed species or state species of concern likely to be in the Intake Project area are discussed below.

## Existing Conditions

### *Federally-Listed Species*

**Interior Least Tern (Endangered)** Interior least terns nest on sparsely vegetated sandbars on the Missouri and Yellowstone rivers in Montana and North Dakota. On the Yellowstone River, nesting occurs on bare sands and gravels on the upstream portions of vegetated channel bars below Miles City (Bacon and Rotella 1998). Most breeding sites on the Yellowstone River are in a section of the river where channel meandering increases, and there are more channel bars and overlapping islands (Service 2003). Interior least terns feed mostly on small fish. Their breeding season lasts from May through August, with peak nesting occurring from mid-June to mid-July.

**Typical least tern nesting habitat, Yellowstone River, Montana** (photo courtesy of Montana Game, Fish & Parks)

Although Montana supports one of the smallest populations of interior least terns, Montana's Yellowstone and Missouri rivers may offer suitable habitat for breeding birds during years when more southern reaches have abnormal weather and river conditions (Montana FWP 2006).

**Whooping Crane (Endangered)** The whooping crane passes through Montana and North Dakota during both spring (April-mid-June) and fall (late August to mid-October) migration. These migration flights are between its breeding territory in northern Canada and wintering grounds on the Gulf of Mexico. Frequently, whooping cranes migrate with sandhill cranes. Whooping cranes inhabit shallow wetlands but may also be found in upland areas, especially during migration. The whooping crane prefers freshwater marshes, wet prairies, shallow portions of rivers and reservoirs, grain and stubble fields, shallow lakes, and wastewater lagoons for feeding and loafing during migration.

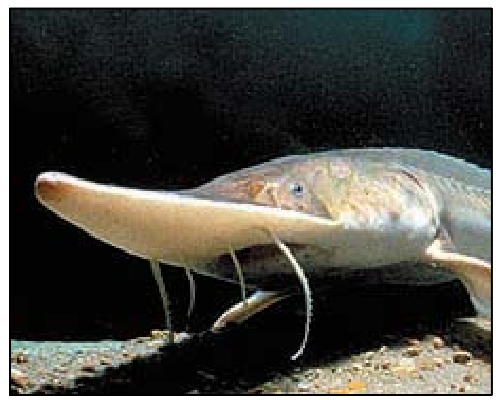
**Whooping Crane**
(whoopers.usgs.gov)

Overnight roosting sites usually have shallow water in which whooping cranes stand. Whooping cranes roost on unvegetated sandbars, in wetlands, and in some isolated stock ponds. Whooping cranes are usually found in small groups of seven or fewer individuals. They are easily disturbed when roosting or feeding.

Whooping cranes are largely opportunistic in their use of stopover sites along the Central Flyway, and will use sites with available habitat when weather or diurnal conditions require a break in migration. There are documented sightings of whooping crane along the Yellowstone River Corridor but not immediately adjacent neither to the river nor in the project area.

In Montana, these cranes have been recorded in the marsh habitats at Medicine Lake and Red Rock Lake national wildlife refuges and on riparian habitats on the Missouri and Poplar rivers. In North Dakota there have been many sightings in areas along the Missouri River, some in McKenzie County.

**Pallid Sturgeon (Endangered)** Pallid sturgeon occupy the Missouri and Yellowstone rivers in Montana and North Dakota. These sturgeon use the Missouri River year-round and the Yellowstone River primarily during spring and summer spawning. Klungle and Baxter (2005) estimated 158 wild adult pallid sturgeon inhabit Recovery-Priority Management Area 2 (RMPA 2). This includes the Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea and the Yellowstone River below Intake Diversion Dam (Dryer and Sandvol 1993).



**Pallid Sturgeon** (www.sierraclub.org)

Kapuscinski (2003a; 2003b) projects that the population of wild pallid sturgeon in RPMA 2 will become locally extinct during the year 2018. Bramblett (1996) documented that pallid sturgeon prefer the Yellowstone River over the Missouri River below Fort Peck. Evidence from Bramblett (1996) strongly suggests that pallid sturgeon spawning occurs in the lower 6 - 9 river miles of the Yellowstone River. This evidence includes many fish moving into the lower Yellowstone River during spawning season, ripe fish occurring in the Yellowstone River, and fish aggregating during the spawning season (late May and early June). Spawning has occurred in the Yellowstone River, but there is no evidence that the resulting young survive to adulthood and reproduce (Bergman et al. 2008; [reported as M. Jaeger and D. Fuller personal communication in 2009 Draft Recovery Plan for the Pallid Sturgeon]).

Pallids in the Yellowstone River prefer sandy substrates and deep channels and select reaches with numerous islands (Bramblett and White 2001). They primarily inhabit about a 70-mile stretch of river below Intake Diversion Dam. More recently radio-tagged hatchery-reared pallid sturgeon have been placed above the dam (Jaeger et al. 2005). Most of these fish stayed above the Intake Diversion Dam, but some were found in the main canal of the Lower Yellowstone Irrigation Project (Jaeger et al. 2004).

Despite recent evidence of spawning in the lower Yellowstone River, there are no detectable levels of recruitment occurring (Bergman et al. 2008 [reported as M. Jaeger and D. Fuller personal communication in 2009 Draft Recovery Plan for the Pallid Sturgeon]). The Service (1993) has suggested that the Intake Diversion Dam is a barrier to upstream passage that may prevent pallid sturgeon from accessing upstream reaches. The best available science suggests that the diversion dam is a partial barrier to some species (Helfrich et al. 1999; Jaeger et al. 2004; Backes et al.1994; Stewart 1986, 1988, 1990, 1991). It is likely a total barrier to other species, including pallid sturgeon, due to impassable turbulence and velocities associated with the rocks at the dam and downstream (Jaeger et al. 2008; Fuller et al. 2008; Helfrich et al. 1999; White and Mefford 2002; Bramblett and White 2001; Service 2000a, 2003, 2007).

Braaten et al. (2008) suggests larval drift distance presently available below Intake Diversion Dam is insufficient in length and settling habitat. Larvae could drift into the headwaters of Lake Sakakawea where survival is unlikely. The Garrison reach of the Missouri River is outside the recovery priority areas identified in the Pallid Sturgeon Recovery Plan (Service 1993). Reaches outside the recovery priority areas are not excluded from recovery actions but are designated as lower priority, because these areas have been altered to the extent that major modifications would be needed to restore natural physical and hydrologic characteristics.

### *Montana and North Dakota Species of Special Concern*

Although many of these species are found in both states, they may not be classified as species of concern in both nor are records of occurence within the Intake Project area the same in each state (see appendix C). For example, bald eagles nest along the Yellowstone River in both states, but only Montana identifies them as a species of concern.

**Bald Eagle** This raptor is found in forested areas along rivers and lakes in Montana and North Dakota including along the Yellowstone River. Eagles can occupy these habitats year-round so long as food resources are available. Nesting site selection depends upon maximizing available food and minimizing disturbance from human activity. Nesting usually occurs from March to July. There are numerous bald eagle nesting territories along the Yellowstone River and its tributaries but none have been found in the project area.

**Bald Eagle** (www.images.fws.gov)

On July 9, 2007, the final rule removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife was published (*Federal Register* 72:37346). Delisting was effective August 8, 2007. Bald eagles will continue to be protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both acts prohibit killing, selling or otherwise harming eagles, their nests or eggs. The term “disturb” under the protection act has recently been defined as, “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior (*Federal Register* 72:31332)."

**Baird's Sparrow** This sparrow occupies prairie habitat in the eastern two-thirds of Montana but is relatively rare. It is a ground-nesting bird that prefers native mixed-grass prairie. Nesting generally begins in late May and continues through August (Casey 2000). Baird's sparrows also nest on native prairie in North Dakota.

**Bobolink** This bird builds its nest in tall grass, mixed-grass prairie, and hay fields with high grass-to-legume ratios.

**Chestnut Collared Longspur** This species prefers to nest in short-to-medium grasses that have been recently grazed or mowed, especially native prairie. It will also use hay fields.

**Golden Eagle** This eagle usually nests on high cliffs or large trees and hunts prairie and wooded habitats. Nesting in most cases is from March to early August.

**Grasshopper Sparrow** Like most prairie sparrows, it inhabits idle or lightly grazed mixed-grass prairie, meadows and hayfields. It is a ground-nester.

**Loggerhead Shrike** Loggerhead shrikes prefer open habitat characterized by low grasses and forbs interspersed with bare ground and shrubs or low trees (Dechant et al. 2002). In the Intake Project area they can be found in prairies, pastures, sagebrush fencerows or shelterbelts of agricultural fields, as well as riparian areas, open woodlands, and farmsteads.

**Loggerhead shrike** (www.images.fws.gov)

**Long-Billed Curlew** This bird is the largest shorebird in North America. It nests in short-grass prairie or in grazed mixed-grass prairie usually near water.

**Red-Headed Woodpecker** Little is known about this medium-sized woodpecker and its habitat in Montana. In other areas in their range, they are usually found in riparian forests along major rivers, like the Yellowstone.

**Sprague's Pipit** This extremely secretive grassland bird prefers extensive tracts of ungrazed or lightly-grazed prairie. Native prairie of medium to intermediate height is preferred, but these birds can be found in shortgrass prairie in areas of taller grass. Nesting occurs from May through August.

**Dwarf Shrew** This shrew has been found in a variety of habitats in Montana but is most likely to be in grassland and prairie riparian habitat in the Intake Project area.

**Meadow jumping mouse**
(www.images.fws.gov)

**Meadow Jumping Mouse** In Montana these mice have been found in dense, tall and lush grass and forbs in marshy areas (sometimes with standing water), riparian areas, woody draws, and grassy upland slopes. Sometimes they live within or near forested sites of ponderosa pine (Lampe et al. 1974; Matthews 1980; Matthews and Swenson 1982).

**Preble's Shrew** Little is known about this shrew, but throughout its range it is known to occupy a variety of habitats, including arid and semiarid shrub-grass associations, often with sagebrush, willow-fringed creeks and marshes, bunchgrass associations, sagebrush-aspen associations, and sagebrush-grassland.

**Townsend's Big-Eared Bat** Caves and abandoned mines are used for maternity roosts and hibernation shelter. Habitats for this bat include cottonwood bottomland, and it feeds on various nocturnal flying insects found near tree and shrub foliage.

**Milksnake** These snakes prefer open sagebrush grassland habitat and near rocky outcrops and hillsides.

**Sagebrush Lizard** Not much is known about this lizard's habitat in Montana but in other parts of its range, it is found in sage-steppe habitats, sometimes on sedimentary rock outcrops.

**Short-Horned Lizard** Habitats for this species are relatively unknown in Montana, but habitat reports throughout its range include ridge crests between coulees, and in sparse, short grass and sagebrush with sun-baked soil.

**Snapping Turtle** Habitat use by this turtle in Montana is probably similar to elsewhere in the range, but studies are lacking and there is little qualitative information available. Mostly bottom dwellers these turtles are usually observed in river backwaters and in flowing water with sandy or muddy bottoms.

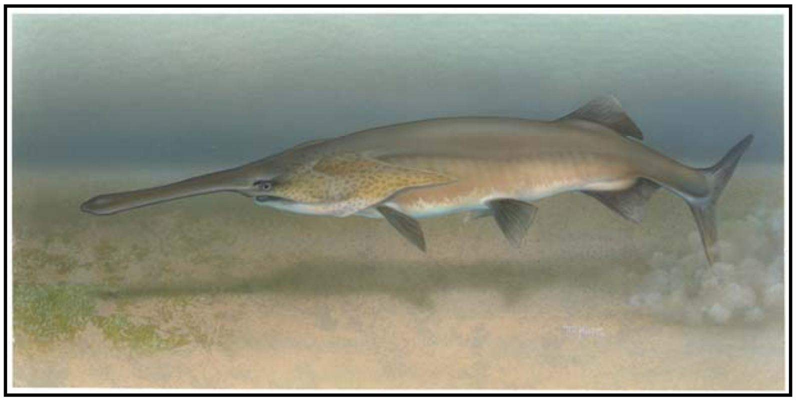
**Spiny Softshell** This turtle is primarily a river species. It usually is found in areas with open sandy or muddy banks, a soft bottom, and submerged brush and other debris. These reptiles bask on shores or on partially submerged logs and burrow into the river bottom 1 - 23 ft deep to spend the winter. Eggs are laid in nests dug in open areas in sand, gravel, or soft soil near water.

**Spiny softshell**
(http://fieldguide.mt.gov/detail_ARAAG01030.aspx)

**Western Hog-Nosed Snake** This snake, named for its upturned nose used to shovel loose soil, typically prefers sandy or gravelly habitats, often by rivers. In Montana they have also been reported in areas of sagebrush-grassland habitat and near pine savannah in grasslands underlain by sandy soil.

**Blue Sucker** This long, slender fish that grows up to 3 ft long is found in both the Missouri and Yellowstone rivers. They prefer swift currents in large, turbid rivers with rocky or gravelly bottoms.

**Paddlefish** This fish prefers slow or quiet waters and spawns (May to June) on Yellowstone River gravel bars near Sidney and Fairview. Paddlefish swim with their mouths wide open and filter aquatic insects from the water with filament-like gill rakers.



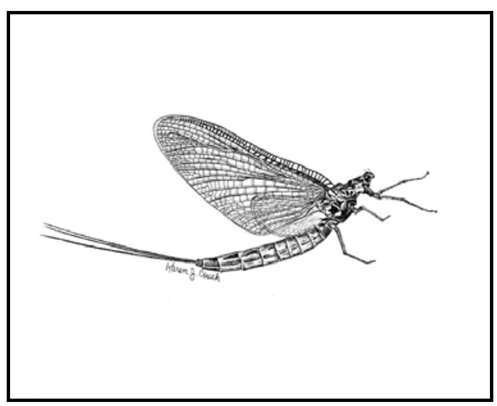
**Paddlefish** (www.images.fws.gov)

**Sauger** The sauger spawns in the Yellowstone River and tributaries on gravelly or rocky areas in shallow water and prefers turbid waters. Spawning occurs from mid-April to May when temperatures are 50° F.

**Sicklefin Chub** This fish prefers large turbid rivers, usually with a sandy or gravelly bottom. This chub swims in the main river channel at any depth but prefers 7 - 16 ft deep and summer water temperatures in the range of 68 to 75° F. Populations concentrate in the Yellowstone and upper Missouri rivers near the confluence of the two rivers.

**Sturgeon Chub** This chub prefers slow-moving, turbid water in the upper Missouri and lower Yellowstone rivers in North Dakota. It lives primarily in the main channel. It survives at all depths in this habitat, but prefers 6 - 16 ft deep with water temperatures in the range of 64°F - 75°F. Populations live near the confluence of the two rivers.

**Brimstone Clubtail** The clubtail is a rare dragonfly that as an adult flies over sandy-bottomed rivers like the Yellowstone River and perches in low vegetation in open fields. Like other dragonflies they have an amphibious life history, beginning as a water-breathing, aquatic juvenile stage called a naiad and finishing as a winged air-breathing adult.



**Mayfly** (www.images.fws.gov)

**Mayfly Species (*Lachlania saskatchewanensis*)** This species lives along the Yellowstone River near sand-gravel dominated bottoms with cobble riffles. The larvae develop in aquatic habitats, and the short-lived strong-flying adults seek to reproduce and disperse. Larvae cling to submerged willow roots and sticks in rapid water (Webb 2002).

**Sand-Dwelling Mayfly *(Homoeoncuria alleni*)** This mayfly thrives on the Yellowstone River associated with sand-gravel dominated bottoms with cobble riffles.

**Sand-Dwelling Mayfly (*Macdunnoa alleni*)** This species is associated with sand-gravel bottoms with cobble riffles along the Yellowstone River. Larvae are found on snags or other woody substrate in fast current (Webb 2002).

**Bractless Blazingstar** This plant is a short-lived perennial that occupies sandy or gravelly soil of open hills and roadsides on the plains. One of its few known locations is along the Yellowstone River in Dawson County, Montana.

**Hayden's yellowcress**
(http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Rorippa_calycina.pdf)

**Hayden's Yellowcress** In the past this very rare plant has been recorded in McKenzie County, North Dakota. It grows in moist sandy to muddy banks or wet meadows along the Yellowstone River.

**Narrowleaf Penstemon** This short-lived perennial herb grows in sandy-soiled, prairie grasslands on hills and slopes. One of its few known locations is along the Yellowstone River in Dawson County, Montana.

**Nine-Anther Prairie Clover** This perennial herb prefers gravelly-soiled grasslands and slopes on the plains. One of its few known locations is near the Yellowstone River in Richland County, North Dakota.

**Pale-Spiked Lobelia** An herbaceous perennial confined to very wet soils, one of its few known locations is along the Yellowstone River in Richland County, North Dakota.

**Poison Suckleya** An annual herb is found in drying mud along ponds and streams, and in disturbed, often alkaline soil on the plains. One of its few known locations is along the Yellowstone River in Dawson County, Montana.

**Prairie Goldenrod** An herbaceous fall-flowering perennial recorded in native tallgrass and mixed grass prairie, it also grows along roadsides, in old fields, disturbed prairies, overgrazed range, open woods, and rocky outcrops (Brown 2002).

**Silky Prairie-Clover** A perennial herb that flowers in later June - early August occupies sparsely vegetated prairies and open woodlands with sandy soils, often near sandstone outcrops or on dunes and roadsides. One of its few known locations is near the Yellowstone River in Richland County, North Dakota.

**Prairie goldenrod**
(www.npwrc.usgs.gov)

## Lower Yellowstone Project Irrigation Districts

### Introduction

- What are the Lower Yellowstone Project facilities and how could these be affected by the proposed alternatives?

**Lower Yellowstone main canal and headworks looking towards the Yellowstone River**

The Board of Control of the Lower Yellowstone Irrigation Project operates and maintains facilities associated with 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). Collectively, the entire irrigation area and facilities are commonly referred to as the Lower Yellowstone Project.

Construction of the Lower Irrigation Districts One and Two; which includes the Intake Diversion Dam, headworks, and main canal, began in 1905. Water was available for irrigation in 1909. The Intake Irrigation District was developed in 1946 to serve approximately 900 acres located in a narrow strip of land just downstream from the Intake Diversion Dam. Water is supplied by a pumping plant located on the main canal of the Lower Yellowstone Project about 2 miles below the main canal headworks. The Savage Irrigation District was constructed in 1949 to irrigate about 2,300 acres on a secondary river terrace in the vicinity of Savage, Montana. The Savage Pumping Plant is located approximately 12 miles downstream of the headworks and pumps water from the Lower Yellowstone main canal into the Savage main canal and lateral system (http://www.usbr.gov/projects/).

All of the irrigation districts obtain water from the Lower Yellowstone Irrigation Project's main canal and could be affected by any modifications to Intake Diversion Dam, headworks and main canal. Reclamation owns the irrigation works and the associated federal lands, while the Board of Control performs all O&M of project facilities for the irrigation districts under contract with Reclamation. This is explained in more detail in the No Action Alternative in chapter two.

#### *General Description*

The first and major portion of the Lower Yellowstone Project was authorized by the Secretary of the Interior on May 10, 1904. The collective features of the Lower Yellowstone Project provide a dependable water supply sufficient to irrigate approximately 54,300 acres of land along the Yellowstone River in east-central Montana and western North Dakota.

The Lower Yellowstone Project is primarily a gravity diversion and distribution system, with approximately 1,400 cfs of water diverted from the Yellowstone River into the main canal by the Intake Diversion Dam during the irrigation season (figure 1.1, page 1-2). The collective Lower Yellowstone Project facilities include the Intake Diversion Dam, canal headworks structure, 4 primary pumping plants (including the Intake and Savage pumping plants), 4 supplemental river pumps, 79 miles of main canal, approximately 234 miles of laterals, and 118 miles of open drains, and over 2,500 water control structures. The total irrigated acreage is 54,300 acres, with an average annual water diversion of 327,000 acre-ft. Electric pumping power service to five of the pumping plants is supplied by the Pick-Sloan Missouri Basin Program.

Since the early 1950s, both the agricultural economy and lands served by the Lower Yellowstone Project have remained relatively stable. In contrast to a dry-land farming trend towards larger, consolidated farms, the number of farm units on the Lower Yellowstone Project 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.

## Methods

Irrigation project information was obtained from Reclamation's Dataweb; Jerry Nypen, Manager for the Board of Control; miscellaneous reports on the consolidated Lower Yellowstone Project area; and site visits.

## Existing Conditions

### *Intake Diversion Dam*

This 700 ft long diversion dam is a 12-foot high, timber, stone-filled structure that spans the Yellowstone River and diverts water into the headworks of the Lower Yellowstone Project's main canal. The crest of the diversion dam lies about 5 ft above the natural low water mark of the river and 9 ft above the riverbed. A cableway system is used to replace rock at the diversion dam as needed to maintain sufficient elevation for diversion into the main canal headworks (see the No Action Alternative, chapter two).

### *Headworks*

The Intake Diversion Dam diverts water from the Yellowstone River through the canal headworks structure into the main canal for distribution to the lateral system. Ample flow in the Yellowstone River precludes the need for a water storage reservoir. Irrigation waters are distributed primarily through a gravity flow system, but three pumping plants on the main canal supply water for a small area not reached by the gravity system.

The headworks contain 11 5-foot diameter conduits, each controlled at the inlet by metal slide gates. When a gate is open, water above the diversion dam flows through the headworks conduits and into the head of the main canal. Approximately 1,400 cfs can be diverted through the headworks into the main canal.

### *Lower Yellowstone Main Canal and Lateral Systems*

The main canal of the Lower Yellowstone Project is an open earthen ditch varying from more than 30 ft wide and 11 ft deep at the intake in Dawson County, Montana, to less than 10 ft wide and 3 ft deep at its terminus at the Missouri River near Nohly, Montana. The main canal conveys water to supply a distribution system of 57 laterals, many with numerous sub-lateral ditches. The main canal and laterals are public waterways used to distribute project water to approximately 1,500 farm units.

**Sublateral ditch delivering water to crops**

The main canal runs along the west side of the Yellowstone River valley along the base of the upland hills (figure 1.1). As the irrigation water is diverted into laterals, the capacity and size of the main canal decreases. For its first 26 miles the canal passes through relatively rugged terrain with little irrigable land along a narrow river valley. In the vicinity of Crane, Montana, the valley bottom expands out 5 miles. Approximately 70% of the Intake Project's irrigable lands are between this point and the end of the canal at the Missouri River. Two pumps lift water to serve lands above the canal, and a third pumping plant is located on a project drain that reuses project water.

On the main canal there are flumes, conduits, and inverted siphons that allow the canal to cross 14 major drainages. Spillway gates at nine of these natural drainage crossings are used for quick evacuation of water from the main canal in emergencies, to release excess water, and to dewater the main canal at the end of the season. Four of the spillways are actively regulate the level and flow of water in the canal during the season, and three are automated to maintain main canal water levels. Numerous control structures or checks along the main canal divert water into the laterals at low flow, which improves water deliveries and reduces the amount of water diverted at Intake. Six of the checks are automated to keep water surfaces and main canal diversions constant. The Board of Control plans to continue improving conservation and to install five additional automated checks.

### *Supplemental Pumping Plants*

Two pumping plants in the main canal lift and supply water to serve the Intake and Savage Irrigation Districts. There are 10 pumping stations within Lower Yellowstone Irrigation Districts One and Two:

- 1 lifts and supplies water from the main canal to a 2300-acre lateral system west or above the canal;
- 1 boosts water to a high lateral east of the canal;
- 4 pump water from the rivers to supplement lateral systems in the lower reaches of the project, and
- 4 re-lift water from project drains to supplement lateral systems in the lower reaches of the project.

The 8 supplemental pumps operate infrequently only when water demand exceeds the capacity of the distribution system. All of the pump intakes are covered with coarse screens intakes and could entrain small fish.

### *Conversion from Flood Irrigation to Sprinkler Irrigation*

Irrigators have been converting from flood irrigation to more efficient sprinkler irrigation, predominately center pivots. While center pivots are more efficient in terms of labor and water application, each irrigator evaluates whether the savings would offset the high initial cost of conversion and increased annual cost for energy and maintenance. Other factors that influence an irrigator's decision to convert to center pivot irrigation are current crop prices, cost of water, cost of energy to pump the water and operate the pivots, and the availability of cost-share funding from the Natural Resources Conservation Service. There is a consistent conversion of flood methods to sprinkler methods. Approximately 6 pivot machines are being installed each year and the total sprinkler acreage is approaching 5,000 acres, or about 9% of the total acres. Sprinkler irrigation has the potential to reduce the total volume of water applied by 50% or more, and reduce return flows (field runoff) by up to 90%.

### *Water Measurement and Accounting*

Water diverted at Intake Diversion Dam is measured daily at a bridge on the main canal, approximately 2.8 miles downstream of the headworks. The annual diversions range from approximately 234,000 acre-ft to 378,000 acre-ft, with an average of 327,000 acre-ft. There are 18 strategic locations along the main canal that are monitored for water depth twice daily. All main canal and lateral diversions and all farm deliveries are measured and recorded. Water spilled from the main canal and all laterals are measured and recorded. Water delivery efficiencies range from 62 - 68%, which is common for large, open and unlined distribution systems. There have been no attempts to quantify the evaporation, seepage, or transportation losses due to the complexity of the distribution system and expense of such an intensive investigation.

### *Conservation Efforts*

An ongoing effort is being made to complete installation of adequate water measuring facilities. About 1/3 of the laterals lack measurement structures, and approximately 30% of farm delivery turnouts do not have water measurement capabilities, although about 80% of the spillways have accurate measuring devices. Additional water control structures are planned in the future in order to deliver water at lower canal flows, which would mean smaller diversions and spills, especially during low demand periods. Conversion of open-unlined laterals to buried pipe will proceed as center pivot sprinkler development continues. There are many opportunities for water conservation measures. The Lower Yellowstone Project has recently prepared a conservation plan pursuant to Reclamation requirements, which describes conservation opportunities, current conservation efforts and planned projects (Board of Control 2009).

## Recreation

### Introduction

- What is the current recreation in the area that could be affected by the proposed alternatives?

**Overview of Intake FAS picnic area taken from the edge of the main canal**

Two recreation areas are within the area of potential effects of the proposed Intake Project. Intake Fishing Access Site (Intake FAS) is located beside and immediately downstream of the Intake Diversion Dam main canal and headworks (see figure 3.7). It is approximately 16 miles northeast of Glendive, Montana, on Highway 16. The Intake FAS includes approximately 93 acres of land accessible by paved road and overlooks the north side of the Yellowstone River.


**Figure 3.7 – Map of Recreation Areas Potentially Affected by the Intake Project** (base map courtesy of Google Earth).

The second recreation area is Joe's Island on the opposite side of the Yellowstone River. Access to Joe's Island is very limited; travel to the island is along a 20 mile gravel road, and during high river flows, the ford used to cross the river channel to the south of the island is flooded and access is cut off. Joe's Island comprises approximately 997 acres of land and is located on the south side of the Yellowstone River.

Intake FAS and Joe's Island are local and regional recreational resources for swimming, picnicking, fishing, boating, hunting, and camping. In contrast, the paddlefish season generates state and national attention. Family traditions and historic use draw many visitors from the greater Montana area as well as from other states.

Land ownership at Intake FAS and Joe's Island is a mixture of federal, state, and private property (figure 3.8). The federal land is administered by Reclamation, and the state land is administered by the FWP. Private land within the Intake FAS is leased by FWP from a private land owner. Most of Reclamation's land is managed by FWP in accordance with a 50-year contract (Reclamation 1969). Dawson County developed and maintains access to the Intake FAS.

## Methods

Recreation information was obtained from a site visit to Intake FAS and Intake Diversion Dam; interviews with Reclamation and FWP staff; and reviews of various documents, news articles, contracts, and brochures.

**There were 3,110 visitors and 214 camps registered at Intake FAS during the 2008 paddlefish season**

## Existing Conditions

### *Camping*

Seventeen campsites at Intake FAS are open year-round and are available on a first-come, first-served basis. Many are shaded by mature cottonwood trees and have visual and/or physical access to the river. Campsites feature picnic tables and metal or rock fire rings but lack utility hook-ups, although many are large enough to accommodate campers and travel trailers. Potable water is available from May 15 to October 1 from spigots throughout the campground and vault toilets are minimally accessible. Group, overflow camping, and other group activities are allowed in an open area within the campground loop.

Camping at Intake FAS is an important recreational activity; however, most campers visit Intake FAS primarily to fish. On most Memorial Day and 4th of July holidays, camping is at capacity. During the paddlefish season, individual and group campsites fill to overflowing. During the 2008 paddlefish season, FWP recorded 3,110 visitors and 214 camps. During the non-paddlefish season, 4,325 visitors and 300 campers were recorded in 2008.

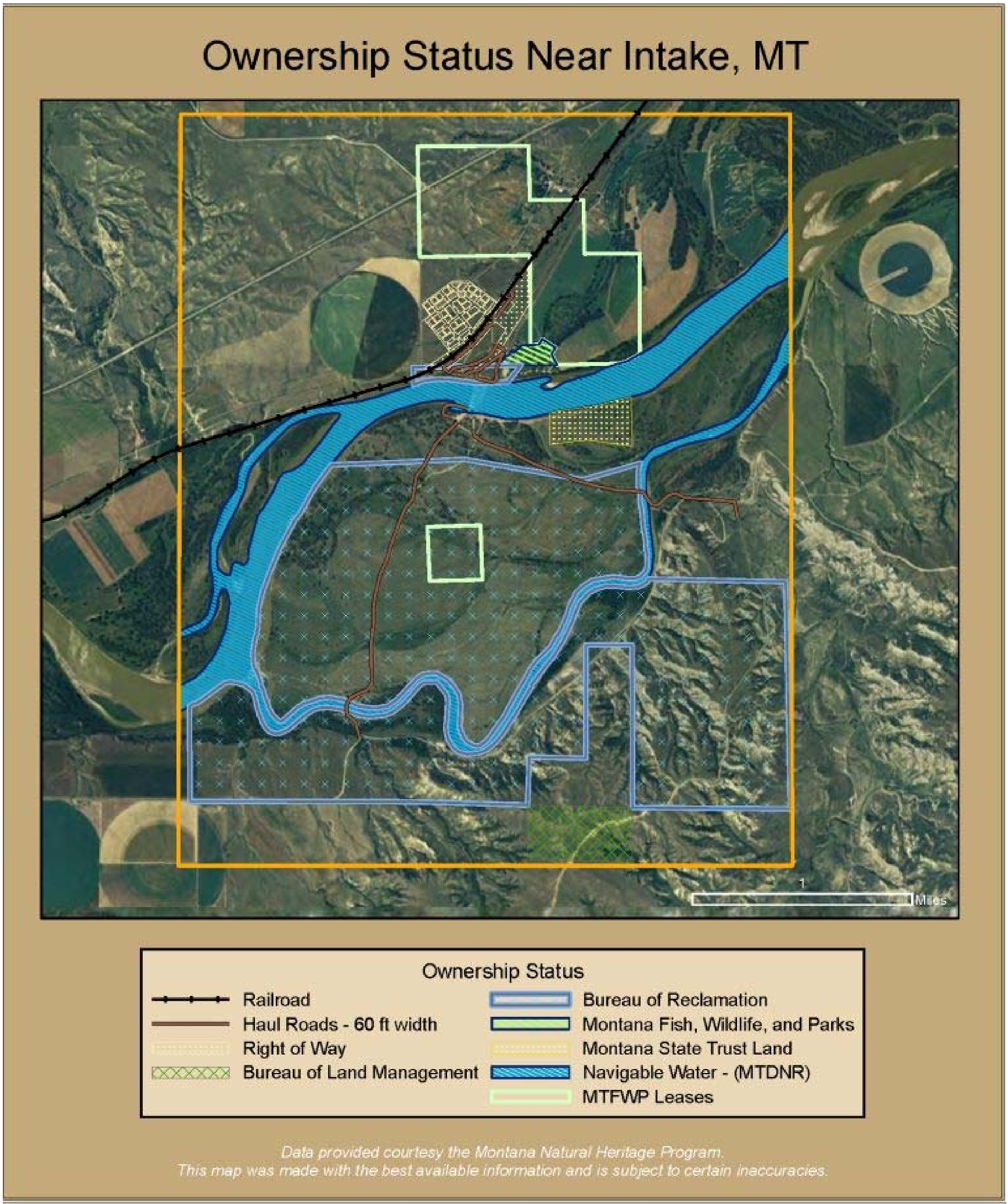
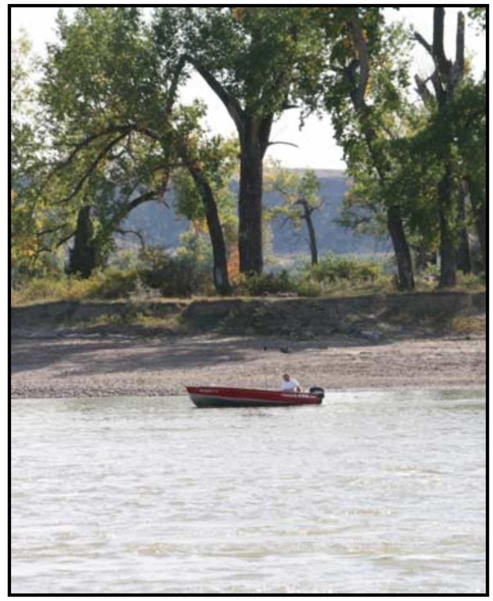



**Figure 3.8 – Ownership of Land in the Vicinity of the Proposed Intake Project.**

Camping is allowed on Joe's Island; however campsites are primitive, undesignated, and lack potable water and vault toilets. Visitation rates are not recorded.



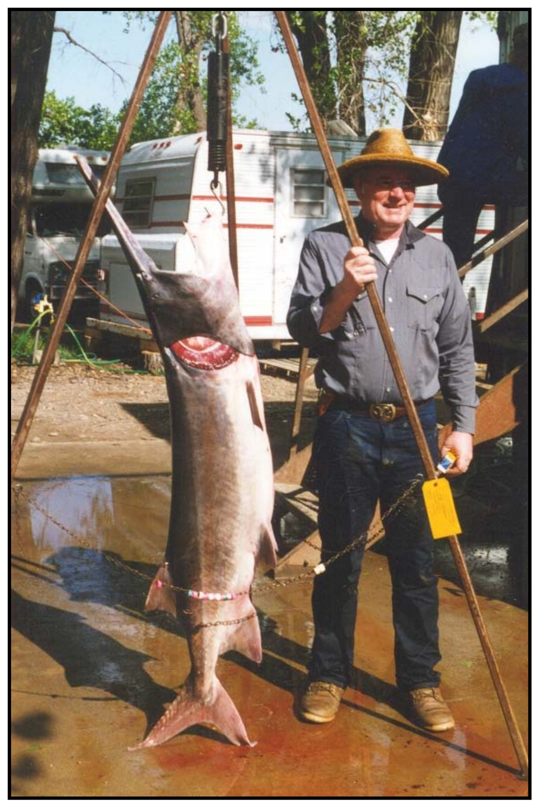
**Fisherman below Intake Diversion Dam beside Joe's Island**

***Hunting***

Hunting at the Intake FAS is prohibited; however, hunters may park and or launch boats at the ramp to access the river. Hunting is allowed on Joe's Island without firearms limitations. Many species may be hunted during appropriate seasons, including deer, pheasant, waterfowl, turkeys, rabbits, squirrels, etc.

***Fishing***

Although paddlefish are the most popular game fish at the Intake FAS, other game fish include shovel nose sturgeon, walleye, sauger, catfish, bass, and trout. Pallid sturgeon must be released if caught. Almost half the yearly recreational site visits occur during paddlefish season. Due to the impediment of the Intake Diversion Dam, paddlefish congregate downstream of the dam making snagging easier than elsewhere on the Yellowstone River. For some anglers paddlefish snagging at the Intake FAS has become a family tradition; some travel great distances to participate in this annual event.



**Paddlefish angler snags his limit. The overall annual limit of paddlefish that can be caught at Intake is 800.**

Fishing seasons, restrictions, and take limits are regulated by FWP. Anglers are limited to one paddlefish permit per season, and they may select only one of three areas to fish:

- Upper Missouri River, upstream from Fort Peck Dam to Fort Benton;
- Yellowstone river or Missouri River downstream from Fort Peck Dam; or,
- Fort Peck Dredge Cuts (west of Park Grove Bridge and Nelson Dredge) on the lower Missouri River.

In 2008, the total limit on the number of paddlefish that could be caught in the Missouri River downstream of Fort Peck Dam and the Yellowstone River was 1,000. The FWP may close the season within 24 hours notice in any year if it appears that the limit might be exceeded and immediately when 800 paddlefish are recorded at Intake FAS. The 2008 paddlefish season was May 15 – June 30; however, the season was closed at the Intake FAS after 8 days. Other restrictions and limitations unique to the paddlefish season may apply. As an example, fishing or snagging for any species from boats from the Intake Diversion Dam to approximately ¼ mile downstream is prohibited during the paddlefish season. During this closure fishing from boats launched at Intake FAS is allowed only outside the closed zone.

Montana law prohibits commercialization of fish and wildlife; however, special state legislation authorizes a FWP designated Montana non-profit corporation to accept paddlefish roe donations and process and market the roe as caviar. The FWP issues a yearly MOU 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.

**Glendive Chamber of Commerce paddlefish cleaning and roe harvest station**

The Chamber maintains a cleaning station at the Intake FAS during the paddlefish season and offers free cleaning for all paddlefish caught on the Yellowstone River between the Burlington Northern Railroad Bridge at Glendive, Montana, and the North Dakota state line. Roe from female paddlefish may be donated to the Chamber. Thirty percent of the proceeds from the sale of paddlefish caviar products, in excess of the costs of collection, processing, and marketing, must be deposited in a special state fund established for FWP. Such funds and interest are used for beneficial purposes supporting paddlefish fisheries, fishing access, habitat improvements, etc. The remaining 70% of the proceeds go to the non-profit association that processes and markets the caviar. Such proceeds may be used to cover administrative costs and to fund historical, cultural, recreational, and fish and wildlife projects and as seed money for grants.

The Intake Diversion Dam creates an upstream slack water fishing opportunity. Snagging for paddlefish downstream of the Diversion Dam is enhanced due to the dam. Most fishing immediately upstream of the dam is from the shore, because boats are generally unable to travel upstream over the dam.

As water is diverted from the Yellowstone River, fish are entrained in the main canal. These captured fish provide a limited canal fishing opportunity for anglers until the canal is de-watered.

***Boating***

The Intake FAS, the Sidney Bridge FAS and the Fallen Bridge FAS have concrete boat launch ramps. The downstream Elk Island FAS, Seven Sister FAS, and the Diamond Willow FAS provide primitive hand-launch opportunities. The recently acquired but undeveloped Glendive FAS and the Fallon Bridge FAS are both upstream of Intake Diversion Dam. Table 3.2 shows the river mile locations of public boat ramps on the Lower Yellowstone River.

**Table 3.2 – Locations of Boat Ramps on the Lower Yellowstone River**

| Fishing Access Site | Boat Ramp Type | River Mile Location |
|---|---|---|
| Intake Dam | concrete | 71.2 |
| Elk Island | primitive | 51.6 |
| Seven Sisters | primitive | 40.1 |
| Diamond Willow | primitive | 21.0 |
| Sidney Bridge | concrete | 30.5 |
| Glendive | under development | 91.6 |
| Fallon Bridge | concrete | 124 |

Except during high water conditions, boats are generally unable to travel upstream from the Intake FAS because of the diversion dam. An occasional rafter, kayaker, or boater may go downstream over the diversion dam. Boats launched at Intake FAS usually head 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.

***Concessions and Sub Contracts***

The Chamber, under its MOU, is authorized to issue a 3-year concession permit for limited commercial services at the FAS. Only one concession is authorized and offers food and fishing items for rent or purchase, such as rods and reels, tackle, hooks, snacks, ice, drinks, etc. The FWP receives an annual permit fee from the concession operations of approximately $750. The Chamber also issues a number of subcontracts for these services, which expire when the paddlefish season closes:

- Intake Chamber liaison;
- Fish cleaning;
- Roe processing;
- Shuttle service for Yellowstone River access (river transport to and from Intake FAS to Joe's Island and other downstream locations);
- Fish Shuttle Contract (transporting paddlefish from Sidney FAS to Intake FAS);
- Caviar Shuttle (for transporting roe from Intake FAS to the Chamber's processing center); and
- Concessionaire.


**Swimming warning sign at Intake FAS**

***Other Recreational Activities***

**Swimming** Swimming is not a popular recreational activity and is discouraged due to turbulent water conditions immediately downstream of the dam. Warning signs are posted within the FAS (see photo). Submerged logs and lost treble hooks also pose hazards to swimmers.

**Picnicking/Day Use** Picnic tables, shade shelters, fire rings and parking are available for public use. Domestic water and vault toilets are available. Day use activities at Intake FAS are free (see photo on page 3-35).

**Ice Fishing** Although the water surface area immediately around the dam often does not freeze due to turbulent water, anglers ice fish both upstream and downstream of the dam.

## Social and Economic Conditions

### Introduction

- What are the current social and economic conditions in the Intake Project area that could be affected by the proposed alternatives?

The social and economic affected area includes counties that have social and economic links to the region that would be directly impacted by the alternative actions. The affected area includes Dawson, McCone, Prairie, Richland, Roosevelt, and Wibaux counties in Montana and McKenzie and Williams counties in North Dakota. This section describes the current demographic, economic, and educational aspects of the regional economy. Indicators of regional social and economic conditions include population, value of output, percentage output value by sector, household income, per capita income, labor force, and employment.

**A major sector of economic activity in the region is agriculture**

### Method

An evaluation of social and economic conditions requires data on current baseline conditions from which the significance of economic impacts can be measured. Data were obtained from the U.S. Bureau of the Census, U.S. Department of Agriculture, and Bureau of Labor Statistics. Oil and gas information was obtained from the North Dakota Industrial Commission, Department of Mineral Resources, Oil and Gas Division and from the Montana Board of Oil and Gas Conservation.

### Existing Conditions

#### *Population*

The eight county impact area is rural in nature, with a total 2007 population of slightly over 56,700 people. The regional population has declined by 10.8% over the last 17 years. All of the counties have experienced a loss in population, but the largest percentage decrease was in the three lowest population counties (McCone, Prairie, and Wibaux). The larger population counties have retained their population. County level population estimates are presented in table 3.3.

The largest municipalities in the region are Williston, North Dakota, and Sidney and Glendive, Montana. The larger municipalities have not experienced as much of a decrease in population on a percentage basis as the smaller municipalities. Municipal population estimates are in table 3.4.

**Table 3.3 – County Level Population Estimates for the Intake Project Area (U.S. Census Bureau 2009a, 2009b, 2009c, 2009d).**

| COUNTIES | 1990 | 2000 | 2007 | 2008 | % CHANGE FROM 1990 TO 2007 |
|---|---|---|---|---|---|
| **Montana** | | | | | |
| Dawson | 9,505 | 9,059 | 8,558 | 8,490 | -10.68 |
| McCone | 2,276 | 1,977 | 1,724 | 1,676 | -26.36 |
| Prairie | 1,383 | 1,199 | 1,044 | 1,064 | -23.07 |
| Richland | 10,716 | 9,667 | 9,182 | 9,270 | -13.49 |
| Roosevelt | 10,999 | 10,620 | 10,148 | 10,089 | -8.27 |
| Wibaux | 1,191 | 1,068 | 898 | 866 | -27.29 |
| **North Dakota** | 6,383 | 5,737 | 5,617 | 5,674 | -11.11 |
| McKenzie | 21,129 | 19,761 | 19,540 | 19,846 | -6.07 |
| Williams | | | | | |
| **Study Area Total** | **63,582** | **59,088** | **56,711** | **56,975** | **-10.39** |

**Table 3.4 – Study Area County Seat Populations (U.S. Census Bureau 2009a, 2009b, 2009c, 2009d).**

| COUNTY | 1990 | 2000 | 2007 | 2008 | % CHANGE FROM 1990 TO 2007 |
|---|---|---|---|---|---|
| Circle (McCone) | 805 | 644 | 558 | 1,676 | -26.36 |
| Glendive (Dawson) | 4,802 | 4,729 | 4,615 | 8,490 | -10.68 |
| Sidney (Richland) | 5,217 | 4,774 | 4,746 | 9,270 | -13.49 |
| Terry (Prairie) | 659 | 611 | 534 | 1,064 | -23.07 |
| Watford City (McKenzie ND) | 1,784 | 1,435 | 1,373 | 5,674 | -11.11 |
| Wibaux (Wibaux) | 628 | 567 | 481 | 866 | -27.29 |
| Williston (Williams) | 13,131 | 12,512 | 12,393 | 19,846 | - 6.07 |
| Wolf Point (Roosevelt) | 2,880 | 2,663 | 2,525 | 10,089 | -8.27 |

The relatively small, shrinking population indicates a decline in economic activity needed to support the population, as well as a decrease in the potential labor supply, which may inhibit future long-term commercial activity. The most recent population data are available for 2007. As a result, the increase in population associated with the recent increase in oil and gas production is not reflected in tables 3.3 and 3.4. However, unless oil and gas prices increase and remain high enough over the long term to support increased oil and gas production, the population increase associated with oil and gas production will be temporary and will not reverse the long term downward trend.

***Sectors of Economic Activity***

The primary sectors of economic activity in the region include agriculture, recreation, transportation and utilities, government, wholesale and retail, and mineral extraction, including oil and natural gas production. Table 3.5 shows the percentages of total earnings attributable to the primary sectors of activity in each county, as defined by the U.S. Department of Commerce in 2006. There are many more sectors that generate earnings other than those shown in table 3.5, but these are relatively small compared to the primary sectors.

**Table 3.5 - Earnings as a Percentage of Total Earnings in 2006.**

| COUNTY | FARMING AND AGRICULTURAL SERVICES % | TRANSPORTATION, WAREHOUSING, AND UTILITIES % | GOVERNMENT % | WHOLESALE AND RETAIL % | MINING % |
|---|---|---|---|---|---|
| **Montana** | | | | | |
| Dawson | | | | | |
| McCone | 6.70 | 24.43 | 19.80 | 11.88 | 3.95 |
| Prairie | 24.76 | 28.21 | 20.90 | 14.65 | 0.94 |
| Richland | 37.97 | 6.66 | 36.00 | 3.02 | 0.40 |
| Roosevelt | 7.71 | 10.01 | 14.60 | 9.88 | 15.76 |
| Wibaux | 10.79 | 3.55 | 51.60 | 9.51 | 0.93 |
| | 31.08 | 15.39 | 29.30 | 12.74 | 0.00 |
| **North Dakota** | | | | | |
| McKenzie | 14.60 | 5.74 | 44.40 | 6.36 | 9.69 |
| Williams | 2.17 | 6.12 | 14.40 | 15.10 | 22.65 |

The wholesale and retail earnings percentages are relatively low, because of the small population in the area. Transportation, utilities, mining, and government sectors are based on the availability of natural resources and infrastructure in the region and, therefore, represent a larger percentage of regional earnings. The government sector accounted for a little more than $268 million in total earnings, mining for $146.6 million in earnings, wholesale and retail for $132.4 million in earnings, and transportation and utilities for $49.5 million in earnings in 2005.

**Agriculture** As shown in table 3.6, agriculture is also an important sector of economic activity in the region. Farm earnings in the eight county region totaled a little more than $76.7 million in 2006. Table 3.6 shows irrigated crop acreage for all sources of irrigation water for the three counties in which the Lower Yellowstone Project is located.

**Table 3.6 – Primary Irrigated Crop Acreage by County in 2006.**

| COUNTY | SUGAR BEETS | HAY | WHEAT | BARLEY |
|---|---|---|---|---|
| Dawson (Montana) | 2,400 | 6,500 | - | 3,100 |
| McKenzie (North Dakota) | 10,400 | 3,500 | 4,200 | 4,400 |
| Richland (Montana) | 13,900 | 10,500 | 15,900 | 17,000 |

**Recreation** Recreation expenditures represent a substantial proportion of spending in the regional economy. It is difficult to isolate the effects of recreation-related spending on the earnings data presented in table 3.5, and other earnings categories not shown because these expenditures affect many different commercial activities. Therefore, supplemental information is needed to understand the importance of recreation in the regional economy.

A 2003 analysis of recreation and tourism by FWP estimated total Montana nonresident recreation expenditures that year to be $10 million to $24 million each in Dawson and Richland counties, Montana. The 2003 analysis also estimated nonresident expenditures for the other 4 study area counties in Montana to be $10 million or less. Recent recreation expenditure data at the county level were not available for North Dakota. Nonresident expenditures are the most important type of spending to local economies because these represent an inflow of revenues into the region. Resident expenditures are more likely to represent movement of money within the region. Nonresident recreation spending in the 8 county area could be up to $100 million. To provide some context for the importance of recreation spending to the regional economy, data for business receipts and the value of agricultural products sold are presented in table 3.7. The most recent data available for business receipts at the county level is the 2002 Survey of Business Owners, and the most recent agricultural market value data available are for 2007. Since the two sets of data are for different years, the values should be compared in terms of magnitudes rather than as precise values. However, this provides enough information to indicate the relative importance of recreation to the regional economy.

**Table 3.7 – Business Receipts and Market Value of Agricultural Products.**

| County | All Business Receipts, Not Including Farm Sales in 2002 (Millions $) | Market Value of Agricultural Products Sold in 2007 (Millions $) |
|---|---|---|
| **Montana** | | |
| Dawson | 317.7 | 56.6 |
| McCone | 42.9 | 51.6 |
| Prairie | 12.4 | 24.4 |
| Richland | 616.0 | 107.0 |
| Roosevelt | 232.4 | 67.8 |
| Wibaux | 10.2 | 18.6 |
| | | |
| **North Dakota** | | |
| McKenzie | 125.9 | 78.1 |
| Williams | 922.7 | 127.3 |
| **Total** | **$2,280.2** | **$531.4** |

The data presented in table 3.7 indicate that nonresident recreation expenditures may account for as much as 5% of total non-farm expenditures in the region. The data also indicate that recreation expenditures could be about 1/5 of the value of agricultural products sold.

Recreation at the Intake FAS provides measurable positive economic impacts to the local economy in terms of recreational expenditures of visitors and proceeds from the sales of paddlefish caviar products. The direct economic impact of recreation visitation to the Intake FAS can be measured in terms of expenditures made by visitors to the site. Ideally, these expenditures would be estimated using the results of participant surveys. However, in the absence of survey information, the magnitude of impacts from recreation expenditures can be estimated using data from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2006 National Survey) combined with estimated visitation at the Intake FAS.

The 2006 National Survey provides estimates of trip related and equipment recreation expenditures in Montana as well as estimates of total statewide Montana trips. Using this information, the average expenditure per trip can be estimated for Montana. This average expenditure can then be applied to the Intake FAS visitation data. The expenditure data includes spending for equipment and transportation, which may not entirely occur within the recreation area. Equipment is likely to be primarily bought at home before the trip, and transportation costs such as gasoline and wear and tear on the vehicle will not occur on site. Therefore, the actual in region expenditures will be less than total expenditures. The expenditure estimates per trip are presented in table 3.8.

**Table 3.8 – Recreation Expenditure Estimates.**

| Expenditure Category | Statewide Montana Expenditures $ | Estimated Expenditures per Trip $ | Likely Estimated In-Region Expenditures $ |
|---|---|---|---|
| Food | 36,991,000 | 18.34 | 18.34 |
| Lodging | 21,101,000 | 10.46 | 10.46 |
| Transportation | 61,516,000 | 30.50 | 15.25 |
| Privilege and other fees | 15,194,000 | 7.53 | 7.53 |
| Boating Costs | 10,890,000 | 5.40 | 5.40 |
| Bait, Ice, etc. | 4,108,000 | 2.04 | 2.04 |
| Fishing Equipment | 23,765,000 | 11.78 | - |
| **Total** | **$173,565,000** | **$86.05** | **$59.02** |

As stated in the recreation section, during 2008 approximately 3,110 visitors used Intake FAS during the short paddlefish season in mid-May and 4,325 visitors during the non-paddlefish season, for a total of 7,435 visitors that year. Assuming that the number of visitors estimated for the FAS is equal to the number of trips and using the likely estimated expenditures in the region, total recreation expenditures would be about $440,000 annually for the Intake FAS area alone.

Thirty percent of the proceeds from the sale of paddlefish caviar products, in excess of the costs of collection, processing, and marketing must be deposited in a special state fund established for FWP. Such funds and interest are used for beneficial purposes supporting paddlefish fisheries, fishing access, habitat improvements, etc. The remaining 70% of the proceeds go to the non-profit association that processes and markets the caviar. Such proceeds may be used to cover administrative costs and to fund historical, cultural, recreational, and fish and wildlife projects and as seed money for grants.

Gross revenue from caviar sales from 1990 to 2007 ranged from about $45,800 in 1998 to a little over $296,500 in 2006, averaging about $146,600 over the 18 year period. Net income after accounting for processing and marketing costs has averaged nearly $95,200. The FWP portion of sales has averaged about $22,600. The remaining revenues were distributed for grants and projects.

**Oil and Gas** Oil and gas production represents an important source of revenue, income and employment in the study region. The recent increase energy resource prices generated a substantial increase in economic activity in the region in 2008. The data presented in table 3.5 do not account for the increased importance of oil and gas production in the local economy as a result of increased energy prices, and although prices have decreased from their highs in mid-2008, oil and gas production continues to contribute substantially to the local economy.

Total 2008 oil production in the eight county study area region was about 32.7 million barrels, and total natural gas production was about 55.3 Mcf (1,000 cubic ft). Oil production in the Montana counties accounted for about two-thirds of total Montana oil production and oil production in the North Dakota counties was 20.1% of total North Dakota oil production. Natural gas production in the Montana counties was 17.6% of total Montana gas production, while the North Dakota counties amounted to 43.5% of total North Dakota gas production. The combined study region counties accounted for 35% of total oil production in Montana and North Dakota combined, and 29% of total gas production in both states in 2008. Oil and gas production in each of the study area counties along with state totals are presented in table 3.9.

**Mcf** is 1,000 cubic ft, a unit of measure in the oil and gas industry for natural gas.

**Table 3.9 – 2008 Oil and Natural Gas Production.**

| State/County | Oil (barrels) | Natural Gas (Mcf) |
|---|---|---|
| **Montana** | **29,700,000** | **101,732,231** |
| Dawson | 430,112 | 190,856 |
| McCone | 10,311 | NA |
| Prairie | 80,043 | 7,919 |
| Richland | 17,463,729 | 16,436,738 |
| Roosevelt | 1,347,969 | 720,624 |
| Wibaux | 739,324 | 555,032 |
| | | |
| **North Dakota** | **62,776,000** | **86,085,600** |
| McKenzie | 7,498,864 | 14,789,956 |
| Williams | 5,108,164 | 22,635,858 |

Oil and gas revenues are substantial in the eight county region. Based on average annual 2008 prices for crude oil and natural gas in Montana and North Dakota estimated by the Energy Information Administration, the total value of oil and gas production in the eight county study region was about $3.3 billion. Using 2007 prices and production estimates, the total value of production in the study area was about $2.5 billion. Oil and gas production also generates substantial tax revenues to the counties and states. Combined oil and gas production tax collections totaled more than $186 million in fiscal year 2006 for all of Montana. North Dakota oil and gas production tax revenues were $104.4 million in 2006 and more than $209 million in 2008. Fiscal year 2006 oil and gas production tax collections in the six Montana counties totaled nearly $76 million, or 40.8% of the state total.

### *Income and Poverty*

An important economic measure of impacts associated with an action is the effect on income and related impacts on poverty rates. Frequently used measures of income include median household income and per capita income. Median household income is a good measure of the total available resources a household has to spend on goods and services as a total unit, although per capita income is a better measure of the economic resources available to each person for goods and services.

Large households may have greater income as a unit, but may be relatively poor in terms of providing goods and services for each individual; therefore, both measures of income provide important information. The poverty rate indicates the percentage of the population that falls below the official threshold of poverty. The poverty threshold varies according to household size and location. For 2007 – 2008 the poverty rate for a family of four in the 48 contiguous states was $21,200. Median household income, per capita income, and the poverty rate for the study area are shown in table 3.10 for each county and in table 3.11 for the county seats.

**Table 3.10 – Income and Poverty Data for Study Area Counties.**

| COUNTY | MEDIAN HOUSEHOLD INCOME $ (2007) | PER CAPITA INCOME $ (1999) | PERSONS BELOW POVERTY % (2007) |
|---|---|---|---|
| **Montana** | **43,000** | **17,151** | **14.1** |
| Dawson | 43,678 | 15,368 | 12.2 |
| McCone | 38,533 | 15,162 | 11.8 |
| Prairie | 32,857 | 14,422 | 13.1 |
| Richland | 49,168 | 16,006 | 11.3 |
| Roosevelt | 29,744 | 11,347 | 30.3 |
| Wibaux | 35,045 | 16,121 | 13.0 |
| | | | |
| **North Dakota** | **43,936** | **17,769** | **11.8** |
| McKenzie | 41,333 | 14,732 | 13.8 |
| Williams | 48,919 | 16,763 | 10.2 |

**Table 3.11 – Income and Poverty Data for Study Area Counties.**

| CITY (COUNTY) | MEDIAN HOUSEHOLD INCOME (1999) $ | PER CAPITA INCOME (1999) $ | PERSONS BELOW POVERTY (1999) % |
|---|---|---|---|
| Circle (McCone) | 27,500 | 13,412 | 18.3 |
| Glendive (Dawson) | 30,943 | 15,544 | 14.8 |
| Sidney (Richland) | 32,109 | 16,911 | 12.7 |
| Terry (Prairie) | 25,294 | 15,093 | 8.4 |
| Watford City (McKenzie) | 29,688 | 18,084 | 12.2 |
| Wibaux (Wibaux) | 26,518 | 18,105 | 10.2 |
| Williston (Williams) | 29,962 | 16,656 | 13.4 |
| Wolf Point (Roosevelt) | 27,962 | 13,605 | 17.9 |

As an overall region, the study area has relatively low income and high poverty rates compared to overall state averages. The data show that Roosevelt County, Montana, has the lowest median household income, lowest per capita income, and the highest poverty rate of the study area counties. Wolf Point, Montana, which is the Roosevelt County Seat, also shows low income and a relatively high poverty rate. Prairie County, Montana, has the second lowest median household income, the second lowest per capita income, and the third highest poverty rate of the study area counties. McKenzie County has the third lowest per capita income and the second highest poverty rate of the study area counties.

***Labor force, Unemployment, Educational Attainment***

Labor force, unemployment, and educational attainment are indicators of the number of workers potentially available to support current and future economic activity and the population's level of training to provide skilled labor for commercial activities. The small population of the study region limits the size of the available labor force. Large demands for labor would need to be supplied from outside the region. The study region provides less than 4% of the total labor force of the state of Montana and less than 5% of the labor force of North Dakota. Labor force data are presented in table 3.12.

In addition, as of 2007 the unemployment rate in the study region was generally very low. Unemployment was 3.1% or less for all of the study region counties except Roosevelt County, Montana. This indicates that there are few unemployed resources available in the region for expansion of commercial activities in the present. Unemployment rates for the study area are presented in table 3.12.

Educational attainment is an indicator of the skill level of the labor force and the attractiveness of the area to businesses and industry considering expanding or locating in the area. This can influence the future labor force and income potential of the region. The percentage of the population 25 years of age or older with a high school diploma or the equivalent for each county and the percentage with a bachelors degree or higher is shown in table 3.12.

**Table 3.12 – Labor Force, Unemployment, and Educational Attainment.**

| STATE/COUNTY | LABOR FORCE (2007) | ANNUAL AVERAGE UNEMPLOYMENT (2007) % | HIGH SCHOOL DIPLOMA OR EQUIVALENT (2000) % | BACHELORS DEGREE (2000) % |
|---|---|---|---|---|
| **Montana** | **510,000** | **3.4** | **87.2** | **24.4** |
| Dawson | 4,253 | 2.5 | 82.7 | 15.1 |
| McCone | 998 | 2.0 | 86.1 | 16.4 |
| Prairie | 545 | 3.1 | 78.8 | 14.8 |
| Richland | 5,438 | 2.1 | 83.5 | 17.2 |
| Roosevelt | 3,829 | 5.5 | 80.6 | 15.6 |
| Wibaux | 511 | 2.5 | 76.8 | 16.0 |
| **North Dakota** | **368,000** | **3.1** | **83.9** | **22.0** |
| McKenzie | 2,952 | 3.1 | 79.1 | 15.7 |
| Williams | 13,075 | 1.9 | 82.5 | 16.5 |

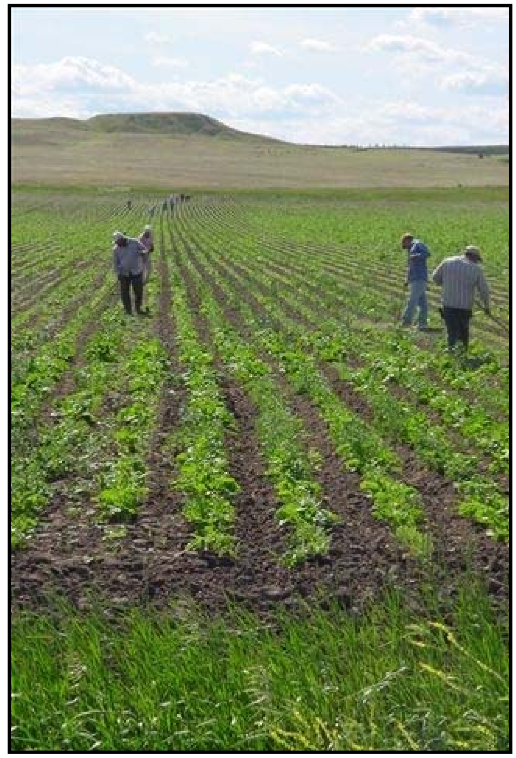
The percentage of the population 25 years of age or older in each study area county that has a high school diploma or the equivalent ranges from 76.8% in Wibaux County to 86.1% in McCone County. This compares to 87.2% for all of Montana and 83.9% for all of North Dakota. The percentage of the population in the study area counties that have a Bachelor's degree or higher ranges from 14.8% in Prairie County to 17.2% in Richland County. This can be compared to 22.0% for all of North Dakota and 24.4% for all of Montana. The lower level of bachelor's degrees in the region may limit some employment opportunities to the current population.

## Environmental Justice

### Introduction

- What are the current conditions of the low-income and minority communities within the area that could be disproportionately affected by the proposed alternatives?

Environmental justice refers to the distribution of affects from a federal action on people with respect to income, race, ethnicity, or some other group characteristic. More specifically, Executive Order 12898 indicates that federal actions must be evaluated to determine if they place a disproportionate share of negative impacts on a group of people and if so how the negative impacts can be mitigated. Environmental justice recognizes that no group of people should bear a disproportionate share of negative impacts from an action. Negative impacts can be considered disproportionately distributed if the percentage of total impacts imposed on a specific group is greater than the percentage of the total population represented by that group.



**Roosevelt, Prairie, and McKenzie counties have some potential environmental justice concerns because of low income and high poverty rates.**

### Methods

An evaluation of environmental justice impacts requires an understanding of where the impacts are likely to occur and where potentially affected groups are located. The analysis relies on demographic data from the U.S. Bureau of the Census to determine the location of different groups of people. The analysis also requires collection of income and other economic data from the U.S. Bureau of the Census, Bureau of Labor Statistics, and state and local agencies to identify low income areas. Identifying the location of specific groups can be complicated by nonpermanent residents or other groups that do not participate in demographic data counting. Census data tends to undercount the number of people in rural areas due primarily to difficulties in contacting residents in sparsely population regions. However, Census data are typically the most complete and comparable demographic and economic data available for individuals and households. The most recent Census data are from 2007 for population and demographic data.

### Existing Conditions

#### *General Population Characteristics*

Income and poverty rate data are described in the previous Social and Economics Conditions section. The data indicate that, with the exception of Roosevelt County, Montana, and McKenzie County, North Dakota, the economic impact area has low unemployment and fairly low poverty rates compared to state averages. However, median household and per capita incomes are also low. The American Indian population in the study area as a percentage of total population is much lower than state averages, except for Roosevelt County and McKenzie County.

***Comparison of Population Characteristics Within the Impact Region***

In order to identify potential environmental justice issues within the impact area, data for individual counties were compared to each other. Table 3.13 shows income, poverty, unemployment, and population characteristics for the study area. The black population is 1% or less for both Montana and North Dakota at the state level and for all study area counties.

**Table 3.13 – Environmental Justice Related Characteristics of Study Area Counties.**

| State/ County | Median household income 2007 $ | Per capita income 1999 $ | Persons below poverty % 2007 | Annual Average Unemployment % 2007 | White % 2007 | American Indian % 2007 | Hispanic % 2007 |
|---|---|---|---|---|---|---|---|
| **Montana** | **43,000** | **17,151** | **14.1** | **3.4** | **90.6** | **6.3** | **2.8** |
| Dawson | 43,678 | 15,368 | 12.2 | 2.5 | 96.8 | 1.7 | 1.8 |
| McCone | 38,533 | 15,162 | 11.8 | 2.0 | 96.4 | 1.6 | 1.2 |
| Prairie | 32,857 | 14,422 | 13.1 | 3.1 | 98.1 | 0.5 | 0.7 |
| Richland | 49,168 | 16,006 | 11.3 | 2.1 | 96.8 | 1.9 | 2.8 |
| Roosevelt | 29,744 | 11,347 | 30.3 | 5.5 | 37.7 | 59.3 | 1.9 |
| Wibaux | 35,045 | 16,121 | 13.0 | 2.5 | 97.9 | 0.6 | 0.4 |
| | | | | | | | |
| **ND** | **43,936** | **17,769** | **11.8** | **3.1** | **91.6** | **5.4** | **1.9** |
| McKenzie | 41,333 | 14,732 | 13.8 | 3.1 | 76.4 | 21.5 | 1.5 |
| Williams | 48,919 | 16,763 | 10.2 | 1.9 | 92.8 | 4.9 | 1.3 |

The data show that Roosevelt County, Montana, has the lowest median household income and lowest per capita income of the study area counties. Roosevelt County also has the highest poverty rate and the highest unemployment rate of the study area counties. Data for Wolf Point, Montana, which is the Roosevelt County Seat, also shows low income and a relatively high poverty rate.

Another potential county of concern from an environmental justice perspective is Prairie County, Montana. Prairie County has the second lowest median household income, second lowest per capita income, and third highest poverty rate of the study area counties combined with the second highest unemployment rate. There could be some potential environmental justice concerns in McKenzie County, because it has the third lowest per capita income and the second highest poverty rate of the study area counties, along with the same unemployment rate as Prairie County, Montana.

Roosevelt County, Montana, and McKenzie County, North Dakota, are also potential areas of environmental justice concerns due to very high percentages of American Indian population. More than one-half of the population of Roosevelt County and about 40% of the population of the municipality of Wolf Point are American Indians. About 21.5% of the total population in McKenzie County is American Indian compared to 5.4% for all of North Dakota. Alternatives that have a disproportionate adverse effect on Roosevelt County, Prairie County, or McKenzie County could potentially have environmental justice issues.

## Lands and Vegetation


**Noxious weed sign at Intake FAS**

### Introduction

- What lands and vegetation (wetlands, grasslands, woodlands, riparian areas, and noxious weeds) in the area could be affected by the proposed alternatives?

This section identifies lands and vegetation that may be affected either by construction of Intake Project features or any secondary impacts that project features may have on flows in the Yellowstone River. Lands and Vegetation include wetlands, grasslands, woodlands, riparian areas and noxious weed areas. The following discussion centers on habitat types within the Northwestern Great Plains Ecoregion in the Intake Project's area of potential effects in the Yellowstone River Basin (see figure 1.1).

### Methods

#### *Inventory of Construction Areas*

To inventory lands and vegetation in potential construction zones for action alternatives, GIS layers were used. The layers were developed using state and federal agency land use databases. This inventory was done by superimposing alternative features over land use data sets and identifying the types of lands that coincide with the proposed location of Intake Project features. These inventories covered wetlands, riparian areas, woodlands, and grasslands. Combinations of data sets were used, including the National Land Cover Dataset for woodlands and grasslands and wetland and riparian mapping drafted by the Montana Natural Heritage Program. Wetland and riparian data were digitized and classified by the Montana Natural Heritage Program using Service National Wetland Inventory (NWI) standards (Service 2004). The data used in this EA were draft data that have been through two stages of internal review but have not been field checked or approved by the Service's NWI. The NWI definition of a wetland is more inclusive than of a jurisdictional wetland. The boundaries shown in this dataset cannot substitute for boundaries mapped in a wetland delineation. Mapped riparian types are not wetlands but have vegetation affected by the hydrology of a nearby water body (river, stream, or lake).

Noxious weed information was only available on a county-by-county basis.

**Wetlands Definitions**
***Riverine*** wetlands are typically narrow, wet areas within a channel. These wetlands, which are common in and along the Yellowstone River, usually are flowing or at least soaked periodically, because both surface and subsurface water flows toward them.

***Palustrine*** wetlands are typically shallow to wet basins usually dominated by vegetation. Along the Yellowstone River these wetlands usually occur in strips adjacent to the river and could include emergent and scrub-shrub vegetation.

## Existing Conditions

### *Wetlands*

For Montana, Ellis and Richard (2008:2-1) suggest the following definition of wetlands:

> Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturation soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Federal Register 1982).

It is estimated that about 30% of Montana's wetlands have been lost because of agriculture and development (Bender-Keigley 2008). Wetlands now comprise less than 1% of Montana's land base (Ellis and Richard 2008). There are a diversity of wetland types within the Project area (Cowardin et al. 1979), including riverine wetlands and palustrine wetlands. Wetlands most likely to be affected are those located within the riparian areas.

Table 3.14 lists wetlands within the construction area footprint for each alternative. Because each alternative could affect riverine wetlands, those acres are also identified in table 3.14.

**Table 3.14 – Wetlands Within the Construction Footprint of Proposed Action Alternatives.**

| Alternative | Palustrine (acres) | Riverine (acres) | Total Wetlands (acres) |
|---|---|---|---|
| **No Action** | 0 | 2 | 2 |
| **Relocate Main Channel Alternative** | 13 | 293 | 306 |
| **Rock Ramp Alternative** | 0 | 55 | 55 |

### *Riparian Areas*

In Montana, riparian areas have been described as plant communities next to rivers, streams, and drainage ways, commonly associated with a valley (Ellis and Richard 2008). These also have one or both of the following characteristics:

- Distinctively different vegetative species than adjacent areas; and/or
- Species similar to adjacent areas but exhibiting more vigorous or robust growth forms (Service 1997).

**Riparian Area Definitions**
***Emergent*** Supports vegetation that is erect and rooted with herbaceous stem.
***Forested*** Supports woody vegetation greater than 19 ft high e.g. cottonwood trees
***Scrub-shrub*** Supports woody vegetation less than 19 ft high e.g. willow

Riparian areas can include wetlands, grasslands, and woodlands. Riparian areas now comprise less than 3% of Montana's land base (Ellis and Richard 2008).

In order to identify and evaluate potential impacts of the alternatives, riparian areas were defined by the Montana Natural Heritage Program that is mapping wetland and riparian areas along the Yellowstone River using the *System for Mapping Riparian Areas in the Western United States* (Service 1997). The analyses for this EA used definitions adopted by this program. Mapped riparian types may not be jurisdictional wetlands but have vegetation affected by the hydrology of a nearby water body (river, stream, or lake). Table 3.15 lists acres of riparian areas within the construction area footprint for each alternative.

**Table 3.15 – Riparian Areas Currently in Construction Footprint of Alternatives.**

| Alternatives | Riparian Acres | | | |
|---|---|---|---|---|
| | Emergent | Forested | Scrub-shrub | Total |
| **No Action** | 0 | 0 | 0 | 0 |
| **Relocate Main Channel Alternative** | 10 | 144 | 56 | 210 |
| **Rock Ramp Alternative** | 0 | 5 | 0.1 | 5 |

***Woodlands***

Woodlands include areas with trees usually greater than 19 ft tall with a tree canopy covering 25% -100%. Within the Intake Project area this includes deciduous and evergreen forests and shrubland. Deciduous woodlands are generally made up of cottonwood, green ash, Russian olive, and box elder trees. The evergreen forest consists mostly of juniper species and ponderosa pine. Shrublands are areas dominated by shrubs with a shrub canopy covering 25% - 100% of the area. In the Intake Project area this includes sagebrush communities dominated by silver sagebrush, chokecherry shrubland, buffaloberry shrubland, and some drier willow shrub areas. Table 3.16 lists acres of wooded areas within the construction area footprint for each alternative.

**Table 3.16 – Woodlands Currently in Construction Footprint of Alternatives.**

| Alternatives | Woodland Acres | | | |
|---|---|---|---|---|
| | Deciduous | Evergreen | Shrubland | Total |
| **No Action** | 0 | 0 | 0 | 0 |
| **Relocate Main Channel Alternative** | 9 | 82 | 95 | 186 |
| **Rock Ramp Alternative** | 0 | 5 | 7 | 12 |

***Grasslands***

The grasslands in this ecoregion include sparse wheatgrass on the heavy, slowly permeable bottomland and threadleaf sedge and needle and thread on the gravelly soils of hill slopes. Both little bluestem and buffalo grass are found along flat-bottomed channels. Table 3.17 lists acres of grasslands that are currently within the construction area footprint for each alternative.

**Table 3.17 – Grasslands Currently in Construction Footprint of Alternatives.**

| Alternatives | Grassland Acres |
|---|---|
| **No Action** | 0 |
| **Relocate Main Channel Alternative** | 256 |
| **Rock Ramp Alternative** | 21 |

### *Noxious and Invasive Plants*

Currently 15 different noxious weeds infest counties in the Intake Project area (table 3.18).

**Table 3.18 – Noxious Weeds Currently in Counties in the Intake Project Area.**

| Noxious Weeds | MT Category | MT Dawson County[1] | MT Richland County | ND McKenzie County |
|---|---|---|---|---|
| Absinth wormwood | | | | X |
| Canada thistle | 1 | X | X | X |
| Common tansy | 1 | X | | |
| Dalmatian toadflax | 1 | | X | |
| Dyers woad | 3 | X | | |
| Field bindweed | 1 | X | X | |
| Hoary cress | 1 | X | X | |
| Houndstongue | 1 | X | X | |
| Leafy spurge | 1 | X | X | X |
| Musk thistle | | | | X |
| Purple loosestrife | 2 | X | X | |
| Russian knapweed | 1 | X | X | X |
| Russian Olive[3] | invasive | X | X | X |
| Saltcedar | 2 | X | X | X |
| Spotted knapweed | 1 | X | X | X |
| Yellow toadflax | 1 | X | | |

[1] Data accessed (February 2009) through http://agr.mt.gov/weedpest/pdf/county-listed_5-07.pdf, http://maps2.nris.mt.gov/mapper/county.html, http://agr.mt.gov/weedpest/pdf/2008weedPlan.pdf
Montana Category 1 noxious weed species are currently established and generally widespread in many counties. Montana Category 2 noxious weed species have recently been introduced into the state or are rapidly spreading from their current infestation sites. Montana Category 3 noxious weed species may be found only in small, scattered, localized infestations.
[2] Data accessed (February 2009) through http://www.agdepartment.com/Programs/Plant/NoxiousWeedSurveys.htm
[3] Included based on Yellowstone River Conservation District Council Best Management Practice adopted June 21, 2007.

## Wildlife

Badgers live in grassland habitat (www.wildernesscommittee.org)

### Introduction

- Which mammals, amphibians, reptiles, and birds currently inhabit areas that could be affected by the Intake Project alternatives?

The habitat types in the ecoregion (see figure 3.1) support various wildlife species within the Intake Project area. The diversity of habitats across this ecoregion sustains an abundant diversity of wildlife.

### Methods

A literature search was performed to identify mammals, migratory birds, amphibians, and reptiles currently inhabiting areas that could be affected. Lists of mammals were obtained from FWP websites. Consideration was also given to the types of habitats and how these habitats might be impacted, either through construction or alterations that might occur through geomorphological changes that could result from any of the alternatives. appendix F lists the common and scientific names of species discussed in this section.

### Existing Conditions

***Mammals***

Across the plains areas the wildlife habitat is a unique blend of grasslands; including native prairie, tame prairie, and Conservation Reserve Program plantings; prairie wetlands, shelterbelts, riparian woodland valleys, in-channel islands, and riparian complexes. All of these are integrated within an agricultural setting. Mammals in these areas are typical of those in Northwestern Great Plains Ecoregion environments. Table 3.19 lists the mammals anticipated to be in the Project area and their habitats.

**Table 3.19 – Mammals Anticipated in the Intake Project Area and Their Habitats.**

| SPECIES | HABITAT TYPES |
|---|---|
| Antelope | Grassland/agricultural mix |
| Badger | Grasslands |
| Beaver | Water and associated woody vegetation. |
| Big brown bat | Grasslands, riparian areas |
| Desert cottontail | Grasslands and sagebrush areas |
| Eastern cottontail | Riparian habitats and brushy thickets |
| Eastern fox squirrel | Riparian cottonwood forests |
| Eastern red bat | Wooded riparian areas in late summer early fall |
| Hayden’s shrew | Moist grassy environments |
| Hoary bat | Wooded riparian areas |
| Least weasel | Meadows, fields, brushy areas, and open woods |
| Little brown myotis | Variety of habitats near rivers, year-round |
| Long-eared myotis | Woody and rocky areas, year-round |

| SPECIES | HABITAT TYPES |
|---|---|
| Long-legged myotis | Wooded areas, likely migratory |
| Long-tailed weasel | Found in almost all land habitats near water |
| Meadow vole | Wet grassland habitat |
| Mink | Along streams and lakes |
| Mountain cottontail | Primarily dense shrubby undergrowth, riparian areas |
| Mule deer | Grasslands interspersed with brushy coulees or breaks; riparian habitat along river; and agricultural grassland mix |
| Muskrat | Marshes, edges of ponds, lakes, streams, cattails, and rushes are typical habitats |
| Northern Pocket Gopher | Cultivated fields, prairie, and wooded areas |
| Olive-backed pocket mouse | Grasslands and meadows in sandy habitats |
| Ord’s kangaroo rat | Sandy areas along dry streams and flats |
| Porcupine | Wooded and brushy areas along streams |
| Prairie vole | Grassland and sometimes riparian areas |
| Raccoon | Riparian and wetland habitats |
| Silver-haired bat | Wooded areas |
| Snowshoe hare | Dense riparian thickets |
| Striped skunk | Mixed woods, prairie and brush |
| Thirteen-lined ground squirrel | Tallgrass, brushy edges, herbaceous vegetation, dense cover |
| Townsend’s big-eared bat | Cottonwood stands with bluffs nearby |
| Western jumping mouse | Usually tall grass along streams, with or without a brush or tree canopy |
| Western small-footed myotis | Rocky outcrops near grasslands, year round |
| White-tailed deer | River and creek bottoms and agricultural grassland mix |
| White-tailed jackrabbit | Grasslands and wooded or riparian areas in winter |

### *Birds*

Important habitats for birds in the Intake Project area include floodplain cottonwood forests, mixed-grass prairie, islands, and sandbars. Riparian habitats are vital for many birds, particularly in arid and semiarid environments. A study on the lower Yellowstone River showed that the riparian forest had the highest density and diversity of birds of 10 habitat types evaluated (Silverman and Tomlinsen 1984).

**The red-tailed hawk’s habitat is the floodplain forest**
(www.images.fws.gov)

Characteristic breeding birds of floodplain forests include red-tailed hawk, black-billed cuckoo, great horned owl, downy woodpecker, hairy woodpecker, red-headed woodpecker, northern flicker, least flycatcher, black-billed magpie, common crow, black-capped chickadee, American robin, red-eyed vireo, warbling vireo, yellow warbler, American redstart, ovenbird, black-headed grosbeak, lazuli bunting, and spotted towhee (Stewart 1975).

Floodplain forests also provide important habitat for migrating birds, particularly those that overwinter in the tropics. Many of these species, termed neotropical migrants, have experienced substantial population declines.

Characteristic breeding birds of the mixed grass prairie include sharp-tailed grouse, horned lark, western meadowlark, brown-headed cowbird, grasshopper sparrow, and chestnut-collared longspur (Stewart 1975). Populations of many prairie birds are declining due to habitat fragmentation.

**Habitat fragmentation is affecting prairie birds, like the brown-headed cowbird** (www.images.fws.gov)

Unvegetated or sparsely vegetated sandbars and islands provide breeding habitat for endangered least terns. Periodic flooding is necessary to maintain such habitats. However, high flows during the breeding season may inundate nests. More heavily vegetated islands are used extensively for nesting by Canada geese.

### *Amphibians and Reptiles*

Relatively little is known about the demography and life history of most Montana amphibian and reptile species, because most have only been studied in detail at a handful of locations. However, the unique blend of wet meadows, grasslands, prairie wetlands, riparian woodlands and in channel islands and riparian complexes, within an integrated agricultural setting offers suitable habitat to a number of amphibians and reptiles. Table 3.20 shows the amphibian and reptile species anticipated in the Intake Project area and their habitats.

**Table 3.20 – Amphibian and Reptiles Anticipated in the Intake Project Area and Their Habitats.**

| SPECIES | HABITAT TYPES |
|---|---|
| Boreal chorus frog | May occupy wetlands in riparian areas |
| Common gartersnake | All habitats, particularly moist habitats near water |
| Eastern racer | Associated with relatively open habitats either in shortgrass prairie or forested areas |
| Painted turtle | Wetlands that contain some shallow water areas and a soft bottom; also river backwaters and oxbows |
| Plains gartersnake | Grasslands near wetlands |
| Snapping turtle | Backwaters along rivers, with permanent flowing water and sandy or muddy bottoms |
| Spiny softshell turtle | Occupy larger rivers and tributaries; in areas of soft sandy and muddy banks |
| Tiger salamander | May occupy wetlands in riparian areas |
| Western hog-nose snake | Prefers sandy or gravelly habitats, often by rivers or sagebrush-grassland habitat and near pine savannah in grasslands |
| Woodhouse's toad | May occupy wetlands in riparian areas |

## Historic Properties

### Introduction

- What types of historic properties (significant cultural resources) have been previously recorded in the area of potential effects?

This section presents an inventory of cultural resources in the area that could be affected by Intake Project alternatives. Cultural resources are the physical remains of a site, building, structure, object, district, or property of traditional religious and cultural importance to Native Americans. Historic properties are significant cultural resources that are either included on or have been determined eligible for listing on the National Register of Historic Places. Because some of the cultural resources have not been evaluated to determine if they are eligible for listing, the more generic term "cultural resources" is used in this discussion. The terms used in this section are defined in the blue box to the right.

Because the proposed Intake Project is a federal action, it must comply with federal legislation concerning historic properties, specifically Section 106 of the National Historic Preservation Act of 1966, as amended. appendix G includes correspondence documenting consultation under this Act.

**Cultural Resource Terms**

**Archaeological Site** – is physical evidence or remains of past human activity at a specific location. Prehistoric archaeological sites predate written records and historic archaeological sites generally are associated with European exploration and settlement of the area.

**Architectural Site –** is a building, which is a structure created to shelter any form of human activity (such as a house, barn, church, or hotel) or a structure, which is a work composed of interdependent and interrelated parts in a definite patter or organization (such as bridges, tunnels, canals, or fences).

**Cultural Resource –** The physical remains of a site, building, structure, object, district, or property of traditional religious and cultural importance to Native Americans.

**Historic Property –** Any prehistoric or historic site, building, structure, object, district, or property of traditional religious and cultural importance to Native Americans that is included on or has been determined eligible for listing on the National Register of Historic Places. Only historic properties are protected under the National Historic Preservation Act.

**Isolated Find** – is a location with fewer than five artifacts, which shows little potential for additional finds. Finds are generally not considered to qualify as historic properties.

**National Register of Historic Places** – A registry maintained by the Secretary of the Interior of sites, buildings, structures, objects, or districts or properties of traditional religious and cultural importance to Native Americans that have local, state, regional, or national historic or prehistoric significance.

**Site Lead –** is a site that was insufficiently recorded or reported by the public but not professionally verified. Site leads are generally not considered to qualify as historic properties without verification.

### Methods

The Lower Yellowstone Project was inventoried for cultural resources during the fall of 1996 and 1997 in anticipation of pending legislation to transfer title of the Lower Yellowstone Reclamation projects from Reclamation to the appropriate irrigation districts. The legislation did not pass; however, the University of North Dakota assisted by Renewable Technologies, Inc., completed an inventory of cultural resources under contract with Reclamation (table 3.21).

A search of records, called a Class I inventory, was completed to identify all previously recorded cultural resources in the Lower Yellowstone Project area. This was followed by an intensive pedestrian inventory (Class III) of selected areas to locate unrecorded resources (figure 3.9). During the Class III inventory the selected areas were walked, and cultural resources in these tracts were recorded. The Class III inventory covered most of the area of potential effects of the proposed Intake Project (see figure 3.9, BA-1). In addition to the pedestrian survey, local residents were interviewed to find site leads, and county title records were searched to identify historic persons associated with any of the recorded historic archaeological sites or structures (Kordecki et al. 1999).

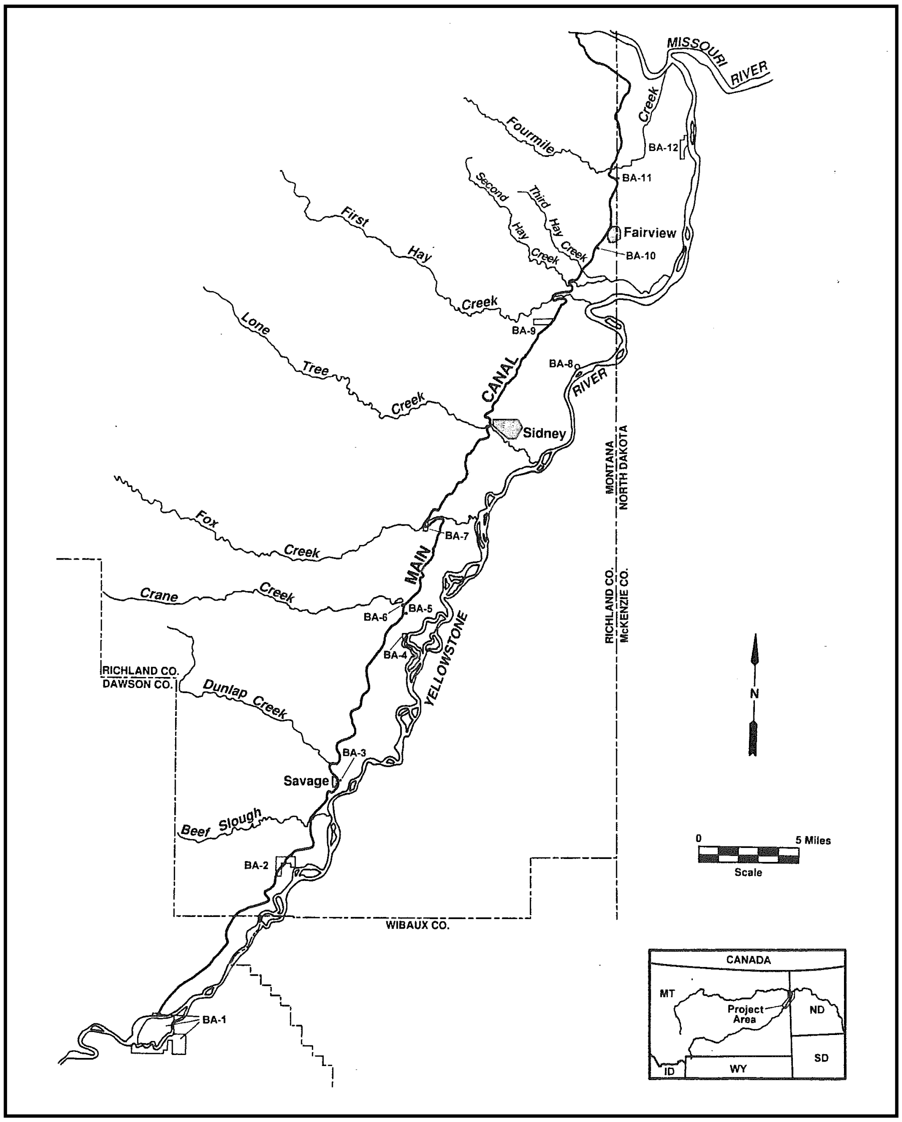



**Figure 3.9 - Lower Yellowstone Project Main Canal** (from Kordecki et al. 1999:1.3). Note: Areas marked with BA are survey blocks.

The No Action Alternative area of potential effects was surveyed in 1991 by Reclamation in advance of reactivation of the rock quarry used to O&M Intake Diversion Dam (Coutant 1991).

## Existing Conditions

The cultural resources inventories located and recorded 15 cultural resources within or adjacent to the area of potential effects of the three alternatives described in chapter two. These are listed in table 3.21. Of the 15 resources, 7 are significant and eligible for listing on the National Register of Historic Places, and the significance of 2 prehistoric archaeological sites have not been determined.

**Table 3.21 – Cultural Resources Located Within the Area of Potential Effects of the Action and No Action Alternatives[1].**

| Site Number | Type | Description | National Register Eligibility |
|---|---|---|---|
| 24DW287 | Architectural structure | Lower Yellowstone main canal and headworks constructed in 1905-1909 | Eligible for listing |
| 24DW295 | Prehistoric archaeological site | Scatter of stone tools, flaking debris, rock cairn, and fire-cracked rock | Unknown eligibility |
| 24DW296 | Historic and prehistoric archaeological site | Historic rock quarry used for construction of Intake Diversion Dam and two small flaking debris and fire-cracked rock scatters. | Eligible for listing |
| 24DW298 | Historic archaeological site | Depressions marking locations of former structures at Old Cameron and Brailey Sub-Camp occupied in 1906 by workers building the main canal. | Eligible for listing |
| 24DW299 | Historic archaeological site | Two depressions with metal scraps and wooden fence posts | Not eligible |
| 24DW300 | Historic archaeological site | Two sod rimmed dugout depressions with rusted wire, granite block, and concrete | Not eligible |
| 24DW430 | Prehistoric archaeological site | Late Plains Archaic campsite | Eligible |
| 24DW431 | Historic archaeological site | Three depressions and dump | Not eligible |
| 24DW433 | Prehistoric archaeological site | Scatter of stone tools and flaking debris – possible stone tool workshop | Unknown eligibility |
| 24DW434 | Prehistoric archaeological site | Middle Plains Archaic artifact scatter | Eligible for listing |
| 24DW436 | Historic archaeological site | Possible homestead site, although no patent was ever issued | Not eligible due to lack of integrity |
| 24DW437 | Historic archaeological site | Log foundation of a former structure – possible attempt at homesteading | Not eligible due to lack of integrity |
| 24DW443 | Architectural structure | Intake Diversion Dam built in 1906-1910, dike, cableway system and engineer's house, and abandoned power plant | Eligible for listing |
| 24DW444 | Historic archaeological site | Archaeological remains of two cabins | Not eligible due to lack of integrity |

[1] National Register of Historic Places eligibility based upon consensus determinations with the Montana State Historic Preservation Office.

| Site Number | Type | Description | National Register Eligibility |
|---|---|---|---|
| 24DW447 | Architectural buildings and historic archaeological site | Headworks Camp/Gate Tender Residence, garage, and outhouse | Eligible for listing |

***Historic Properties***

Three of the cultural resources eligible for listing on the National Register of Historic Places (24DW287, 24DW443, and 24DW447) within the area of potential effects are architectural sites associated with the Lower Yellowstone Project. These include the main canal and headworks, Intake Diversion Dam, and the Headworks Camp and Gate Tender Residence. Another important site is Old Cameron and Brailey Sub-Camp (24DW298) that was occupied by workers building the main canal. Finally, the Lower Yellowstone Rock Quarry (24DW295) is the original source of rock used to build Intake Diversion Dam. It also has a prehistoric archaeological component. These five sites, along with other features of the Lower Yellowstone Project, are part of an historic district significant for its association with the broad pattern of federal reclamation efforts in the early twentieth century and agricultural development of the Lower Yellowstone valley. When consulted by Reclamation, the Montana State Historic Preservation Office agreed these sites are significant under NHPA.

Based on consultation with the Montana State Historic Preservation Office, two prehistoric archaeological sites in the area of potential effects are eligible for listing on the National Register of Historic Places. Site 24DW430 is an extensive scatter of stone tools, pieces of bone, and fire-cracked rock. It appears to be a campsite occupied during the Late Plains Archaic, a period dating to 3,000 to 1,500 years ago. Finally, the second (24DW434) is a multi-component campsite with prehistoric stone tools and pottery from the Middle Plains Archaic, which dates to 5,000 to 3,000 years ago.

Site 24DW295, a scatter of stone tools, flaking debris, rock cairn, and fire-cracked rock; the prehistoric component of 24DW296; and a prehistoric stone tool workshop (24DW433) are of unknown significance and have been recommended for archaeological testing. The remaining six sites in table 3.20 are ineligible due to lack of integrity or the ability to yield important information (see Kordecki et al. 1999).

# Indian Trust Assets

## Introduction

- What are the Indian trust assets that could be affected by the proposed alternatives?

This section addresses the current condition of Indian trust assets (ITAs) that may be affected in the proposed Intake Project area. The United States has a "trust responsibility" to protect and maintain rights and property reserved by or granted to federally recognized American Indian tribes or to Indian individuals by treaties, statutes, and executive orders. This trust responsibility derives from the historical government-to-government relationship between the federal government and Indian tribes as expressed in treaties and federal Indian law. This responsibility requires that all federal agencies, including Reclamation, take all actions reasonably necessary to protect ITAs.

ITAs are defined as legal interests in property held in trust by the United States for federally recognized Indian tribes or individuals. Examples of things that may be trust assets include "lands, minerals, hunting and fishing rights, and water rights" (Reclamation 1993). These three ITAs are addressed in this section: 1) trust lands; 2) hunting, fishing, and gathering rights; and 3) water rights.

**Table 3.22 – Tribes Consulted About ITAs.**

| **Missouri River Tribes** |
|---|
| Assiniboine and Sioux Tribes of Fort Peck |
| Cheyenne River Sioux Tribe |
| Crow Creek Sioux Tribe |
| Iowa Tribe of Kansas |
| Lower Brule Sioux Tribe |
| Omaha Tribe |
| Ponca Tribe |
| Sac and Fox Nation |
| Santee Sioux Nation |
| Standing Rock Sioux Tribe |
| Three Affiliated Tribes (Mandan, Hidatsa, and Arikara) |
| Winnebago Tribe |
| Yankton Sioux Tribe |
| **Missouri Basin Tribes** |
| Blackfeet Tribe |
| Chippewa Cree Tribe, Rocky Boy Reservation |
| Crow Tribe |
| Eastern Shoshone Tribe |
| Flandreau Santee Sioux Tribe |
| Fort Belknap Assiniboine and Gros Ventre Tribes |
| Kickapoo Tribe |
| Northern Arapaho Tribe |
| Northern Cheyenne Tribe |
| Oglala Sioux Tribe |
| Prairie Bend of Potawatami Nation |
| Rosebud Sioux Tribe |

## Methods

### *Consultation with Tribes to Identify ITAs*

Tribes were invited to consult throughout preparation of the EA. In October 2008 Reclamation sent letters to 25 tribes in the Upper Missouri River Basin. Follow-up telephone calls were made to each tribe listed in table 3.22. All of these tribes could directly or indirectly have historic ties to the Intake Project area. In addition to consultation with tribes, Reclamation staff researched land ownership, treaty boundaries, treaty rights, and consulted with the Bureau of Indian Affairs (appendix H).

## Existing Conditions

The following discussion addresses potential treaty rights of Indian Tribes in this area. The Fort Laramie Treaty of 1851 established boundaries for several Indian Tribes. In the area of the Lower Yellowstone Intake, the Treaty defined the following boundaries:

- **Gros Ventre, Mandan, and Arikara Nations Boundaries** Commencing at the mouth of the Heart River; thence up the Missouri River to the mouth of the Yellowstone River; thence up the Yellowstone River to the mouth of the Powder River, in a southeasterly direction, to the headwater of the Little Missouri River; thence along the Black hills to the head of Heart River; and thence down Heart River to the place of beginning.

- **Assiniboine Boundaries** Commencing at the mouth of Yellowstone River; thence up the Missouri River to the mouth of the Muscle-shell River; thence from the mouth of the Muscle-shell River in a southeasterly direction until it strikes the head waters of Big Dry Creek; thence down that creek to where it empties into the Yellowstone River, nearly opposite the mouth of the Power River; and thence down the Yellowstone River to the place of beginning.

The Assiniboine ceded this country by treaty in 1866, although this treaty was never ratified, but by their acceptance of a home on the reserve for the Blackfeet, Blood, Gros Ventre, Piegan, and River Crow, they practically relinquished it. Other tribes and nations did not abandon any rights or claims they may have to other lands in addition to those defined by the Treaty, including the lands noted above.

The Fort Laramie Treaty of 1868 redefined the boundaries of the Sioux Nation and Arapahoe Tribe to assure undisturbed use and occupation of certain lands. No changes were made in the boundaries of lands for the Gros Ventre, Mandan, Arikara, or Assiniboine as noted in the 1855 Fort Laramie Treaty.

The Executive Order of April 12, 1870, set aside a reservation at Fort Berthold, Dakota Territory, and redefined the Fort Berthold Reservation as described in the 1851 Fort Laramie treaty by striking off lands south and east of a line extending from the point where the Little Powder River unites with Powder River to a point on the Missouri River 4 miles below the Indian Village of Berthold. Executive Order on July 13, 1880, reduced the lands reserved to the Arikara, Mandan and Gros Ventre further. Lands around the Intake were ceded with the Executive Order of July 13, 1880.

The Act of Congress of May 1, 1888, established the Fort Peck and Fort Belknap Reservations for the Gros Ventre and Assiniboine as currently defined. All other lands were ceded to the United States (Royce 1899). The Indian Claims Commission addressed claims during its tenure from 1946 to 1978. Unresolved claims were transferred to the U. S. Court of Claims. There are no known pending cases before the U. S. Court of Claims involving the lands around the intake or treaty rights affecting the tribes associated with this area (http://digital.library.okstate.edu/icc/index.html).

A review of the master title plat files at the Montana Area Office indicates that lands within 2 miles of the Intake are currently either privately owned or within the jurisdiction of Reclamation. There are no vacant and unreserved public domain lands or individual Turtle Mountain Chippewa allotments within two miles of the Intake Project.

Reclamation is not aware of any treaty rights asserted in the area of the Intake. Reclamation has consulted with the Rocky Mountain Region of the Bureau of Indian Affairs (Brenda Schilf, Realty Specialist) and the Corps (Joel Ames, Native American Coordinator, Omaha Division), as well as Reclamation cultural resource specialists. These sources were not aware of any treaty rights asserted in the area of the Intake Project.

# Chapter Four *Environmental Consequences*

**Construction of a rock ramp near Miles City, Montana**
(photo courtesy of FWP)

## Introduction

This chapter describes the anticipated beneficial and/or adverse impacts of the proposed action alternatives on the relevant environmental resources described in chapter three. The likely consequences of the No Action Alternative (Continue Present Operation) are also discussed. The chapter evaluates direct, indirect, and cumulative effects and quantifies these effects whenever possible. Actions and commitments intended to minimize environmental impacts are also described. The net impact on the relevant resources is analyzed by comparing the impacts of the action alternatives to the No Action Alternative (Continue Present Operation).

Issues or resources described in chapter three and analyzed in this chapter are:

- Climate
- Air Quality
- Hydrology
- Geomorphology
- Surface water quality
- Aquatic communities
- Federally-listed species and state species of special concern
- Lower Yellowstone Project irrigation districts and water conservation
- Recreation
- Social and economic conditions
- Environmental justice
- Lands and Vegetation – wetlands, grasslands, woodlands, riparian areas, and noxious and invasive plant areas
- Wildlife
- Historic properties (cultural resources)
- Indian trust assets

The analyses recognize that there are links between resources. For example, the action alternatives propose removing a barrier to fish passage, which would reconnect segments of the Yellowstone River and contribute to restoration of the lower Yellowstone River ecosystem. This would in turn affect aquatic communities and recreational resources, like fishing and boating.

Throughout these impact assessments, linkages are discussed where appropriate and are quantified when possible. Resources and issues that were analyzed and found to be unaffected are noted in the text, and the results of the analyses of relevant resources are documented in appendix C (List of Federally-Listed Species and State Species of Special Concern), appendix D (Biological Assessment for Construction Activities Associated With the Intake Diversion Dam Modification Lower Yellowstone Project), appendix E (Hydraulic Analysis and Pallid Sturgeon Evaluation), appendix G (National Historic Preservation Act Consultation), appendix H (Indian Trust Assets), appendix I (Actions to Minimize Effects), appendix J (Adaptive Management Strategy), appendix K (Surface Water Quality Tables), and appendix L (Missouri River Recovery Implementation Committee Questions and Answers). Actions to minimize effects are listed after each resource section in this chapter and are compiled in appendix I by resource. Species common and scientific names are consolidated in appendix F but also appear where appropriate in sections of this chapter. The results of a review of the Draft Intake EA and appendixes by a panel of pallid sturgeon experts are summarized in appendix M.

To ensure that Intake Project activities are completed concurrently and in full compliance with all environmental commitments specified in this EA, an Environmental Review Team will be formed. Members of the team, as described below, will be established to review and assist Reclamation and the Corps on Intake Project actions during implementation of the environmental commitments. This team also will address other relevant state and federal environmental rules and regulations, such as the Endangered Species Act and the National Historic Preservation Act. Any changes in the construction program warranting additional NEPA review or other environmental compliance will be addressed by the Environmental Review Team. In addition, an Adaptive Management Plan will be developed in accordance with the Adaptive Management Strategy described in appendix J.

The Environmental Review Team could include technical representatives of the following agencies:

- Bureau of Reclamation
- U.S. Army Corps of Engineers
- Lower Yellowstone Irrigation Project Board of Control
- Montana Department of Environmental Quality
- Montana Department of Natural Resources and Conservation
- Montana Fish, Wildlife & Parks
- U.S. Fish and Wildlife Service
- The Nature Conservancy
- Montana Historic Preservation Officer
- Other technical entities as deemed important to the process

## Adaptive Management

### *What Is Adaptive Management?*

Managers in many fields adjust their strategies as new information accumulates and as new practices are developed. Adaptive management is a strategy for addressing a changing and uncertain environment that relies on common sense and learning. Adaptive management looks for ways to understand the behavior of ecosystems and draws upon theories from ecology, economics, social sciences, engineering, and other disciplines. Adaptive management incorporates and integrates concepts such as social learning, operations research, economic values, and political differences with ecosystem monitoring, modeling, and science (National Research Council 2004).

The goal of adaptive management is to enhance scientific knowledge and reduce uncertainties. The uncertainties that are part of any system can come from a number of sources. Parma et al. (1998) and Regan et al. (2002) describe causes of uncertainty in natural systems. Sources of uncertainty include natural variability, incomplete data, and social and economic changes and events, all of which may affect natural resources systems. Adaptive management works to create a framework that help organizations, managers, and other stakeholders respond to and even take advantage of unanticipated events (Holling 1978; Walters 1986; National Research Council 2004).

Application of adaptive management is intended to support actions when the scientific knowledge of their effects on ecosystems is limited (Holling 1978). This does not mean that actions are delayed or postponed until there is agreement that enough has been learned about an ecosystem. Rather, adaptive management provides a means to adjust management actions when new information becomes available.

Adaptive management consists of a set of principles used to guide the implementation of management actions (National Research Council 2004). The fundamental principles of adaptive management, while useful for evaluating problems and adjusting strategies, are not designed to be a strict roadmap to a specific endpoint (National Research Council 2004). Rather, the principles set forth a mechanism that assists in recognizing when changes occur and management should be adjusted. The principles are based on several important aspects of systems.

First, as we learn more about the interactions between humans, their environments, and potential impacts of human activities, there may be a need to develop new courses of action. Second, the environment in which we live is highly variable and is always changing, and these factors can impact operations of projects. Finally, the objectives that society has for a specific project and the outcomes from that project may change, resulting in a need to change how the project is operated (National Research Council 2004).

The basic theme of adaptive management is to continually evaluate project operations and develop courses of actions that can respond to change. This means that project managers must revisit objectives and develop a range of choices for how they would manage a project if changes occur. Managers must also use the information gained through monitoring and evaluation and apply it to future decisions. A key to successful implementation of any adaptive management strategy is to involve stakeholders in the learning and evaluation processes.

***Where Has Adaptive Management Been Used?***

Adaptive management has been used for water resource projects in many areas of the United States. For example, the U.S. Department of the Interior used adaptive management in restoring riparian habitat in the Grand Canyon by releasing large quantities of water from Glen Canyon Dam, monitoring the results, and using those results to guide future restoration actions. A number of projects have incorporated adaptive management to address recovery of threatened or endangered species or in ecosystem restoration programs. For example, the Corps incorporated adaptive management into restoration efforts on the Missouri River. Recently, Reclamation has used adaptive management strategies on the Sacramento River as an important element of the Tehama-Colusa Canal Authority Fish Passage Improvement Project at the Red Bluff Diversion Dam.

**Adaptive management would be an important part of implementation of either of the Intake Project's proposed action alternatives**

For the Sacramento River Project, adaptive management is a process that:

1) Uses monitoring and research to identify and define problems,
2) Examines various alternative strategies and actions for meeting measurable biological goals and objectives, and
3) If necessary, makes timely adjustments to strategies and actions based upon best scientific information.

An adaptive management program for the Intake Project would be similar to the Sacramento River project allowing construction to proceed despite changes (e.g. unanticipated Intake Project changes or impacts to resources), responding to the changes, (adjustments to strategies and monitoring project compliance and mitigation), and "adapting" to conditions in the field.

### *How Would Adaptive Management be Used on the Intake Project?*

For the purposes of this Intake Project, if an action alternative is selected for implementation, Reclamation and the Corps would use adaptive management to determine the effectiveness of the selected alternative to allow passage of adult pallid sturgeon and reduce entrainment into the main canal (appendix J). Using adaptive management, the effectiveness of the fish passage and fish screen features would be monitored and analyzed to determine if they are successful.

**Pallid Sturgeon in Net**

The Intake Project's Adaptive Management Strategy focuses on two specific areas and would continue up to 8 years (appendix J). First, we would monitor the effectiveness of the fish screens installed in the headworks. Second, we would evaluate the effectiveness of the alternative's passage of pallid sturgeon. Adaptive management is based on input from a number of scientific, engineering, and social disciplines. As implementation of the project proceeds, results would be monitored and assessed. If the anticipated goals and objectives of the project are not being achieved, adjustments in structures, operations, or management actions would be implemented and monitored under the Adaptive Management Plan.

Because a key factor in successful implementation of adaptive management is stakeholder involvement, Reclamation and the Corps will follow the strategy outlined in appendix J. Prior to completing construction, a specific Adaptive Management Plan for the selected alternative would be completed.

# Climate

## Introduction

- How could climate change affect the proposed Intake Project?

**Winter at Intake Diversion Dam**

Effects of the alternatives on climate change (e.g., emissions of greenhouse gasses during construction) would be too small to measure, but climate change could affect the Intake Project in several ways. If the average temperature increases in the Yellowstone River Basin, seasonal runoff and annual stream flow in the Yellowstone River and its tributaries could be reduced, thus affecting the amount of water available to meet future irrigation demands or instream flow needs for fish and wildlife. Likewise, increased temperatures, particularly in the winter, could reduce mountain snowpack and affect runoff volumes and patterns. Additionally, climate change could affect the timing and volume of irrigation demands and the effectiveness of fish passage alternatives.

## Methods

The Intergovernmental Panel on Climate Change (IPCC) and the U.S. Climate Change Science Program periodically release climate change assessments. These assessments and other peer-reviewed scientific literature were used to qualitatively assess potential effects of climate change on the Intake Project.

## Results

### *Potential Effects of Climate Change on the Intake Project*

According to the most recent report issued by the IPCC, virtually all climate model simulations agree that average annual temperatures in central North America, which includes the Intake Project area, will continue to increase during this century, with a median projected increase of 3.5$^{o}$C for years 2080 – 2099 as compared to 1980 – 1999 (Christensen et al. 2007). On a global scale, warming is projected to reduce precipitation in the subtropics and increase precipitation at higher latitudes (Arnell et al. 2001; Solomon et al. 2007). However, the location of "boundaries" between areas projected to receive more or less precipitation is uncertain. This uncertainty is reflected in considerable disagreement among model outputs for precipitation change at middle latitudes. For example, the median projected change in annual precipitation for central North America is a 3% increase, but model projections range from a decrease of 16% to an increase of 15% (Christensen et al. 2007).

Figure 4.1 shows projected changes in median annual runoff for 2041-2060 relative to 1901-1970 in major river basins of the United States. For the Missouri River Basin as a whole (which includes the Yellowstone River Basin), no substantive change in median runoff is predicted.

Even if average annual precipitation increases, increased evaporation from rising air temperatures may outweigh the increase in precipitation, thereby reducing soil moisture and increasing the chance of drought (Jacobs et al. 2001).

Variability in stream flow over time is strongly influenced by variability in precipitation over seasonal, annual, and decadal time scales. Thus, changes in precipitation could alter the frequency, magnitude, and duration of future droughts. However, many uncertainties remain that limit the ability to project changes in precipitation over regional or sub-regional scales. Modeled changes in average annual precipitation occur more slowly than changes in temperature, and thus, may be more difficult to detect given the large amount of natural variability in precipitation over annual and decadal time scales (Cohen et al. 2001; Christensen et al. 2007).

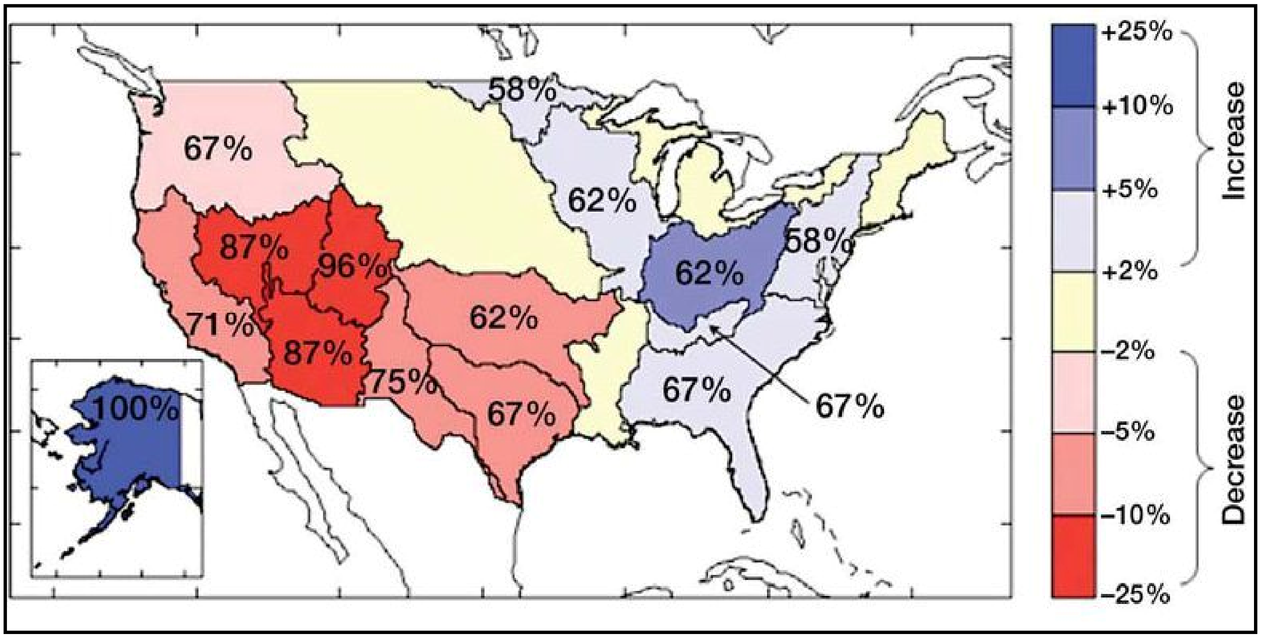



**Figure 4.1 - Median Changes in Projected Runoff for 2041-2060 Relative to 1901-1970. Percentages are fraction of 24 runs for which differences had same sign as the 24-run median. (from Lettenmaier et al. 2008, replotted from Milley et al. 2005).**

Increased temperatures are expected to change the seasonal pattern of runoff and stream flow (Jacobs et al. 2001). In particular, projections show that warmer winters will result in more winter precipitation falling as rain and less as snow. As a result, snowpack will decrease, winter stream flows increase, and spring runoff occur earlier (Christensen et al. 2007). Such changes have already been observed, and the trend is expected to continue. Figure 4.2 shows changes in snowmelt runoff timing in the western U.S. from 1948-2002. Over this period, snowmelt runoff timing has changed by more than 20 days at some sites in the Yellowstone River Basin. Changes in seasonal precipitation could also cause lower summer flows (Christensen et al. 2007). Because the Yellowstone River is essentially unregulated, changes in seasonal runoff could affect availability of water for irrigation, and irrigation withdrawals could constitute a higher proportion of overall flows during the summer.

The fish passage and entrainment alternatives described in this EA are designed to operate effectively at flows of 3,000 cfs or greater. If the frequency of flows below 3,000 cfs increases, reduced fish passage would also be likely.

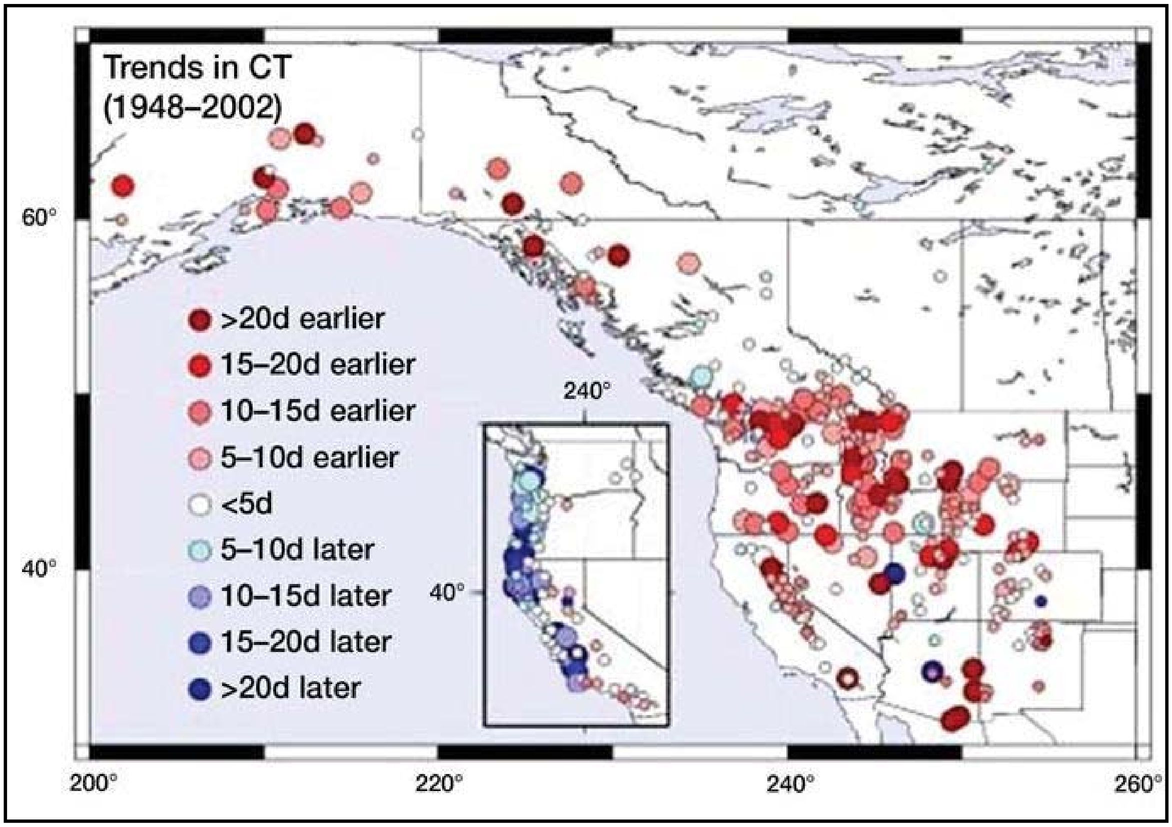



**Figure 4.2 - Changes in Western U.S. Snowmelt Runoff Timing, 1948-2002 (Stewart et al. (2005 from Lettenmaier et al. 2008).** Note: d = days; CT = center of timing of daily flows for a year.

Climate change could also affect other aquatic resources. For example, increased water temperature and changes in ice cover are likely to cause a northward movement in the distribution of many aquatic species, potentially affecting population structure and dynamics (Gleick 2000). Changes in volume and timing of runoff could also affect migration cues for sturgeon and other native fish.

Gray and McCabe (2008) used tree-ring reconstructions to estimate average long-term runoff in the upper Yellowstone River Basin and to project future runoff with increased temperatures based on IPCC predictions. They concluded that even in the absence of additional warming, natural precipitation variability based on tree-ring reconstructions shows the potential for extended low-flow periods far below those observed in the 20th century. Additionally, small amounts of warming could greatly intensify both the magnitude and duration of future droughts on the Yellowstone River.

### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)** Continued operation of the Intake Project would have no measureable effect on climate.

**Relocate Main Channel and Rock Ramp Alternatives** Construction, operation, and maintenance of either action alternative would have no measureable effect on global greenhouse gas emissions or other factors that could affect climate.

### *Cumulative Effects*

None of the alternatives would have any measureable effect on climate.

### *Actions to Minimize Effects*

No mitigation is necessary, because the action alternatives would have no measureable effects on climate.

## Summary

None of the alternatives would have any measureable effect on climate. Air temperatures are very likely to rise this century in the Intake Project area. Warmer temperatures will likely result in increased winter flows, decreased summer flows, and earlier snowmelt runoff. Changes in annual precipitation and annual stream flow are uncertain.

## Air Quality

Construction of the Lower Yellowstone Project main canal in 1908 using a steam shovel

### Introduction

How would the alternatives affect air quality near the proposed Intake Project site?

### Methods

A literature review on the air quality parameters near the project site was used to qualitatively assess foreseeable impacts by the proposed alternatives.

### Results

#### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)** Air quality effects for this alternative would likely be consistent with current conditions with no anticipated long-term impacts to air quality.

**Relocate Main Channel and Rock Ramp Alternatives** Both action alternatives would have similar impacts on air quality. Short-term and temporary increases in monitored air quality parameters related to vehicle emissions from construction equipment and dust from earth-moving activities and driving on dirt haul roads would occur during construction and may be noticeable and measureable at the construction site. However, these increases would be too small to measure at the Sidney air quality monitoring station. Air quality would return to current conditions once construction activities are completed, with no long-term impacts to local air quality.

#### *Cumulative Effects*

There are no reasonably foreseeable actions that would result in adverse cumulative effects on air quality during construction activities associated with the proposed alternatives.

#### *Actions to Minimize Effects*

- Dust suppression techniques, such as sprinkling problem sites with water, will be used during construction activities.

### Summary

No long-term impacts and only minor, short-term impacts to local air quality are expected from the proposed alternatives.

## Hydrology

Gravel bar at Intake Diversion Dam

### Introduction

How would the alternatives affect the hydrologic characteristics of the Yellowstone River?

### Methods

A literature review of the hydrologic and geomorphic characteristics of the lower Yellowstone River in the area of the proposed Intake Project was used to qualitatively assess foreseeable impacts that would be caused by the proposed alternatives.

### Results

***Short-Term and Long-Term Effects of the Alternatives***

**No Action Alternative (Continue Present Operation)** could impact use of water by the Lower Yellowstone Irrigation District. If Reclamation does not initiate and successfully complete consultation with the Service, then the Board of Control's ability to operate the dam and headworks to deliver project water to the Lower Yellowstone Project could be severely constrained or limited in the future (see chapter two, Consequences of No Action Alternative (Continue Present Operation) section).

**Relocate Main Channel and Rock Ramp Alternatives** Neither of the alternatives propose altering the river in ways that would regulate or impound the river. In fact, either of the action alternatives would restore ecologic connectivity of the Yellowstone River at Intake, Montana, and contribute to ecosystem restoration.

The timing and seasonal variation of flow in the Yellowstone River is not related to the existing structures or to the proposed alternatives. Neither of the action alternatives would impact the seasonal timing of flow in the Yellowstone River.

While ice jams may result in backwater flooding in the area above and below the Intake Diversion Dam as described in chapter three, these events would occur with or without the proposed alternatives. There is no indication that the alternatives are expected to influence the likelihood or occurrence of these events on the Yellowstone River. As explained in chapter two, the action alternatives are designed to have no effect on the 100-year floodplain. The potential for backwater flooding associated with the Rock Ramp Alternative will be evaluated further during final design. Based on the outcome of this evaluation, supplemental NEPA compliance may be necessary to analyze and disclose potential impacts and actions to minimize adverse effects.

If an action alternative is selected, construction would be timed so that no disruption of water delivery to the Lower Yellowstone Irrigation Districts would likely occur.

#### *Cumulative Effects*
There are no known or reasonably foreseeable actions that would result in cumulative impacts related to hydrology.

#### *Actions to Minimize Effects*
No actions to minimize effects are required.

### Summary
The only identified hydrologic impact would occur under the No Action Alternative (Continue Present Operation). If Reclamation does not initiate and successfully complete consultation with the Service, the impact could be a limitation of water to be diverted into the main canal, which would adversely affect the Lower Yellowstone Project Irrigation Districts.

Either action alternative would contribute to ecosystem restoration by reconnecting reaches of the river above and below Intake Diversion Dam.

# Geomorphology

## Introduction

- How would the alternatives affect the geomorphic characteristics of the lower Yellowstone River?

This section evaluates the effects of the proposed alternatives on geomorphologic characteristics of the lower Yellowstone River. The evaluated characteristics are:

- Channel characteristics
- Channel migration zone
- Channel modifications

## Methods

To evaluate effects to channel characteristics, the existing channel slope in the Intake Project area was compared to the designed slope of the action alternatives, as described in chapter two. To assess potential impacts of the channel modifications proposed by alternatives, a GIS analysis quantified changes to the channel migration zone (see chapter three, figure 3.5 for information on this zone). The GIS inventory of physical features along the lower Yellowstone River developed by the Natural Resources Conservation Service in Montana (2003) was used to determine the number and length of existing man-made bank stabilizing structures in the Intake Project area. Channel modifications proposed by each alternative were compared to these existing features in the GIS inventory to evaluate effects.

## Results

### *Short-Term and Long-Term Effects to Channel Characteristics*

**No Action Alternative (Continue Present Operation)** No short-term or long-term changes to channel slope would be expected. Channel slope would remain similar to existing conditions.

**Relocate Main Channel Alternative** When compared to the No Action Alternative, the new channel would decrease the estimated slope near the dam crest and boulder field from an average of 2.0% (0.02 ft/ft) down to 0.085% (0.00085 ft/ft).

**Rock Ramp Alternative** When compared to the No Action Alternative, the Rock Ramp Alternative would decrease the slope near the existing dam crest and boulder field from an average of 2.0% (0.02 ft/ft) down to a maximum of 0.9% (0.009 ft/ft). The final design of the rock ramp likely would have a variable slope of 0.2% - 0.9% (0.002 ft/ft – 0.009ft/ft), but this slope would be based on physical modeling.

### *Short-Term and Long-Term Effects to the Channel Migration Zone*

Analysis of the channel migration zone shows how the alternatives could change the river corridor in the area directly affected by Intake Project features. The analysis did not evaluate whether these changes would be negative, positive, or neutral in their effect but numerically compared the action alternatives to the No Action Alternative.

**No Action Alternative (Continue Present Operation)** Existing features of this alternative affect about 6 acres in the channel migration zone near the Intake Project site. The Board of Control would periodically replace rocks on the crest of the dam to divert water during low flow. This rock would continue to travel a short distance downstream adding to the downstream boulder field; however, is not likely that the boulder field that currently covers about 6 acres of river channel would spread farther downstream. Aside from a small increase in the number of boulders, no additional effects to the channel migration zone would be expected.

**Relocate Main Channel Alternative** Compared to the No Action Alternative, the Relocate Main Channel Alternative would affect a total of 917 acres in the channel migration zone. There would be 597 acres with long-term effects from construction of the new channel, extending the main canal, and filling in the natural channel, as shown in figure 4.3.

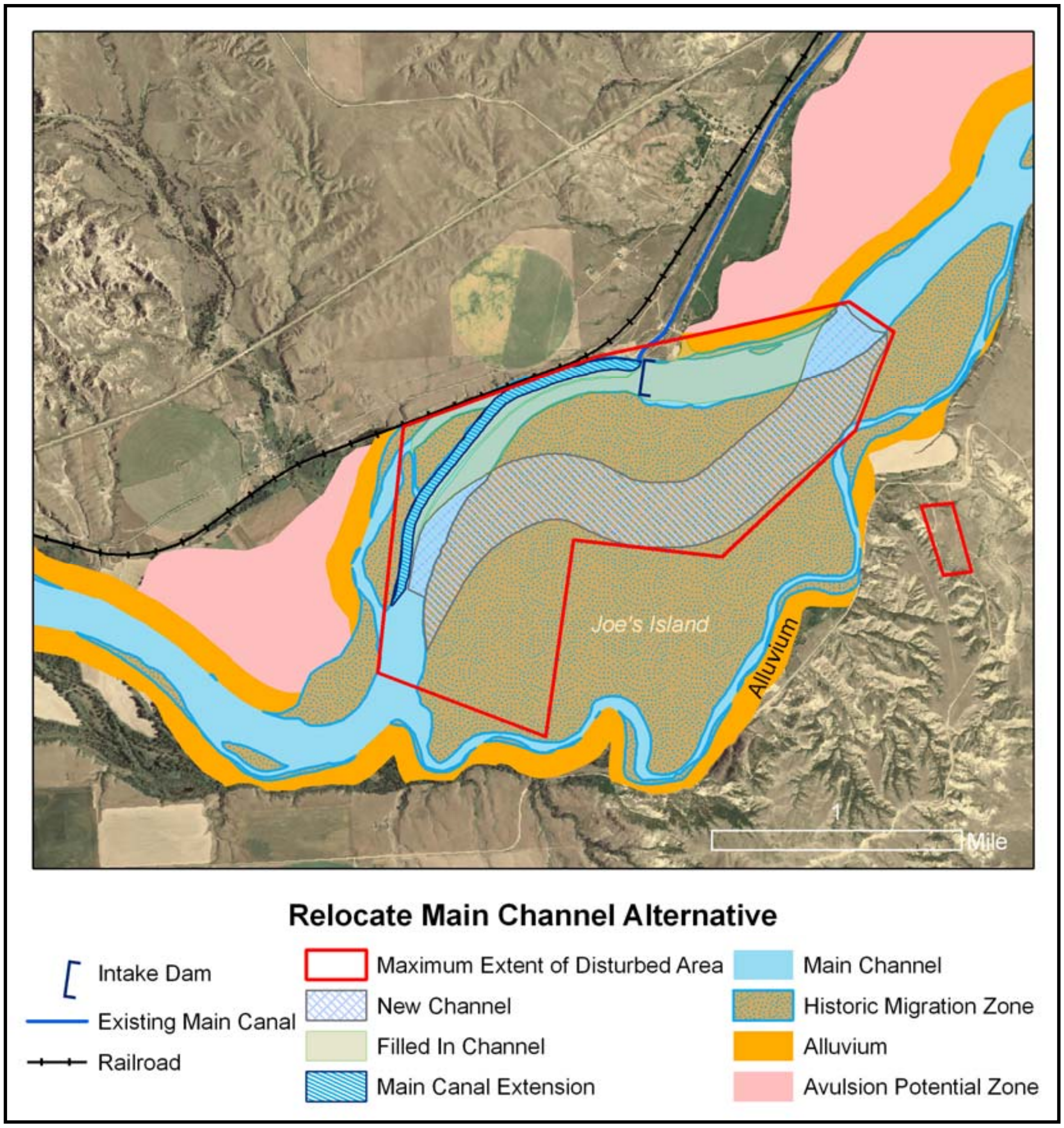



**Figure 4.3 – Relocate Main Channel Alternative Permanent Features on the Channel Migration Zone.**

In addition, approximately 320 acres would have short-term effects on the channel migration zone as a result of temporary features such as haul roads, construction zones, and stockpiles needed to create the permanent features. Table 4.1 shows the number and types of acres in the channel migration zone that would be affected by the alternative.

**Table 4.1 – Channel Migration Zone Acres Temporarily or Permanently Affected by the Relocate Main Channel Alternative.**

| Relocate Main Channel Alternative | | | | | | |
|---|---|---|---|---|---|---|
| | | Main Channel (acres) | Historic Migration Zone (acres) | Alluvium (acres) | Avulsion Potential Zone (acres) | Channel Migration Zone TOTAL (acres) |
| Permanent Features | New Channel | 58 | 339 | 0 | 0 | 397 |
| | Filled in Channel | 145 | 3 | 12 | 0 | 160 |
| | Canal Extension | 39 | 1 | 0 | 0 | 40 |
| Temporary Features | Construction Zone | 4 | 92 | 0 | 0 | 96 |
| | Stockpiles | 0 | 203 | 0 | 0 | 203 |
| | Haul Roads | 1 | 18 | 2 | 0 | 21 |
| **TOTAL Permanent** | | **242** | **343** | **12** | **0** | **597** |
| **TOTAL Temporary** | | **5** | **313** | **2** | **0** | **320** |

**Rock Ramp Alternative** Compared to the No Action Alternative, this alternative would affect a total of 57 acres within the channel migration zone (table 4.2). Of these 57 acres, 32 would have long-term effects from construction of the new weir and rock ramp. The remaining 25 acres would have short-term effects from temporary features, such as construction zones and haul roads. Figure 4.4 shows the permanent features of the Rock Ramp Alternative in the channel migration zones, and table 4.2 shows the numbers and types of acres affected by features.

### *Short-Term and Long-Term Effects of Channel Modifications*

Table 4.3 summarizes the number of man-made structures in each alternative, and the estimated sizes of those features.

**No Action Alternative (Continue Present Operation)** There would be no new channel modifications with the No Action Alternative. The number of river-stabilizing structures would be the same as existing conditions.

**Relocate Main Channel Alternative** The two most notable features of the Relocate Main Channel Alternative are 8,600 ft of fill in the natural channel and 12,500 ft of new channel construction. The entire length of the new channel would be tied into the natural riverbank and stabilized to prevent channel migration. The new channel bed would be stabilized with 8 rock sills, each approximately 2,600 ft long to prevent head-cutting.

**Table 4.2 – Channel Migration Zone Acres Temporarily or Permanently Affected by the Rock Ramp Alternative.**

| Rock Ramp Alternative | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Main Channel (acres) | Historic Migration Zone (acres) | Alluvium (acres) | Avulsion Potential Zone (acres) | Channel Migration Zone TOTAL (acres) |
| Permanent Features | New Weir & Rock Ramp | 32 | 0 | 0 | 0 | 38 |
| | Canal Extension | 0 | 0 | 0 | 0 | 0 |
| | Filled in Canal | 0 | 0 | 0 | 0 | 0 |
| Temporary Features | Construction Zone | 0 | 4 | 0 | 0 | 4 |
| | Stockpiles | 0 | 0 | 0 | 0 | 0 |
| | Rock Unload Area | 0 | 0 | 0 | 0 | 0 |
| | Haul Roads | 1 | 18 | 2 | 0 | 21 |
| **TOTAL Permanent** | | **32** | **0** | **0** | **0** | **32** |
| **TOTAL Temporary** | | **1** | **22** | **2** | **0** | **25** |

**Table 4.3 – Comparison of Bank Stabilization Features by Alternative.**

| Feature | No Action (Existing Conditions) | | Relocate Main Channel | | Rock Ramp | |
|---|---|---|---|---|---|---|
| | # of Structures | Size (feet or acres) | # of Structures | Size (feet) | # of Structures | Size (feet or acres) |
| Existing Headworks | 1 | 285’ | 1 | 285[1] | 1 | 285’[1] |
| New Headworks | 0 | 0 | 1 | 466 | 1 | 440’ |
| Existing Dam | 1 | 664’ | 0 | 0[2] | 0[2] | 0[2] |
| New Control Structure/Weir | 0 | 0 | 1 | 644 | 1 | 664’ |
| Riprap | 2 | 694’ | 1 | 1421 | 1 | 3153’ |
| Existing Boulder Field | 1 | 6 acres | 0 | 0[2] | 0[2] | 0[2] |
| Rock Ramp | 0 | 0 | 0 | 0 | 1 | 32 acres |
| Filled In Natural Channel | 0 | 0 | 1 | 8,600[1] | 0 | 0 |
| New Channel | 0 | 0 | 1 | 12,500 | 0 | 0 |
| Rock Sills | 0 | 0 | 8 | 20,800 | 0 | 0 |
| Levees | 0 | 0 | 2 | 11,870 | 0 | 0 |
| Concrete Bollards | 0 | 0 | 5 | NA | 8 | NA |
| **Total** | **5** | **1643 feet / 6 acres[3]** | **21** | **56,586 feet** | **13** | **4542 feet / 32 acres[3]** |

1 - Buried in place and remains as a bank stabilizing structure.
2 - Buried in place but does not contribute to bank stabilization.
3 - Acres were accounted for in the Channel Migration Zone analysis discussed earlier in this section.

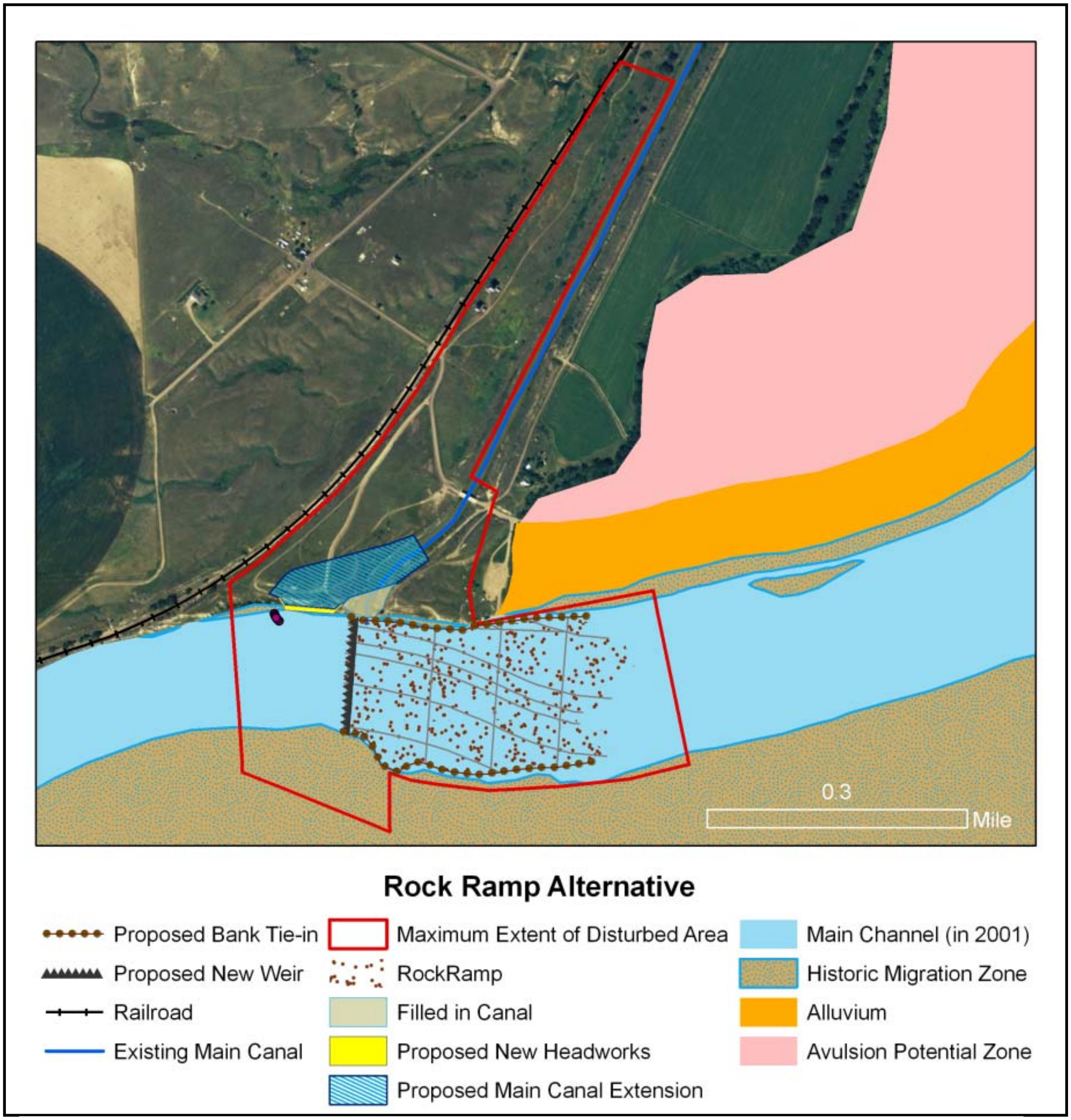



**Figure 4.4 – Rock Ramp Alternative Permanent Features on the Channel Migration Zone.**

This alternative also includes several permanent structures. These structures are 2 tie-back levees, 5 concrete bollards, 1 new revetment, 1 control structure, new headworks with fish screens, and the addition of a boat ramp in an undetermined location near the Intake Project area to mitigate for the loss of the existing boat ramp (see the Recreation section for more information on the replacement boat ramp).

Compared to the No Action Alternative, the Relocate Main Channel Alternative adds a total of 21 new features and structures in or next to the river channel, and removes, buries, or replaces 5 existing features for a net gain of 16 structures. The estimated length of man-made bank stabilizing features, when compared to the No Action Alternative, would increase from 1,643 linear feet to 56,586 linear feet with a net increase of 54,943 ft. This alternative would bury the existing boulder field downstream of Intake Diversion Dam.

**Rock Ramp Alternative** To construct the Rock Ramp Alternative, the existing boulder field would be moved and reworked. The new rock ramp would extend farther downstream than the existing boulder field and be built over the existing Intake Diversion Dam structure. A new weir would be constructed along with new headworks and fish screens and concrete bollards. The existing boat ramp would be removed and replaced at an undetermined location near the Intake Project area.

Compared to No Action, the Rock Ramp Alternative would add a total of 11 new structures in or next to the river channel, and remove, bury, or replace 4 of them for a net gain of 7 structures. The total number of man-made structures in the Rock Ramp Alternative is 12, because the existing headworks would be buried in place and act as a bank stabilizing structure.

The estimated length of man-made bank stabilizing features, when compared to the No Action Alternative, would increase from 1,643 linear feet to 4,542 linear feet, which is an increase of 2,899 ft. This alternative would rework the existing boulder field downstream of Intake Diversion Dam and replace it with a rock ramp. The existing boulder field covers approximately 6 acres of riverbed, and the new rock ramp structure itself would cover approximately 32 acres, for an increase of 26 acres. The additional area of the new rock ramp structure would reduce slope and control water velocity to allow fish passage over the structure.

### *Cumulative Effects*

To assess the cumulative effects of the proposed alternatives, the same GIS inventory of man-made and bank stabilizing structures (Natural Resources Conservation Service 2003) was analyzed from Cartersville Dam to the confluence of the Missouri River. This was done to compare the number of features up to the next fish passage barrier in the context of the larger section of the Lower Yellowstone River. The inventory of man-made stabilization features in the Lower Yellowstone River from Cartersville Dam to the Confluence of the Missouri River is in table 4.4.

**Table 4.4 – Inventory of Existing Bank Stabilization Features on the Lower Yellowstone River From Cartersville Dam to the Confluence of the Missouri River.**

| Type | Number of Features | Length in feet |
|---|---|---|
| Transportation Encroachment | 13 | 69,967 |
| Rock Riprap | 57 | 106,050 |
| Other Erosion Control | 10 | 5,543 |
| Concrete Rubble Riprap | 14 | 14,242 |
| Flow Deflectors | 20 | 27,760 |
| Flood Plain Dike/Levee | 17 | 56,953 |
| **Total** | **131** | **280,515** |

The No Action Alternative would have similar amount of bank stabilizing features as existing conditions and would cause a 0% increase in total linear feet of stabilization from Cartersville Dam to the Confluence of the Missouri River. The Relocate Main Channel Alternative would increase the length of stabilization features on the Lower Yellowstone River by about 20% in the reach from Cartersville Dam to the confluence of the Missouri River. The Rock Ramp would provide a minor increase of 1.6% in the length of stabilization on the Lower Yellowstone River from Cartersville Dam to the confluence of the Missouri River.


**Upstream view of the railroad tracks adjacent to the Yellowstone River near Intake – March 2010.**

Approximately 2,000 ft upstream of Intake Diversion Dam, there is a nearly 1 mile section of railroad tracks adjacent to the Yellowstone River on top of the valley wall. As seen in this photo taken in March 2010, these tracks appear to be vulnerable to river migration. It is reasonably foreseeable that bank stabilization will likely occur along this stretch of the river upstream of the Project area independent of whichever alternative is selected.

***Actions to Minimize Effects***

- River morphology will be monitored to assess potential changes to the stream channel resulting from construction of the selected alternative. The Environmental Review Team will be consulted regarding specific measures to mitigate impacts if substantive changes are determined to have been caused by the Intake Project.

### Summary

The No Action Alternative would have no short-term or long-term effects on channel slope, the channel migration zone, or the amount of bank stabilizing features.

Long-term effects of the Relocate Main Channel Alternative would improve the river channel slope near Intake Diversion Dam and associated features. This alternative would permanently affect 597 acres in the channel migration zone and add 54,943 ft of bank stabilization structures to the Intake Project area. Short-term effects are the temporary disturbance of 320 acres within the channel migration zone.

Long-term effects of the Rock Ramp Alternative consist of an improvement in the slope of the channel in the area of the existing Intake Diversion Dam and associated features. This alternative would permanently affect 26 additional acres in the channel migration zone and increase the amount of bank stabilizing structures by 2899 ft when compared to No Action.

# Surface Water Quality

## Introduction

- How would the Intake Project affect water quality in the lower Yellowstone River?

This section addresses water quality effects that could result from construction of Intake Project features. Because the Intake Project would not affect river flows, point source discharges, or non-point source discharges after construction, all water quality effects would be temporary.

## Methods

Under the relocate main channel alternative, a segment of the existing channel would be filled with material excavated for the new channel. Construction of either action alternative would disturb existing sediments, potentially releasing contaminants into the water column. Additionally, sediments upstream of the existing dam could be mobilized due to altered hydraulic properties. To evaluate potential impacts associated with construction, sediment samples from sites upstream and downstream of Intake Dam were analyzed. Sediment samples were thoroughly mixed with river water, and after settling, the water was analyzed for nutrients, trace elements, and organic compounds. Details of the sampling methods and results are described in *Results of Elutriate Sampling Conducted Along the Yellowstone River at Intake Dam, Montana on April 29-30, 2009* (Corps 2009b) which is attached as a supporting document.

Locations of sampling sites are shown in figure 4.5. Five sites were upstream of Intake Dam, and three sites were downstream. Six of the samples were from the river bed, and two were from islands.

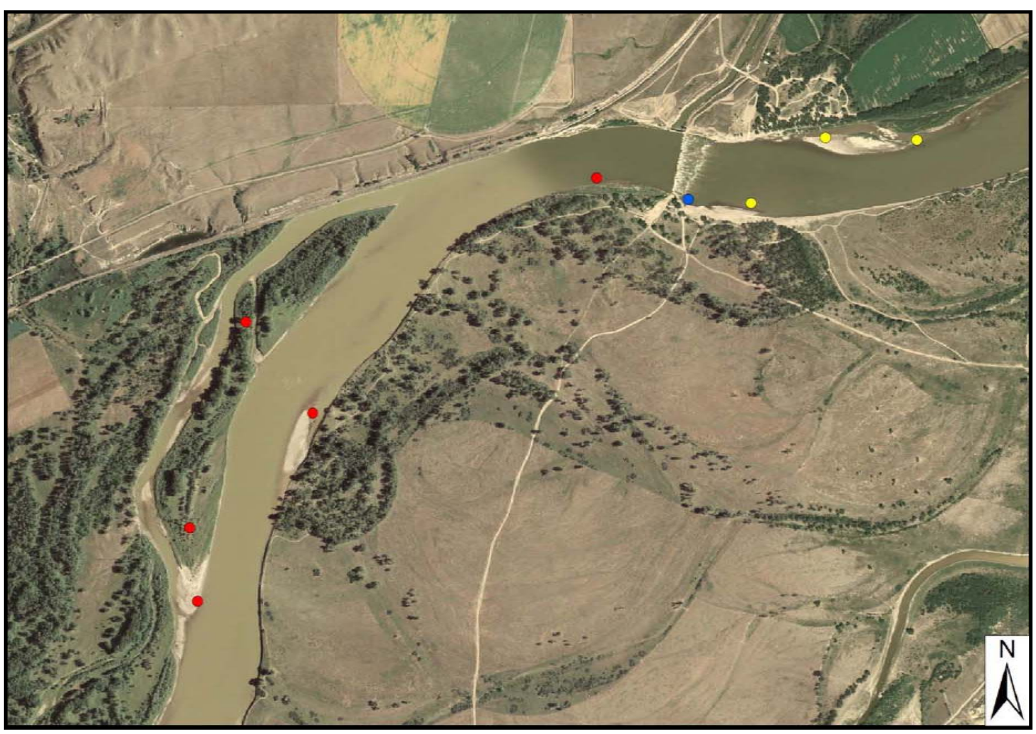



**Figure 4.5 - Location of Water Quality Sampling Sites.**

## Results

No pesticides or polychlorinated biphenyls (PCBs) were detected in the collected water or in any of the prepared sediment samples (Corps 2009b). USGS (2000) also found very low concentrations of pesticides in bed sediments in the lower Yellowstone River. Thus, it is unlikely that construction of either action alternative would release substantial amounts of pesticides into the Yellowstone River.

Appendix K, table K.1 summarizes the general water quality characteristics and nutrients in the collected water and prepared sediment samples. In general, nutrient concentrations in the prepared sediment samples are similar to the ambient water, indicating that disturbance of sediments during construction would probably not result in temporary nutrient enrichment downstream of Intake.

One downstream sample appears to be atypical. It has relatively high concentrations of total ammonia and ammonia plus organic nitrogen. The sediment sample collected at this site apparently was in a localized area of organic matter high in nitrogen that was exposed to oxygen-free conditions. Based on the results of data collected, this sample appears to represent an isolated occurrence that is not indicative of the sediments upstream from Intake Dam. However, if other sediments high in ammonia occur in the area and are disturbed by construction, there could be a temporary slight increase in downstream ammonia concentrations. Because dissolved oxygen in the Yellowstone River is usually near saturation, ammonia would be rapidly oxidized, and no significant adverse effects would be anticipated.

Appendix K, table K.2 summarizes the metal concentrations in the water and the prepared sediment samples. Because the dissolved phase of metals tends to be the most toxic to aquatic life, the total metal concentrations measured would be indicative of “worst-case” conditions that would not occur unless all the measured total metal concentration is dissolved.

High levels of total iron, manganese, and aluminum were present in the Yellowstone River water sample and the prepared sediment samples. The high levels of total iron, manganese, and aluminum likely represent a natural condition associated with the geology and soils of the region (Corps 2009b).

Detectable levels of total arsenic, lead, and zinc were measured in all of the prepared sediment samples (appendix K, table k.2). Arsenic and zinc were also detected in the Yellowstone River water. Lead concentrations were similar upstream and downstream of Intake Diversion Dam. Thus, it does not appear that lead fishing sinkers lost below the dam have increased sediment lead concentrations. The detectable levels of arsenic, lead, and zinc in the sediments appear to be an ambient condition of the Yellowstone River in the area of the Intake Dam (Corps 2009b).

### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)** This alternative would have essentially no impact on water quality. The Board of Control’s continued action of placing rocks along the crest of the dam and the subsequent movement of rocks downstream would result in minor disturbance of sediments, which could cause a temporary localized increase in turbidity.

Disturbance of sediments would not increase concentrations of nutrients, trace elements, or organic compounds in the lower Yellowstone River.

Yellowstone River at Intake during high flow

**Relocate Main Channel Alternative**
Approximately 6.1 million cubic yards of soil would be excavated to construct the new channel using either mechanical excavation or hydraulic dredging. Approximately 3.4 million cubic yards of material excavated from the new channel would be used to fill the existing channel of the river. This alternative would result in more disturbance of sediments during construction than either the No Action alternative or the Rock Ramp alternative. Filling the existing channel would temporarily increase turbidity during construction and would result in some sedimentation and siltation downstream. Sediments deposited near the dam would likely be transported considerable distances downstream during subsequent high flow events. Sediments would continue to erode and be transported from the new channel until it stabilizes.

Because concentrations of nutrients and trace elements are similar in the prepared sediment samples and the river water, no significant change in concentrations of these constituents would be expected to occur. It is unknown to what extent any sediments deposited upstream of the existing dam would be transported downstream in the new channel. However, sediment deposition upstream of Intake Dam is relatively minor and appears to be limited by frequent scouring during high flow events.

**Rock Ramp Alternative** Construction of the rock ramp would disturb sediments in the existing main channel, but the amount of sediment transported downstream during construction would probably be lower than with the Relocate Main Channel Alternative. Sediment deposition upstream of the rock ramp would be similar to No Action Alternative (Continue Present Operation) with the existing dam maintenance.

Because concentrations of nutrients and trace elements are similar in the prepared sediment samples and the river water, no substantial change in concentrations of these constituents would be expected to occur.

***Cumulative Effects***
With implementation of actions to minimize effects, impacts of the action alternatives on water quality would be minimal and temporary. No changes in beneficial uses or identified impairments would occur.

***Actions to Minimize Effects***

- A water quality monitoring program will be established for ensuring that water quality standards are not violated during construction activities.
- Equipment for handling and conveying materials during construction shall be operated to prevent dumping or spilling the materials into wetlands and waterways.
- Discharges of dredge or fill material into waters of the U.S. will be carried out in compliance with provisions of Section 404 of the Clean Water Act  the permit requirements of the Corps, and requirements contained in the Section 401 water quality certification issued by the Montana Department of Environmental Quality.
- Erosion control measures will be employed where necessary to reduce wind and water erosion.  Erosion and sediment controls will be monitored daily during construction for effectiveness, particularly after storm events, and the most effective techniques will be used.
- Silt barriers, fabric mats, or other effective means will be placed on slopes or other eroding areas where necessary to reduce sediment runoff into stream channels and wetlands until vegetation is re-established.  This will be accomplished either before or as soon as practical after disturbance activities.
- Contamination of water at construction sites from spills of fuel, lubricants, and chemicals will be prevented by following safe storage and handling procedures in accordance with state laws and regulations.
- Hazardous materials will be handled and disposed of in accordance with a hazardous waste plan.

## Summary

The No Action Alternative (Continue Present Operation) would have essentially no impact on water quality.  In contrast, the Relocate Main Channel Alternative would cause temporary increases in turbidity and sedimentation during construction, but no long-term changes in water quality are anticipated.  The Rock Ramp Alternative would cause temporary increases in turbidity and sedimentation during construction, but these increases would be less than under the Relocate Main Channel Alternative.  No long-term changes in water quality are anticipated as a result of any of the alternatives.

## Aquatic Communities

### Introduction

- How would the alternatives affect aquatic communities in the Intake Project area?

Fisherman with sauger (photo courtesy of Montana State University)

This section addresses aquatic communities that may be affected either by construction of Intake Project features or by subsequent changes in habitat conditions on the lower Yellowstone River. Intake Project construction may impact aquatic communities on either a temporary or permanent basis. Temporary impacts are associated with initial construction or temporary fixtures associated with construction after which habitats are expected to revert to previous conditions. Temporary impacts also could include short-term changes in flows or water quality that may affect aquatic communities. Permanent impacts are long-term impacts associated with construction of permanent facilities, such as a new concrete weir, rock ramp, and new headworks.

### Methods

To analyze the impacts of the proposed Intake Project in the Yellowstone River, a literature search was conducted to identify fish, mussels, and macroinvertebrates currently inhabiting areas that could be affected by the Intake Project. Consideration was also given to the types of habitats and how those habitats might be impacted, either by construction or geomorphologic changes caused by the alternatives. Potential impacts were identified and related to the different aquatic communities. All impact analyses included comparison of the action alternatives to each other and to No Action Alternative (Continue Present Operation).

### Results

#### *Short-Term and Long-Term Effects of the Alternatives*

**Fish** Pallid sturgeon are discussed in the next section (Federally-Listed Species and State Species of Special Concern).

***No Action Alternative (Continue Present Operation)*** Intake Dam would continue to be a fish barrier, preventing or reducing upstream movement of many species. Entrainment into the main canal would be a substantial source of mortality for sauger and many other fish species. Paddlefish would congregate downstream of the dam during spawning season and would move upstream only during high flows when the side channel around Joe's Island is flowing.

***Relocate Main Channel Alternative*** Overall, this alternative would benefit fish by improving upstream passage and reducing entrainment into the main canal. The relocated channel would have lower velocities and greater depth than the existing dam, thus greatly improving fish passage as compared to No Action Alternative (Continue Present Operation). This alternative would have the lowest velocity for representative flows from April through September (see appendix E).

Providing passage at Intake would open approximately 165 miles of additional habitat in the Yellowstone River to native fish. Additionally, improved fish passage at Intake would increase ecological connectivity and help maintain genetic diversity in populations of fish that might otherwise be isolated.

Strong swimming fish (e.g., adult sauger) can currently pass upstream at Intake Dam under most flows. Nonetheless, the Relocated Main Channel Alternative would still improve passage for these species by allowing passage of juveniles and increasing the range of flows in which fish can pass.

The new headworks and screened intake would greatly reduce entrainment of most adult and juvenile fish. The criteria used for design of the screens were developed by the National Marine Fisheries Service for protection of salmonid fry. Mefford and Sutphin (2008) reported that these criteria were appropriate for effectively protecting pallid sturgeon greater than 40 mm total length. Hiebert et al. (2000) estimated that about 500,000 fish of 36 species are annually entrained at Intake, and Jaeger et al. (2005) identified entrainment at Intake as the largest cause of non-fishing mortality of saugers. Thus, the fish screens would benefit the entire fish community in the lower Yellowstone River.

This alternative would result in more disturbance of sediments during construction than either the No Action alternative or the Rock Ramp alternative. Increases in sedimentation and turbidity during construction could cause temporary adverse effects on fish populations, particularly if they occurred during the spawning season. However, most of the fish species in the lower Yellowstone River are adapted to highly turbid water, so construction-related effects on fish populations would likely be minor and not significant.

***Rock Ramp Alternative*** Overall, this alternative would benefit fish by improving upstream passage and reducing entrainment into the main canal. The rock ramp would have lower velocities and greater depth than the existing dam, thus greatly improving fish passage as compared to No Action. In essence, the rock ramp would function as a long riffle, allowing passage and providing foraging and spawning habitat for a variety of fish species.

Strong swimming fish (e.g., adult sauger) can currently pass upstream at Intake Dam under most flows. Nonetheless, the Rock Ramp Alternative would improve passage for these species by allowing passage of juveniles and increasing the range of flows in which fish can pass. The new headworks and screened intake would greatly reduce entrainment of adult and juvenile fish benefiting the entire fish community.

This alternative would result in some disturbance of sediments during construction, but less than would occur under the Relocate Main Channel Alternative. Increases in sedimentation and turbidity during construction could cause a temporary adverse effect on fish populations, particularly if they occurred during the spawning season. However, most of the fish species in the lower Yellowstone River are adapted to highly turbid water, so construction-related effects on fish populations would likely be minor and not significant.

**Mussels**

***No Action Alternative (Continue Present Operation)*** There would be no additional impacts on mussels than already exist under current operations. Consequences of the No Action Alternative would include continued fish entrainment, which in turn reduces the number of fish to transport mussel young.

***Relocate Main Channel Alternative*** Minor and temporary short-term impacts from construction activities in and adjacent to the river channel could temporarily affect water quality and subsequently mussels. Freshwater mussels are mostly filter-feeders and construction activities that produce sediment and increase turbidity, even with environmental commitments in place, may have minor effects on mussels in the immediate vicinity of construction activities. Although mussel bed locations on the Yellowstone River are not well known, the only native mussel on the Yellowstone, the fatmucket, is Montana's most widespread and abundant mussel.

A survey of mussels in the Yellowstone River was conducted in July and September 2009 by the Montana Natural Heritage Program. According to the report, “ten transects (with shallow aquascopes and SCUBA) on the north and south shores performed between the FWP Intake FAS Boat Ramp and the Intake Diversion Dam produced only 3 live fatmuckets and 2 recent shells. The estimated number of mussels in the cross-sectional area between the FAS boat ramp and the base of the Diversion Dam is 24 individuals, not worth relocation efforts” (Stagliano 2009:2).

Under the Relocate Main Channel Alternative, the new headworks and screened intake would minimize fish entrainment. Minimizing fish entrainment would provide for a potentially greater, more diverse and healthy fish population. Because mussel young depend on fish for transportation, minimizing entrainment could moderately benefit mussel populations by allowing them passage upstream.

Excavation of a new channel in upland areas across Joe’s Island would not impact current mussel populations and may create new habitat for mussels where previously there was none. However, much of the area proposed for construction (including staging and stockpile areas) of the new headworks and screens, bank stabilization, tie-back levees, canal extension, and filling in of the main channel would impact mussels located immediately upstream and downstream of the Intake Dam. Approximately 24 mussels would be affected, which is insignificant.

***Rock Ramp Alternative*** The same minor and temporary short-term impacts as described for the Relocate Main Channel Alternative could occur with this alternative. Construction on the river bank could result in the loss of mussels hidden in the riverbank. Rock ramp placement could cover mussel beds below the Intake Diversion Dam, and the headworks construction could affect approximately 24 mussels, which is insignificant.

**Macroinvertebrates**

***No Action Alternative (Continue Present Operation)*** There would be no additional impacts to macroinvertebrates.

***Relocate Main Channel Alternative*** Minor and temporary short-term impacts could occur due to construction activities in and adjacent to the river channel that would suspend sediments, increase turbidity, and affect water quality. While most Yellowstone River macroinvertebrates tolerate sediment suspension, others do not. Even with actions to minimize effects, there may be short-term minor effects near construction activities. Any release of additional sediments or organic material could settle downstream of islands. This could increase insect production, like midges, while distribution of fine inorganic sediment may eliminate potential habitat (cited in Zelt et al 1999 as Baril and others 1978).

Macroinvertebrate distribution and abundance often varies widely through the year in response to seasonal flow variations. For instance, high spring flows can transport invertebrates that would not drift otherwise. Macroinvertebrates can be affected by elevated levels of suspended sediment (Newcombe and MacDonald 1991), which could occur during construction. However, impacts are expected to be minor and temporary, and macroinvertebrate populations should recover quickly. Overall, with actions to minimize effects, long-term construction impacts would be minor.

***Rock Ramp Alternative*** The rock ramp would convert approximately 32 acres of native bed materials (silts/sand/gravel) to large stones. This would increase habitat complexity, which would likely be reflected in higher macroinvertebrate diversity. The native bed materials currently provide limited habitat for macroinvertebrates, a key source of food for fish. Overall, conversion of native bed materials to large stones, when combined with the creation of fish passage and the new screened intake, would greatly benefit native fish populations. Changes in substrate(s) associated with the project would be highly localized and would not negatively impact aquatic organisms at the species level. Short term impacts to local populations might occur during construction, but the large increase in the amount of interstitial spaces resulting from the placement of stones for ramp construction would likely provide substantial improvement for macroinvertebrates as well.

**Aquatic Invasive Species**

***No Action Alternative (Continue Present Operation)*** Continuing present operations would probably have little effect on the spread of most aquatic invasive species. Intake Dam is not a barrier to upstream movement of strong swimming fish. For example, if Asian carp became established in the lower Yellowstone River, they would easily be able to pass upstream at Intake. The existing dam could be a barrier to upstream movement of invasive fish that are not strong swimmers.

***Relocate Main Channel Alternative*** Improved fish passage under this alternative would probably have little effect on the spread of most invasive aquatic invertebrates, fish, fish diseases, or fish parasites. If invasive fish that are not strong swimmers become established in the lower Yellowstone River, improved passage at Intake would increase the risk of dispersal upstream. Excavation of a new channel and filling of the existing channel could provide a pathway for dispersal and establishment of invasive plants, including Saltcedar.

***Rock Ramp Alternative*** Improved fish passage under this alternative would probably have little effect on the spread of invasive aquatic invertebrates, fish, fish diseases, or fish parasites. If invasive fish that are not strong swimmers become established in the lower Yellowstone River, improved passage at Intake would increase the risk of dispersal upstream.

### *Cumulative Effects*

Improved fish passage and reduced entrainment at Intake would benefit aquatic communities, and these benefits would be magnified if similar projects are undertaken at other upstream irrigation intakes (e.g., Cartersville diversion). Adverse impacts to aquatic communities from the action alternatives would be relatively minor and temporary. There are no known or reasonably foreseeable actions that would elevate these minor impacts to greater magnitude.

### *Actions to Minimize Effects*

**General**

- All work in the river will be performed in a manner to minimize increased suspended solids and turbidity, which may degrade water quality and damage aquatic life outside the immediate area of operation.
- All areas along the bank disturbed by construction will be seeded with native vegetation to minimize erosion.

**Fish**

- To avoid potential impacts, coffer dam construction and in-stream heavy equipment activity will be coordinated with fishery experts from the Service, FWP, Reclamation and the Corps to avoid and or minimize potential impacts.
- All pumps will have intakes screened with no greater than ¼” mesh when dewatering cofferdam 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 FWP prior to final dewatering.
- Reclamation will consult with FWP to ensure that flows comparable to environmental baseline are maintained during construction to support the fishery during low-flow periods (late summer/early autumn).

## Summary

The No Action Alternative (Continue Present Operation) would continue to cause adverse impacts because of fish passage and entrainment issues. With environmental commitments, impacts to aquatic communities, including fish, mussels, macroinvertebrates and aquatic invasive species, would be minor and temporary for both action alternatives. Both action alternatives could benefit fish and mussels that cannot currently find passage over the current dam and benefit fish populations by preventing entrainment.

## Federally-Listed Species and State Species of Special Concern

### Introduction

- How would the Intake Project affect federally-listed species and state species of special concern in the area of potential effects?

**Release of pallid sturgeon into the Yellowstone River**

Under NEPA, the effects of the alternatives on federally-listed species and species of special concern in the Intake Project area are measured against the No Action Alternative (Continue Present Operation). Assessing impacts under the ESA can be different than under the NEPA. However, for the purposes of this Intake Project, we conclude that the NEPA analysis prepared below can also be used as the Biological Assessment (BA) for Intake Project construction, as required by section 7 of ESA. The BA was included as appendix D in the Draft Intake EA and Reclamation requested written concurrence from the Service that the proposed action is not likely to adversely affect the whooping crane, interior least tern, or the pallid sturgeon. The Service concurred with Reclamation's determination and a copy of the letter of concurrence is included with the BA (see appendix D).

The Service agreed in a coordination meeting held between the Corps, Reclamation and the Service in Billings, Montana, May 12, 2009, that analysis for this EA would also serve as the BA for construction of the Intake Project. It was also agreed that operations of the Intake Project would be included in a separate but parallel section 7 consultation. This parallel effort will result in formal Section 7 consultation with the Service. The BA on operations will be completed on the selected alternative and prior to the actual operation of the Intake Project.

### Methods

Analysis of potential impacts used the resource information described in chapter three to establish current conditions, which was compared to No Action Alternative (Continue Present Operation) to identify the consequences of no action.

Analyses of impacts to resources (hydrology, geomorphology, surface water quality, and lands and vegetation) were used to analyze potential impacts to federally protected species and species of special concern. The resource analyses took into account applicable environmental commitments from this and other resource areas (see below and appendix I). Additionally, federal and state lists and databases were searched to determine the distribution and occurrence of these species within the Intake Project area. The federal list was confirmed in the May 12, 2009, coordination meeting with the Service. The species of special concern were confirmed by the cooperating agencies after review of a preliminary draft of chapter three of the Intake EA and subsequent comments (see chapter five for further information).

Potential impacts to species in the Intake Project area were assessed. Federally threatened and endangered species and species of special concern potentially in the Intake Project area are listed in appendix C. Life histories were also reviewed for all species. Life history information was evaluated against potential habitat in the Intake Project area. Much of this habitat information was obtained during analysis of lands and vegetation.

Analyses of impacts to resources (hydrology, geomorphology, surface water quality, and lands and vegetation) were used to analyze potential impacts to federally protected species. Possible direct and indirect short-term effects to pallid sturgeon impacts due to construction could include:

- Changes in water quality related to temporary sediment dispersal and turbidity during construction may affect fish.
- Dewatering the Yellowstone to install cofferdams may strand fish.
- Instream construction activities may impact fish directly or indirectly.
- Construction activities during the transitioning from one construction stage to another and initiation of operation of the Intake Project may impact fish.

To further evaluate the differences between the two action alternatives, a hydraulic model was used (Corps 2009a) with pallid sturgeon biology scoring criteria developed by the BRT (Jordan 2009). Appendix E provides the details of this analysis of the alternatives and evaluates the effectiveness of the two action alternatives in providing passage for pallid sturgeon. The results of this analysis are summarized below.

**ESA Effects**

**Is Not Likely to Adversely Affect** – the appropriate conclusion when effects to listed species are expected to be discountable or insignificant or completely beneficial.
**Discountable Effects** – are those extremely unlikely to occur.
**Insignificant Effects** – relate to the size of the impact and should never reach the scale where take occurs.
**Take** – regarding protected species, includes to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.

## Results

***Short-Term and Long-Term Effects of the Alternatives***

**No Action Alternative (Continue Present Operation)**

***Federally-Listed Species*** No impacts to whooping cranes and Interior least terns were identified for current operations, and none are expected under future operations. Therefore, this alternative is “not likely to adversely affect” Interior least terns and whooping cranes.

Adverse consequences have already been identified for the pallid sturgeon under the No Action Alternative (Continued Present Operation), as noted in chapters one and three. Reclamation has been in Section 7 consultation with the Service on the potential effects of current and future operations of the Lower Yellowstone Project since Intake Diversion Dam was cited as an impediment to pallid sturgeon recovery in the 1993 *Pallid Sturgeon Recovery Plan*. The two issues of concern that would continue under No Action Alternative (Continue Present Operation) to the pallid sturgeon are as follows:

- The current Intake Diversion Dam does not allow the passage of pallid sturgeon and
- Pallid sturgeon are being entrained into the canal system

Reclamation has agreed that there are consequences associated with not taking any action for the conservation and recovery of pallid sturgeon and that something needs to be done for pallid sturgeon in regard to future operations of the Lower Yellowstone Project. The pallid, sturgeon in this area are genetically distinct from other parts of the species range (Heist et. al. 2009), meaning preserving their genetics is essential to the overall extinction vulnerability of the pallid sturgeon population. The Service has already noted that the upper basin sturgeon, as well as the entire population, is vulnerable to extinction (Service 2007). If No Action Alternative (Continue Present Operation) were selected, the recovery of pallid sturgeon particularly in the Upper Missouri River Basin would be unlikely. Therefore, the consequences of taking no action is "likely to adversely affect" the pallid sturgeon.

***State Species of Special Concern*** The No Action Alternative would continue to entrain blue sucker, paddlefish, sauger, sicklefin chub, and sturgeon chub. Passage for these species would be impaired to varying degrees by the Intake Diversion Dam. Therefore, the consequences of taking no action would be continued adverse impacts to these fish species.

**Relocate Main Channel Alternative**

***Federally-Listed Species*** No impacts were identified for any of the action alternatives for the federally-listed whooping crane and Interior least tern. Environmental commitments listed in chapter four and in appendix I would be incorporated into all the action alternatives to avoid potential adverse effects to these species. Therefore, because environmental commitments would be incorporated to avoid potential adverse impacts, and any potential adverse impacts would not result in "take" and would be extremely unlikely to occur, no adverse impacts are anticipated for the whooping and Interior least tern. Therefore, this alternative is "not likely to adversely affect" the whooping crane and least tern. The details of the analysis that led to this conclusion can be found in the BA in appendix D.

Regarding pallid sturgeon, implementation of environmental commitments would reduce any short-term impacts of construction related activity to less than significant. Furthermore, the overall purpose of the project would benefit pallid sturgeon recovery by allowing fish passage and minimizing entrainment. However, the hydraulic analysis and pallid sturgeon evaluation (appendix E) found that the Relocate Main Channel Alternative scores lower and less favorably for pallid sturgeon than the Rock Ramp Alternative. The overall long-term effect of the project would benefit pallid sturgeon and more than offset minor short-term impacts caused by construction. Any potential short-term effect would be considered insignificant and discountable. Incidental take of pallid sturgeons during construction is not anticipated. Therefore, the construction of this alternative is "not likely to adversely affect" the pallid sturgeon.

***State Species of Special Concern*** Much of the area proposed for construction (including staging and stockpiling areas) of the new headworks and screens is in a previously disturbed area and not likely to impact most species of special concern. Construction activities for all Intake

Project features would have a temporary effect on any species of concern located in the immediate vicinity of the construction area. Human activity and noise emitted from equipment and machinery would disturb some species that are sensitive to this type of activity causing animals to move to other areas. A limited number of trees, shrubs, and vegetative cover would be eliminated at some sites during construction.
Construction activity in the river and adjacent bank would affect fish and aquatic invertebrates, but these species are mobile enough to move out of construction areas. Excavation of a new channel in the uplands on Joe's Island would not impact aquatic invertebrates and might provide new habitat as upland would be converted to riverine habitat. It should be noted that the new channel created by this alternative would allow passage of fish but the channel would not be allowed to migrate. This could limit the habitat structure of the new channel for fish and aquatic invertebrates.

Minor and temporary short-term impacts to water quality could occur due to construction activities in and adjacent to the river channel. The overall effect of the project would benefit native fish species of concern and would more than offset minor short-term impacts caused by construction. The potential impacts to these species are listed in table 4.5.

**Table 4.5 – Potential Impacts to State Species of Special Concern.**

| Species | Potential Impacts |
|---|---|
| ***BIRDS*** | |
| Bald Eagle | None if no nesting or active winter roosts are within 0.25 miles. |
| Baird's Sparrow | Not likely to be in Intake Project area |
| Bobolink | Not likely to be in Intake Project area |
| Chestnut Collared Longspur | Not likely to be in Intake Project area |
| Golden Eagle | Not likely to be in Intake Project area |
| Grasshopper Sparrow | None, if no nests are in grassland areas subject to disturbance |
| Loggerhead Shrike | Not likely to be in Intake Project area |
| Long-Billed Curlew | Not likely to be in Intake Project area |
| Red-Headed Woodpecker | None, if no nests are in riparian areas that may be removed during construction. |
| Sprague's Pipit | Not likely to be in Intake Project area |
| ***MAMMALS*** | |
| Dwarf Shrew | May be in area and likely to be temporarily displaced |
| Meadow Jumping Mouse | May be in area and likely to be temporarily displaced |
| Preble's Shrew | Rare occurrence but could be temporarily displaced |
| Townsend's Big-Eared Bat | None, unless roosting sites are destroyed |
| ***REPTILES AND AMPHIBIANS*** | |
| Milk Snake | Not likely to be in Intake Project area |
| Sagebrush Lizard | Not likely to be in Intake Project area |
| Short-Horned Lizard | Not likely to be in Intake Project area |
| Snapping Turtle | Minimal impacts - see the environmental commitments for turtles in the Wildlife section |
| Spiny Softshell | Minimal impacts - see the environmental commitments for |

| Species | Potential Impacts |
|---|---|
| | turtles in the Wildlife section |
| Western Hog-Nosed Snake | May be in area and likely to be temporarily displaced |
| ***FISH*** | |
| Blue Sucker | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities (Fish) section and those for pallid sturgeon |
| Paddlefish | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities (Fish) section and those for pallid sturgeon |
| Sauger | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities (Fish) section and those for pallid sturgeon |
| Sicklefin Chub | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities (Fish) section and those for pallid sturgeon |
| Sturgeon Chub | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities (Fish) section and those for pallid sturgeon |
| ***AQUATIC INVERTEBRATES*** | |
| Brimstone Clubtail | Minimal impacts - see environmental commitments in the Aquatic Communities section and those for pallid sturgeon |
| Mayfly Species | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities section and those for pallid sturgeon |
| Sand-Dwelling Mayfly (two species) | Minimal and beneficial impacts - see environmental commitments in the Aquatic Communities section and those for pallid sturgeon |
| ***PLANTS*** | |
| Bractless Blazing Star | Not likely to be in Intake Project area |
| Hayden's Yellowcress | Not likely to be in Intake Project area |
| Narrowleaf Penstemon | Not likely to be in Intake Project area |
| Nine-Anther Prairie Clover | May occur; survey may be necessary |
| Pale-Spiked Lobelia | May occur; survey may be necessary |
| Poison Suckleya | Not likely to be in Intake Project area |
| Prairie Goldenrod | Not likely to be in Intake Project area |
| Silky Prairie Clover | May occur; survey may be necessary |

Environmental commitments would be incorporated into all the action alternatives to avoid potential adverse effects. Therefore, because environmental commitments would be incorporated to avoid potential adverse impacts and any potential adverse impacts would not result in take and are extremely unlikely to occur. Only temporary minor impacts to state species of special concern are anticipated.

**Rock Ramp Alternative**

***Federally-Listed Species*** The impacts identified for this alternative are the same as described above for the Relocate Main Channel Alternative but are relatively less, because the size of this alternative's footprint is smaller. The hydraulic analysis and pallid sturgeon evaluation (appendix E) found that the Rock Ramp Alternative scores higher and more favorably for pallid sturgeons than the Relocate Main Channel Alternative. The construction of this alternative is "not likely to adversely affect" the whooping crane, least tern, or pallid sturgeon.

***State Species of Special Concern*** Any construction impacts from the new headworks and screens to species of special concern would be the same as for the Relocate Main Channel Alternative. Impacts to land areas adjacent to the river during construction would be minimal, thus impacts to species of concern are minimal. The potential impacts to species of special would be as described in table 4.5

Rock ramp placement could impact fish and aquatic invertebrates listed as species of special concern. Construction activity in the river and adjacent bank would affect fish and aquatic invertebrates, but these species are mobile enough to move out of construction areas. Actions to minimize effects are identified in environmental commitments to avoid and minimize these adverse impacts. Even with environmental commitments in place there may be short-term minor effects to aquatic invertebrates in the immediate vicinity of construction activities. Overall, with environmental commitments in place, the long-term impact of construction activities on aquatic invertebrate assemblages would be minor. Because large, stable substrates such as boulders and cobbles support larger, more productive invertebrate populations than do unstable gravel and sand substrates, creating a rock ramp could result in minor improvements in the diversity of the aquatic invertebrate community.

Environmental commitments would be incorporated into all the action alternatives to avoid potential adverse effects. Therefore, with environmental commitments, any potential adverse impacts would not result in a loss of a species and are extremely unlikely to occur. Only minor impacts to state species of special concern are anticipated.

***Cumulative Effects***

Impacts to federally-listed species and state species of special concern from the action alternatives would be relatively minor and temporary. Improved fish passage and reduced entrainment at Intake would benefit federally-listed fish species and state fish species of special concern, and these benefits would be magnified if similar projects are undertaken at other upstream irrigation intakes (e.g., Cartersville diversion). There are no known or reasonably foreseeable actions that would elevate these minor impacts to greater magnitude.

**Environmental Review Team** – A group of representatives, such as federal, state, and tribal agencies and other entities, established to advise Reclamation and the Corps on Intake Project mitigation. The purpose of this team is to ensure that the selected alternative would be in compliance with all environmental commitments in NEPA documents, such as the Final EA and FONSI. This team will also address other relevant state and federal environmental rules and regulations, such as the Endangered Species Act and the National Historic Preservation Act.

### *Actions to Minimize Effects*

The following commitments have been considered and would be incorporated into the Intake Project to avoid, minimize, and/or mitigate construction impacts.

**Whooping Crane**

- Reclamation will monitor the Service's whooping crane sighting reports to ensure that whooping cranes are not in the Intake Project area during construction. If any are sighted within the Intake Project area, Reclamation will consult with the Service regarding appropriate actions.

**Interior Least Tern**

- Visual surveys will be conducted weekly from May 15 to August 15 at all potential least tern nesting areas (sparsely vegetated sandbars) within line-of-site of the construction area.
- All surface-disturbing and construction activities will be restricted from May 15 to August 15 within 0.25 mile or the line-of-site of any active interior least tern nest.

**Pallid Sturgeon**

- A physical model of the rock ramp will be constructed to provide additional velocity and turbulence data needed for final design of an effective ramp.
- Reclamation and the Corps will consult with the BRT during the design of the selected alternative, including but not limited to reviewing results and making recommendations on the physical model, hydraulic modeling, and final alternative design.
- The construction activities within the wetted perimeter of the active channel will be observed and monitored by a qualified fisheries biologist to avoid direct impacts to adult or juvenile pallid sturgeon. In-stream construction activities will cease if the fisheries monitor determines there is potential for direct harm or harassment of pallid sturgeon, until the potential for direct harm or harassment has passed. This will include coordination with FWP to make sure radio-tagged pallid sturgeon and other monitored native fish continue to be monitored, especially during the construction season.
- Any in-stream construction activity will be conducted during periods most likely to minimize the potential impact to the pallid sturgeon. The months to avoid and/or minimize impacts to pallid sturgeon are June and July.

**Species of Special Concern**

- Before every construction season, the Environmental Review Team will meet with FWP to determine procedures to minimize impacts to species of special concern. Surveys for species likely to occur in the Intake Project area may be required as some of these species could be potentially harmed by construction activities. Survey requirements will be coordinated with Montana Natural Heritage Program and FWP prior to any construction activities. These species could require surveys: bald eagle, grasshopper sparrow, red-headed woodpecker, Townsend's big-eared bat, nine-anther clover, pale-spiked lobelia, and silky-prairie clover.

### Summary

With environmental commitments, impacts to federally-listed species and state species of special concern would be insignificant, discountable, and temporary for all alternatives. The No Action Alternative (Continue Present Operation) would likely cause the greatest consequences to pallid sturgeon and other native fish species of special concern. The hydraulic analysis and pallid sturgeon evaluation (appendix E) found that the Rock Ramp Alternative scores higher and more favorably for pallid sturgeons than the Relocate Main Channel Alternative.

## Lower Yellowstone Irrigation Project

### Introduction

- How would the alternatives affect the Lower Yellowstone Irrigation Project?

**Irrigation districts could experience temporary, short-term impacts associated with reliability of water delivery during Intake Project construction**

This section addresses how the No Action Alternative and the proposed action alternatives may affect the lands and appurtenances associated with delivery of water to Intake Irrigation District, Savage Irrigation District, Lower Yellowstone Irrigation District 1, and Lower Yellowstone Irrigation District 2. There may be temporary, short-term impacts associated with reliability of water delivery during construction of the proposed alternatives. The long-term impacts of constructing either the Rock Ramp Alternative or the Relocate Main Channel Alternative would be increased O&M costs, which are addressed in the Social and Economic Conditions section of this chapter.

Impacts to the lands and appurtenances of the irrigation districts are limited to the river diversion, canal headworks, and initial section of the main canal. There would be no impacts to prime farmland, irrigation distribution, or drainage facilities within the districts.

### Methods

Baseline information on the reliability and O&M activities of the existing project facilities was provided by Jerry Nypen, Manager for the Board of Control. This information was used to identify the potential impacts of each of the alternatives.

### Results

#### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)** Under this alternative there would be no short-term impacts relative to the reliability of providing a full water supply or the O&M of the Intake Diversion Dam and headworks. Reclamation would continue consulting with the Service under Section 7(a)(2) of the ESA. Based on Reclamation's experience with Section 7 consultation and ESA compliance on other projects and facilities, the Service would likely require that improved fish passage and entrainment minimization be in place by a certain date. Failure to achieve compliance with ESA could result in severe curtailment of project water deliveries over the long-term.

**Relocate Main Channel Alternative** There may be temporary, short-term impacts associated with reliability of water delivery during construction. The long-term impacts of relocating the channel would be increased O&M costs, which is addressed in the Social and Economic Conditions section of this chapter. The irrigation districts are responsible for operating and maintaining the project facilities under the conditions of contracts with Reclamation. The contracts are:

- ✓ Contract ILR-103, September 23, 1926, with Lower Yellowstone Irrigation District #1.
- ✓ Contract ILR-104, November 2, 1926, with Lower Yellowstone Irrigation District #2.
- ✓ Contract ILR-1436, March 30, 1945, with Intake Irrigation District.
- ✓ Contract ILR-1525, July 14, 1948, with Savage Intake Irrigation District.

Reliability of providing a full water supply to the project has been addressed by incorporating an additional removable rotating drum screen into the engineering designs and cost estimates. The additional screen is a back-up to be used if a screen malfunctions or is damaged. The following list summarizes the impacts to the districts:

- Physical changes would result from extending the main canal, constructing a new concrete control structure, and constructing new headworks with removable rotating drum screens.
- Proposed facilities would require additional O&M time compared to existing facilities due to increased complexity.
- New facilities may require additional maintenance staff.
- New facilities may require hiring new or training existing staff to meet increased technical skill levels at a higher pay scale.
- Replacement costs would be substantively higher than the existing facilities.
- Power costs would increase to operate intake screens.

**Rock Ramp Alternative** There may be temporary, short-term impacts associated with reliability of water delivery during construction. The long-term impacts of a rock ramp and new headworks with removable rotating drum screens would be increased O&M costs, which is addressed in the Social and Economic Conditions section of this chapter. Reliability of providing a full water supply to the project would be addressed by installing one or more additional removable rotating drum screens to be used if one malfunctions or is damaged. The impacts of this alternative would be the same as those listed above for the Relocate Main Channel Alternative. Additional impacts are as follows:

- Displaced rip-rap in the rock ramp must be replaced or repaired by a contractor at a substantially increased cost.
- Replacement rip-rap would not be quarried locally and would be imported at an increased cost.

### *Cumulative Effects*

Based on Reclamation's experience with Section 7 consultation and ESA compliance on other projects and facilities, the Service would likely require that improved fish passage and entrainment minimization be in place by a certain date. Failure to achieve compliance with ESA under No Action could result in severe curtailment of project water deliveries over the long-term and adverse consequences for irrigated agriculture. The Relocate Main Channel and Rock Ramp Alternatives would increase O&M costs, which would reduce the financial viability of the irrigation districts but would continue delivery of a reliable water supply.

### *Actions to Minimize Effects*

Modification of the original engineering design to incorporate an additional screen and phasing construction would avoid interruptions in water deliveries to the irrigation districts during the irrigation season.

- If the Relocate Main Channel Alternative is selected, a cofferdam would be used during construction to maintain flow in the existing river channel to allow uninterrupted operation of the Lower Yellowstone Project irrigation facilities during the irrigation season.
- If the Rock Ramp Alternative is selected, construction of the north half of the concrete weir and rock ramp will start after completing the headworks and canal extension to continue diversion of flows for uninterrupted operation of the irrigation districts.
- If either action alternative is selected flows would continue to be diverted into the main canal through the existing headworks while building the new headworks.

## Summary

All of the alternatives would ultimately result in construction of improved fish passage and entrainment minimization facilities. Failure to achieve compliance with ESA could result in severe curtailment of project water deliveries under No Action. There may be temporary, short-term impacts associated with reliability of water delivery during construction.

The long-term impacts would be increased O&M costs, which is addressed in the Social and Economic Conditions section of this chapter. Reliability of effectively delivering a full water supply to the project has been addressed by providing an additional removable rotating drum screen to be used if a screen malfunctions or is damaged.

# Recreation

## Introduction

- How would the Intake Project affect recreational opportunities, including camping, hunting, fishing, boating, concessions, swimming, picnicking, and day use at the Intake FAS and Joe's Island?

- How would the Intake Project affect the recreation infrastructure, including the campground, picnic/day use area and the boat ramp at Intake FAS and Joe's Island?


**Welcome sign at Intake FAS**

This section addresses recreational opportunities and associated recreation infrastructure that may be affected during and after Intake Project construction, if an action alternative is selected. Recreational opportunities include camping, hunting, fishing, boating, concessions, swimming, picnicking, and day use. Associated recreation infrastructure includes the campground, picnic/day use area, and boat ramp.

Construction activities may impact the quality of the recreational experience and or the physical environment on a temporary basis. These impacts are expected to be short-term, depending upon the alternative selected for implementation and the Intake Project construction schedule. Construction would take approximately 2 ½ years for the Rock Ramp Alternative and 3 years for the Relocate Main Channel Alternative. However, some Intake Project construction activities would result in temporary or permanent minimal impacts to recreational opportunities and or to the recreation infrastructure. This means that some recreational opportunities and or infrastructure may be lost for future use or enjoyment, although actions to minimize effects would offset these impacts (see Actions to Minimize Effects subsection).

## Methods

An assessment of the existing recreational opportunities and infrastructure was conducted and is presented in chapter three, Affected Environment. An analysis of the potential impacts due to the proposed Intake Project, during construction and as a result of the final Intake Project, was conducted. The analysis took into consideration impacts to the physical environment as well as certain intrinsic values such as the quality of the view shed, sense of quiet and solitude, and access to water.

## Results

### *Short-Term and Long-Term Effects of the Alternatives*

**Camping and Picnicking/Day Use**

***No Action Alternative (Continue Present Operation)*** This alternative would have no new impacts on the existing recreational opportunities or infrastructure of the campground or picnicking/day use area.

***Relocate Main Channel and Rock Ramp Alternatives*** Neither alternative would physically impact the campground or picnic/day use area. Both alternatives would have similar short-term impacts to recreational opportunities at the Intake FAS. During Intake Project construction noise, dust, and construction equipment could impact the sense of quiet and solitude traditionally experienced in these areas. Ease of access to the campground and picnic/day use area might be reduced during periods of heavy construction adjacent to the recreation areas or along the entrance road. These impacts could discourage recreational use of the campground or picnic/day use area. At times, due to construction need or for public health and safety, the recreational areas might be closed for limited periods of time.

Temporary closure of the boat ramp could reduce recreational use of the campground or picnic/day use area during Intake Project construction. Permanently closing the boat launch ramp would result in long-term impacts to recreationists wishing to access the river by launching boats at the Intake FAS. This could result in reduced visitation to the FAS, until a new boat ramp is constructed at or near the Intake FAS (see Actions to Minimize Effects subsection).

Once the Relocate Main Channel is constructed, the short-term construction impacts to the campground and picnic/day use area noted above should be alleviated. Long-term impacts to camping and picnicking/day use, due to reduced visual and audio aesthetics previously provided by the river, could result in reduced visitation. Without direct foot access to the river visitation could also be reduced. To recreate these conditions the campground and picnic/day use area would have to be relocated closer to the river.

**Visual and audio aesthetics recreation at Intake FAS would be affected by the Relocate Main Channel Alternative by moving the river away from the recreational facilities.**

Once the Rock Ramp Alternative is constructed, the short-term construction impacts to the campground and picnic/day use area noted above should be alleviated. The river would flow in the same channel and the visual and audio aesthetics of the river should remain the same. There should be no long-term impacts to the campground or picnic/day use areas.

Both alternatives would impact the camping and picnicking/day use opportunities on Joe's Island during Intake Project construction. There are no developed campgrounds or day use facilities on Joe's Island, but the area is used for primitive camping and picnicking. Short-term construction impacts due to either alternative may result in use of Joe's Island being restricted or temporarily prohibited. This could result in fewer visitations to the area.

A long-term impact of the Relocate Main Channel Alternative would be less land on Joe's Island for recreational activities. This could result in reduced visitation to the area. There should be no long-term impacts to Joe's Island due to the Rock Ramp Alternative.

If either action alternative is constructed, roads that were constructed for Intake Project purposes should improve access to Joe's Island.

**Hunting**

***No Action Alternative(Continue Present Operation)*** There would be no new impacts to hunting due to this alternative. Hunting is prohibited at the Intake FAS; Joe's Island is open to hunting.

***Relocate Main Channel and Rock Ramp Alternative*s** Hunting is prohibited and would remain so at Intake FAS, during and after construction of either action alternative. During Intake Project construction hunters wishing to access the river by boat might experience short-term impacts when the boat ramp at the Intake FAS is temporarily closed, or if foot access is limited through the construction zone. This could result in fewer visits to the river by hunters; however, hunting access to the river is nominal during designated hunting seasons. Foot access restrictions to the river should be alleviated once the Intake Project is completed.

Permanently closing the boat launch ramp would result in long-term impacts to hunters wishing to access the river by launching boats at the Intake FAS. This could result in reduced visitation to the FAS until a new boat ramp is constructed at or near the Intake FAS (see Actions to Minimize Effects).

Hunting on Joe's Island and access to downstream lands could be impacted on a short-term basis during construction of either alternative if the island is closed for safety purposes. Once the Intake Project is completed, it is likely that hunting restrictions would be lifted.

Once the Relocate Main Channel Alternative is constructed, Joe's Island would become smaller, thereby reducing the amount of land available to hunting. This would be a long-term but minimal impact; hunting on Joe's Island only provides limited opportunities, and there are other hunting opportunities on block management lands and other public lands along the river.

If the Rock Ramp Alternative is constructed, hunting on Joe's Island should not be substantially changed.

**Fishing**
***No Action Alternative (Continue Present Operation)*** There would be no new impacts to fishing due to this alternative.

***Relocate Main Channel and Rock Ramp Alternatives*** During Intake Project construction anglers using either side of the river (Intake FAS or Joe's Island) might experience short-term impacts when access to the river is temporarily restricted within the construction zone. Construction activities in the river would also restrict fishing opportunities temporarily. Fishing outside the construction zone would still be available.

**Paddlefish snagging would be temporarily affected by construction of an action alternative at Intake FAS and Joe's Island**

During Intake Project construction, snagging for paddlefish could be impacted. Intake Project construction activities may alter paddlefish concentrations at the dam site discouraging paddlefish from lingering below the dam. This may reduce the number of paddlefish snagged at the FAS. However, this could increase overall snagging opportunities if more paddlefish migrate up river. Historically, the paddlefish season at Intake is closed when a designated number of paddlefish are snagged. This often occurs before the season's established closing date. Without the high numbers of paddlefish snagged at Intake, the yearly quota might not be filled as quickly, and the season might stay open longer affording angler more days to snag paddlefish until the quota is either met or the season officially ends.

Once either action alternative is completed, paddlefish would be less inclined to congregate or linger at the Intake FAS. This should reduce snagging opportunities at the FAS but should also increase snagging opportunities further up river. As discussed in the Aquatic Communities section, paddlefish may benefit from additional spawning areas up river, which could improve reproduction and increase populations.

As a byproduct of the recreational paddlefish fishery on the lower Yellowstone River, the Glendive Chamber of Commerce and Agriculture (Chamber of Commerce) administers the Yellowstone Caviar program. Before and after Intake Project construction anglers would be able to donate roe from paddlefish snagged between Glendive and the Montana/North Dakota State line to the Chamber of Commerce; and, the Chamber of Commerce would be able to accept and process the donated paddlefish roe into caviar. Intake Project construction should not reduce the number of paddlefish in the Yellowstone River or the quota for the number of paddlefish to be taken. However, during and after Intake Project construction the Yellowstone Caviar program could be impacted by a number of factors. Most of the donated roe comes from paddlefish that are currently snagged below the Intake Dam. Impacts from restricted angler access to the river or reduced numbers of paddlefish snagged at the FAS could result in less paddlefish roe donated to the program, unless the Chamber of Commerce maximizes its authorized opportunities to collect paddlefish snagged between Glendive and the North Dakota-Montana state line. Reduced donations would lower income for the Chamber of Commerce.

Permanently closing the boat launch ramp would result in long-term impacts to anglers wishing to access the river by launching boats at the Intake FAS. This could result in reduced visitation to the FAS, unless a new boat ramp is constructed at or near the Intake FAS.

**Boating**

***No Action Alternative (Continue Present Operation)*** There would be no new impacts to boating due to this alternative.

***Relocate Main Channel and Rock Ramp Alternatives*** Both of these alternatives would have virtually the same short-term and long-term impacts to the existing Intake FAS boat ramp. Once Intake Project construction activities begin, the boat ramp would be closed periodically. After Intake Project completion, the boat ramp would be closed permanently. This would impact recreationists wishing to launch boats at Intake FAS for boating, fishing, or hunting activities on the river.

Table 3.2, chapter three, identifies the locations of other boat ramps above and below the Intake FAS. Boaters would have to travel greater distances to access a concrete boat ramp. The “water taxi” that operates during the paddlefish season would launch and be retrieved further downstream. There is a “primitive” ramp at the Elk Island FAS, a distance of 20 miles downstream. If the water taxi needs to launch from a concrete ramp, the boat would have to be launched at the Sidney Bridge FAS, a distance of 41 miles downstream.

As noted above in the Hunting and Fishing sub-sections, any action that reduces access to the river could impact hunting and fishing activities at and around the FAS. A 20 mile upstream boat trip from Elk Island would be a difficult trip for most boaters. Reducing boat access to the river for fishing may also impact the Yellowstone Caviar program. Anglers cannot fish or snag for paddlefish or any other species from a boat within ¼ mile downstream of Intake Dam. However, this existing restriction does not prevent boaters from launching at Intake FAS and boating below the closed area to snag paddlefish.

The lack of a concrete boat ramp may result in fewer yearly visitors to the FAS, until a new boat ramp is constructed at or near the Intake FAS (see Actions to Minimize Effects).

The Relocate Main Channel Alternative would remove the dam at Intake FAS and create a new river channel. The new channel would allow greater boat traffic up river and down river of the FAS, which would benefit boating.

The Rock Ramp Alternative would change the grade of the dam at Intake FAS. A gentler slope with a higher river level over the dam could allow for greater boat traffic up river and down river of the FAS.

**Concession Operation and Sub-Contractors**
***No Action Alternative (Continue Present Operation)*** There would be no new impacts to the concession operation or sub-contractors operating at the Intake FAS due to this alternative. The concession and sub-contractors only operate during the paddlefish season.

***Relocate Main Channel and Rock Ramp Alternatives*** The concession and sub-contractors only operate during the paddlefish season. Both alternatives would have virtually the same short-term and long-term impacts to the concession operation and sub-contractors operating at the Intake FAS. Intake Project construction would not have a direct physical impact to the concession operation and sub-contractors, those opportunities would remain.

During the paddlefish season Intake Project construction noise, dust, and construction equipment could impact the sense of quiet and solitude traditionally experienced in these areas. Ease of access to the campground, picnic/day use area, and boat ramp might be reduced during periods of heavy construction activities adjacent to these areas or along the entrance road. These impacts could discourage use of the recreation areas, thereby reducing potential income for the concessionaire. Any reduction in paddlefish snagging opportunities at the Intake FAS might impact the sub-contractors operating at the FAS. If the sub-contractors are paid by the number of paddlefish processed, a longer season would mean they would have to work more days; or, if the sub-contractors are paid by the hour or day, it would cost the Chamber of Commerce, the entity which administers the Yellowstone Caviar Program, additional money.

**Swimming and Ice Fishing**
***No Action Alternative (Continued Present Operation)*** There would be no new impacts to swimming or ice fishing opportunities due to this alternative.

***Relocate Main Channel and Rock Ramp Alternatives*** Both alternatives would have virtually the same short-term impacts to swimming and ice fishing opportunities. Short-term impacts would include no river access within the construction zone; however, swimming is already discouraged downstream of the dam because of turbulence. These opportunities would still exist outside the construction zone and would be available upon Intake Project completion.

***Cumulative Impacts***
With implementation of actions to minimize effects, the action alternatives would have minimal impacts to the recreation opportunities and infrastructure at the Intake FAS.

***Actions to Minimize Effects***
- In order to minimize impacts to recreationists, the construction contractor will implement dust abatement activities on all dirt or gravel roads within or leading to the construction zone, on both sides of the river.
- To allow access to recreation areas, the construction contractor will grade, on an as needed basis, all dirt or gravel roads within or leading to the construction zone, on both sides of the river, except in areas with historic properties.
- The construction contractor will use “flaggers” during periods of time when large volumes of vehicles cross the entrance road to the campground and picnic/day use area.

- The construction contractor, Reclamation, and the FWP will 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. within or on both sides of the river.
- The construction contractor, Reclamation, and the FWP will identify a "portage" route around or through the construction zone to allow boaters to hand-carry or drag their boats past the construction zone.
- The construction contractor will clearly post and sign any areas within any designated construction zones. Signs will include warnings limiting or prohibiting certain recreational uses within the zone, such as swimming, fishing, boating, hiking, camping, etc. Signs will be posted upstream and downstream of the Intake Diversion Dam to warn boaters of construction activity.
- The FWP will designate access corridors through the existing Intake FAS campground and picnic/day use area that could be used to access the river by foot or to launch boats under "primitive" conditions.
- To the extent possible, construction activities will cease during the paddlefish season or until the paddlefish season is closed at Intake FAS.

For either action alternative, Reclamation and the FWP will evaluate and the Corps will construct either :

- A new boat ramp at the existing Intake FAS, or
- A new boat ramp immediately adjacent to the existing Intake FAS, or
- A new boat ramp at a site near the existing Intake FAS on the west side of the Yellowstone River and accessible by Highway 16

For the Relocate Main Channel Alternative, Reclamation and the FWP will evaluate and provide for:

- Constructing a road from the campground and picnic/day use area to a location adjacent to the new channel, and a parking area; or
- A new campground and picnic/day use area adjacent to the relocated channel on the Intake FAS or on Joe's Island side of the river

Reclamation and the FWP will develop a public notification plan to include:

- Signs on the road leading to the FAS or Joe's Island advising the public of closures or restrictions.
- Signs indicating the location of other recreation sites including campgrounds, picnic/day use areas and boat ramps.

## Summary

The No Action Alternative (Continue Present Operation) would have no short-term or long-term impacts on recreation.

In the short-term, both action alternatives (the Rock Ramp Alternative and Relocate Main Channel Alternative) would have impacts to the campground, day use area, and boat ramp as well as impacts to recreational opportunities such as camping, picnicking, boating, and fishing due to temporary closures, noise, dust, and restricted access to the river.

In the long-term, both action alternatives would require closure and relocation of the boat ramp. The Relocate Main Channel Alternative would also result in closing and relocating the campground and day use area. Most fishing and boating opportunities on the river should improve with either action alternative after construction of the Intake Project and of a new boat ramp. Boats traffic would improve upstream of the Intake FAS. Paddlefish snagging opportunities, which would continue might be less plentiful at the Intake FAS, because paddlefish would not congregate to the same degree below the new rock ramp or would bypass the location through the alternate channel. However, there paddlefish snagging opportunities should improve upstream during the season.

## Social and Economic Conditions

Irrigation districts could be affected by an increase in O&M costs

### Introduction

- How would the alternatives affect the regional economy of the region?

This section addresses how the proposed alternatives may affect the regional economy. These impacts could occur as a result of operational changes that could affect the four irrigation districts in the Yellowstone project in three ways:

- Short-term construction impacts,
- Increase in long-term O&M costs, and
- Short term changes in recreation visitation and related expenditures due to construction.

It is assumed for the purposes of this analysis that cropping patterns, yields, and irrigation deliveries would be the same under the No Action (Continue Present Operation), Relocate Main Channel, and Rock Ramp Alternatives. Therefore, the economic impacts associated with irrigated production would all be the result of changes in water supply costs for each alternative. Recreation impacts would be related to decreases in the number of recreationists using Intake FAS during construction (see Recreation section).

### Methods

The regional economic impacts from implementation of the Relocate Main Channel Alternative and the Rock Ramp Alternative were compared to the consequences of No Action in order to evaluate the significance of each action alternative to the regional economy. The regional impacts from construction and O&M expenditures were analyzed using the IMPLAN (IMpact analysis for PLANing) model.

The IMPLAN model is based on national estimates of flows of commodities used by industries and commodities produced by industries. The flow of commodities to industry from producers and consumers, as well as consumption of the factors of production from outside the region, is represented within IMPLAN. These also account for the percentage of expenditures in each category within the region and expenditures that would flow outside the region.

In order to estimate the regional economic impacts associated with an alternative, estimates of changes in expenditures for goods and services were input into the IMPLAN model. Estimating the impacts of construction and O&M activities required estimates of these expenditures by expenditure category. The impacts associated which each of the alternatives were based on changes in industry output, employee compensation, and employment. Industry output is a measure of the value of industry's total production. Industry output is directly comparable to Gross Regional Product. Employee compensation represents wages and benefits paid to employees.

The impacts associated with payment of O&M costs associated with the Relocate Main Channel and Rock Ramp Alternatives were evaluated using farm budgets, which represent net revenues from irrigated agriculture. Farm budgets were developed using cropping patterns, input costs, crop yields and prices. A simplified approach based on the concept of farm payment capacity was used in this analysis to represent the net farm revenues available from irrigated acreage to pay increased O&M costs. Payment of increased O&M costs would lead to reduced disposable farm income.

## Results

### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)**
Under this alternative O&M expenditures would continue at their present rate for Intake Diversion Dam and headworks. These expenditures are estimated to be $139,281 annually. The current O&M expenditures are estimated to generate $178,000 worth of regional output, $41,800 in employee compensation, and one full time equivalent job. There would be no regional impacts associated with new construction and impacts. Agricultural production, recreational activities, and associated spending would continue as before.

**Rock Ramp and Relocate Main Channel Alternatives**
***Regional Economic Impacts*** Both of the action alternatives would generate positive impacts to the regional economy. Any action that increases levels of spending tends to lead to increased value of output, employment, and income. The value of output represents the market value (as measured by price) of goods and services produced and sold in the region. Increased spending would increase economic activity, if the funds come from sources outside the study area or if spending comes from local sources that would otherwise not be spent in the region.

The short-term regional impacts are based on an estimated construction cost of $38.8 million for the Rock Ramp Alternative and $68.9 million for the Relocate Main Channel Alternative (see chapter two). These one-time maximum short-term impacts are shown in table 4.6. These beneficial impacts represent additional regional economic activity from an action alternative that is constructed with federal funding.

**Table 4.6 - One Time Regional Beneficial Economic Impacts From Construction.**

| Alternative | Construction cost (millions) | Value of output (millions) | Employee Compensation (millions) | Employment |
|---|---|---|---|---|
| No Action | $0 | $0 | $0 | 0 |
| Rock Ramp | $38.8 | $56.02 | $16.9 | 480 |
| Relocate Main Channel | $68.9 | $90.09 | $19.1 | 478 |

The 2002 Survey of Business Owners provides the most recent data for business receipts at the county level. The 2007 survey data are not available yet at the county level. Business receipts in 2002 for the eight county impact area totaled $2.28 billion. The U.S. Bureau of the Census 2006 County Business Pattern data indicated the total eight county payroll in 2006 was $499.4 million, and there were 17,775 paid employees.

Table 4.7 shows the maximum potential one-time impact of construction of the two action alternatives. The impacts are shown as a percentage of total receipts, employment, and payroll in one year. Construction would have a positive impact in the very short-term, but the impact would be fairly small.

**Table 4.7 – One Time Regional Economic Impacts From Construction as a Percentage of 2006 Receipts, Employment, and Payroll.**

| Alternative | Percent of 2002 receipts | Percent of 2006 payroll | Percent of 2006 employment |
|---|---|---|---|
| No Action | 0% | 0% | 0% |
| Rock Ramp | 2.46% | 3.37% | 7.70% |
| Relocate Main Channel | 3.95% | 3.82% | 2.69% |

Regional economic impacts may also occur as a result of increased O&M expenditures associated with the Rock Ramp and Relocate Main Channel Alternatives. Table 4.8 shows the O&M costs and regional impacts associated with each alternative. The impacts in table 4.8 are less than 1/10 of 1% of the value receipts, payroll, and employment of the economic region and represent the case where all O&M expenditures are additional expenditures to the region. However, increased O&M expenditures are likely to correspond with decreased spending on other goods and services.

**Table 4.8 – Regional Economic Impacts Associated with Annual O&M Costs for Each Alternative, Including No Action.**

| Alternative | Annual O&M cost | Value of Output | Employee Compensation | Employment |
|---|---|---|---|---|
| No Action | $139,281 | $178,000 | $41,800 | 1.0 |
| Rock Ramp | $272,807 | $351,100 | $80,200 | 1.8 |
| Relocate Main Channel | $333,755 | $386,300 | $58,225 | 1.2 |

Table 4.9 shows the incremental O&M costs of the Rock Ramp and Relocate Main Channel Alternatives, as compared to No Action.

**Table 4.9 – Regional Economic Impacts Associated with Annual O&M Costs for the Rock Ramp and Relocate Main Channel Alternatives Compared to No Action.**

| Alternative | Value of Output | Employee Compensation | Employment |
|---|---|---|---|
| Rock Ramp | $173,100 | $38,400 | 0.8 |
| Relocate Main Channel | $208,300 | $16,400 | 0.2 |

If it is assumed that increased O&M spending leads to a proportional decrease in general consumer spending, then the Rock Ramp Alternative would generate a positive value of output impacts of only about $17,000 annually and the Relocate Main Channel Alternative leads to essentially no change in the value of output. In other words, if the money spent for O&M ultimately leads to a decrease in spending that is currently occurring, then O&M expenditures would have an insignificant impact on the regional economy.

***Effects of O&M Payments on Irrigation Districts*** The increase in O&M costs associated with the Rock Ramp and Relocate Main Channel Alternatives would have a negative financial impact on the four irrigation districts. Impacts from changes in O&M payments were estimated previously at the regional level. However, distributional effects are not accounted for in the regional impact analysis. The impacts of increased O&M costs on the irrigation districts are evaluated by comparing the O&M costs per acre for each alternative with per acre net farm income.

If the current No Action O&M costs are applied to approximately 58,400 acres reported in the Lower Yellowstone Irrigation Project crop reports, the cost would be $2.38 per irrigated acre. Applying O&M costs for the Rock Ramp Alternative results in a cost of $4.67 per irrigated acre and O&M costs for the Relocate Main Channel Alternative are $5.71 per irrigated acre.

In order to evaluate the significance of the O&M expenditure impacts, a payment capacity type of approach is used to estimate the impact of additional O&M costs on net farm income. Payment capacity represents the residual net farm income available to irrigators to pay the costs associated with supplying irrigation water. A payment capacity study is the first step in the completion of an ability to pay analysis. A full scale payment capacity analysis was not completed as part of the EA, because the primary purpose of this evaluation is to determine the significance of the economic impacts associated with the alternatives rather than precise estimate of the resources available for repayment. However, the analysis must be detailed enough to be able to determine the magnitude of impacts.

A payment capacity study is based on the use of representative farm characteristics, representative crop yields, and representative input and crop prices. A 5-year time horizon is typically used for crop yields and prices. Representative farm characteristics refer to the fact that not all crops grown in an area and not all farm management practices must be included in a payment capacity analysis. However, the farm budget used in a payment capacity analysis must be reasonable for the region of analysis. The purpose of this analysis is to evaluate the impact of O&M costs associated with the action alternatives on net farm revenue.

*Representative cropping patterns, crop prices, and yields* Representative irrigated cropping patterns for the four irrigation districts are based on the crop acreages reported by the Lower Yellowstone Irrigation Project Board of Control for 2003 to 2007. Historical county level data were also obtained from U.S. Department of Agriculture National Agricultural Statistics Service to determine if there appeared to be any significant trends in crops grown in the area. Irrigated crop acreages for 2007 for the study area are shown in table 4.10, and the average crop percentages for the five year period from 2003 to 2007 for the four irrigation districts in the Lower Yellowstone Project are presented in table 4.11. Lower Yellowstone Districts #1 and #2 are evaluated as one unit because the Lower Yellowstone Irrigation Project Board of Control operates these districts as one with a common Montana water right. The percentages shown in table 4.11 are representative of the crops actually produced in the area but do not exactly match the percentage of all crops grown in the districts.

**Table 4.10 – 2007 Irrigated Crop Acreage by Irrigation District.**

| District | Sugar beets | Hay | Wheat | Barley | Corn | Other |
|---|---|---|---|---|---|---|
| Lower Yellowstone Districts #1 & #2 | 24,944 | 6,493 | 8,793 | 11,024 | 3,987 | 3,516 |
| Intake Irrigation District | 392 | 156 | - | 192 | 146 | - |
| Savage Irrigation District | 820 | 215 | 162 | 707 | 263 | 143 |

**Table 4.11 - Irrigated Cropping Percentage Based on 2003 to 2007 Average Crop Acreage.**

| Irrigation District | Sugar beets | Hay | Wheat | Barley | Corn |
|---|---|---|---|---|---|
| Lower Yellowstone District #1 and #2 | 45% | 10% | 22% | 13% | 10% |
| Intake Irrigation District | 36% | 13% | 21% | 12% | 18% |
| Savage Irrigation District | 35% | 15% | 15% | 20% | 15% |

Crop prices and yields are needed in order to estimate representative farm revenues. Crop prices for the most recent 5 years for which data are available were obtained at the state level for both Montana and North Dakota from the United States Department of Agriculture, National Agricultural Statistics Service. These prices are shown in table 4.12.

**Table 4.12 – State Level Crop Prices Used to Evaluate Net Farm Income.**

| Crop | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | Most current 5 Year Average |
|---|---|---|---|---|---|---|---|
| **Montana** | | | | | | | |
| Barley (bushel) | $2.93 | $2.85 | $2.92 | $3.00 | $4.14 | $5.78 | $3.74 |
| Corn (bushel) | $2.65 | $2.42 | $2.54 | $3.93 | $4.76 | NA | $3.26 |
| All Hay (ton) | $73.50 | $76.00 | $71.00 | $78.00 | $78.50 | $116.00 | $83.90 |
| Sugarbeets (ton) | $43.00 | $40.80 | $45.30 | $41.60 | $39.10 | NA | $41.96 |
| Wheat (bushel) | $3.73 | $3.61 | $3.63 | $4.54 | $7.14 | $6.84 | $5.15 |
| **North Dakota** | | | | | | | |
| Barley (bushel) | $2.59 | $2.12 | $1.99 | $2.65 | $3.91 | $5.18 | $3.17 |
| Corn (bushel) | $2.37 | $1.88 | $1.80 | $2.77 | $4.06 | NA | $2.58 |
| All Hay (ton) | $52.50 | $58.50 | $52.00 | $64.00 | $57.00 | $79.50 | $62.20 |
| Sugarbeets (ton) | $46.30 | $39.50 | $49.20 | $48.90 | $46.30 | NA | $46.04 |
| Wheat (bushel) | $3.63 | $3.40 | $3.55 | $4.50 | $7.74 | $7.31 | $5.30 |
| **Two state average** | | | | | | | |
| Barley (bushel) | $2.76 | $2.49 | $2.46 | $2.83 | $4.03 | $5.48 | $3.46 |
| Corn (bushel) | $2.51 | $2.15 | $2.17 | $3.35 | $4.41 | NA | $2.92 |
| All Hay (ton) | $63.00 | $67.25 | $61.50 | $71.00 | $67.75 | $97.75 | $73.05 |
| Sugarbeets (ton) | $44.65 | $40.15 | $47.25 | $45.25 | $42.70 | NA | $44.00 |
| Wheat (bushel) | $3.68 | $3.51 | $3.59 | $4.52 | $7.44 | $7.08 | $5.23 |

The two-state average price was used to estimate gross farm revenues from irrigated production for each crop except corn. The two-state average was considered more representative of prices for the study area that includes both states. Montana prices were used for corn, because essentially all corn production in the area is in the Montana districts.

Richland County yields were used to estimate agricultural production revenues due to limited irrigated acreage yield data available for McKenzie and Dawson Counties in the National Agricultural Statistics Service database. The price and yield data were used to estimate gross farm revenues for each of the four Lower Yellowstone Project irrigation districts. Crop yields are shown in table 4.13.

**Table 4.13 – Crop Yields Used to Estimate Irrigated Agricultural Revenues.**

| Year | Alfalfa (tons) | Barley (bushels) | Sugar beets (tons) | Wheat (bushels) | Corn (bushels) |
|---|---|---|---|---|---|
| 2004 | 4.5 | 102 | 19.5 | 73.3 | 120.0 |
| 2005 | 4.7 | 93 | 21.2 | 67.5 | 118.0 |
| 2006 | 4.7 | 93 | 25.0 | 71.4 | 115.0 |
| 2007 | 4.7 | 92 | 24.0 | 58.9 | 154.0 |
| 2008 | NA | 84 | NA | 58.0 | 136.0 |
| **5 year average** | **4.56** | **92.8** | **22.84** | **65.82** | **128.6** |

***Representative Crop Production Costs*** Representative irrigated agricultural production costs were estimated for alfalfa, barley, and wheat using North Dakota State University Extension Service farm management planning guides for western North Dakota. These planning guides represented center pivot irrigation practices, while the dominant irrigation practice in the study area is flood irrigation. Therefore, adjustments were needed to represent flood irrigation costs. Northern Colorado flood irrigation budgets were used as a basis for estimating irrigation labor hours for the study area. The average wage for irrigation labor was based on data from the May 2008 Bureau of Labor Statistics State Occupational Employment and Wage Estimates for agricultural labor related to crop production in Montana and North Dakota. The average wage was $9.75 per hour.

Sugarbeet production costs were based primarily on information from the North Dakota State University Department of Agribusiness and Applied Economics report “Economic Contribution of the Sugarbeet Industry in Minnesota, North Dakota, and Eastern Montana.” The representative costs per acre are shown in table 4.14. It should be noted that the costs presented in table 4.14 do not include district irrigation assessments. The current water assessment charges vary by district and are shown in table 4.15.

**Table 4.14 – Costs Used to Evaluate Irrigated Agricultural Production.**

| Cost category | Seeded Alfalfa | Established Alfalfa | Barley | Sugar Beets | Wheat | Corn |
|---|---|---|---|---|---|---|
| **Variable Costs** | | | | | | |
| -Seed | $45.00 | $0.00 | $23.95 | $45.00 | $19.50 | $61.25 |
| -Chemicals | $13.75 | $0.00 | $31.75 | $150.00 | $31.75 | $22.00 |
| - Fertilizer | $44.82 | $44.82 | $70.37 | $80.00 | $104.95 | $109.28 |
| -Crop Insurance | $0.00 | $0.00 | $14.65 | $0.00 | $17.88 | $21.57 |
| -Fuel & Lubrication | $22.09 | $27.92 | $15.92 | $61.89 | $15.43 | $22.13 |
| -Repairs | $10.36 | $8.97 | $10.89 | $49.00 | $10.89 | $15.22 |
| -Labor, incl. irrigation labor | $19.50 | $19.50 | $10.72 | $142.25 | $10.72 | $29.95 |
| -Miscellaneous | $11.57 | $12.00 | $9.19 | $49.11 | $10.51 | $34.55 |
| **Sum of variable costs** | **$167.09** | **$113.21** | **$187.44** | **$577.25** | **$221.63** | **$315.95** |
| **Fixed Costs** | | | | | | |
| -Overhead/Land Charge | $38.38 | $38.09 | $37.75 | $49.16 | $37.75 | $40.18 |
| -Machinery Depreciation | $63.57 | $62.02 | $56.01 | $78.48 | $56.01 | $70.18 |
| -Machinery Investment/Misc. | $43.02 | $41.70 | $38.62 | $105.38 | $38.62 | $48.62 |
| **Sum of fixed costs** | **$144.97** | **$141.81** | **$132.38** | **$233.02** | **$132.38** | **$158.98** |
| **Sum of all costs** | **$312.06** | **$255.02** | **$319.82** | **$810.27** | **$354.01** | **$474.93** |

**Table 4.15 – District Irrigation Assessments**

| Year | Lower Yellowstone District #1* | Lower Yellowstone District #2 | Intake ID | Savage ID |
|---|---|---|---|---|
| 2005 | $24.00 | $25.50 | $23.00 | $28.00 |
| 2006 | $25.00 | $26.50 | $24.00 | $28.00 |
| 2007 | $25.50 | $27.00 | $25.00 | $29.00 |
| 2008 | $25.50 | $27.00 | $25.50 | $29.00 |
| 2009 | $30.00 | $30.00 | $30.00 | $30.00 |

- The District #1 assessment was temporarily reduced until 2008. Future assessments will be the same as District #2. Therefore, an assessment of $30.00 per acre is used in the analysis for both District #1 and District#2, as well as for Intake ID and Savage ID.

Gross crop revenue, variable and fixed costs of production, irrigation district assessments and the distribution of crops can be used to estimate net revenue from irrigated crop production. The 2009 district assessments are used to estimate net revenue due to the general upward trend over the last five years. The results are in table 4.16.

**Table 4.16 – Net Revenue per Acre for Lower Yellowstone Irrigation Districts.**

| | Gross Revenue | Total Cost | District O&M cost | Net Revenue | Crop Distribution | Weighted Net Revenue |
|---|---|---|---|---|---|---|
| **District #1 & #2** | | | | | | |
| Sugarbeets | $1,004.96 | $810.27 | $30.00 | $164.69 | 0.45 | $74.11 |
| Hay | $333.11 | $266.43 | $30.00 | $36.68 | 0.10 | $3.67 |
| Wheat | $344.24 | $354.01 | $30.00 | -$39.77 | 0.22 | -$8.75 |
| Barley | $321.09 | $319.82 | $30.00 | -$28.73 | 0.13 | -$3.73 |
| Corn | $419.24 | $474.93 | $30.00 | -$85.69 | 0.10 | -$8.57 |
| ***Average*** | | | | | | ***$56.73*** |
| **Intake ID** | | | | | | |
| Sugarbeets | $1,004.96 | $810.27 | $30.00 | $164.69 | 0.36 | $59.29 |
| Hay | $333.11 | $266.43 | $30.00 | $36.68 | 0.13 | $4.77 |
| Wheat | $344.24 | $354.01 | $30.00 | -$39.77 | 0.21 | -$8.35 |
| Barley | $321.09 | $319.82 | $30.00 | -$28.73 | 0.12 | -$3.45 |
| Corn | $419.24 | $474.93 | $30.00 | -$85.69 | 0.18 | -$15.42 |
| ***Average*** | | | | | | ***$36.83*** |
| **Savage ID** | | | | | | |
| Sugarbeets | $1,004.96 | $810.27 | $30.00 | $164.69 | 0.35 | $57.64 |
| Hay | $333.11 | $266.43 | $30.00 | $36.68 | 0.15 | $5.50 |
| Wheat | $344.24 | $354.01 | $30.00 | -$39.77 | 0.15 | -$5.97 |
| Barley | $321.09 | $319.82 | $30.00 | -$28.73 | 0.20 | -$5.75 |
| Corn | $419.24 | $474.93 | $30.00 | -$85.69 | 0.15 | -$12.85 |
| ***Average*** | | | | | | ***$38.58*** |

Multiplying the number of acres in each district by the weighted net revenue per acre and summing the result leads to an estimated net revenue of $3.25 million annually or $55.70 per acre. The average net revenue per acre for all four districts is considered representative for the entire Lower Yellowstone project. The payment capacity guidelines allow for a reasonable family farm income, which would include any dryland based farm revenues that would be part of the farm operation. The predominant dryland agricultural activity in the area is pastureland. The National Agricultural Statistics Service estimates that the average 2009 pastureland rental rate in McKenzie County is $9.40 per acre. If pasture rental rate data was not available at the county level for the Montana area, a pasture rental rate of $9.40 was used. Assuming a farm operation would include 360 irrigated acres and 160 acres of rented pasture, net revenues for a farm operation would be about $21,600 per farm operation.

Assuming the additional O&M costs are passed on to irrigated crop production, the Rock Ramp Alternative would add $825 in costs to each farm operation, and the Relocate Main Channel Alternative would add $1,200 in costs to each farm operation. It is assumed that the O&M costs for No Action are included in the representative cost estimates. Net farm revenues are sufficient to pay the increased O&M costs, but they would reduce net farm income by 3.8% for the Rock Ramp alternative and by 5.6% for the Relocate Main Channel alternative.

### *Cumulative Effects*

Based on Reclamation's experience with Section 7 consultation and ESA compliance on other projects and facilities, the Service would likely require that improved fish passage and entrainment minimization be in place by a certain date.  Failure to achieve compliance with ESA under No Action could result in severe curtailment of project water deliveries over the long-term and adverse economic consequences.  The Relocate Main Channel and Rock Ramp Alternatives would increase O&M costs, which would reduce the financial viability of the irrigation districts. Increased economic activity associated with construction and O&M activities would lead to potentially positive overall regional economic impacts and continued delivery of a reliable water supply.

## Summary

Based on the expected continuation of current agricultural production or trends in production and recreation activities, as described in the Lower Yellowstone Irrigation District and Recreation sections, there are no significant regional economic impacts associated with changes in output in these two sectors.  There would be short-term positive regional economic impacts (increased output, employee compensation, and employment) associated with initial construction of the proposed action alternatives.  These short-term positive impacts would be relatively large if project costs inject federal funds into the region.  Some positive regional impacts would also be expected in the long run at a much lower level due to increased O&M costs.  However, these short-term O&M impacts are likely to be insignificant compared to the size of the regional economy.  Increased O&M costs associated with the action alternatives may reduce net farm income by 3.8% to 5.6%, but farm revenues appear to be sufficient to pay the increased O&M costs.

## Environmental Justice

### Introduction

- What impacts would the alternatives have on minority and low income populations in the area, and would these impacts be disproportionate compared to other groups?

**The alternatives would not cause adverse environmental justice impacts**

This section addresses how the impacts of the proposed alternatives would be distributed throughout the impact area. The regional impacts identified in the Social and Economics Conditions section would result from construction expenditures and changes in O&M costs. The physical impacts from construction and the O&M cost impacts would occur in the three irrigation district counties (Dawson, Richland, and McKenzie). The secondary regional economic impacts could occur throughout the study region, but these impacts would be positive in terms of increased income and employment. Therefore, the regional economic impacts from construction would not create environmental justice impacts. The following discussion concentrates on potential impacts to residents in Dawson, Richland, and McKenzie counties.

### Methods

The environmental justice impacts were analyzed by simply comparing impact zones to those areas with a relatively large number of minority or low income residents. If a disproportionate share of adverse impacts would occur in an area identified as minority or low income, then this would be identified as an environmental justice concern.

### Results

#### *Short-Term and Long Term Effects of Alternatives*

**No Action Alternative** Under this alternative, regional impacts associated with O&M expenditures would continue, but there would be no environmental justice issues. Agricultural production, recreational activities, and associated spending would be as before.

**Rock Ramp and Relocate Main Channel Alternatives** The Social and Economic Conditions section indicates that the primary regional economic impacts would be in the irrigation district counties, which are Dawson and Richland counties in Montana and McKenzie County in North Dakota. As a result, the evaluation of potential environmental justice concerns is focused on these three counties.

Richland County has the highest median household income of the study area counties, and Dawson County has the third highest median household income in the study area. Both Dawson and Richland County have median household incomes that are higher than the Montana median household income. The counties have poverty rates that are lower than the Montana average.

McKenzie County, North Dakota has a median household income that is 5.9% lower than the state average. Its poverty rate is 2% higher than the state average. It should be noted that Roosevelt County, Montana, has the lowest household and per capita income and the highest poverty and unemployment rates.

The minority population in the study area counties is lower than state averages, except for Roosevelt County, Montana, and McKenzie County, North Dakota. A little over 59% of the population of Roosevelt County is American Indian, compared to 6.3% for all of Montana. Twenty-one and a half percent of the population of McKenzie County is American Indian, compared to 5.4% for all of North Dakota. Income and population data indicate Roosevelt County is the area most susceptible to environmental justice concerns. There is also some potential for environmental justice concerns in McKenzie County.

The potential negative impacts on irrigated agriculture associated with paying increased O&M costs would not be imposed on Roosevelt County. It is possible that some of the positive short-term impacts associated with project construction would spill over into Roosevelt County, which would create beneficial income and employment impacts. Some additional O&M costs would be imposed on irrigated agriculture in McKenzie by the Rock Ramp and Relocate Main Channel Alternatives. However, the analysis of net farm income in the Social and Economic Conditions section indicates the highest net farm revenue in the study area is in McKenzie County, which compensates for increased O&M costs.

The 2007 Census of Agriculture indicates that 20 farm operators in McKenzie County were American Indian, totaling 52,497 acres. In 2007 there were 585 farms and 1.07 million acres in farms in McKenzie County. Therefore, 3.4% of the farms and 4.9% of the farm acreage in McKenzie County were operated by American Indians. These relatively small percentages indicate there is not a disproportional impact from increased O&M costs on the American Indian population in McKenzie County. The Rock Ramp and Relocate Main Channel Alternatives would not have any adverse environmental justice impacts.

#### *Cumulative Effects*

There are no cumulative impacts associated with the No Action Alternative. The Relocate Main Channel and Rock Ramp Alternatives would increase annual O&M costs, but these costs would not be imposed on a minority population area or in an area that has significantly lower income or higher unemployment.

### Summary

The evaluation of potential environmental justice concerns focused on Richland and Dawson County in Montana and McKenzie County in North Dakota, because these counties are where Intake Project O&M costs would increase with an action alternative.  Of these three counties, only McKenzie county has a minority population greater than the state average and lower than average income.  The number of minority farm operators that would be affected by higher O&M costs is not disproportionately large, and the O&M costs would be a very small percentage of income.  The Rock Ramp and Relocate Main Channel Alternatives would not have any adverse environmental justice impacts.

## Lands and Vegetation

Vegetation near Intake

### Introduction

- How would the Intake Project affect lands and vegetation including wetlands, grasslands, woodlands, riparian areas and noxious weeds in the area of potential effects?

This section addresses lands and vegetation that may be affected either by construction of Intake Project features or by changing hydrology on the Yellowstone River. Lands and vegetation include wetlands, grasslands, woodlands, riparian areas, and noxious weeds. Addressing impacts to these resources is important for compliance with Section 404 of the Clean Water Act (see appendix B). Section 404, administered by the Corps with oversight from EPA, is a permitting program that regulates activities of the placement of dredged or fill materials into waters of the United States.

Construction may impact lands and vegetation on either a temporary or permanent basis. Temporary impacts generally are short-term and associated with project construction, after which land reverts to its previous use. Permanent impacts are long-term impacts associated with construction of permanent facilities. Permanent impacts could result in the irretrievable commitment of resources. This means that some of the natural resources discussed would be lost due to conversion of land to permanent facilities. The second way natural resource areas may be impacted is any Intake Project features that could potentially influence hydrology on the Yellowstone River. For example, a change in river flows could lead to bank erosion and loss of land.

### Methods

To analyze the impacts of the proposed Intake Project, land use databases developed by various state and federal agencies were used to inventory land cover types within the area of potential effects using GIS. The methods used to compile the inventory are explained in the chapter three Lands and Vegetation section.

To compare alternatives, the lands and vegetation impact zones were delineated using estimated construction footprints for construction features as discussed in chapter three. To evaluate the potential influences the Intake Project might have on hydrology and subsequently on natural resources the qualitative impacts to hydrology and geomorphology were reviewed to see how these issues may affect natural resources.

## Results

### *Short-Term and Long-Term Effects of the Alternatives*

**Wetlands**

***No Action Alternative (Continue Present Operation)*** The Board of Control's continued action of placing rocks along the crest of the dam and subsequent movement of rocks downstream would continue to fill riverine wetlands. However, even with the current redistribution of rock, riverine wetlands remain. Current fill from this action is about 2 acres and would expand in subsequent years as additional rock is added.

***Relocate Main Channel Alternative*** A total of 306 wetland acres fall within the construction area footprint and could be impacted. Permanent impacts would result from filling the existing channel and construction of the tie-back levees. There would be 222 acres of exiting riverine wetland filled and eliminated as riverine habitat. Construction of tie-back levees and the headworks would fill an additional 29 acres of riverine and palustrine wetlands. The 7 acres of wetlands between the tie-back levees would be temporarily impacted during construction, but the quality of this wetland could also be impacted longer term due to its isolation.

Temporary impacts would result from the placement of box culverts on two haul roads on Joe's Island filling in less than an acre. Additional temporary impacts to wetlands could occur during stockpile placement but would be offset through environmental commitments to avoid placement of materials in wetlands. An additional 48 wetland acres currently in the construction area would be protected by environmental commitments.

Excavation of the new main channel would create 403 acres of riverine wetlands for a net gain or creation of an additional 152 acres of riverine wetland habitat. This gain in wetland acres offsets the 222 acres that would be lost to filling the existing channel and 29 acres lost due to construction of tie-back levees. Overall with environmental commitments in place and a net gain of 152 acres of created riverine wetlands, wetland impacts would be minor.

***Rock Ramp Alternative*** Approximately 55 acres of riverine wetland fall within the construction area footprint and could be impacted. Of these 55 acres, about 2 acres are already impacted by the existing dam structure and rock that has been added to the top of the dam and subsequently displaced downstream. Replacing the dam with a new concrete structure would not increase impacts, as compared to No Action Alternative (Continue Present Operation).

The addition of rock to build the ramp would temporarily impact about 32 acres of riverine wetlands. However, after completion of the rock ramp the riverine wetlands would remain. The remaining 23 acres of riverine wetlands in the construction area could be temporarily impacted during project construction activities (e.g. equipment movement). All temporary impacts would be addressed by environmental commitments. Overall wetland impacts are considered minor.

**Riparian Areas**

***No Action Alternative (Continue Present Operation)*** There would be no consequences to riparian areas as a result of this alternative.

***Relocate Main Channel Alternative*** This action alternative would have the greatest potential to impact riparian areas. A total of 210 acres of riparian areas fall within the construction area footprint and could be impacted. Permanent impacts would include filling the existing channel and constructing tie-back levees. There would be 39 acres of existing riparian areas filled and eliminated as riparian habitat due to the excavation of the new channel. The construction of the tie-back levees would result in temporary and permanent impacts to about 42 acres of riparian areas.

Temporary impacts would occur during construction but permanent impacts could occur due to the isolation of these riparian areas. Additional moderate temporary impacts to 14 acres of riparian areas could occur during stockpile placement but would be offset through environmental commitments to avoid placement of materials in riparian areas. The remaining 125 riparian area acres in the construction area would be protected by environmental commitments. All temporary and permanent impacts to riparian areas are considered moderate and would be offset by environmental commitments.

***Rock Ramp Alternative*** Of the two action alternatives, this one would have the least impact to riparian areas. Approximately 5 acres of riparian areas fall within the construction footprint and could be impacted. All of these 5 acres would be temporarily impacted during project construction and staging activities. All temporary impacts would be addressed by environmental commitments. Overall riparian area impacts are considered minor.

**Woodlands**

***No Action Alternative (Continue Present Operation)*** There would be no consequences to woodlands as a result of this alternative.

***Relocate Main Channel Alternative***
This action alternative would have the greatest impact to woodlands. A total of 186 acres fall within the construction footprint and could be impacted. Permanent impacts would include filling of the existing channel, construction of the tie-back levees, excavation of the new channel, and in staging and stockpile areas. Impacts to these woodland areas would be offset through avoidance and actions to minimize effects listed in the environmental commitments. Overall with environmental commitments in place woodland impacts are considered minor.

**Woodlands upstream of Intake**

***Rock Ramp Alternative*** This action alternative would have the least impact to woodlands. Approximately 12 acres of woodlands fall within the construction footprint and could be impacted. All of these 12 acres would be temporarily or permanently impacted during project construction and staging activities. Impacts to these woodland areas would be offset through avoidance and actions to minimize effects outlined in the environmental commitments. Overall with environmental commitments in place woodland impacts are considered minor.

**Grasslands**

***No Action Alternative (Continue Present Operation)*** This alternative probably would have the smallest consequence to grasslands. The Board of Control's continued action of quarrying rocks and placing them along the crest of the dam would continue to have a small temporary impact on grasslands as rocks are moved and stored prior to placement on the dam.

***Relocate Main Channel Alternative*** This action alternative would have the greatest impact to grasslands. A total of 256 acres of grasslands fall within the construction footprint and could be impacted by construction activities. Permanent impacts would include excavation of the new channel and in staging and stockpile areas. Impacts to these grassland areas would be offset through actions to minimize effects listed in the environmental commitments. Overall with environmental commitments in place, grassland impacts are considered minor.

***Rock Ramp Alternative*** This action alternative would have the fewer impacts to grasslands than the other action alternative. Approximately 21 acres of grasslands fall within the construction footprint and would be impacted. All of these 21 acres would be temporarily or permanently impacted during project construction and staging activities. Impacts to these grasslands would be offset through the actions to minimize effects listed in the environmental commitments. Overall with environmental commitments in place, grassland impacts would be minor.

**Noxious Weeds**

***No Action Alternative (Continue Present Operation)*** There would be no additional consequences to noxious weeds as a result of this alternative than what already occurs**.**

***Relocate Main Channel Alternative*** As this alternative has the largest construction footprint, there is a greater opportunity for this alternative to impact or affect the spread of noxious weeds. Joe's Island has a large infestation of leafy spurge that would be compounded by construction activities. However, environmental commitments in place would offset the spread of noxious weeds.

***Rock Ramp Alternative*** This alternative has a relatively small overall footprint compared to the Relocate Main Channel Alternative. Ground disturbance associated with construction activities could provide a pathway for dispersal and establishment of invasive plants including Saltcedar, although the risk would be lower than under the Relocate Main Channel Alternative. Environmental commitments in place would offset the spread of noxious weeds during and after construction.

### *Cumulative Effects*

With implementation of actions to minimize effects, the action alternatives would minimally impact lands and vegetation. Additionally, there are no known present or future projects that would make these resources especially vulnerable to incremental effects beyond current agricultural practices. Therefore, cumulative impacts to these resources in the Yellowstone River Basin would be minimal.

### *Actions to Minimize Effects*

**General**

- The Environmental Review Team will play a role in oversight of actions to minimize effects for land and vegetation.
- Before every construction season, Reclamation and Corps will meet with the Service and the appropriate state wildlife agencies to determine a procedure to minimize impacts to lands and vegetation. A reconnaissance survey of construction easements will be conducted to identify and verify wetlands, grasslands, woodlands, and riparian areas subject to disturbance and/or destruction in the Intake Project area during construction activities. The Environmental Review Team will be consulted, as necessary, to determine appropriate avoidance and/or protection measures. If adverse impacts cannot be avoided, appropriate procedures and requirements for minimizing or mitigating effects will be discussed with the Environmental Review Team.
- Disturbance of vegetation will be minimized through construction site management (e.g., using previously disturbed areas and existing easements when feasible and designating limited equipment/materials storage yards and staging areas.) It will be limited to that which is absolutely necessary for construction of the Intake Project.
- All areas disturbed or newly created by the construction activity will be seeded with vegetation indigenous to the area for protection against subsequent erosion and noxious weed establishment.
- All equipment tracks and tires working on Joe's Island or other noxious weed infested areas will be cleaned prior to transportation to an uninfested site.
- An integrated weed plan will be developed and approved by the Environmental Review Team. It will identify best management practices to control the spread or introduction of any noxious weeds or plants. The weed plan will be implemented during and subsequent to construction.
- Erosion control measures will be employed where necessary to reduce wind and water erosion. Erosion and sediment controls will be monitored daily during construction for effectiveness and only effective techniques will be used.
- No permanent or temporary structures will be located in any floodplain, riparian area, wetland or stream that would interfere with floodwater movement, except for those described in chapter two of the Intake Final EA.

**Wetlands**

- Prior to beginning construction through Conservation Reserve Program lands or program wetlands, the Natural Resource Conservation Service, Consolidated Farm Services Agency, and respective landowners will be consulted to ensure that landowner eligibility in farm subsidy programs (if applicable) will not be jeopardized and that Sodbuster or Swampbuster requirements will not be violated by construction.
- Waste material, topsoil, equipment, debris, excavated material, or other construction related materials will not be disposed of within 50 feet of any wetland, drainage channel, irrigation ditch, stream, or other aquatic systems.
- If wetland mitigation is necessary wetland soils will be stockpiled for use when constructing new areas.
- Discharges of fill material associated with unavoidable crossings of wetlands or intermittent streams will be carried out in compliance with provisions of Sections 401 and 404 of the Clean Water Act and the nationwide and/or Intake Project-specific permit requirements of the Corps. The Natural Resource Conservation Service may evaluate isolated, non-navigable wetlands outside the jurisdiction of the Corps for jurisdiction and impacts.
- Rock quarry materials will come from sites with no potential to impact wetlands or other protected resources.
- The Environmental Review Team will play a role in oversight of actions to ensure compliance with Sections 401 and 404 of the Clean Water Act and will suggest actions to minimize effects to wetlands.

**Grasslands**

- Whenever possible, grasslands affected during Intake Project construction will be restored. Where existing native prairie cannot be re-seeded in its current location, procedures will be reviewed by the Environmental Review Team.
- Disturbed native grassland will be reseeded with native species with the seed mix being determined during final design and reviewed by the Environmental Review Team. Planted grassland will be reseeded with a seed mixture appropriate for the site and watered, if necessary, during establishment. Reseeding may require mulching in order to be successful.
- Areas requiring re-vegetation will be seeded and mulched during the first appropriate season after redistribution of topsoil. If reseeding cannot be accomplished within 10 days of topsoil replacement, erosion control measures will be implemented to limit soil loss. Local native grass species would be used (mixture to be reviewed by the Environmental Review Team).
- Grassland seeding will be completed prior to May 15, where feasible. If spring seeding is not feasible, fall seeding will be performed between August 15 and October 15 prior to ground freezing.
- To reduce erosion, water bars will be installed at specified intervals, depending upon soil type, grade, and terrain on disturbed slopes with grades of 6% or greater.
- Vegetation and soil removal will be accomplished in a manner that will prevent erosion and sedimentation.

- Noxious weeds will be controlled, as specified under state law, within the construction footprint during and following construction. Herbicides will be applied in accordance with labeled instructions and state, federal, and local regulations.
- Grass-seeding plantings will be monitored for at least three years. Where grasses do not become adequately established, areas will be reseeded with appropriate species.

**Woodlands and Riparian Areas**

- No disposal of waste material, topsoil, equipment, debris, excavated material, or other construction related materials will be done within 50 feet of any riparian area.
- Woodland and riparian areas will be avoided where practical when constructing permanent facilities.
- Whenever possible, woodland and riparian areas impacted by the Intake Project will be restored with native species. Where existing woodland and riparian areas cannot be restored in original locations, then off-site mitigation will be considered by the Environmental Review Team.
- Native trees and shrubs will be replaced with similar native species at a ratio of two trees or shrubs planted for each tree or shrub removed, when shelterbelts, riparian woodlands, or woodland vegetation cannot be avoided. Long-term success of plantings will be reviewed and approved by the Environmental Review Team.
- Weed growth in tree planting will be controlled and tree plantings will be monitored for three years. Where plantings do not adequately succeed, they will be replanted with appropriate species.
- Where practicable, replanted riparian areas will be watered to ensure survival of planted vegetation. Long-term success of plantings will be reviewed and approved by the Environmental Review Team.

### Summary

No Action Alternative (Continue Present Operation) would have the smallest impact on lands and vegetation, as relatively little would change under current operations. The construction footprint for the Relocate Main Channel Alternative is the largest, thus the impacts to this alternative are the greatest. Environmental commitments in place would minimize or offset any potential impacts. The Rock Ramp Alternative would have less impact, because the construction footprint is smaller than the Relocate Main Channel Alternative. Environmental commitments would minimize or offset any potential impacts.

# Wildlife

## Introduction

- How would the Intake Project affect wildlife including mammals, migratory birds, amphibians, and reptiles currently living in the Intake Project area?

Whitetail Deer

This section addresses the effects of alternatives on wildlife other than special status species (federally-listed species and state species of special concern). Most wildlife concerns can be addressed by considering the effects of the Intake Project on wildlife habitat, as represented by lands and vegetation discussed previously.

Many species use woody plants directly as nest sites or cover (e.g. raptors and squirrels), and others use some woody plants as food. Other species, such as waterfowl, nest in emergent marsh plants and other suitable sites. Riparian vegetation and grasslands provide cover for mammals and birds. Amphibians and reptiles use terrestrial and aquatic habitats in and adjacent to the Yellowstone River.

## Methods

The analysis of impacts on wildlife species considered changes in wildlife habitat represented by wetlands, woodlands, riparian areas, and grasslands. Impacts to wildlife essentially are limited to short-term or temporary disturbances and loss of habitat from construction of project features.

Potential impacts to wildlife habitat on wetlands, woodlands, riparian areas, and grasslands are discussed in the Lands and Vegetation section of this chapter by alternative. Most wildlife populations are resilient and able to adapt to cycles of habitat abundance. Impacts to the groups most likely impacted, mammals, migratory birds, amphibians, and reptiles are discussed. However, a few species with small populations could experience impacts from temporary disturbances and loss of habitat. These species are evaluated in the Federally-Listed Species and State Species of Special Concern section.

## Results

### *Short-Term and Long-Term Effects of the Alternatives*

**No Action Alternative (Continue Present Operation)**

***Mammals*** There would be no additional impacts on mammals than under current operations.

***Birds*** There would be no additional impacts on birds than under current operations.

***Amphibian and Reptiles*** There would be no additional impacts on amphibians and reptiles than under current operations.

**Relocate Main Channel Alternative**

***Mammals*** Much of the area proposed for construction (including staging and stockpile areas) of the new headworks and screens, bank stabilization, tie-back levees, canal extension and relocated channel is minimally disturbed. Access to Joe's Island is very limited. Current activities on the island include light recreation, like hunting, camping, and fishing. Travel to the island is along a 20 mile gravel road. Construction activities would have temporary (e.g., noise) and permanent (habitat conversion) effects on wildlife species and their habitats in the immediate vicinity of the construction area. Human activity and noise emitted from equipment and machinery would disturb some species that are sensitive to this type of activity. Those animals would move to other areas.

The excavated new channel would impact approximately 403 acres of mixed habitats, including wetlands, riparian areas, woodlands and grasslands. However, filling existing habitat would gain 222 acres that would be used to offset losses from the excavation of the new channel. Environmental commitments, including those listed under the lands and vegetation section, would offset any temporary or permanent impacts. Any affected animals would be expected to return to mitigated acres or areas minimally disturbed by construction. Overall impacts on mammals would not be significant after implementation of environmental commitments.

***Birds*** The excavated new channel would convert approximately 403 acres of primarily riparian woodlands and grasslands on Joe's Island to riverine aquatic habitat. Most of the woodlands are relatively sparse with an open canopy and mixed herbaceous and shrubby understory. The areas identified for stockpiling construction materials are primarily grassland habitat.

Filling part of the existing main channel would create 222 acres of riparian and terrestrial habitat. Trees, shrubs, and native grasses would be planted on this and other disturbed areas to offset habitat losses from excavation of the new channel. Given the actions to minimize effects and the relative abundance of riparian forest habitat along the lower Yellowstone River, adverse effects on breeding and migratory birds would be relatively minor. There would, however, be a lag time between planting of trees and shrubs and establishment of mature habitat. With similar habitat adjacent to the proposed project area, this impact would not be significant.

***Amphibians and Reptiles*** Impacts to amphibians and reptiles would be similar to those described above for mammals.

Construction activity in the existing river and adjacent bank would affect amphibian and reptiles but these species are mobile enough to move out of construction areas. However, turtle eggs are not mobile and could be the exception. Turtle densities below Intake Diversion are relatively sparse, with turtles per trap night rate of 0.001 (Dood et al. 2009). When nesting, turtles need soft banks for their burrows. If banks proposed for construction activity are used for nesting, then construction would impact turtles.

Environmental commitments including those listed under the natural resources section would offset any temporary or permanent impacts. Any potential disturbed or displaced animals would be expected to return to mitigation sites and other areas minimally disturbed during construction. Overall impacts on amphibian and reptiles would be minor after implementation of environmental commitments.

### Rock Ramp Alternative

***Mammals*** Much of the area proposed for construction (including staging and stockpile areas) of the new headworks and screens is previously disturbed. Construction activities for all project features would have a temporary effect on wildlife species located in the immediate vicinity of the construction area. Human activity and noise emitted from equipment and machinery would disturb some species that are sensitive to this type of activity causing animals to move to other areas. A limited amount of trees, shrubs, and vegetative cover would be eliminated at some sites and only during construction. Environmental commitments including those listed under the natural resources section would offset any temporary or permanent impacts. Overall impacts on mammals would be negligible.

***Birds*** The rock ramp would be constructed in the main channel of the river, and would have little or no effect on avian breeding or migratory habitat. Examination of aerial photographs did not reveal the presence of any sandbars within the footprint of the proposed rock ramp that would typically be exposed during the breeding season.

Much of the area proposed for construction (including staging and stockpile areas) of the new headworks and screens has been previously disturbed. Adverse effects on trees, shrubs, and native grasslands would be minimal. Construction activity would displace birds that are sensitive to disturbance. Staging and stockpile areas would be revegetated after construction, reestablishing any bird habitats on these areas that were lost during construction. Overall impacts to birds would not be significant.

***Amphibians and Reptiles*** Much of the area proposed for construction (including staging and stockpile areas) of the new headworks and screens is previously disturbed area. Construction activities for all project features would have a temporary effect on amphibians and reptile species located in the immediate vicinity of the construction area, similar to the impacts described for the other action alternative. Environmental commitments would be implemented to offset any temporary or permanent impacts. Overall impacts to amphibian and reptiles would be minor.

#### *Cumulative Effects*

Impacts to wildlife from the action alternatives would be relatively minor and temporary. There are no known or reasonably foreseeable actions that would elevate these minor Intake Project impacts to be of greater magnitude.

***Actions to Minimize Effects***

**Mammals and Migratory Birds**

- Before each construction season, the Environmental Review Team will meet with FWP to determine procedures for avoiding and minimizing impacts to nesting or migrating birds.
- Areas potentially hazardous to wildlife will be adequately protected (e.g., fenced, netted) to prevent access to wildlife.
- To protect wildlife and their habitats, Intake Project-related travel will be restricted to existing roads and Intake Project easements. No off-road travel will be allowed, except when approved through the Environmental Review Team.
- Wildlife-proof fencing will be used on reclaimed areas, if it is determined that wildlife species and/or livestock are impeding successful vegetation establishment.

**Amphibian and Reptiles**

- 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 mitigation measures approved by the Environmental Review Team will be implemented.

## Summary

With actions to minimize effects, the impacts to wildlife, including mammals, amphibians, reptiles and migratory birds, would be minor and temporary for all alternatives. The No Action Alternative (Continue Present Operation) would cause the least consequence to wildlife habitats. Based upon the total construction footprint, the Relocate Main Channel Alternative would have the most impacts (over 680 acres). The Rock Ramp Alternative would have a smaller amount of impacts (28 acres), as compared to the other action alternative. The No Action Alternative would have the least impacts to wildlife, but would not meet the purpose and need for the Intake Project.

# Historic Properties

## Introduction

- Would the Intake Project affect historic properties (significant cultural resources)?

**Headworks Gate Tender's Residence**

Section 106 of the NHPA requires that federal agencies consider the effects of federal undertakings on historic properties. Historic properties are significant cultural resources; including sites, buildings, structures, objects, or districts, or properties of traditional religious and cultural importance to Native Americans; that are either included in or have been determined eligible for inclusion in the National Register of Historic Places. Only historic properties are protected by the NHPA and are evaluated in this section.

To evaluate the effects of a proposed undertaking on historic properties, federal agencies are required to consult with the appropriate State Historic Preservation Officer, any tribe, or Tribal Historic Preservation Officer with a historic interest in the Intake Project's undertaking area of potential effects, and the interested public. Environmental documents prepared in compliance with the NEPA can be used to examine and address these effects and as the basis for consultation. Consultation documents for this federal undertaking are in appendix G.

## Methods

Until consultation is concluded, the actual effects of the proposed Intake Project under Section 106 of the NHPA are undetermined. At this point consultation is in progress, so the discussion in this section is based upon the best available information that compares alternatives to each other and to the No Action Alternative (Continue Present Operation) and assesses effects under NEPA and unofficially under NHPA. It should be noted that an "adverse effect" that cannot be mitigated to "not adverse" under NHPA, can be mitigated to insignificance under NEPA. That is because of a difference in the laws.

This section also includes environmental measures to ensure that compliance with the NHPA would be completed prior to any earth disturbance. For instance, if the Rock Ramp Alternative is selected for construction, rock would be acquired by the construction contractor from a commercial quarry in Montana. An environmental commitment would ensure that NHPA Section 106 consultation on the rock source would be completed prior to acquisition of rock.

As explained in the Historic Properties Section of chapter three and listed in table 3.21, 15 cultural resources have been recorded within or near the area of potential effects of the proposed Intake Project, but only 7 have been determined to be historic properties protected under NHPA. The effects of the proposed federal undertaking on those 7 historic properties are discussed in this section.

To estimate direct effects, locations of the historic properties recorded by Kordecki et al. (1999) were plotted on a GIS layer, which was overlain with impact corridors for all three alternatives. In addition, direct impact areas outside of the Kordecki et al. (1999) survey but inside the area of potential effects were intensively inventoried and previously recorded sites were revisited and site forms updated (Snortland 2009). Table 4.17 lists the historic properties located within the area of potential effects of each of the alternatives.

## Results

### *Short-Term and Long-Term Effects of the Alternatives*

Before an action alternative is constructed, Reclamation would complete consultation with the Montana State Historic Preservation Officer and other interested parties, as appropriate, to assess the effects of the proposed Intake Project on the identified historic properties and resolve potential adverse effects under Section 106 of the National Historic Preservation Act. Analysis indicates that all of the alternatives, including No Action (Continue Present Operation), would likely have an adverse effect(s) to historic properties.

Avoidance is the preferred method of mitigating any adverse effects, as it would preserve the historic properties. However, should avoidance not be possible, actions to minimize effects would be developed in consultation with the Montana State Historic Preservation Officer, as appropriate. All of the properties that would be affected by action alternatives are historic structures or buildings associated with the Lower Yellowstone Irrigation Project. Table 4.17 compares the impacts of the alternatives on historic properties.

**No Action Alternative (Continue Present Operation)** This alternative would have the fewest impacts to historic properties, except that neglect of the Headworks Gate Tender Residence and outbuildings (24DW447) would be considered an adverse effect under the NHPA. In addition, continued removal of rocks from the historic Lower Yellowstone Quarry (24DW296) to use in O&M of the Intake Diversion Dam is an ongoing adverse effect.

**Table 4.17 – Comparison of Effects of the Alternatives on Historic Properties.**

| Historic Property | No Action Alternative | Relocate Main Channel Alternative | Rock Ramp Alternative |
|---|---|---|---|
| Headworks and Main Canal (24DW287) | Regular maintenance would continue using traditional methods and materials. | The historic headworks would remain in place but the slide gates would be left open.<br><br>The historic main canal would not be modified or disturbed but would be extended upstream 7,400 feet. | The main canal inlet channel behind the headworks would be filled in, but the historic headworks would be preserved in place.<br><br>The vast majority of the historic main canal would be undisturbed and would continue its historic function, although it would be extended slightly to the southwest to hook up to the new headworks.<br><br>The new headworks would be built adjacent to the west edge of the historic headworks. |
| Lower Yellowstone Quarry (24DW296) | Rocks would continue to be quarried adversely affecting this historic property. | No impact | No impact |
| Late Plains Archaic Campsite (24DW430) | County road maintenance is continuing to damage the historic property under existing conditions. No additional impact. | County road maintenance is continuing to damage the historic property under existing conditions. No additional impact. | County road maintenance is continuing to damage the historic property under existing conditions. No additional impact. |
| Middle Plains Archaic Campsite (24DW434) | No impact | No impact | No impact |
| Old Cameron and Brailey Sub-Camp (24DW298) | No impact | No Impact | A rock unload area beside the railroad is adjacent to the historic property but outside of its boundaries.<br><br>A rock stockpiling area would be relocated to avoid direct impacts to the historic property. |

| Historic Property | No Action Alternative | Relocate Main Channel Alternative | Rock Ramp Alternative |
|---|---|---|---|
| Intake Diversion Dam (24DW443) | Regular maintenance would continue using historic methods. Rocks displaced by flooding and ice would be continue to be replaced by depositing locally quarried rocks on the crest of the dam using an historic tower and overhead cable system. | The existing Intake Diversion Dam would be buried in place and preserved.<br><br>The north tower and cable system would be preserved in place.<br><br>The south tower of the cableway, power plant, and engineer's house on Joe's Island are within the construction zone and would be moved offsite.<br><br>A dike running southwest across Joe's Island from the south side of the dam is also in the construction zone and would be damaged or removed. | The existing Intake Diversion Dam would be preserved in place, although a small section might be removed to facilitate flows into the main canal.<br><br>A new concrete weir would be built upstream from the existing dam. Some rocks might be removed from the top of the existing dam, but historically rocks have been pushed periodically downstream by floodwaters and ice and have been replaced.<br><br>The north tower and cable system would be preserved in place, if possible. The south tower of the cableway, power plant, and engineer's house on Joe's Island are within the construction zone and would be moved offsite.<br><br>A historic dike running southwest across Joe's Island from the south side of the dam is also in the construction zone and would be damaged or removed. |
| Headworks Camp/Gate Tender Residence (24DW447) | The historic property would be undisturbed, although the three original buildings are neglected and deteriorating.<br><br>Historic archaeological features would be preserved in place. | The property would be undisturbed, although the three original buildings are neglected and deteriorating.<br><br>Historic archaeological features would be preserved in place and would be avoided by a haul road. | The house, garage, and outhouse would be relocated to nearby property and preserved.<br><br>Historic archaeological features in the Headworks Camp would be destroyed by extension of the main canal and construction of the new headworks. |

**Relocate Main Channel Alternative**
Of the two action alternatives, this alternative would have fewer impacts to historic properties. Most potential effects to historic properties would be avoided, although neglect of the Headworks Gate Tender Residence and outbuildings (24DW447), an adverse effect under NHPA, would continue.

**Historic buildings on Joe's Island (24DW443)**

There would be impacts to Intake Diversion Dam (24DW443), and an associated dike and three buildings on Joe's Island. The dam could be preserved by being buried in place, but the historic dike would be damaged in the construction staging area on Joe's Island. The three buildings could be moved out of the staging area to protect them, but moving historic buildings would be considered an adverse effect under the NHPA.

**Rock Ramp Alternative** The main canal (24DW287) would be minimally affected by filling in a relatively small portion of the 71.6 mile-long canal. The historic headworks would be preserved in place beside the new headworks.

The Intake Diversion Dam (24DW443) and an associated dike and three buildings on Joe's Island would also be impacted. Except for minimal modification, the dam would be preserved in place and buried underneath the new rock ramp. Part of an historic dike would be damaged in the construction staging area on Joe's Island. The three buildings associated with the dam could be moved out of the staging area to protect them, but this would be an adverse effect under the NHPA.

The Headworks Camp and Gate Tender Residence (24DW447) are in an area that would be excavated to extend the main canal upstream and build the new headworks The house, garage, and outhouse could be relocated to nearby property and preserved. Historic archaeological features in the Headworks Camp would be destroyed by excavation of the main canal through the site and construction of the new headworks, although archaeological mitigation could preserve data and artifacts. Other actions to minimize effects are also possible.

Impacts to the Old Cameron and Brailey Sub-Camp (24DW298) could be avoided by fencing the historic property and monitoring construction activities in the area. The two prehistoric archaeological sites can be avoided during construction activities.

***Cumulative Effects***
No other projects within the area of potential effects have been identified that would affect historic properties.

### *Actions to Minimize Effects*

Reclamation is presently consulting with the Montana State Historic Preservation Officer and other interested parties, as appropriate, regarding a memorandum of agreement and data recovery plan. The Advisory Council on Historic Preservation is being notified of an adverse effects determination under the NHPA.

Reclamation proposes to implement the following actions to offset any adverse effects to historic properties:

- Engineering drawings and photographs of affected buildings and structures, if available, will be filed with the State Historic Preservation Office and the National Archives.
- If engineering drawings and photographs are not available, the buildings and structures will be recorded in accordance with the Historic American Buildings Survey and the Historic American Engineering Record, as appropriate.
- If practicable, historic buildings or structures that must be moved for construction will be returned to their original locations after construction of the Intake Project is completed. If that is not feasible, Reclamation will seek a party willing and able to adopt the historic structure or building with appropriate preservation covenants.
- Reclamation will develop and implement a data recovery plan in consultation with the Montana State Historic Preservation Officer, Advisory Council on Historic Preservation, and other interested parties, as appropriate, for mitigation of the Headworks Camp (24DW447).
- One or more signs will be installed at or near the Intake FAS to summarize the history of the Lower Yellowstone Irrigation Project.
- A fence will be installed around the Old Cameron and Brailey Sub-Camp (24DW298) to protect it from disturbance by unloading and storage of rock or other construction activities.
- All construction activities will avoid using the road through the late plains archaic campsite (24DW430).
- All gravel, fill, and rock materials will be obtained from a source approved by Reclamation to ensure compliance with Section 106 of the NHPA.
- Reclamation will continue consultation with the Montana State Historic Preservation Office on the preparation of a formal memorandum of agreement stipulating the mitigation and treatment plan.

## Summary

All alternatives could be considered to have potential adverse effects to historic properties under the NHPA. Under NEPA the actions to minimize effects listed above would offset any significant adverse effects and make the impacts insignificant. Of the two action alternatives, the Relocate Main Channel would affect fewer properties than the Rock Ramp. The Montana State Historic Preservation Officer and other interested parties, as appropriate, would be consulted to complete a determination of effects and to identify appropriate actions to minimize effects. These actions to minimize effects would be carried out prior to initiating construction of the Intake Project to offset any adverse impacts.

## Indian Trust Assets

### Introduction

- Would the Intake Intake Project affect Indian trust assets?

Reclamation is required to consult with affected or involved tribes regarding impacts from Reclamation's activities on Indian trust assets. Indian trust assets are defined as legal interests in property held in trust by the United States for Indian tribes or individuals, or property that the United States is otherwise charged by law to protect. The United States has a trust responsibility to protect and maintain rights reserved by or granted to American Indians or Indian individuals by treaties, statutes and executive orders. These rights are sometimes further interpreted through court decisions and regulations.

This trust responsibility requires that all federal agencies take all actions reasonably necessary to protect this trust. As a federal agency, Reclamation would carry out its activities in a manner that protects these assets and avoids adverse impact when possible. When impacts to such assets cannot be avoided, Reclamation would provide appropriate actions to minimize effects or compensation. Assets can be real property, physical assets, or intangible property rights. Examples of trust assets include lands, minerals, hunting, fishing and gathering rights, and water rights.

### Methods

The methods used to identify Indian trust assets were explained in chapter three, Indian Trust Assets section and Appendix H. Because none were identified, no impact analyses were conducted.

### Results

None of the proposed alternatives would have an effect on any Indian trust assets. Mitigation for adverse impacts is not required.

#### *Cumulative Effects*

None were identified.

#### *Actions to Minimize Effects*

- Reclamation will continue to consult with the Bureau of Indian Affairs and tribes to identify potential Indian trust assets and any adverse effects to them.

### Summary

None of the proposed alternatives would affect Indian trust assets.

# Chapter Five *Consultation and Coordination*

This chapter describes public involvement activities, agency consultation and coordination, and acknowledges the people who have been involved with this NEPA process.


**Reclamation and Corps Staff at NEPA Public Meeting in Billings, Montana**

## Public Involvement Program

Scoping is an important part of the NEPA process. It serves as the public's opportunity to provide input and direction to the Intake EA throughout its preparation. In 2008, Reclamation and the Corps began a public involvement program to provide the public, organizations, and government agencies a variety ways to learn about and participate in the Intake Project. Reclamation and the Corps developed a public involvement strategy that included:

- Publishing a Notice of Intent in the *Federal Register*
- Holding three formal public scoping meetings
- Meeting with state and federal agencies
- Mailing scoping information to agencies, public, and tribes
- Forming a cooperating agency team
- Issuing news releases
- Posting information on the Montana Area Office Reclamation website
- Publishing and distributing a newsletter and *Public Scoping Summary Report, Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Environmental Impact Statement* (Reclamation and Corps 2009)

### Scoping Notice

A scoping notice was prepared to distribute information on the proposed Intake Project and offer an opportunity for the public to provide input and direction on the Intake NEPA process. The notice was published in the September 12, 2008, *Federal Register* Volume 73, Number 178:52964-52966.

## Public Scoping Meetings

The intent of the public scoping meetings was to inform people about the Intake Project and to collectively identify key issues. In addition to the *Federal Register* notice, news releases were made available to local media announcing a series of public meetings. The locations and dates for these meetings were:

- Sidney, Montana
  October 21, 2008
- Glendive, Montana
  October 22, 2008
- Billings, Montana
  October 23, 2008

**Audience participating in public scoping meeting at Glendive, Montana**

A public field trip to the Intake Diversion Dam was held on October 22, 2008. Although the initial scoping period was originally scheduled to end on November 14, 2008, it was extended to December 15, 2008, in response to requests for additional time for comments.

During public scoping a total of 46 letters and e-mails were received in addition to the oral comments presented at three public scoping meetings. All comments were carefully considered by the interdisciplinary team. A total of 222 comments were identified and grouped into 18 issue categories. All comments were reviewed and compiled in the *Public Scoping Summary Report, Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Environmental Impact Statement* (Reclamation and Corps 2009).

## Website

A website (http://www.usbr.gov/gp/mtao/loweryellowstone) was established to post information about the Intake Project and give the public opportunities to ask questions, submit comments, and be added to the mailing list.

## Newsletter

One newsletter was distributed during the NEPA process to more than 900 entities on the Intake Project mailing list. This newsletter, published in February 2009, summarized background and information on the NEPA process and the alternatives being evaluated in the EA. The issues of fish passage and fish entrainment were explained, as well as the ESA. The outcome of the public scoping process, key issues, and alternatives being evaluated in the EA were also discussed.

## Public Meetings on the Draft EA

On February 12, 2010, Reclamation and the Corps released the Intake Draft EA for public review and comment. The public was encouraged to provide written comment and/or participate in the public meetings hosted by the joint lead agencies. Public meetings were held in Glendive and Sidney, Montana on February 24 and 25, 2010. During the public meetings information about the proposed project was presented and members of the public were encouraged to provide comment. Comments from the meetings were recorded and posted on Reclamation's website following the meetings, along with the nine comment letters received. The public comment period closed on March 16, 2010. All comments were carefully considered, and substantive comments are addressed in appendix N. Where appropriate, additional information was included in the Final Intake EA.

## Cooperating Agency Team

Reclamation and the Corps established a Cooperating Agency Team to facilitate communication among state and federal agencies. The team met frequently and exchanged information throughout the NEPA process. Cooperating agencies provided information based upon their special expertise or jurisdiction related to the Intake Project, assisted with analyses, and reviewed draft documents and analyses. The following organizations participated as cooperating agencies:

- Montana FWP
- Montana DEQ
- Montana Department of Natural Resources and Conservation
- Lower Yellowstone Irrigation Project
- Service

In addition to these agencies, the EPA, Natural Resource Conservation District, The Nature Conservancy, and the USGS provided input during cooperating agency meetings (table 5.1).

## Biological Review Team

In 2006, the Service created a BRT of fisheries biologists and engineers with expertise in fish passage and pallid sturgeon to review preliminary alternatives. This team consisted of the following:

- George Jordan, Service
- Aaron Delonay, USGS
- Pat Braatten, USGS
- Brent Mefford, Reclamation
- Matt Jaeger, FWP

## Missouri River Recovery Implementation Committee

The Missouri River Recovery Implementation Committee (MRRIC), authorized by Congress in Section 5018 of the 2007 Water Resources Development Act, offers guidance to the Corps with respect to the Missouri River Recovery and Mitigation Plan. MRRIC includes representatives from federal agencies, tribes, states, local governments and non-governmental stakeholders in the Missouri River basin. MRRIC also provides guidance to the Corps and any affected federal agency, state agency, or Indian tribe on an ongoing study of the Missouri River and its tributaries. The study is known as the Missouri River Ecosystem Recovery Plan.

MRRIC invited the Corps and Reclamation to summarize the proposed Intake Diversion Dam Modification, Lower Yellowstone Project at its July 2009 meeting. As a result of that presentation, MRRIC sent the agencies a series of questions about the project, which Reclamation and the Corps answered (see appendix L). A few members of MRRIC also requested an independent science review (see appendix M).

The Corps and Reclamation agreed to convene a panel of sturgeon species experts to review Reclamation's and the Corps' responses to MRRIC questions and to determine whether such responses are supported by the best available scientific information (appendix M). The panel's final report states "The panel concluded that additional analysis or research might marginally reduce uncertainties regarding the probability of success but is not likely to lead to fundamentally different conclusions. The true test and quantification of project benefits can only be made by project implementation and subsequent monitoring of the response. This action clearly represents a reasonably realistic alternative for restoration of natural recruitment for this distinct and evolutionarily significant population of pallid sturgeon."

## Meetings

Staff representing the joint-lead agencies met with staff from other state and federal agencies to gather information on resources, discuss potential impacts on the environment, and clarify procedures for compliance with laws, regulations, and policies. The purpose of these meetings, agencies involved, and meeting dates and locations are listed below in table 5.1.

**Table 5.1 – Resource Meeting Topic, Participants, Dates, and Locations.**

| Topic | Participants | Date | Location or Method |
|---|---|---|---|
| EA process and team formation | Cooperating Agency Team | 9/24/2008 | Meeting – Billings, MT |
| ESA issues | FWP, Service, Reclamation, Corps | 10/22/2008 | Meeting – Intake, MT |
| Defining No Action | Reclamation and Service | 12/10/2008 | Billings MT |
| Success criteria related to comparing alternatives for incremental cost analysis. | FWP, Service, Reclamation, Corps | 12/18/2008 | Conference call |
| Larval drift | FWP, Service, Reclamation, Corps, Upper Basin Pallid Sturgeon Workgroup | 12/19/2008 | Conference call |
| Alternatives and public scoping results | Cooperating Agency Team | 1/29/09 | Meeting - Billings, MT |
| Pallid sturgeon | Service's Biological Review Team, Corps, Reclamation | 2/17-18/2009 | Meeting Billings, MT |

| Topic | Participants | Date | Location or Method |
|---|---|---|---|
| ESA compliance and alternatives | Lower Yellowstone Irrigation District No 1 and 2, Savage Irrigation District, and Intake Irrigation District Water Users, Sidney Area Public | 2/12/2009 | Districts' Annual Meeting Sidney, MT |
| Alternatives | Natural Resources Conservation Service (District Conservationists, Engineers, Region and State Employees) | 2/19/2009 | Meeting Billings, MT |
| Draft EA chapters | Cooperating Agency Team | 5/11/2009 | Meeting – Billings, MT |
| NEPA and Section 404 of the Clean Water Act | EPA, Corps, Reclamation, Service | 5/19/2009 | Meeting – Denver, CO |

## Endangered Species Act Consultation

Federal agencies are required to consult with the Service under Section 7 of the ESA when federally-listed species may be affected by an agency action. In 1992 the Service initiated discussions with Reclamation regarding Reclamation's obligation to address fish passage and entrainment issues at Intake Diversion Dam. Over the years these discussions continued in order to identify the best way to resolve these issues and avoid jeopardizing the continued existence of federally-listed species. A detailed discussion of the consultation history, including associated research, is in the BA in Appendix D.

As a result of these discussions, studies and evaluations were conducted at Intake. These studies and other pallid sturgeon research revealed the importance of the Yellowstone River to pallid sturgeon recovery. Concurrently, the Corps was consulting with the Service on the operations of their main-stem dams and reservoirs on the Missouri River. At the conclusion of the Missouri River ESA consultation, the Service recommended that the Corps work with Reclamation to resolve pallid sturgeon issues at Intake Diversion Dam. A value engineering study (Reclamation 2002) was the first product of this collaboration amongst Reclamation, the Corps, and the Service.

Subsequently, in 2005 the Corps, Service, Reclamation, FWP, and The Nature Conservancy signed a MOU agreeing to work together to resolve the passage and entrainment issues at Intake. By 2006, preliminary designs for passage and entrainment were being considered, in addition to continuing research on fish passage and entrainment issues specific to pallid sturgeon.

In 2007, the Water Resources Development Act was passed. It authorized the Corps to use funding from the Missouri River Recovery and Mitigation Program to assist Reclamation with compliance with federal laws and to design and construct modifications to the Lower

Yellowstone Project for the purpose of Yellowstone River ecosystem restoration. By 2008, alternatives to resolve the fish passage and entrainment issues were identified, and the joint-lead agencies were ready to initiate the NEPA process, which began in September 2008.

During the preparation of the EA, Reclamation continued consultation with the Service and jointly determined that this EA would contain a Section 7 BA for construction of the Intake Project. The BA and letter of concurrence from the Service are included in appendix D. It was also agreed that a concurrent formal consultation process would continue on the operation of the Lower Yellowstone Project, including the proposed fish passage and entrainment structures, which would be evaluated in a separate BA. This second consultation would be completed prior to completion of construction of the new Intake Project.

After Reclamation completes this EA evaluating construction of the Intake Project and a second BA on operation of that Intake Project, the Service will prepare a Biological Opinion on operation of the new fish passage and screens. It will include an incidental take statement for any pallid sturgeon larvae and/or eggs that might be entrained even with screens installed in the new headworks.

## Coordination and Compliance with Other Applicable Laws, Regulations, and Policies

Analysis and implementation of the Intake Project requires consistency, coordination, and compliance with multiple federal and state laws, regulations, executive orders, and policies. The following have known application to the Intake Project.

### Native American Consultation

Consultation with tribes is documented in Appendix H.

### Archaeological Resource Protection Act of 1979

This Act protects archaeological resources on federal and tribal lands and requires a permit to remove archaeological resources from these lands. Permits may be issued to educational or scientific institutions only if the removal would increase knowledge about archaeological resources. Compliance with this law would be accomplished through specific environmental commitments for all of the action alternatives (see Historic Properties section).

### Clean Water Act of 1977 (as amended)

The Clean Water Act is the principal law governing pollution control and water quality of navigable waterways of the United States. Section 402 of the Act establishes a National Pollution Discharge Elimination System permitting program to regulate the point source discharge of pollutants into waters of the United States. Both Montana and North Dakota administer state-level programs pursuant to authority delegated by the EPA.

Section 404, administered by the Corps with oversight from EPA, is another permitting program that regulates activities of the placement of dredged or fill materials into waters of the United States. The Corps issues nationwide permits on a state, regional, or nationwide basis for similar activities that cause only minimal adverse environmental effects both individually and cumulatively. Individual permits may also be issued for specific activities on specific water bodies under Section 404. If the Corps determines that an individual Section 404 permit is required for the Intake Project, a Montana State Water Quality Certification Permit (Section 401) would also be required. The Corps will complete the 404(b)1 guidelines analysis for the Intake Project (see Appendix B).

Section 401, administered by the Montana DEQ, allows states to review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state waters, including wetlands. States make their decisions to deny, certify, or condition permits or licenses primarily by ensuring the activity will comply with state water quality standards. In addition, states look at whether the activity will violate effluent limitations, new source performance standards, toxic pollutants, and other water resource requirements of state law or regulation. The Section 401 review allows for better consideration of state-specific concerns. A 401 Water Quality Certification would be obtained from Montana DEQ, if appropriate.

### Farmland Protection Policy Act of 1995

The purpose of this Act is to ensure that impacts to prime or unique farmlands are considered in federal projects. It requires federal agencies to consider alternative actions that could lessen impacts and to ensure that their actions are compatible with state, local government, and private programs to protect prime and unique farmland. The Natural Resources Conservation Service is responsible for administering this Act. Farmlands were considered in the Intake Project analysis using the key indicators of changes in farm acreage and production. Prime and unique farmlands would be protected to the extent possible during implementation of the Intake Project consistent with the Act (see chapter four, Lower Yellowstone Irrigation Project section).

### Fish and Wildlife Coordination Act of 1958 (as amended)

The Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) provides a procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into federal projects and federally permitted or licensed water resource development projects. Agencies that construct, permit, or license projects impacting a water body must consult with the Service and the state agency having jurisdiction over fish and wildlife resources, FWP. Full consideration must be given to the recommendations made through this consultation process.

Section 2 states that fish and wildlife conservation shall receive equal consideration with other project purposes and will be coordinated with other features of water resource development projects. The FWCA specifically authorizes the Secretary of the Interior to prepare a report and recommendations on the fish and wildlife aspects of projects, including mitigation. The FWCA report provides input to preparation of draft environmental impact statements.

Reclamation normally appends FWCA reports to NEPA documents. However, both the Service and FWP are participating cooperating agencies and have been working closely with the Corps and Reclamation to initiate and implement studies, surveys, gather and analyze data and contribute to reports since 1994. This continuous input into the decision making process reduces the need for a technical 2(b) FWCA report to prevent or reduce the adverse impacts to fish and wildlife. Therefore, there will be no FWCA report issued. The final NEPA documents will provide preventive measures to avoid impacts and mitigation to offset impacts that are unavoidable. Consultation with the Service under Section 7(a)(2) of the ESA will also provide conservation measures to avoid and minimize adverse impacts.

### Migratory Bird Treaty Act and Executive Order 13186 (January 2001)

Under the provisions of this Act it is unlawful "by any means or manner to pursue, hunt, take, capture [or] kill" any migratory birds except as permitted by regulations issued by the Service. Migratory birds include all native birds in the United States with the exception of non-migratory species managed by states. The Service has defined "take" to mean "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture or collect" any migratory bird or any part, nest, or egg of any migratory bird (50 *Code of Federal Regulations* Section 10.12). Project level compliance with this law would be accomplished through specific environmental commitments for all of the action alternatives (see chapter four Wildlife section).

### Native American Graves Protection and Repatriation Act (Public Law 101-601)

This Act establishes federal policy with respect to Native American burials and graves located on federal or tribal lands. Federal agencies are required to consult with and obtain the concurrence of the appropriate tribes with respect to activities that may result in the disturbance and/or removal of burials and graves from federal lands or lands held in trust for a tribe. To ensure compliance with the Act, Reclamation would consult with the tribes if any unanticipated discoveries are made during the construction phase of the Intake Project. Project level compliance with this law would be accomplished through specific environmental commitments for all of the action alternatives (see chapter four Historic Properties section).

### National Historic Preservation Act of 1966 (as amended in 2006)

The Act establishes protection of historic properties as federal policy in cooperation with states, tribes, local governments, and the public. Historic properties are those buildings, structures, sites, objects, and districts, or properties of traditional religious and cultural importance to Native Americans, determined to be eligible for inclusion in the National Register of Historic Places. Section 106 of the Act requires federal agencies to consider the effects of proposed actions on historic properties and gives the Advisory Council on Historic Preservation an opportunity to comment. Reclamation is responsible for consultation with the State Historic Preservation Officer and/or Tribal Historic Preservation Offices, tribes, applicants, interested parties, and local governments regarding federal undertakings. Compliance with this law would be accomplished through specific environmental commitments for all of the action alternatives (see chapter four Historic Properties section and Appendix G).

### Rivers and Harbors Appropriation Act of 1899

Under Section 10 of the Act, the construction of any structure in or over any navigable water of the United States, the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. This Intake Project would be implemented with design measures deemed compatible with the Act. However, Intake Project design features requiring recommendation and approval would be reviewed by the Corps for permitting consideration in compliance with the Act.

### Executive Order 13112 for Invasive Species

In 1999, an executive order was issued to prevent the introduction of invasive species and to provide for their control. It directs federal agencies to identify applicable actions and to use programs and authorities to minimize the economic, ecological, and human health impacts caused by invasive species. To meet the intent of this order, the Intake Project includes environmental commitments to prevent and control the spread of invasive species (see chapter four Aquatic Communities and Lands and Vegetation sections).

### Other Executive Orders

Executive Order 11988 (Floodplain Management) requires federal agencies to avoid developments on floodplains whenever possible or to minimize potential harm to the floodplains. Executive Order 11990 (Protection of Wetlands) directs federal agencies to avoid destruction, loss, or degradation of wetlands. Executive Order 13007 (Indian Sacred Sites) orders federal agencies to accommodate Indian tribes' requirements for access to and ceremonial use of sacred sites on public lands and to avoid damaging the physical integrity of such sites. Executive Order 12898 (Environmental Justice) directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Compliance with these orders was considered in the development of action alternatives in this EA (see chapter four Lands and Vegetation, Historic Properties, and Environmental Justice sections).

### State Water Rights

Montana waters belong to the state, with ownership on behalf of all state citizens. Because water belongs to the state, water rights holders do not own the water; they have a right to use the water within state guidelines. Water rights in Montana are guided by the prior appropriation doctrine, or first in time, first in right. A person's right to use a specific quantity of water depends on when the use first began. The first person to use water from a specific source established the first right, the second established a right to the remaining water and so on. Water rights holders are limited to the amount of water that can be beneficially used. Beneficial uses of water include agricultural purposes, domestic, fish and wildlife, industrial, mining, municipal, power, and recreational uses.

> **Adjudication** is a judicial decision that determines the quantity and priority date of all existing water rights in a basin.

The Montana Water Use Act passed July 1, 1973, changed water rights administration by requiring a statewide adjudication process on all water right claims existing at that time. It also established a permit system for obtaining water rights for new or additional water developments, created an authorization system for changing water rights and a centralized records system, and provided a system to reserve water for future consumptive uses and maintain minimum instream flows for water quality and fish and wildlife. Senate Bill 76 and House Bill 22 further defined the adjudication process and established a funding mechanism to complete statewide adjudication in 2015.

The Lower Yellowstone Irrigation District #1, Intake Irrigation District, Savage Irrigation District, and Reclamation hold the following unadjudicated water rights in the State of Montana totaling 1,374 cfs:

- 1000 cfs Statement of Claim
- 300 cfs Statement of Claim
- 18 cfs Statement of Claim
- 42 cfs Statement of Claim
- 14 cfs Provisional Permit (Savage Irrigation District)

### Montana Environmental Policy Act

State agencies on the Cooperating Agency Team provided input for compliance with the Montana Environmental Policy Act (MEPA). MEPA was passed in 1971 instituting a policy requiring state agencies to consider the environmental, social, cultural and economic impacts of proposals prior to project approval. The purpose of MEPA is to foster state government decisions that are informed, accountable, open to public participation, and balanced. MEPA gives a community the ability to provide input into decision making and help resolve issues before they become a problem. No other law allows consideration of such issues. The agencies may adopt the Intake EA completed by the co-leads or complete further documentation as they see fit to comply with the MEPA process.

### Stream Protection Act

Any agency or subdivision of federal, state, county, or city government proposing a project that may affect the bed or banks of any stream in Montana for any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries must comply with this act. The purpose of the Act is to protect and preserve fish and wildlife resources and to maintain streams and rivers in their natural or existing state. FWP administers the law. Their concerns regarding fish, wildlife, and riverine environments have been addressed in this document. A stream protection permit would be obtained for the Intake Project the FWP prior to construction.

### Short-Term Water Quality Standards for Turbidity (318)

Any person, agency, or entity, both public and private, initiating construction activity that will cause short term or temporary violations of state surface water quality standards for turbidity requires a state permit. The purpose of the permit is to provide a short term water quality turbidity standard for construction activities, so that construction is carried out in accordance with conditions prescribed by the Montana DEQ, to protect water quality and to minimize sedimentation. Montana DEQ administers the permit, and their concerns regarding water quality, sedimentation, and the Intake Project have been addressed in this EA.

### Montana Land-use License of Easement on Navigable Waters

Any entity proposing a project on lands below the low water mark of navigable waters requires a state license. Projects include the construction, placement, or modification of a structure or improvements in, over, below, or above a navigable stream. The purpose of the law is to protect riparian area and the navigable status of the water body and to provide for the beneficial use of state lands for public and private purposes in a manner that will provide revenues without harming the long term capability of the land or restricting the original commercial navigability. The Department of Natural Resources and Conservation administers the law, and their concerns have been addressed in chapter four Lands and Vegetation and Recreation sections in this EA.

### Stormwater Discharge General Permits

Any person, agency, or entity, either public or private, proposing a construction, industrial, mining, or other defined activity that has a discharge of storm water into surface waters must obtain a permit. Under the authority of the Montana Water Quality Act, permit authorization is typically obtained under a Montana Pollutant Discharge Elimination System "General Permit." A permit is generally required for construction activity that will disturb one or more acres, including clearing, grading, and excavating activities.

The purpose of the law is to prevent degradation of surface waters from pollutants such as sediment, waste materials, industrial chemicals or materials, heavy metals, and petroleum products; to protect existing water quality, and to implement and monitor the effectiveness of Best Management Practices (erosion and sediment controls, etc.) used to reduce pollutant loads. The Montana DEQ administers the permit. Their concerns regarding water quality, sedimentation, and the overall project have been addressed in chapter four Hydrology and Geomorphology, Surface Water Quality, and Lands and Vegetation sections in this EA.

### 401 Water Quality Certification for Other Federal Permits & Licenses

Under Section 401 of the federal Clean Water Act, states and tribes can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state or tribal waters, including wetlands. The major federal licenses and permits subject to Section 401 are Section 402 and 404 permits (in non-delegated states), federal Energy Regulatory Commission hydropower licenses, and Rivers and Harbors Act Section 9 and 10 permits. States and tribes may choose to waive their Section 401 certification authority.

States and tribes make their decisions to deny, certify, or condition permits or licenses primarily by ensuring the activity will comply with state water quality standards. In addition, states and tribes look at whether the activity will violate effluent limitations, new source performance standards, toxic pollutants, and other water resource requirements of state/tribal law or regulation. The Section 401 review allows for better consideration of state-specific concerns. Their concerns have been addressed in chapter four Surface Water Quality and Lands and Vegetation sections in this EA.

## List of Preparers

Reclamation and Corps staff responsible for preparation of this EA include:

| | |
|---|---|
| Steve Anderson | Recreation Planner, Reclamation Great Plains Regional Office |
| Sue Camp | Natural Resource Specialist (ESA), Reclamation Montana Area Office |
| Gary Davis | Environmental Specialist, Reclamation Great Plains Regional Office |
| Clayton Jordon | Project Manager, Reclamation Montana Area Office |
| Greg Johnson | Project Manager, Engineer, Corps |
| Gregory Hiemenz | Environmental Specialist, Reclamation Dakotas Area Office |
| Patience Hurley | Public Involvement Specialist, Reclamation DKAO |
| Justin Kucera | Natural Resource Specialist, Reclamation Montana Area Office |
| Nell McPhillips | Natural Resource Specialist (ESA), Reclamation Dakotas Area Office |
| Steven Piper | Economist, Reclamation, Denver Technical Center |
| Alison Schlag | Hydrologist, GIS, Reclamation Dakotas Area Office |
| Signe Snortland | EA Team Lead, Editor, Reclamation Dakotas Area Office |
| Kelly Titensor | Tribal Liaison, Reclamation Montana Area Office |
| Tiffany Vanosdall | Lead Plan Formulator/Project Manager, Corps |
| Alicia Waters | EA Team Lead, Editor, Reclamation Dakotas Area Office |
| James Weigel | Engineer, Reclamation Dakotas Area Office |

# Distribution List

## Agencies and Contact Persons

The entities listed below received an Executive Summary of the Draft EA and/or the Final EA along with a compact disk which contains the full text of the document and the supporting documents used to prepare them.

**Elected Officials**

Honorable Jon Tester - Senator
Honorable Denny Rehberg – Representative
J.T. Korkow — Field Representative Congressman Denny Rehberg
Honorable Max Baucus – Senator

**Tribal Officials**

Honorable Richard Brannan — Chairman Northern Arapaho Tribe
Honorable A.T. Stafne — Chairman Assiniboine and Sioux Tribes of Fort Peck
Honorable Willie Sharp, Jr. — Chairman Blackfeet Tribe
Honorable Joe Brings Plenty — Chairman Cheyenne River Sioux Tribe
Honorable John Houle — Chairman Chippewa Cree Tribe of the Rocky Boys' Reservation
Honorable James Steele, Jr. — Chairman Confederated Salish and Kootenai Tribes
Honorable Brandon Sazue Chairman Crow Creek Sioux Tribe
Honorable Carl Venne — Chairman Crow Nation
Honorable Ivan D. Posey — Chairman Eastern Shoshone Tribe
Honorable Joshua Weston — President Flandreau Santee Sioux Tribe
Honorable Julia Doney — President Gros Ventre and Assiniboine Tribe of Fort Belknap
Honorable Arlan Whitebird – Chairman Kickapoo Tribe of Kansas
Honorable Michael Jandreau — Chairman Lower Brule Sioux Tribe
Honorable Richard Marcellais — Chairman Turtle Mountain Band of Chippewa
Honorable Geri Small — President Northern Cheyenne Tribal Council
Honorable Theresa B Two Bulls — President Oglala Sioux Tribe
Honorable Mitchell Parker — Chairman Omaha Tribe of Nebraska
Honorable Larry Wright, Jr. — Chairman Ponca Tribe of Nebraska
Honorable Steve Oritz — Chairman Prairie Band of Potawatomi Nation
Honorable Rodney M. Bordeaux — President Rosebud Sioux Tribe
Honorable Twen Barton — Chairperson Sac and Fox Nation of Missouri in Kansas and Nebraska
Honorable Roger Trudell — Chairman Santee Sioux Nation
Honorable Michael I. Selvage, Sr. — Chairman Sisseton-Wahpeton Sioux Tribe
Honorable Myra Pearson — Chairperson Spirit Lake Sioux Tribe
Honorable Charles W. Murphy — Chairman Standing Rock Sioux Tribe
Honorable Marcus Levings — Chairman Three Affiliated Tribes
Honorable Walt Moran — Chairman Trenton Service Area
Honorable Matthew Pilcher — Chairman Winnebago Tribe of Nebraska
Honorable Leon Campbell — Chairman Iowa Tribe of Kansas and Nebraska
Honorable Robert Cournoyer — Chairman Yankton Sioux Tribe

Honorable Leroy Spang ─ President Northern Cheyenne Tribe
Honorable Leon Campbell ─ Chairman Iowa Tribe of Kansas and Nebraska

**Federal Agencies**

**Environmental Protection Agency**

Stephen Potts ─ NEPA Coordinator
John Wardell ─ Director Region 8 Montana Office
Toney Ott ─ Environmental Scientist

**Bureau of Land Management**

Gene Terland ─ Director

**Agricultural Research Service**

**U.S. Fish and Wildlife Service**

Lou Hanebury ─ Fish and Wildlife Biologist
George Jordan ─ Pallid Sturgeon Recovery Coordinator

**U.S. Army Corps of Engineers**

Cathy Juhas ─ Project Manager

**Tribal Agencies**

Shauna Walker – Tribal Historic Preservation Office, Standing Rock Sioux Tribe

**State Agencies**

Jeff Ryan ─ Environmental Science Specialist Montana Department of Environmental Quality
Rick Strohmyer ─ Eastern Land Office Area Manager
Department of Natural Resources and Conservation
Richard Opper ─ Director Montana Department of Environmental Quality
Jeff Hagener ─ Director Montana Fish, Wildlife and Parks
Mark Baumler ─ State Historic Preservation Officer Montana Historical Society
Jim Robinson ─ Department of Natural Resources and Conservation
Greg Hallsten ─ EIS Coordinator Montana Department of Environmental Quality
John Little ─ Regional Parks Manager Montana Fish, Wildlife and Parks
Brad Schmitz ─ Regional Fisheries Manager Montana Fish, Wildlife and Parks
Mary Sexton ─ Director Department of Natural Resources and Conservation Montana Fish Wildlife & Parks
North Dakota Game and Fish Department
John Tubbs ─Department of Natural Resources and Conservation

**County Government**

Julie Goss ─ Administrator Richland County Conservation District
Henry Johnson ─ Commissioner Richland County Commission
Mark Rehbein ─ Commissioner Richland County Commission
Don Steppler ─ Commissioner Richland County Commission
Peggy Newton ─ Administrator Dawson County Conservation District
Doug Buxbaum ─ County Commissioner Dawson County Commission
Jim Skillestad ─ County Commissioner Dawson County Commission
Bruce Smith ─ Agriculture and Community Development Dawson County Extension Office
Richland County
Adam Gartner ─ County Commissioner Dawson County Commission

**City Government**

City of Sidney
Dawson County Economic Development Council
Wade Vanevery ─ Executive Director Sidney Area Chamber of Commerce and Agriculture
City of Fairview
Kim Trangmoe ─ Glendive Chamber of Commerce and Agriculture

**Environmental Organization**
Rankin Holmes — Project Manager
Montana Water Trust
Craig Sharpe — Executive Director
Montana Wildlife Federation
Kat Imhoff — State Director
The Nature Conservancy of Montana
Brett Swift — Deputy Director
American Rivers – Northwest Regional Office
Bruce Farling — Executive Director
Montana Trout Unlimited
Doug Hill — Chapter President
Walleyes Unlimited (Mon-Dak) Chapter
Steve Hoffman — Executive Director
Montana Audubon
John Hart — President Montana Environmental Information Center
Jerry Nypen — Project Manager
Lower Yellowstone Irrigation District
Mary Hanson — Manager
Montana Land Reliance
Mike Newton — President
Montana Walleyes Unlimited
Jeff Van Den Noort — Chairman
Montana Chapter of the Sierra Club
Bob Gilbert — Executive Director
Montana Walleyes Unlimited
Teresa Erickson — Executive Director
Northern Plains Resource Council
Brady Cullen — The Nature Conservancy
Michael Powelson — The Nature Conservancy
Travis Horton — Native Species Coordinator Fish, Wildlife & Parks
Jeff Tiberi — Coordinator Montana Association of Conservation Districts
Rebecca Wodder — President
American Rivers – National Office
April Johnston — Conservation Director
American Wildlands
Joe Gutkoski — President
Montana River Action
Burt Williams — Yellowstone River Project Manager -The Nature Conservancy

**Water User**
Conrad Conradson — Lower Yellowstone Irrigation Board of Control
Hugo Asbeck — Lower Yellowstone Irrigation District #1
Walt Reichenbach — Lower Yellowstone Irrigation District #1
Don Steinbeisser — Lower Yellowstone Irrigation District #1
Mark Iversen — Chairman Lower Yellowstone Irrigation District #1
Philip Hurley — Lower Yellowstone Irrigation District #2
Todd Cayko — Lower Yellowstone Irrigation District #2
Dale Danielson — Lower Yellowstone Irrigation District #2
Orvin Finsaas — Lower Yellowstone Irrigation District #2
Dan Rice — Intake Irrigation District
Steve Pust — Chairman Savage Irrigation District
Leeroy Schmierer — Savage Irrigation District
Mel Tombre — Savage Irrigation District
Richard Cayko — Chairman Lower Yellowstone Irrigation Board of Control
Matt Rosendale — Chairman Intake Irrigation District
Bud Groskinsky — Lower Yellowstone Irrigation Board of Control
Roger Muggli — T&Y Irrigation District

**Newspaper**
Sidney Herald
Amanda Breitbach — Glendive Ranger-Review
Minot Daily News
Bismarck Tribune
Williston Herald
Miles City Star
Brett French — Billings Gazette
Great Falls Tribune
Emilie Boyles — News Director Montana East News
High Country News

**Interested Party**
Barbara A Ranf — Burlington Northern Railroad
Yellowstone Caviar Project

DJS Farms LLC
Schueler Farm
American Foundation for Wildlife
GPJC
Headington Oil LP
F.F.A.
GPS Sidney Partners
MON-KOTA
Nabors Well Service
Savage Ag Vocation & Growth Endeavor Inc
Cross Petroleum Services
Steve E Park ─ Aparies Inc.
Turcotte Farms Inc.
Thelmer Aalgaard
Joel Albert
Bob & Scott Albin
Richard Albin
Richard Aldrich
John Allen
John Almond
Leroy Amundson
Tyler Amunrud
David Anderson
Jeff Anderson
Orin Anderson
Stephen Anderson
William Anderson
Mary Beth Andrews
Sandra Angel
Michael Armstrong
Frederick Arndt
Gene Asbeck
Glen Asbeck
Harvey Asbeck
James Asbeck
John Asbeck
Patrick Asbeck
Randy Asbury
Loye Ashton
Vivian Atchison
Donna Ault
Terry Averett
Tim Averett
Robert Badt
Edna Bahls
Tim Baisch
Gary Baker
Marty Bakken
Brian Barels
David Barfield
Fred Barkley
Tom Barnent
James Barnes
Tim Barnett
Tony Barone
Craig Bartelson
Jim Basta
Todd Basta
Lyle Bateman
Nancy Baue
Larry Bawden
Elizabeth Baxter
William Beacom
John Beagle
Ingrid Bearman
Jim Becic
Lloyd Becker
Randy Bell
Robert Bell
Rod & Randy Bell
Barry Benson
Arnold Berg
Walter Berg
John Berger
Edward Bergin
Jerry Bergman
Hank Berry
Ilene Berry
Ron Berry
Shawn Berry
Duane BerubeLynn Beyerle
Dennis Bieber
Harlow Bieber
Jeff Bieber
Jim Bieber
Michael Bingen
Mike Black
Rick Blanksma
Mary Bloom
Loren Boese
Larry Bond
David Borgman
Kent Bos
Arthur Bouchard
Bud Bouchard
Don Bouchard
Tim & Evah Bouchard
Paul Boylan
Gordon Bradley
William Brenner
Leon Brodhead
Ken Brose
Kenneth Brost
Darrel Brown
Julia Brown

Ralph Brown
Ron Brown
Steve Brown
Bruce Browne
Doug Brunsvold
Mary Jo & Lance Brunsvold
Tim Bryggman
Jess Burman
Valerie Burnison
Brian Buxbaum
Charles Buxbaum
Edward Buxbaum
Freddie Buxbaum
Gilda Buxbaum
Gregory Buxbaum
Joy Buxbaum
Kelvin Buxbaum
Richard Buxbaum
Robert Buxbaum
Scott Buxbaum
V John Buxbaum
Paul Callahan Vice President PBS&J
James Campbell
Casey Candee
Garey Candee
Judy Candee
Thomas Carlsen
Mark Carlson
Mike Carlson
Lisa Carnicom
Barry Carpenter
Benton Carr
Claire Carr
Don Carter
Garrick Carter
Loran Casey
Edmundo Castro
Gonzalo Castro
Michael Catches Enemy
Louis Cauffman
Patrick Cassidy
Stephen Cayer
Daniel Cayko
Ivan Cayko
Joseph Cayko
Nickie Cayko
Terry Cayko
Landan Cheney
Steve Chick
Bryan Christensen
Curt Christensen
Marion Christensen
Gaven Clifton
Jacqeline Lewis Cloidt
Jan Cole
Harlan Conradsen
Elsie Cook
Albert Cooley
Douglas Copeland
Jerry Cornelia
June Cornelia
Joe Cothern
Pete Council
Glenn Cowell
Gary Cox
Robert Crandall
Bud Crosby
Betty Cumming
Betty Cummings
Brian Cummings
Matt & Lisa M Curtis
Julie Dahl
Michael Dahl
Vincent Daly
Arthur Damm
Delmore Damm
Edwin Damm
Jack Damm
Kevin Damm
Terry Damm
Sharon L Daniels
Darin Danielson
Doug Danielson
Duane Danielson
Sherri Dardis
Virginia Dardis
Jerry Darter
Kirby Dasinger
Dale Davis
Arne Degn
Roy Degn
Michael Denowh
Stella Denowh
Tim Denowh
Jeanne Dethman
Frank Difonzo
Albert Dige
Arnold Dige
Diana Dige
Russell Dige
Carl Dilday
Vera Dishon
Lonnie Dolney
Dale Dombrosky
Gordon Donohoe
Alida Dore

Delmar Dschaak
Janet Duda
Jon W Dunbar
Bruce Dunn
Keith Dynneson
Sherman Dynneson
Michael Eastwood
Christoffer Eckhoff
Dale Edam
Dennis Eggum
Paul Eldridge
Thomas Eleson
Roger Emery
Harold Emily
Richard Engstrom
Dale Erickson
Margaret Erickson
Monty Erickson
Wes Erickson
Torbin Erikstrup
Wayne Eschenbacher
Donn Eskridge
Max Ethridge
Bob Evans
Jace Everett
Edward Falkenhagen
Dean Faulkner
Mark Fedora
Rick Fehrs
Edward Fergurson
Clinton Filler
Clinton & Brenda Filler
Eugene Fink
Jim Fink
Marvelle Fink
Bobby Finnicum
Naomi Finnicum
Darrell Finsaas
Gladys Finsaas
Gabriel Fischer
Gerald Fischer
Gregg Fischer
Joey Fischer
Leo Fischer
Michael Fisher
Donna Fisser
Terry Fleck
Charles Flynn
Eldean Flynn
Scott Flynn
Rene France
Susan France
John Franklin
Don Franz
Hazel Larson French
Dan Fritz
Robert Fulton
John Gable
Thomas Gable
Terry Gaffield
Willis Galleske
Larry Garmen
Bryan Gartner
Ron Gebhardt
Pat Gehnert
Gail Geiser
Jim Gentry
Charlie Gephart
Cole Germann
Joseph Gibbs
Robert Gilbert
Reinhold Ginther
Derek Glyman
Jake Godfrey
Darrell Goebel
Mark Goeden
William Goff
Robert Goodwin
Shirley Grandlund
Thomas Graves ─ Executive Director
Mid-West Electric Consumers
Association
Steven Greenwood
Ronald Gross
Troy Guffey
James Gullickson
Ronald Gurney
Russell Gurney
Steven Gurney
Ronald Haase
Tom Hafele
Joanne Hagler
Wade Hagler
Craig Hall
Daniel & Teresa Halley
Harvey Hamburg
William Hamburg
Theresa Hanley
Arnold Hansen
Greg & Cheryl Hansen
Robert & Betty Hansen
Linda Hanson
Rick Haraldson
Boyd Hardy
David Hardy
Jack Hardy

Mark Hardy
Valerie Hardy
Howard Harmon
Tom Harmon
David & Kathleen Harris
Larry Harris
Clarence Hartle
Wade Hartle
Dave Haverkamp
Dale Hayes
Arvin Heinle
William Heiser
Harold Helland
Todd Hellikson
Dale Helm
Don Helm
John Helm
Bill Henderson
Thomas Henderson
Craig Herbert
Robert Herbst
Elmer Herdt
Larry Herman
Robert Hernandez
Doug Hettich
Alton Hillesland
Goldie Hilliard
Richard Hobbs
Frances Hodson
Carol Hoeger
Kenneth Hoff
James Holst
Edith Holt
Dreamland Homes
R C Hord
Dwight Houchen
Terry Houchen
Jim Hovde
Steve Hudson
Eugene Hueth
Lyle Huff
William Huft
Roger Huizenga
Dale Hurley
Ralph Hurley
Richard Hurley
Rodney Hurley
Ronnie Hurley
Vess Hurley
Gloria Huse
John Hutter
Hugh Hutton
Darrell Hystad
Dale Iversen
Don Iversen
Kenneth Iversen
Marlow Iversen
Ruth Iversen
William Iversen
Albert Jackson
Gary Jackson
David Jacobsen
Henry Jaskot
Curtis Jensen
Harry Jensen
Ron Jensen
Michael Jepsen
Agnes Johnson
Arden Johnson
Craig Johnson
David Johnson
Don Johnson
Donald Johnson
Duane Johnson
Eldin Johnson
Ervin Johnson
Harry Johnson
Kirk Johnson
Kirk Johnson
Lloyd Johnson
Michael Johnson
Mike Johnson
Richard Johnson
Russell & Sandra Johnson
Scott Johnson
Warren Johnson
Darold Jones
John Jones
Char Jonsson
Kjeld Jonsson
Dave Jorgensen
Jeff Jorgensen
Jon Jorgensen
Laverne & Jonald, Trustees Jorgensen
Don Josephson
Steve Joslin
Russell Kaldenberg
J. Rebecca Kallevig
Ralph Kappel
Arlene Karst
Donald Karst
Jim Karst
Justin Karst
Richard Karst
Robert Karst
Ted Karst

Tim Karst
Virgil Karst
Edgar Keller
Kayla Keller
Lila Keller
Lloyd Keller
Alan Kelley
Allen Kessler
Jeff Ketterling
Jim Ketterling
Donna Kiamas
Zadena Kingland
Ernest Klasna
Terry Klein
Jeff Klempel
Richard Klinger
Kent Klose
Vernon Klose
Doug Kluck
Michael Knaff
Ken Knels
Larry Knels
Gene Koch
Robert Koeppler
Kurt Koffler
Betty Kringen
Randal Kringen
Travis Kutzler
Marilyn Lake
Bob Lange
Nathan Langwald
Tim Langwald
John Larsen
Stacey Larsen
Lowell Larson
Dennis Latka
William Lay
Robert Lebsock
Virginia LeClere
Bryant Lee
Bert Lepel
Paul Lepisto
Brian Ler
Matt Ler
Lloyd Lester
Rodger Lewis
William Lewis
Brandon Ligon
David Linde
Ronald Linker
Teresa Livers
David Loomer
Daniel Lorenz
Tom Lorenz
R F Lovec
Chuck Lowman
Linda Lowry
Sue Lowry
Steve Lunderby
Marian Maas
Henry Maddux
Michael Madell
Clyde Madison
Deb Madison
Gary Malsam
Forrest Markle
Randy Marmon
Vicki Marquis
Marion Martin
Monte Martin
Ruth Martin
Toni Martini
Buzz Mattelin
Cody Mavity
Ed Maynard
Nicole Mcclain – Coordinator
Yellowstone River
Conservation District Council
David McDonald
Brian McGinnis
Robert McGinnis
Mary McGlynn
Charlene McIntyre
Joseph McKinley
David McMillen
Coy McMorris
Jan McNamara
Craig McPherson
Steven Meagher
Alan Mehl
Lanny Meng
Leo Mestas
Dallas Metcalf
Larry & Sandra Metcalf
Joel Metrick
Pat Micheletto
Vernon Milender
Alvin Miller
Carl Miller
Kirk Miller
Lance Miller
Martin Miller
Melvin Miller
Randy Miller
Terry Miller
Thomas Miller

Walter Miller
Gary Mindt
Larry Mindt
Henry Mischel
Clyde & Duane Mitchell
Everett Mitchell
Viola Mitchell
Gary Moen
Greg Mohr
Clinton Molloy
David Moore
Dennis Moore
Mary Moore
Patrick Moore
Harold Moran
Bud Morrill
Wayne Morrill
Jim Morsette
Tarry Mueller
Lynn Muench
Cheryl Murphy
William Nankivel
Gerald & Mary Ellen Navratil
David Nay
Randy Nay
Stuart Neer
Dennis Nelson
Keith Nelson
Don Netzer
Mark Neu
Richard Neuleib
Floyd Neumann
Susan Newell
Dennis Nice
Jesse Nickolson
Rex Niles
Del Nollmeyer
Lori Norby
Marlin Norby
Palmer Norby
Rocky Norby
Harvey Noteboom
Fred O'Brien
Bruce O'Connor
Lynell Odenbach
Todd O'Donnell
James Oldson
Stephan Oliver
Buck Olmsted
Anthony Olsen
Barbara Olson
Myrna Olson
Sharon Olson
Martin Ortloff
Tom Ortloff
Paul Ossowski
William Owens
Michael Pacovsky
Dennis Palmer
Gene Papka
Allyn Partin
Perry Partin
5 S Partnership
Katherine Paschke
Thomas Pavek
Kent Payette
Milo Payette
Sandra Perez
James Pesek
Monte Pesek
Kermit Petersen
Robert Petersen
Gale Peterson
Gene Peterson
Ivan Peterson
James Peterson
Lyle Peterson
Ray Peterson
Roger Peterson
Ronald Peterson
Vernon Peterson
Joyce Petrik
Albert Picchioni
Bing Poff
David Ponganis
Lee Pourroy
John Pozzo
Clint Prevost
Elwin Prevost
Fred Prevost
Walter Prevost
Rod Prewitt
Arlen Price
Dick Propp
Arline Pust
Dan Pust
Doug Pust
Gayle Pust
Jason Quale
Lloyd Quinnell
Howard Rambur
Scott Ramus
Elaine Rang
Gary Rauschendorfer
Robert Rauschendorfer
Marjorie Redding

Kenneth Redman
James Redmond
Kenneth Reeder
Ronald Rehbein
Gerhard Reichenbach
Wayne Reid
David Reidle
Earl Reidle
Larry Reidle
Steven Reidle
Mark Reihbein
Richard Rein
Kenneth Reitz
Marlene Reitz
Ted Reitz
Derald Reno
Carl Renville
Duane Reynolds
Curt Rice
Dan & Dave Rice
Debbie Rice
George Rice
Jenny Rice
Park Rice
David Richey
Albert Riedel
Keith Riedel
Lillian Riedel
Richard Riedel
Jim Riis
Sam Ritter
Carmen Roberts
Dave & Bobbie Roberts
Lyle Roberts
Dorothy Rodgers
Allen Rosaaen
Jay Rosaaen
Perry Roth
Margaret Rowley
Michael Rueckert
Joe Russell
Barbara Sanders
Ronald Sannes
Luke Savage
Dennis Scarnecchia ─ Professor
University of Idaho
Charlie Schaubel
Stella Scheetz
Tom Scheetz
Lonnie Schipman
Dirk Schlothauer
Don Schlothauer
Harold Schlothauer
Ken Schlothauer
Dennis Schmierer
Gottlieb Schmierer
Herbert Schmierer
Lillie Schmierer
Fred Schmitt
Larry Schmitt
Vernon Schmitt
Gary Schow
Vernon Schroeder
Marvin Schulz
Dan Schumacker
Schwans Schwans
John Schwartzenberger
David Schwarz
Constantine Scordalankes
Shane Seader
Ben Sedlacek
Gary Sedlacek
Craig Seeve
Alan Seigfreid
John Seitz
Philip Seitz
Wm Seitz
Leon Selensky
Harvey Senn
Chris Severson
Mike Severson
Vi Shannon
Bonnie Sharbono
James Sheehan
Michael Sheehan
Randy Sherven
Mildred Shields
Robert Shields
David Shorr
David Sieck
Pete Sifers
Harold Simard
Edward Simmons
Melvin Simmons
Cheryl Simon
Terry Simonsen
Robert Sink
Jim Sitter
Jim Skillestad
Jason Skold
Roy Slate
L R Smith
Milton Smith
Myron Smith
Randy Smith
Darwin Snyder

Eugene Sondeno
Gary Sorensen
Harold Sorensen
Lucille Sorensen
Clifton Sowle
Daniel Sparks
Lyle Sponheim
Scott Staffanson
Robert Starkey
Nick Stas
Mike Steffan
James Steffen
Ronald Steffens
Bill Steinbeisser
Craig Steinbeisser
David Steinbeisser
Joe G & Sons Steinbeisser
John Steinbeisser
Johnny Steinbeisser
Russel Steinbeisser
Dean Steinley
Garry Steinley
Todd Steinley
Louis Stepan
Robbie Stepan
Leon Stevenson
Frank Sticka
Henry Stip
John Stone
Josh Stordahl
Russell Stotts
Mackenzie Strait
Donald Strasheim
James Strasheim
Marvin Strasheim
Bill Struckman
Tim Stubstad
Al Sturgeon
Sidney Sugars
Doug Sullivan
Duane Sundheim
Byron Sunwall
Will Suralski
Ruth Swanson
Charles Swearingen
Joyce Sweley
Ruby Sweley
Dennis Swenson
George Swenson
Frank Swisse
Buck Syth
Greg Temple
Lou Temple
Tom Temple
Arnold Thiel
Casey Thiel
Raymond Thiel
Allen Thiessen — President Lower Yellowstone REA, Inc
Gene Thomas
Robert Thompson
Kenneth Thornton
Don Tiffany
Paul Tjelde
Mark Tombre
Mel Tombre
Wade Tombre
Gary Torgerson
Wm Torgerson
Trenton Indian Housing Authority
Conradson Bros Triple C
Blair Troudt
Gene Trudell
Paul Trudell
Jack Tunnell
Lavada Tunnell
Aaron Uecker
Leroy Unterseher
Mark Urlacher
Betty Vaira
Patrick Vaira
Mark Valnes
Kate Vandemoer
Wade Vanevery
Barry Vanhook
William Vanhook
Justin Verhasselt
Terry Verhasselt
A D Volbrecht
William Voss
Craig Wagner
Elizabeth Wakeman
Barbara Walla
Lance Waller
Cleo Walter
Robert Walters
Scott Watkins
Jerry Watson
Daniel Watts
George Watts
James Watts
Mike Weber
Elsa Weebe
Baptiste Weed
Sherry Weimer
Mike Wells

Marvin Welnel
Phil Wendzillo
Ronald West
Dennis Wick
Thomas Wick
Bob Wicorek
Jack Wicorek
Mike Wicorek
Robert Wicorek
Elsa M Wiebe
Allen Wiederrich
Jeremy Wilcoxon
William Wilkinson
Geri Anne Willer
Neil Williams
Robert Williamson
Virgil Wilson
Gordon Wind
Dale Winter
Sam Witt
Helmut Wolff
Michael Wood
Charlie Wyman
Daniel Wyman
Judy Wyman
Larry Wyman
Martha Wyman
Scott Wyss
Gerald Wznick
James Yadon
Ray Yadon
Brian Yanchik
Dean Youngquist
Gregory Zadow
Eileen Ziler
Laurence Ziler
Clifford Zimmerman
Penny Zimmerman
Richard Zoanni
Suzanne Gucciardo – Lewis and Clark NHT
Tom Barnett

# Literature Cited

Arnell, A., C. Liu, R. Compagnucci, L. da Cunha, K. Hanaki, C. Howe, G. Mailu, I. Shiklomanov, and E. Stakhiv. 2001. Hydrology and Water Resources. In: Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change [McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Backes, K. M., W. M.Gardner, D. Scarnecchia, and P. A. Stewart. 1994. Lower Yellowstone River Pallid Sturgeon Study IV and Missouri River Creel Survey. FWP. Miles City, Montana.

Bacon, L.M. and J.J. Rotella. 1998. Breeding Ecology of Interior Least Terns on the unregulated Yellowstone River, Montana. *Journal of Field Ornithology* 69(3):391-401.

Bender-Keigley, J. 2008. *Landowners' Guide to Eastern Montana Wetlands and Grasslands: Incentives to Improve Land for Livestock and Wildlife.* Accessed January 20, 2008 at http://www.mtwatercourse.org/Publications/Publications.htm).

Bergman, H.L., A.M. Boelter, K. Parady, C. Fleming, T. Keevin, D.C. Latka, C. Korschgen, D.L. Galat, T. Hill, G. Jordan, S. Krentz, W. Nelson-Stasny, M. Olson, G.E. Mestl, K. Rouse, and J. Berkley. 2008. *Research Needs and Management Strategies for Pallid Sturgeon Recovery.* Proceedings of a Workshop held July 31-August 2, 2007, St. Louis, Missouri. Final Report to the U.S. Army Corps of Engineers. William D. Ruckelshaus institute of Environment and Natural Resources, University of Wyoming, Laramie.

Board of Control. 2009. Conservation Plan Lower Yellowstone Irrigation Project. On file, Montana Area Office, Bureau of Reclamation, Billings, Montana.

Braaten, P. J. and D. B. Fuller, L. D. Holte, R. D. Lott, W. Viste, T. F. Brandt, R. G. Legare. 2008. Drift Dynamics of Larval Pallid Sturgeon in a Natural Side Channel of the Upper Missouri River, Montana. *North American Journal of Fisheries Management* 28:808-826.

Bramblett, R. G. 1996. Habitats and Movements of Pallid and Shovelnose Sturgeon in the Yellowstone and Missouri Rivers, Montana and North Dakota. Unpublished Ph.D. Thesis. Montana State University, Bozeman, Montana.

Bramblett, R.G. and R.G. White. 2001. Habitat Use and Movements of Pallid and Shovelnose Sturgeon in the Yellowstone and Missouri Rivers in Montana and North Dakota. *Transactions of the American Fisheries Society* 130:1006-1025.

Brown, C.J.D. 1955. A Record-Sized Pallid Sturgeon, *Scaphirhynchus album*, from Montana. *Copeia* 1:55-56.

Brown, Lauren. 2002. *Solidago rigida L. (Stiff Goldenrod) New England Plant Conservation Program Conservation and Research Plan for New England*. New England Wild Flower Society, Framingham, Massachusetts.

Canadian Council of Ministers of the Environment. 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Available online at: http://www.ccme.ca/assets/pdf/sedqg_summary_table.pdf last accessed July 8, 2009.

Cannon, M. R., and D. R. Johnson. 2004. Estimated Water Use in Montana in 2000. United States Geologic Service in Cooperation with Montana Department of Natural Resources and Conservation. *Scientific Investigation Report* 2004-5223. http://pubs.usgs.gov/sir/2004/5223/

Casey, D. 2000. "Partners in Flight Draft Bird Conservation Plan Montana." American Bird Conservancy, Kalispell, Montana.

Christensen, J.H., B.Hewitson,A. Busuioc,A. Chen,X.Gao, I.Held, R. Jones, R.K. Kolli,W.-T. Kwon, R. Laprise, V.Magaña Rueda, L.Mearns, C.G.Menendez, J. Räisänen,A. Rinke,A. Sarr and P.Whetton, 2007. Regional climate projections. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin,M.Manning, Z. Chen,M.Marquis, K.B.Averyt, M.Tignor and H.L.Miller, Eds.,CambridgeUniversity Press, Cambridge and NewYork, 847-940.

Cohen, S., K.Miller, K. Duncan, E. Gregorich, P. Groffman, P. Kovacs,V.Magaňa, D. McKnight, E. Mills and D. Schimel. 2001: North America. Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on ClimateChange, J.J.McCarthy, O.F.Canziani, N.A. Leary, D.J.Dokken and K.S.White, Eds.,Cambridge University Press, Cambridge, 735-800.

Corps. 2002. *Lower Yellowstone River Intake Dam Fish Passage Alternatives Analysis.* Omaha District, Omaha, Nebraska.

Corps. 2008. *Lower Yellowstone Project Fish Screening and Sediment Sluicing Preliminary Design Report, Final Report*, Omaha District, Omaha, Nebraska.

Corps. 2009a. Intake Dam Modification Project Hydraulic Modeling in Support of Fish Passage Evaluation. Omaha District, Omaha, Nebraska.

Corps 2009b. Results of Elutriate Sampling Conducted Along the Yellowstone River at Intake Dam, Montana on April 29-30, 2009. Omaha District, Omaha, Nebraska.

Corps and Reclamation. 1996. *Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone rivers.* Annual Report for Missouri River Benthic Fish Study, PD-95-5832.

Council on Environmental Quality. 1993. *Incorporating Biodiversity Considerations into Environmental Impact Analysis Under the National Environmental Policy Act.* Council on Environmental Quality, Washington, D.C.

Coutant, Brad A. 1991. The Once and Future Quarry: A Class III Cultural Resource Inventory of a Proposed Rock Quarry Near the Lower Yellowstone Diversion Dam, Dawson County, Montana. Unpublished Manuscript on File, Montana Area Office, Bureau of Reclamation, Billings, Montana.

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. 131pp.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, A. L. Zimmerman, and B. R. Euliss. 1998 (revised 2002). *Effects of Management Practices on Grassland Birds: Loggerhead Shrike.* Northern Prairie Wildlife Research Center, Jamestown, North Dakota.

Dood, A.R., B. Schmitz, V. Riggs, N. McClenning, M. Jaeger, D. Fuller, R. Rauscher, S. Leathe, D. Moore, J. Dullum, J. Ensign, S. Story, and M. Backes. 2009. Relative Abundance of Spiney Softshell Turtles (*Apalone Spinifera*) on the Missouri and Yellowstone Rivers in Montana. Final Report. Montana Fish, Wildlife & Parks. Helena, Montana.

Ellis, J. and J. Richard. 2008. *A Planning Guide for Protecting Montana's Wetlands and Riparian Areas.* Revised edition. Montana Watercourse, publication MTW-01-03, Bozeman, Montana.

Elser, A.A., B. McFarland, and D. Schwehr. 1977. The Effects of Altered Streamflow on Fish on the Yellowstone and Tongue rivers, Montana. Yellowstone Impact Study Technical Report 8, Final Report to the Old West Regional Commission, Montana Department of Natural Resources and Conservation, Helena.

EPA. 2001. Ambient Water Quality Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion IV. U.S. Environmental Protection Agency, Office of Water, EPA 822-B-00-013.available online at: http://www.epa.gov/waterscience/criteria/nutrient/ecoregions/rivers/rivers_4.pdf last accessed July 8, 2009.

EPA. 2005 "The Ecoregion Mapping Products and Ecoregion Descriptions Were Completed in Collaboration With the U.S. EPA Regional Offices, State Resource Management Agencies, and With Other Federal Agencies." Online: http://www.epa.gov/wed/pages/ecoregions/level_iii.htm (Version 23 September 2009).

Federal Register. 1982. Title 33: Navigation and Navigable Waters; Chapter II, Regulatory Programs of the Corps of Engineers. *Federal Register* Vol. 47, No. 138: 31810, U.S. Government Printing Office, Washington, D.C.

Franson, J.C., S.P. Hansen, T.E. Creekmore, C.J. Brand, D.C. Evers, A.E. Duerr, and S. DeStefano. 2003. Lead fishing weights and other fishing tackle in selected waterbirds. Waterbirds 26:345-352.

Fuller, D. B., M. E. Jaeger, M. Webb. 2008. Spawning and Associated Movement Patterns of Pallid Sturgeon in the Lower Yellowstone River. Upper Basin Pallid Sturgeon Recovery Workgroup 2007 Annual Report. Upper Basin Workgroup, U.S. Fish and Wildlife Service, Bozeman, Montana.

FWP and Reclamation. 1994. *Lower Yellowstone River Pallid Sturgeon Study III and Missouri River Pallid Sturgeon Creel Survey*.

FWP. 1996. *Lower Missouri River and Yellowstone River Pallid Sturgeon Study*.

FWP. 2006. Montana Interior Least Tern Management Plan. Bozeman, Montana

Gleick, P.H. 2000. Water: the Potential Consequences of Climate Variability and Change for the Water Resources of the United States. Report of the Water Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change for the U.S. Global Change Research Program. Available online at: http://www.gcrio.org/NationalAssessment/water/water.pdf

Goddard, C.I., N.J. Leonard, D.L. Stang, P.J. Wingate, R.A. Rattner, J.C. Franson, and S.R. Sheffield. 2008. Management Concerns About Known and Potential Impacts of Lead Use in Shooting and in Fishing Activities. *Fisheries* 33:228-236.

Graham, P.J., R.F. Penkal, and L. Peterman. 1979. *Aquatic studies of the Yellowstone River. Montana Fish and Game Report* REC-ERC-79-8, Helena, Montana.

Gray, S. and G. McCabe. 2008. Combined water balance and tree-ring approaches to understanding the potential hydrologic effects of climate change on the Yellowstone River. Presentation at 2008 Mountain Climate Research Conference, available online at: http://gis.fs.fed.us/psw/cirmount/meetings/mtnclim/2008/talks/pdf/Gray_Talk2008.pdf

Heist, E.J., M. Saltzgiver, J. Geltz, and P. Hedrick. 2009. *Genetic Management Plan for Captive-Reared Pallid Sturgeon Broodstock*. Contract No. 08-UGPR-56 report to USDOE, WAPA, Billings, Montana. 22pp.

Helfrich, L. A., C. Liston, S. Hiebert, M. Albers, and K. Frazer. 1999. Influence of Low-Head Diversion Dams on Fish Passage, Community Composition, and Abundance in the Yellowstone River, Montana. *Rivers* 7:21–32.

Hiebert, S., R. Wydoski, and T. Parks. 2000. *Fish Entrainment at the Lower Yellowstone Diversion Dam, Intake Canal, Montana 1996-1998*. Bureau of Reclamation Denver Office and Montana Area Office.

Holling, C.S. 1978. *Adaptive Environmental Assessment and Management.* John Wiley and Sons, New York, NY.

Jacks, G., M. Bystrom, and L. Johansson. 2001. Lead Emissions from Lost Fishing Sinkers. *Boreal Environment Research* 6:231-236.

Jacobs, K., D.B. Adams, and P. Gleick. 2001. Potential Consequences of Climate Variability And Change for the Water Resources of the United States. In: *National Assessment Synthesis Team. Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Report for the US Global Change Research Program. Cambridge University Press, Cambridge, United Kingdom

Jaeger, M.E., G.R. Jordan, and S. Camp. 2004. Assessment of the Suitability of the Yellowstone River for Pallid Sturgeon Restoration Efforts, Annual Report for 2004. *In* K. McDonald [ed.] *Upper Basin Pallid Sturgeon Recovery Workgroup 2004 Annual Report*. Helena, Montana.

Jaeger, M., M. Nelson, G. Jordan, and S. Camp. 2005. Assessment of the Yellowstone River for Pallid Sturgeon Restoration Efforts, Annual Report for 2005. *In* Yvette Converse (ed) *Upper Basin Pallid Sturgeon Recovery Workgroup 2005 Annual Report.* Upper Basin Workgroup, Bozeman Fish Technology Center, Bozeman, Montana.

Jaeger, M. E., and T. Watson, A. Ankrum, M. A. Nelson, J. Rotella, G. Jordan, S. Camp. 2008. Assessment of Pallid Sturgeon Restoration Efforts In The Yellowstone River Annual Report for 2007. Upper Basin Pallid Sturgeon Recovery Workgroup 2007 Annual Report. Upper Basin Workgroup, U.S. Fish and Wildlife Service, Bozeman, MT.

Jenkins, P. A. 2007. Map-Based Tests on Controls of Anabranching River Character on the Lower Yellowstone River. Master's Thesis. Montana State University, Bozeman, Montana.

Jewel, D. et al. 2005. U.S. Department of the Interior, Bureau of Reclamation, Great Plains Regional Office, Memorandum of Understanding (MOU No. 05AG602052) with the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the State of Montana, and The Nature Conservancy for Fish Passage, Entrainment Protection and Monitoring of the Lower Yellowstone Diversion Dam (Intake Diversion Dam). On file, Montana Area Office, Bureau of Reclamation, Billings, Montana.

Kapuscinski, K. 2003a. "Population Abundance Estimation of Wild Pallid Sturgeon in Recovery-priority Management Area #2 of the Missouri and Yellowstone Rivers, 1991-2003." Draft Report. Montana Fish, Wildlife & Parks. November 6, 2003.

Kapuscinski, K. 2003b. Pallid Sturgeon in Montana: Is the Extinction of Wild Fish Inevitable? Presentation at the Montana Chapter of the American Fisheries Society. Great Falls, Montana. accessed April 4, 2009 at http://www.fisheries.org/units/AFSmontana/archive/2003_abstracts.pdf

Klungle, M. M. and M.W. Baxter. 2005. Upper Missouri and Yellowstone Rivers Pallid Sturgeon Study 2004 Report. Report Submitted to Western Area Power Administration, Grant Agreement No. 94-BAO-709. Montana Fish, Wildlife & Parks, Fort Peck, Montana.

Koch, R. and Curry, R. 1977. The Effects of Altered Streamflow on the Hydrology and Geomorphology of the Yellowstone River Basin, Montana. Montana Department of Natural Resources and Conservation, Technical Report No. 2.

Kordecki, C., M. McCormick, C. Jackson, and J. Bales. 1999. Lower Yellowstone Irrigation Project, 1996 and 1997 Cultural Resources Inventory, Dawson and Richland Counties, Montana, and McKenzie County, North Dakota. University of North Dakota, Department of Anthropology, Contribution No. 342. Grand Forks, North Dakota.

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. *Journal of Applied Ichthyology* 23:365–374.

Lampe, R. P., J. K. Jones Jr., R. S. Hoffman, and E. C. Birney. 1974. The Mammals of Carter County, Southeastern Montana. *Occasional Paper Museum Natural History University, Kansas* 25:1-39.

Lettenmaier, D., D. Major, L. Poff, and S. Running. 2008. Water Resources. *In: The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research.* Washington, DC., USA.

Lindner-Lunsford, J.B., C. Parrett, J.F. Wilson, and C.A. Eddy-Miller. 1992. Chemical Quality of Surface Water and Mathematical Simulation of the Surface-Water System, Powder River Drainage Basin, Northeastern Wyoming and Southeastern Montana. U.S. Geological Survey Water-Resources Investigations Report 91–4199.

Matthews, W. L. 1980. The Meadow Jumping Mouse in Southeastern Montana. *Prairie Nauralist* 12(2):63-64.

Matthews, W. L. and J. E. Swenson. 1982. The Mammals of East-central Montana. *Procedures Montana Academy of Sciences* 39:1-13.

Mefford, B. and Z. Sutphin. 2008. Intake Diversion Dam Fish Screens: Evaluation of fish screens for protecting early life stages of pallid sturgeon. Bureau of Reclamation, Water Resources Research Laboratory.

Mefford, B., R. Christensen, and A. Glickman. 2000. *Intake Diversion Dam, Yellowstone River, Montana: Fish Protection and Passage Concept Study Report.* Bureau of Reclamation, Water Resources Research Laboratory.

Montana Department of Environmental Quality. 2006. 2006 Integrated 303(D)/305(B) Water Quality Report for Montana. Available online at: http://cwaic.mt.gov/wq_reps.aspx?yr=2006qryId=0, last accessed July 9, 2009.

Montana Field Guide. Retrieved on December 23, 2008, from http://FieldGuide.mt.gov/detail_IMBIV39120.aspx

National Research Council. 2004. *Adaptive Management for Water Resources Planning*, The National Academies Press, Washington, DC.

Natural Resource Conservation Service – Montana. 2003. Lower Yellowstone River Corridor Color Infrared Digital Orthophotography and Physical Feature Inventory Data. Retrieved February 27, 2009 from http://nris.mt.gov/yellowstone/LowerYel/LowerYelPhotos.html

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. *North American Journal of Fisheries Management* 11:72-82.

Newell, R.L., 1977, Aquatic Invertebrates of the Yellowstone River Basin, Montana: Montana Department of Natural Resources and Conservation Technical Report No. 5, Yellowstone Impact Study.

Omernik, J. M. 1987. Ecoregions of the Conterminous United States. *Annals of the Association of American Geographers.* 77:118-125.

PBS&J. 2009. Irrigation in Montana: A Preliminary Inventory of Infrastructure Condition. Prepared for Montana DNRC Conservation & Resource Development Division, Resource Development Bureau, Helena MT. Retrieved June 2, 2009, from http://www.dnrc.mt.gov/cardd/ResDevBureau/irrigation_development/docs/InventoryIrrigationInfrastructureMontana.pdf.

Parma, A., P. Amarasekare, M. Mangel, J. Moore, W. W. Murdoch, E. Noonburg, M. A. Pascual, H. P. Possingham, K. Shea, C. Wilcox, and D. Yu. 1998. What Can Adaptive Management Do for Our Fish, Forests, Food, and Biodiversity. *Integrative Biology* 1:16-26.

Penkal, R.F. 1992. Assessment and Requirements of Sauger and Walleye Populations in the Lower Yellowstone River and Its Tributaries. FWP, Helena, Montana.

Peterman, L.G. 1980. The Ecological Implications of Yellowstone River Flow Reservations, FWP, Helena.

Peterman, L. and F. Nelson. 1986. The Yellowstone River Instream Reservation. Seventh Annual Report. Montana Department of Fish, Wildlife, and Parks.

Reclamation. 1969. Memorandum Of Understanding Between The United States of America, Dawson County, Montana, and the Montana Fish and Game Commission Concerning the Administration and Development of Lands and Facilities at Lower Yellowstone Diversion Dam and Its Impoundment for Recreation And Wildlife Purposes. Dated March 18, 1969. On file, Montana Area Office, Bureau of Reclamation, Billings, Montana

Reclamation 1993. Bureau of Reclamation Indian Trust Asset Policy. Washington, D.C.

Reclamation. 2002. *Value Engineering Final Report: Intake Diversion Dam Fish Protection and Passage Concept Design, Lower Yellowstone Project.* Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Reclamation and Corps. 2009. Public Scoping Summary Report, Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Environmental Impact Statement. Dakotas Area Office, Bureau of Reclamation.

Regan, H. M., M. Colyvan, and M. A. Burgman. 2002. A Taxonomy and Treatment of Uncertainty for Ecology and Conservation Biology. *Ecological Applications* 12: 618-628.

Rehwinkel, B.J. 1978. Powder River Aquatic Ecology Project, Final Report, 1975-1978. FWP, Helena.

Rider, B. 1998. Former Manager, Lower Yellowstone Irrigation Project. Telephone interview in November with Mary McCormick, Renewable Technologies, Inc.

Royce, C. 1899. *Indian Land Cessions in the United States*. Part 2 of the *Eighteenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1896-97*, Washington D.C.

Scheuhammer, A.M., and S.L. Norris. 1996. The Ecotoxicology of Lead Shot and Lead Fishing Weights. *Ecotoxicology* 5:279-295.

Service. 1993. *Recovery Plan for the Pallid Sturgeon (Scaphirhynchus albus).* Region 6, U.S. Fish and Wildlife Service, Denver, Colorado.

Service. 1997. *National Wetlands Inventory*. A System for Mapping Riparian Areas in the Western United States.

Service. 2000a . 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.

Service. 2000b. Memorandum to the Bureau of Reclamation from the Service, September 19, 2000.

Service. 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.

Service. 2007. Pallid sturgeon (*Scaphirhynchus albus*) Five Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Billings, Montana.

Service. 2009. Amendment to Reasonable and Prudent Alternative in the 2003 Amended Biological Opinion to the Corps. U.S. Fish and Wildlife Service, Colorado.

Sidor, I.F., M.A. Pokras, A.R. Major, R.H. Poppenga, K.M. Taylor, and R.M. Miconi. 2003. Mortality of Common Loons in New England, 1987-2000. *Journal of Wildlife Diseases* 39:306-315.

Silverman, A.J., and W.D. Tomlinsen. 1984. Biohydrology of Mountain Fluvial Systems: the Yellowstone (part 1). Project G-853-02 Completion Report. U.S. Geological Survey, Reston, Va.

Snortland, J. Signe. 2009. Class III Survey of a Stockpile Area for the Relocate Main Channel Alternative, Intake Diversion Dam Modification, Lower Yellowstone Project. Unpublished Manuscript on File, Dakotas Area Office, Bureau of Reclamation, Bismarck.

Solomon, S., D. Qin, M. Manning, R.B. Alley, T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, J.M. Gregory, G.C. Hegerl, M. Heimann, B. Hewitson, B.J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T.F. Stocker, P. Whetton, R.A. Wood and D. Wratt. 2007. Technical Summary. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]*. Cambridge University Press, Cambridge, United Kingdom and New York, New York.

Stagliano, D. 2008. *Freshwater Mussels of Montana – A Field Guide.* 2008. Montana Natural Heritage Program. Helena, Montana.

Stagliano D. 2009. MTNHP Yellowstone Mussel Surveys 2009. Unpublished Manuscript on File with the Montana Natural Heritage Program, Montana.

Stewart, R.E. 1975. Breeding Birds of North Dakota. Tri-College Center for Environmental Studies, Fargo, North Dakota.

Stewart, P.A. 1986, 1988, 1990, 1991. Fish Management Surveys. Federal Aid in Fish Restoration, Project F-30-R-22, Montana Department of Fish, Wildlife & Parks.

Thatcher, T., B.Swindell, and K. Boyd. 2008. Yellowstone River Channel Migration Zone Mapping. Prepared for Custer County Conservation District, Yellowstone River Conservation District Council.

U.S. Census Bureau. 2009a. Census 1990, Summary File 1; generated using American FactFinder, http://factfinder.census.gov; August 2009.

U.S. Census Bureau. 2009b. Census 2000, Summary File 1; generated using American FactFinder, http://factfinder.census.gov; August 2009.

U.S. Census Bureau, Population Division. 2009c. Table 1: Annual Estimates of the Resident Population for Counties of Montana: April 1, 2000 to July 1, 2008 (CO-EST2008-01-30). Release Date: March 19, 2009.

U.S. Census Bureau, Population Division. 2009d. Table 1: Annual Estimates of the Resident Population for Counties of North Dakota: April 1, 2000 to July 1, 2008 (CO-EST2008-01-38). Release Date: March 19, 2009.

U.S. Geological Survey. 2000. Organic Compounds and Trace Elements in Fish Tissue and Bed Sediment From Streams in the Yellowstone River Basin, Montana and Wyoming, 1998. *Water-Resources Investigations Report* 00-4190.

U.S. Geological Survey. 2002. *Preliminary Comparison of Pallid and Shovelnose Sturgeon for Swimming Ability and Use of Fish Passage Structure.* S.O. Conte Anadromous Fish Research Center, U.S. Geological Survey, Biological Resources Division, Turner Falls, Massachusetts.

U.S. Geological Survey. 2004. *Water Quality in the Yellowstone River Basin, Wyoming, Montana, and North Dakota, 1999-2001, Circular* 1234.
Upper Missouri River Basin Pallid Sturgeon Work Group 2009. Habitat Availability and Larval Drift Issues for Pallid Sturgeon and Other Native Fishes in the Yellowstone River. White paper submitted to Reclamation by Travis Horton on April 23, 2009.

Walters, C. J. 1986. *Adaptive management of renewable resources.*; McMillan, New York, New York.

Wardell, J. F. 2008. Letter from Director, Montana Area Office, U.S. Environmental Protection Agency, to Dan Jewell, Area Manager, Montana Area Office, Bureau of Reclamation, October 2, 2008.

Watson, J.H., and P.A. Stewart. 1991. Lower Yellowstone River Pallid Sturgeon Study. Montana Department of Fish, Wildlife and Parks, Miles City.

Webb, J.M. 2002. The Mayflies of Saskatchewan. M.S. thesis. University of Saskatchewan. Saskatoon, Saskatchewan, Canada.

White, R.G., and R.G.Bramblett. 1993. The Yellowstone River: Its Fish and Fisheries. Pages 396-414 in: L.W. Hesse, C.B. Stalnaker, N.G. Benson, and R.R. Zuboy, editors. Restoration planning for the rivers of the Mississippi River ecosystem. *National Biological Survey, Biological Report* 19, Washington, D.C.

White, R.G. and B. Mefford. 2002. *Assessment of Behavior and Swimming Ability of Yellowstone River Sturgeon for Design of Fish Passage Devices*. Montana Cooperative Fishery Research Unit, Montana State University-Bozeman and Water Resources Research Laboratory, Reclamation, Denver, Colorado.

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

Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2007. *Adaptive Management: The U.S. Department of the Interior Technical Guide.* Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Zelt, R.B., G. Boughton, K.A. Miller, J. P. Mason, and L.M. Gianakos. 1999. Environmental setting of the Yellowstone River Basin, Montana, North Dakota, and Wyoming. *Water-Resources Investigations Report* 98-4269.