RECLAMATION

Managing Water in the West

Municipal, Rural, and Industrial Water System
Crow Reservation, Montana

Draft
Environmental Assessment

June 2016

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CROW TRIBE
Crow Tribe Water Resources

This page intentionally left blank.

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

The mission of the Bureau of Indian Affairs is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives.

This page intentionally left blank.

Table of Contents

TABLES

FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

$\mu g/m^3$	micrograms per cubic meter
AADT	Annual Average Daily Traffic
AFY	acre-feet per year
APLIC	Avian Power Line Interaction Committee
BIA	Bureau of Indian Affairs
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMPs	Best Management Practices
CAA	Clean Air Act
cfs	cubic feet per second
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CIP	Crow Irrigation Project
CTWRD	Crow Tribe Water Resources Department
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
DECAT	Design, Estimating, and Construction Advisory Team
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FWCA	Fish and Wildlife Coordination Act
GHG	Greenhouse Gas
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HDD	Horizontal Directional Drilling
Hwy	highway
IERT	Interagency Environmental Review Team
IPCC	Intergovernmental Panel on Climate Change
ITA	Indian Trust Asset
MBTA	Migratory Bird Treaty Act
MDT	Montana Department of Transportation
MCL	maximum contaminant level
mg/L	miligrams per liter
mgd	million gallons per day
MR&I	Municipal, Rural, and Industrial
MNHP	Montana Natural Heritage Program
MTDEQ	Montana Department of Environmental Quality
MTFWP	Montana Fish, Wildlife, and Parks

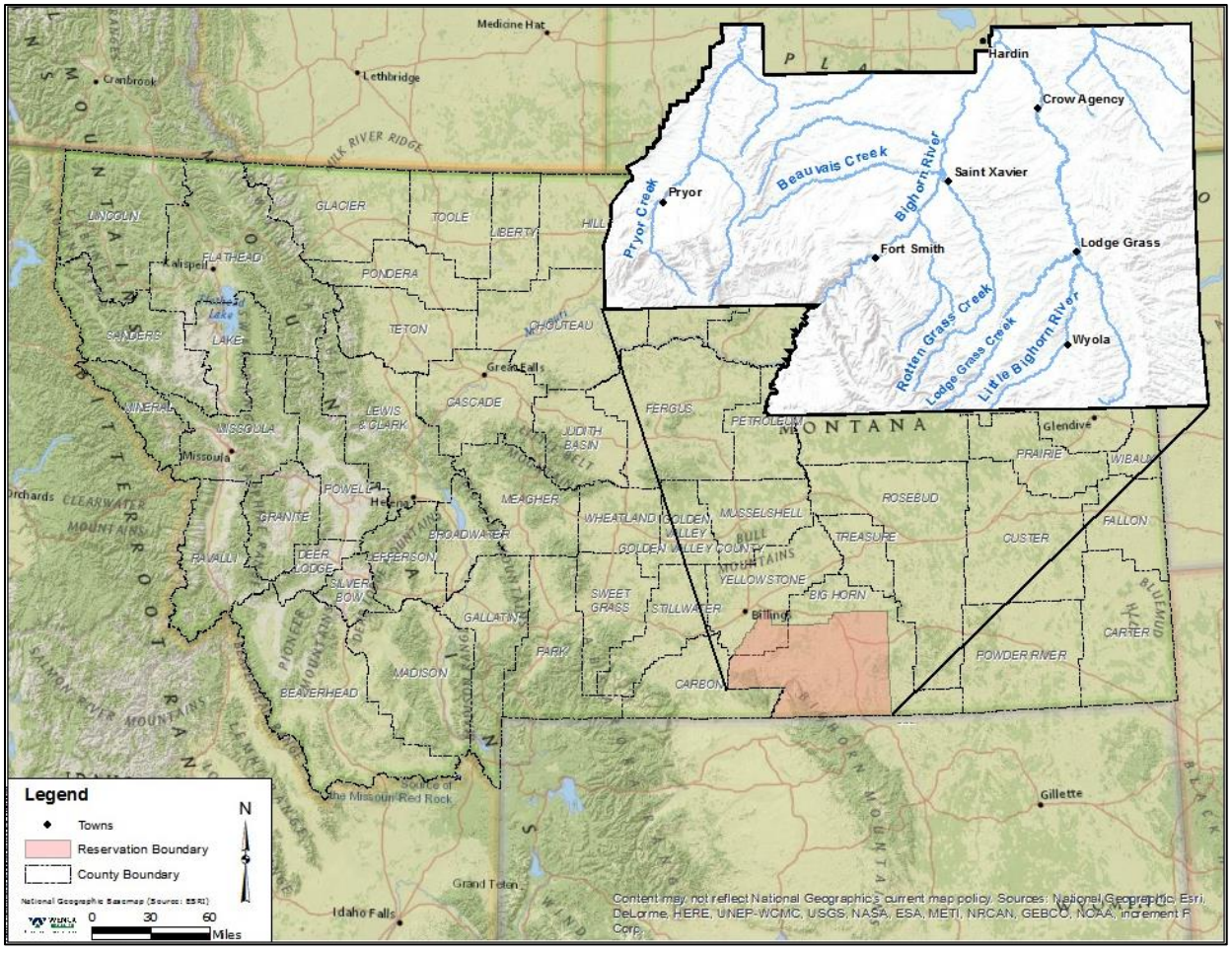
N/A	Not Applicable
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NO_2	Nitrogen Dioxide
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSR	New Source Review
O_3	Ozone
OM&R	Operation, Maintenance, and Repair
OSHA	Occupational Safety and Health Administration
Pb	Lead
PFYC	Potential Fossil Yield Classification
P.L.	Public Law
ppm	parts per million
RCRA	Resources Conservation and Recovery Act
Reclamation	Bureau of Reclamation
Reservation	Crow Indian Reservation
ROW	Right-of-way
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SGCN	Species of Greatest Conservation Need
SIP	State Implementation Plan
SLLMP	Streamflow and Lake Level Management Plan
SO_2	Sulfur Dioxide
SPCC	Spill Prevention Containment and Countermeasures
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
TERO	Tribal Employment Rights Office
THPO	Tribal Historic Preservation Officer
TOC	total organic carbon
Tribe	Crow (Apsáalooke) Tribe
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WTP	Water Treatment Plant

1.0 Purpose of and Need for Action

1.1 INTRODUCTION

The Crow Indian Reservation (Reservation), the largest of Montana's reservations, is approximately 2.3 million acres and is located in south-central Montana, with its southern border following the Montana-Wyoming state boundary. The Reservation is primarily rural with a number of dispersed small towns. These are Crow Agency, Reservation headquarters; Fort Smith; Lodge Grass; Pryor; St. Xavier; and Wyola. The Reservation includes portions of three mountain ranges and three major rivers, surrounded by rolling hills and semi-arid plains (**Figure 1.1**).

Figure 1.1 Crow Reservation, Montana



The existing water facilities on the Reservation include public water systems in each of the communities and private groundwater wells serving most rural households. Crow Agency is served by two water treatment plants (WTPs) sourced by the Little Bighorn River, while the other communities have groundwater systems. Existing water systems have had ongoing problems with drinking water quality.

The condition of the facilities varies; some are in good condition, others need improvements or have limited storage capacity.

The Crow (Apsáalooke) Tribe (Tribe) is proposing to construct a municipal, rural, and industrial (MR&I) water system within the Reservation (proposed project/MR&I system). The proposed system would include facilities to collect, treat, and distribute water to end users throughout the Reservation. The system would provide potable water to communities and rural residents. The system would meet both current and future water needs for domestic, commercial, and industrial uses.

1.2 AUTHORITY

The Claims Resolution Act of 2010 (Section 406 of Public Law (P.L.) 111-291, December 8, 2010), herein referred to as the Settlement Act, authorized approximately $246 million (indexed to May 2008) for the design and construction of an MR&I system and directs the Secretary of the Interior, acting through the Bureau of Reclamation (Reclamation), to plan, design, and construct an MR&I system through an agreement(s) with the Tribe.

At the request of the Tribe, the Secretary of the Interior entered into a formal Self-Determination Construction Contract (pursuant to Title I of the Indian Self Determination and Education Assistance Act, P.L. 93-638), by which Reclamation "transfer to the Tribe the funding and related engineering, planning, design and construction programs, functions, services and activities (or portions thereof) that are otherwise contractible under 25 U.S.C. § 450f, for the planning, design and construction of the MR&I System authorized by the Act." Contract R12AV60002 spells out the specific roles and responsibility of both parties.

1.3 PURPOSE OF THE PROPOSED ACTION

The purpose of the proposed action is to provide an adequate supply of quality potable water for municipal, rural, and industrial uses throughout the Reservation, as specified in the Settlement Act.

1.4 NEED FOR THE PROPOSED ACTION

A high quality, reliable water system is needed on the Reservation because there are multiple deficiencies with the existing water systems serving communities. These deficiencies have been documented by the Indian Health Service's Sanitation Deficiency System, in Community Data Sheets and Sanitary Surveys completed by the U.S. Environmental Protection Agency (EPA) and Montana Department of Environmental Quality (MTDEQ), and in a Needs Assessment report prepared by DOWL-HKM Engineering (1999). A list of the deficiencies is provided in **Appendix A**. These reviews identified several key needs for the proposed project:

- **Impaired water quality.** Several existing systems throughout the Reservation have difficulties meeting primary and secondary Safe Drinking Water Standards.
- **Inadequate capacity.** Existing water supply systems are inefficient and present persistent maintenance challenges that affect the capacity of the system. Peak use demands may lead to a compromise between water quantity and quality. Current water supply and storage facilities were not designed or intended to support the current or future population of their respective communities.

- **Poor condition of facilities.** Lack of water level meters, deteriorating distribution pipes and storage tanks, and lack of maintenance create deficiencies and cause inefficiency, overfilling, leaks, and inadequate water treatment.
- **Groundwater limitations.** Local water sources used for community systems are poor in quality and deficient in quantity; typical shallow wells tend to produce hard, mineralized water.
- **Low water pressure.** Some of the local water systems lack sufficient pressure (less than 20 pounds per square inch) and are unreliable during periods of peak use. Water shortages have been experienced when systems have failed to keep up during peak demands.
- **Inadequate emergency storage.** Fire protection is less than adequate for Pryor, Crow Agency, Lodge Grass, and Wyola. Fire flows (1,000 gallons per minute (gpm) for two hours) are needed to meet industry standards. Some systems do not have enough storage capacity to provide for emergency backup.
- **Underserved rural areas.** There are large areas of the Reservation that do not have a reliable source of water due to the low quality or quantity of groundwater. Currently, water is routinely hauled in these areas.

1.5 BENEFITS AND OPPORTUNITIES

A new MR&I system would provide a number of positive benefits and opportunities to the Tribe and residents living on the Reservation.

- A new MR&I system would provide capacity for the existing population and future growth.
- The Tribe would use its water rights from the Bighorn River for beneficial purposes.
- Potential for reduction of operational and maintenance complexities and inefficiencies.
- Improvement of human health and well-being is an important benefit of clean water.
- A safe and reliable water system in turn provides opportunities for improved economic conditions and sustained viability for local communities.
- Underserved areas of the Reservation could be served and potentially developed for future uses.
- Equal opportunities for community development would be enhanced. The proposed project would fulfill a need to address disadvantages for communities with poor water systems.
- Fire control would be improved through a sufficient supply of water and on-site storage.
- The MR&I system could be designed with “Ten State Standards” and redundancy measures to improve serviceability in rural areas.

1.6 NATURE OF DECISION TO BE MADE

The National Environmental Policy Act (NEPA) requires Federal agencies to consider the potential environmental consequences of their actions and any reasonable alternatives, before deciding whether and in what form to taken an action.

If appropriate, this Environmental Assessment (EA) will culminate in a Finding of No Significant Impact (FONSI) and Decision Document, wherein Reclamation will document its determination that the selected/authorized action will have no significant environmental impacts. Alternatively, Reclamation may determine that the proposed project would have significant environmental impacts and, as a result, work will begin on an Environmental Impact Statement (EIS). Once the EIS is prepared, the NEPA process would conclude when a record of decision is issued.

Reclamation retains the lead federal agency responsibility for providing the funding and technical oversight for the design and construction of the MR&I system, including ensuring that the proposed project meets applicable industry standards, considering the equitable distribution of water, and improving the cost-effectiveness of the proposed project (see contract R12AV60002).

Reclamation will issue any FONSI or prepare an EIS if necessary. The responsible official for making the federal decision is the Regional Director, Great Plains Region, Reclamation.

The Bureau of Indian Affairs (BIA) is a cooperating agency with the authority to facilitate legal access (such as issuance of easements for right-of-way and surface leases and/or permits) across lands held in trust by the United States in order to implement the Tribe's Proposed Action (25 Code of Federal Regulations (CFR) 162 and 25 CFR 169). BIA decision making for these above regulations is established by the BIA's responsibility under 209 DM 8, 230 DM 1, 3 IAM 4 (Release No. 00-03), 10BIAM 4, as amended. The responsible official for making this federal decision and issuing any FONSI or preparing an EIS, if necessary, is the Superintendent, Crow Agency Office, Rocky Mountain Region, BIA.

Reclamation and the BIA also have a responsibility to protect and conserve trust assets of the Tribe and Tribal members. This responsibility extends into providing oversight of the expenditure of appropriated federal project funds to best serve the interests of the Tribe and its members. Project review ensures that collective government actions taken by Interior agencies and the Tribe fulfill trust asset responsibilities while meeting environmental laws and regulations.

1.7 ISSUES TO BE EVALUATED

In an EA, key issues are environmental effects of importance that focus the review. Often they are a combination of environmental, social, and economic concerns. Based upon information obtained through scoping, discussion with interested and affected parties, and existing laws and regulations, 16 key resources, issues, or concerns are potentially relevant to the proposed project, and will be analyzed in the EA, which are the following:

1. Socioeconomics and Environmental Justice
2. Public Health and Safety
3. Water Resources
4. Fisheries and Aquatic Life
5. Soils and Geology
6. Vegetation and Land Use
7. Cultural and Trust Resources
8. Aesthetics/Visual Resources
9. Air Quality

10. Climate Change
11. Floodplains
12. Noise
13. Threatened and Endangered Species
14. Traffic
15. Wetlands
16. Wildlife Resources.

Other issues were identified early in the proposed project planning and scoping process that were determined, upon further analysis, to not be relevant to the proposed project. A discussion of these issues and the rationale for why they were determined to not be pertinent are summarized in the Project Record.

1.8 JURISDICTION AND PERMITS

As a project proposed by the Tribe within the boundaries of the Reservation, the primary regulatory jurisdiction for the proposed project is the Tribe. Laws of the Tribe, including environmental laws and regulations, must comply with applicable federal law. In cases where the Tribe has not yet established or enacted laws, standards, or programs for protection and management of environmental resources, federal jurisdiction and permitting would apply. The State of Montana has limited jurisdiction on the Reservation, however; the riverbed and banks of the Bighorn River were ruled to be under the jurisdiction of Montana in a 1981 Supreme Court ruling (Harris 2013a).

The Tribe has an Environmental Policy Act that mirrors the federal environmental review process under NEPA (CLOC Title 24, Chapter 2; Harris 2013b). Aside from formal laws, the Apsáalooke tribal culture is one that in general places value and importance on the natural world; the connection of plants, animals, and the elements to human life; and on analyzing the effect of present actions on future generations (Reed 2002).

Jurisdiction and permitting requirements anticipated for the proposed project are summarized in **Table 1.1**. Required consultation and agency involvement are discussed in the introduction to each section in Chapter 3 and summarized in Chapter 5, Consultation and Coordination. The necessity of certain state and local permits would be determined upon final project design.

Table 1.1: Environmental Laws That May Require Consultation or Permitting

Oversight Agency	Statute	Action-Forcing Device
US Environmental Protection Agency (EPA)	Clean Water Act, Sections 401, 402, and 405	Construction disturbance more than one acre, project discharges into Bighorn River, and land application of biosolids sludge. National Pollutant Discharge Elimination System (NPDES) and Storm Water Permits would be obtained prior to design and construction and maintained per periodic inspections.
	Clean Air Act, Section 112	Attainment of National Ambient Air Quality Standards (NAAQS). No permit required.
	Resource Conservation and Recovery Act	Generation and disposal of solid or hazardous waste must comply with guidelines per compliance monitoring.

Oversight Agency	Statute	Action-Forcing Device
	Safe Drinking Water Act	Drinking water from public water systems. Periodic testing must meet primary standards for contaminant levels.
US Army Corps of Engineers (USACE), Billings Regulatory Office	Clean Water Act, Section 404	Dredge or fill of navigable waters, including some wetlands, may require permit.
	River and Harbors Act, Section 10	
US Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	Farmland Protection Policy Act	Conversion of farmland to non-agricultural use. Permanent structure sites may need evaluation by NRCS.
Tribal Historical Preservation Office (THPO)	National Historic Preservation Act, Section 106	Excavation and construction. Consultation with THPO required. Permits may be necessary.
US Fish and Wildlife Service (USFWS)	Endangered Species Act	Consultation with USFWS required.
	Migratory Bird Treaty Act	
	Bald and Golden Eagle Protection Act	
	Fish and Wildlife Coordination Act	
	Wetland and grassland easements	Consultation with USFWS recommended.
Montana Department of Natural Resources and Conservation	Montana Natural Streambed and Land Preservation Act, Section 310	Permit potentially applicable for work on Bighorn River.
	Montana Land-use License of Easement on Navigable Waters	Potentially applicable for work on Bighorn River.
Montana Fish, Wildlife and Parks	Montana Stream Protection Act, Section 124	Permit potentially applicable for work on Bighorn River.
Montana Department of Environmental Quality (MTDEQ)	Short-term Water Quality Standard for Turbidity, Section 318	Authorization potentially applicable on Bighorn River.
Montana Department of Transportation (MDT)	Not applicable (N/A)	Permit required for work within MDT right-of-way (ROW). Consultation with MDT required.
Federal Emergency Management Agency, Local Floodplain Administrator	National Flood Insurance Program	New development within designated Special Flood Hazard Areas must apply for a Floodplain Development Permit. Potentially applicable for Bighorn River.

2.0 Description of Proposed Action and Alternatives

2.1 INTRODUCTION

This chapter describes the alternatives considered for the Crow MR&I proposed project including the proposed action and no-action alternative as well as a number of preliminary alternatives that have been considered during the planning of the proposed project. A screening process was used to refine alternatives and to identify a "Preferred Alternative" that best satisfies the purpose and need for the proposed project. The preliminary alternatives were determined to be infeasible or less desirable for various reasons and have not been included in further analysis.

Further detail on the Proposed Action Alternative, and other alternatives considered but rejected, is provided in the *Master Plan* (Bartlett & West 2014), the *Engineering Report* (DOWL HKM 2009), the *WTP Alternatives Report* (Bartlett & West and CTWRD 2015a), and the *Pilot Results Report* (Bartlett & West and CTWRD 2016). Copies of these documents and associated studies and reports summarized herein are available electronically and at Reclamation's Great Plains Regional Office in Billings, Montana.

2.2 ALTERNATIVES DEVELOPMENT AND SCREENING

Three key iterations of alternatives development and screening have occurred over the course of project planning which have been documented in the following stages: 1) a needs assessment and engineering report, 2) a master engineering plan, and 3) a water treatment alternatives analysis. During the first two iterations, water needs and design criteria were defined, project-level alternatives were developed, and a screening process was completed to analyze and select a project-level alternative that best met the defined needs. During the third iteration, water treatment process alternatives were developed and screened based on water treatment requirements, goals, and results of a pilot study. Ultimately, 13 project-level alternatives and 21 water treatment process alternatives were examined. A summary of the alternatives screening process and results are provided below.

2.2.1 Needs Assessment and Engineering Report

The first iteration of alternatives development was prior to and leading up to the Settlement Act and involved two different studies: the *Needs Assessment: MR&I Water System, Crow Reservation, Montana* (MSE-HKM 1999) (*Needs Assessment*) and the *Crow Indian Reservation MR&I Water System Engineering Report* (DOWL HKM 2009) (*Engineering Report*). The *Needs Assessment* evaluated the current and future water needs of the Reservation based on evaluation of water use, current and future population estimates, and existing facilities in the Reservation communities of Crow Agency, Pryor, Lodge Grass, and Wyola. This study also documented existing surface and groundwater sources of the project area and presented available data on the quantity and quality of those sources (MSE-HKM 1999, p. 11-28).

The *Needs Assessment* led to an engineering analysis that compared six alternatives for a regional water system (i.e., *Engineering Report* Alternatives 1 through 6, described further in **Appendix B**). The

Engineering Report analyzed the service area for a regional system, established preliminary design criteria, analyzed six alternative water system configurations, and estimated the cost to plan, design, construct, operate, and maintain a regional system. Design criteria were based on estimates of water use, population projections, potential livestock and industrial water demands, and engineering related factors (for specific criteria used see DOWL HKM 2009, p. 3-12).

The *Engineering Report* also evaluated water resources on the Reservation to determine an appropriate source for a regional water system. The evaluation considered quantity and quality of water sources as well as the legal context for diverting water for an MR&I water system (DOWL HKM 2009, p. 13-18). The report concluded that of the major surface water drainages that cross the Reservation, the Bighorn River Basin was the only source with an adequate and reliable water supply for a Reservation-wide MR&I system. The other drainages are short of water from existing uses, and tribal water rights are junior in priority. Groundwater sources were also reviewed; similar to the findings from the *Needs Assessment*, the *Engineering Report* determined that the variation in yield and quality of shallow and deep aquifers would not provide a reliable and sufficient water supply for a Reservation-wide MR&I system.

Of the six alternatives developed in the *Engineering Report* (described further in **Appendix B**), two base pipeline layouts were considered which differ in how water is delivered to the Crow Agency and Lodge Grass areas. The remaining alternatives considered various water demands by comparing a base service to meet the needs of Reservation communities with additional service options to the city of Hardin, for livestock demands, and for future heavy industrial use or economic development. Hardin is outside the Reservation adjacent to its north boundary (**Figure 1.1**). Similarities between the alternatives included use of the Bighorn River as the water source and the intake and water treatment plant location below the Yellowtail Afterbay Dam.

The screening criteria for these six initial alternatives considered engineering constraints, costs, and Tribal preferences on service options (Bartlett & West, pers. comm.). Alternatives that did not use direct routing to deliver water to the Little Bighorn Valley were rejected because they were higher in estimated cost due to the necessity of larger diameter pipe and more pumping in the long-term. Alternatives serving Hardin were rejected at this stage because Hardin had not committed to using the water, and thus the Tribe did not want the added cost of up-sizing facilities to accommodate an unclear need. Alternatives that included service separately for livestock and industrial demands were rejected in favor of an alternative that included service for both of those options. The preferred alternative in the *Engineering Report* combined the desired portions of the other alternatives and was therefore ultimately selected to be used as a component of the Settlement Act, i.e. the "Authorized Alternative." **Appendix B** is a summary of the six alternatives.

In October 2012, after the Settlement Act had been passed by Congress, Reclamation conducted a *Value Planning Study* on the "Authorized Alternative" (Reclamation 2012). The purpose of the study was to develop solutions for the proposed project that would reduce costs and/or improve cost-effectiveness of delivering MR&I system water. The study resulted in two formal proposals and many other ideas that were recommended for further consideration during the final design process. One of the proposals that was accepted by the Tribe was to prepare a Master Plan to refine the proposed action and to guide final design of the system (*Accountability Report*, CTWRD 2013). Other value planning study ideas included reassessing current and future population projections, evaluating current and future water demands, reevaluating the water treatment process, and analyzing the viability of relocating the intake and water treatment plant along the Bighorn River near St. Xavier.

2.2.2 Master Plan Screening Summary

The second iteration of alternatives development occurred after the conclusion of the Settlement Act. The Settlement Act directed the Tribe to design and construct a Reservation-wide MR&I water system as generally described in the preferred alternative presented in the *Engineering Report*, as a means to apply the water to beneficial use [Sect. 406 (c)(1)]. As directed by the guidance of the *Value Planning Study* and *Accountability Report*, estimated Reservation water needs were updated and design criteria were further refined as part of the *Crow MR&I System Master Plan* (Bartlett & West 2014, Section 3, p. 32-50 and Section 6, p. 117-269) (*Master Plan*). The design criteria were developed using U.S. Census Bureau data, the EPA sanitary survey data, household surveys, commercial and industrial water use estimates, and other engineering reports for rural water systems of similar size and type. These refined criteria, summarized in **Table 2.1**, were used to develop a final range of alternatives for the overall project and distribution system route (described further in **Appendix B**).

Table 2.1: Design Criteria for the Alternatives

Variable	Criteria
Water Demand	
Design Life	50 years
Design Population	9,060
Design Flow	450 gpcd (average daily water use rate of 180 gpcd, and a peaking factor of 2.5)
Water Delivery Period	24-hour operating day
Total System Storage	Approximately 4.5 million gallons, including community and regional tanks, as well as peak equalization, reserve, operational, and fire storage.
Total Water Need	Approximately 6.7 mgd with Hardin
Physical Parameters	
Pipeline Size	1.5 to 24 inches
Delivery Pressure Range	30-55 psi
Pipeline Depth	6 feet for distribution and transmission pipelines; 6.5 feet for service lines

Source: *Master Plan*, Bartlett & West 2014; Abbreviations: gpcd (gallons per capita per day); mgd (million gallons per day); psi (pounds per square inch)

Seven project-level alternatives, including a no action alternative, were developed using the criteria summarized in **Table 2.1**. These seven alternatives were outlined in the *Master Plan* (Bartlett & West 2014, p. 272-333). The main differences between alternatives were the location of the water treatment plant and the recommended water treatment process. Service with and without Hardin was again considered. An alternative that would include upgrading and expanding existing systems (i.e., satellite system alternative) was also considered. **Appendix B** includes a summary of the seven alternatives.

The *Master Plan* alternatives were evaluated using a matrix to compare the ability of each alternative to meet multiple selection criteria (*Master Plan*, p. 333-350). The selection criteria were based on proposed project requirements that focus on technical or engineering adequacy, economic adequacy, environmental impact, and social impact, summarized in **Table 2.2**.

Table 2.2: Selection Criteria for Evaluation of *Master Plan* Alternatives

Technical or Engineering Adequacy	How well the alternatives meet industry standards, how well they fulfill the stated purpose and need for the proposed project, and how well alternative system facilities will perform. 1) *Purpose and Need:* the ability of the project alternative to develop a reliable supply of raw water, produce high quality potable drinking water, and distribute that water to meet estimated water demands throughout the Reservation.

	2) *Technical Complexity:* the extent to which more complicated equipment and systems are necessary to deliver the intended proposed project benefits (also relating to staff needs, automation, and maintenance frequency). 3) *Constructability:* ease with which proposed project facilities may be constructed (minimizes construction challenges such as rock excavation, high water table, crossings, permitting, easement acquisition, etc.). 4) *Operational Flexibility:* assesses how well the alternative can operate under a range of conditions, including raw water quality, adequate raw water supply, variable demand, minimized operation, maintenance, and replacement (OM&R), etc. 5) *System Redundancy, Reliability, and Efficiency:* how well the alternative can deliver water service during periods of operational anomalies, and incorporates water and energy conservation into facility design and operations. 6) *Compliance with Standards and Regulations:* how well the alternative meets various requirements, including the Ten State Standards and/or the Montana Department of Environmental Quality Circular DEQ-1, Safe Drinking Water Act Standards, Clean Water Act, and other laws.
Economic Adequacy	Because the annual benefits resulting from each of the system alternatives under consideration are expected to be approximately the same, an alternative was deemed cost effective if it had the lowest cost of all alternatives over the projected life of the system. This includes construction; and operating and maintenance costs, specifically: 1) Minimizes total capital cost. 2) Minimizes present value of annual OM&R costs. 3) Minimizes net present value.
Environmental Impacts	The relative extent to which each alternative would affect the natural and human environment. The criteria include: 1) Adverse impacts to the natural environment are minimized. 2) Adverse impacts to threatened and endangered species are minimized. 3) Adverse impacts to cultural resources and historic properties are minimized.
Social Impacts	The degree to which each alternative benefits society, the Tribe, its members, and residents of the Reservation. The criteria include: 1) *Job creation:* extent to which the proposed project results in new jobs on the Reservation. 2) *Public health and safety:* how well the new water supply provided by each alternative will contribute to the health and well-being of the residents throughout the service area. 3) *Governance and cultural integration:* extent to which each alternative would promote or enhance Tribal sovereignty and self-determination.

Source: *Master Plan*, p. 334-346

As a result of the matrix screening process, the satellite system alternative was identified as having distinct disadvantages compared to a regional system in terms of cost and efficiency. For these reasons, as well as being outside the scope of the Settlement Act, it was rejected (see **Appendix B** for further discussion). The screening process also determined that the four system alternatives presented in the *Master Plan* (i.e., *Master Plan* Alternatives 1, 1A, 2, and 2A) met the purpose and need for the proposed project better than the Authorized Alternative (*Engineering Report* Alternative 6) that resulted from the Settlement Act. Of these four, the two alternatives with the intake and WTP near Fort Smith may present permitting challenges, construction problems due to bedrock, viewshed impacts, and higher cost. In comparison, the two alternatives with the WTP near St. Xavier would require approximately 100,000 fewer feet of pipe. The two alternatives including service to Hardin were expected to generate more economic activity than alternatives without service to Hardin.

After a draft *Master Plan* had been prepared, Reclamation conducted a Design, Estimating, and Construction Advisory Team (DECAT) Review (Reclamation 2014). The purpose was "to provide independent technical review to assess whether products related to design, cost estimating, and construction, as presented in the draft Master Plan, were technically sound and provide a credible basis for decision making." This review was instrumental in addressing several differences in professional opinion over certain design criteria that had been vigorously debated throughout preparation of the draft *Master Plan*. Recommendations in the DECAT report served as a mechanism for resolving concerns and ensuring that the Tribe was fully aware of decisions that were being made in the *Master Plan*.

Ultimately, the decision process resulted in the Tribe's selection of *Master Plan* Alternative 2 as their "Proposed Action Alternative," with the intake and WTP near St. Xavier and no initial service to Hardin (but with the capacity to expand to Hardin in the future). At the time the *Master Plan* was finalized (2014), there was no indication that the city of Hardin would be interested in receiving water service from the project, however the Tribe decided that there was a reasonable possibility that Hardin would eventually request water service. As a result, Alternative 2 was selected with the understanding that the option of building the intake and water treatment plant large enough to eventually develop an ultimate capacity of 6.7 mgd would remain under consideration.

2.2.3 Water Treatment Process Alternatives Screening Summary

In the third iteration of alternatives development, 21 technically feasible water treatment processes (also called "treatment trains") were considered and evaluated using raw water quality information and a set of defined water treatment goals. The evaluation of the treatment trains is described in the following three reports: the *Crow MR&I System, Water Treatment Plant Alternative Analysis Report* (Bartlett & West and CTWRD 2015a) (*WTP Alternatives Report*); the *Final Crow MR&I System Pilot Results Report* (Bartlett & West and CTWRD 2016a) (*Pilot Results Report*); and the *Crow MR&I System Final Alternative Analysis Report* (Bartlett & West and CTWRD 2016b) (*Final Alternatives Report*).

The alternatives were developed based on the Tribe's following treatment goals:

1) Requirement-Water produced will meet the Safe Drinking Water Act (SDWA), including:
   a) National Primary Drinking Water Regulations
   b) Stage 1 and Stage 2 Disinfection / Disinfection By-Product Rule
   c) Lead and Copper Rules
   d) Total Coliform Rule
   e) Long-Term 2 Enhanced Surface Water Treatment Rule
   f) Filter Backwash Recycling Rule
2) Goal- Water produced shall be softened from the raw water hardness level of "Very Hard" (approximately 180-300+ miligrams per liter (mg/L) as CaCO3) to "Moderately Hard" (125-150 mg/L as CaCO3) or less.
3) Goal- Effluent Water quality will meet National Secondary Drinking Water Standards for contaminants of concern, such as iron, manganese and aluminum.
4) Goal -Effluent Water quality will achieve sufficient total organic carbon (TOC) reduction to minimize disinfection by-product formation to 33 percent lower than regulatory mandates, but not less than 10 percent lower than regulatory limit.
5) Goal- Flexibility of the selected process to adapt and have the ability to achieve the potential treatment goals presented by future regulations. Water will be compliant with potential future

regulations, specifically Nitrosodimethylamine and the formation of other nitrogenous disinfection by-products associated with Chloramines.

The preliminary alternatives differed in combinations of water treatment technologies for filtration, softening, pretreatment and post-treatment stages to reach the above goals. Several were rejected based on concerns with particular technologies to meet treatment goals, regulatory concerns, equipment limitations, and costs (detailed on p. 20-21, Bartlett & West and CTWRD 2015a).

Eight of the water treatment process alternatives were carried forward and compared in detail using water treatment process flow schematics, capital and OM&R cost estimates, and an evaluation of water treatment goals and operational complexity (e.g., labor intensity, technical difficulty) (*WTP Alternatives Report*, p. 21-44 and *Final Alternatives Report*, p. 5-15). The main differences were the types of treatment technologies, OM&R costs, and the ability to meet water treatment goals. **Appendix B** includes a summary of these eight alternatives. Select treatment steps of each of the eight treatment trains were carried forward into on-the-ground pilot scale testing for further study, as reported in the *Pilot Results Report* (Bartlett & West and CTWRD 2016a). The results of pilot testing showed that Alternative Train #7 best met the defined treatment requirements and goals.

2.2.4 Conclusion

Based on these evaluations, this EA carries forward for further analysis the "No Action Alternative" and Alternative 2 from the *Master Plan*, using Alternative Train #7 for the water treatment process, as the "Proposed Action Alternative". The Proposed Action Alternative is also referred to as the proposed action or the proposed project.

2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, a new MR&I system would not be constructed, nor would existing public systems be expanded to serve the region (i.e., satellite system) under the authority of the Settlement Act. The No Action Alternative does not meet the purpose and need for the proposed project, and was implicitly considered during the decision-making process leading up to the Settlement Act. The No Action Alternative is presented here and evaluated throughout the EA for purposes of a general comparison.

Under the No Action Alternative, existing water systems would continue to be used and small community systems would likely continue to struggle to comply with EPA Safe Drinking Water Standards. Many of the public systems are approaching the end of their useful life and would need to be replaced, likely within the next five to ten years.

Rural residents would continue to maintain existing individual water supply systems for themselves and their livestock. Water supply would continue to be a limiting factor for commercial and industrial growth. While it is not possible to predict site-specific future activities associated with the No Action Alternative, it would be likely that efforts to obtain or improve domestic and industrial water supply would continue to occur. Examples include drilling additional wells, acquiring new supply and distribution systems, or hauling water. These activities would have the potential to affect the natural and physical environment and would have associated costs. It would be likely that water needs would become more dependent on groundwater sources.

2.4 PROPOSED ACTION ALTERNATIVE

The Proposed Action Alternative, also referred to as the proposed action or proposed project, is the construction, operation, maintenance, and replacement of a Reservation-wide water system designed to provide 4.5 mgd of reliable high quality water to residents and communities of the Reservation, with the capacity to expand to 6.7 mgd if future service to Hardin is requested. The proposed MR&I system would serve three regional service areas on the Reservation: the Bighorn Valley, the Little Bighorn Valley, and the Pryor Extension. **Figure 2.1** shows the layout of the proposed water system, and the main components are described below.

The proposed action represents the maximum project development that is expected to occur. Therefore, the analysis of potential effects in Chapter 3 reflects the maximum effects that could occur as a result of the proposed action. The geographic extent and population served by the proposed project could be smaller depending on participation in the proposed project. Specifically, the proposed action assumes that every rural residence would be served; however, it is likely that there would be rural residents that decline water service. It is also possible that Hardin will never request water service. There may also be some service lines, such as those at higher elevations, which are determined to be infeasible due to excessive pumping costs. Further, the proposed action assumes the entire construction easement/footprint for pipelines and facilities would be disturbed, whereas in practice, surface disturbance would be limited to the space necessary to maintain a safe work area.

Design and construction of the proposed action would be guided by the engineering *Master Plan*, which contains technical details about location, design, materials, methods, testing, and operation of the proposed MR&I system. Proposed project completion may require 15 to 20 years (see Section 2.4.4), which would require updates to the *Master Plan* as new details are agreed upon between the Tribe and Reclamation. Over the course of proposed project construction, annual work plans or unit work plans would be prepared by the Tribe before the start of each construction season, and reviewed by Reclamation, with involvement and input from an interagency environmental review team (IERT) (refer to **Appendix D**). This would allow for scheduling of site-specific field surveys and environmental review if needed.

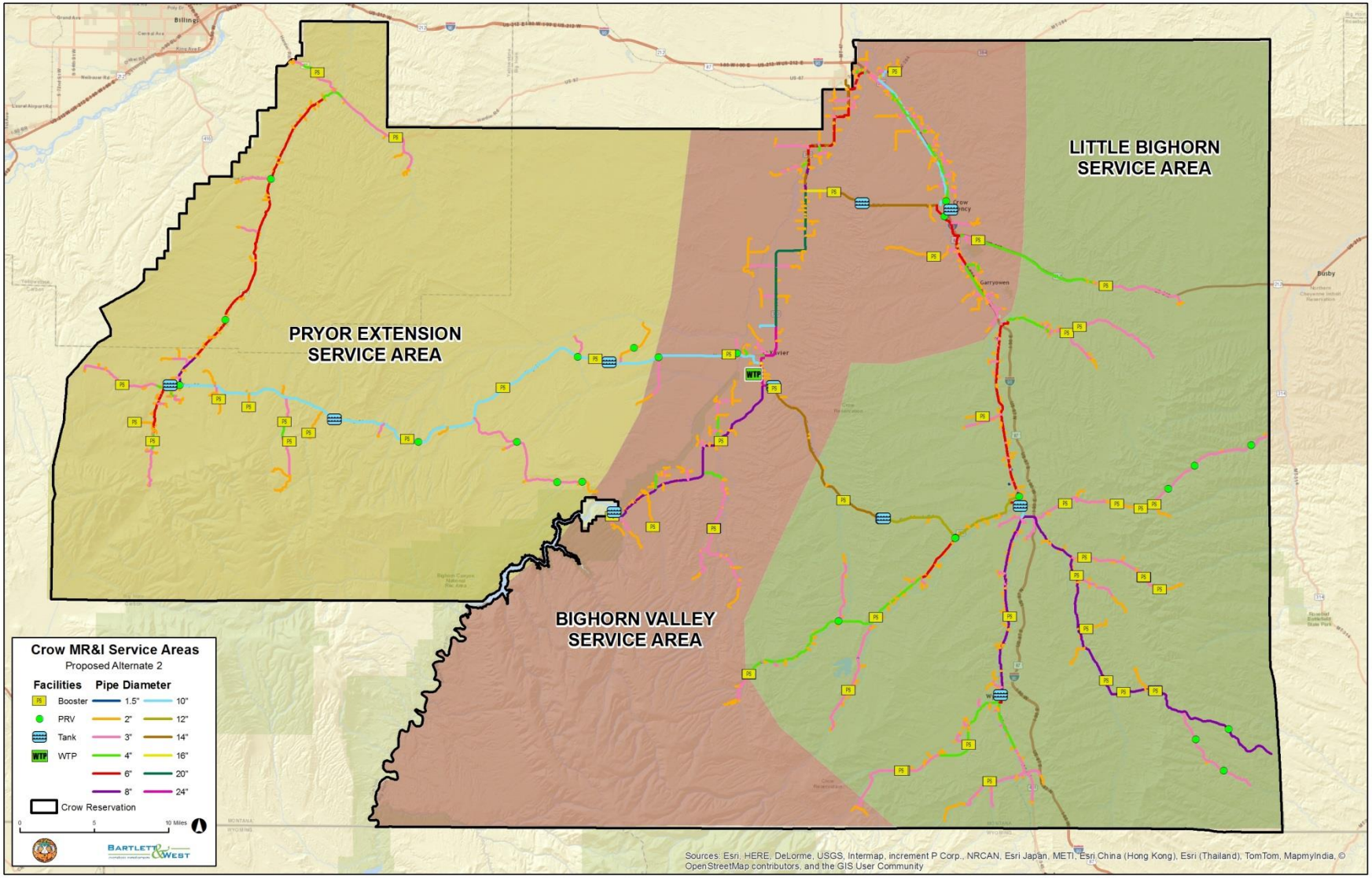
2.4.1 Project Components

The proposed project consists of eight major components: intake, WTP, distribution system (pipeline), pump stations, storage facilities, valves and accessory structures, Supervisory Control and Data Acquisition (SCADA) and electrical systems, and service connections. Each project component is described in the sections that follow, with the typical construction steps for each described in **Appendix C**. Further detail is provided in the *Master Plan*, Sections 6 and 7 (p. 130-245 and p. 350-391). Some details of the eight major components, such as the location of the intake, the exact pipeline route, and location of valves and accessory structures, would be finalized during the design phase and with input from the IERT.

Intake

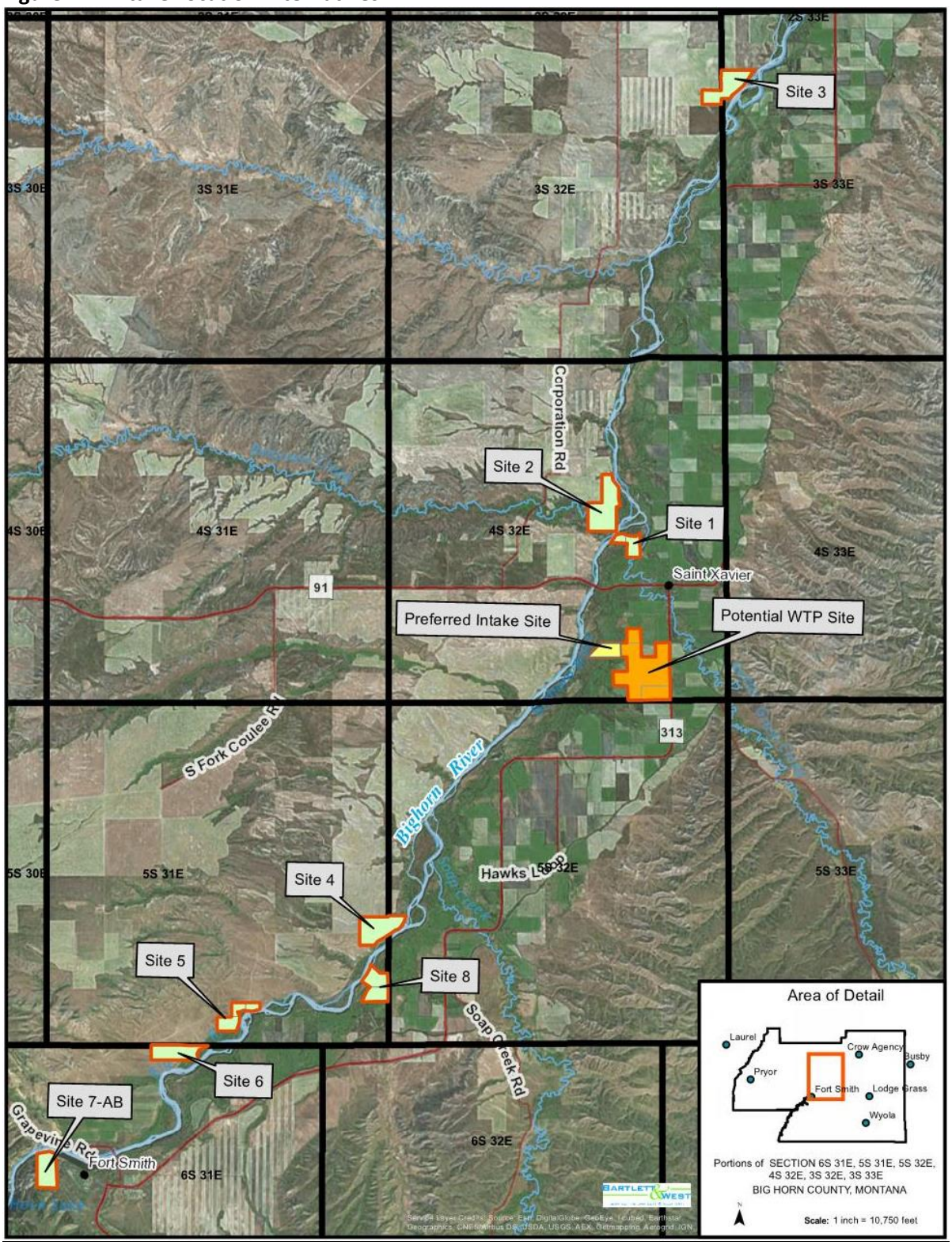
The proposed raw water intake would be constructed on the bank of the Bighorn River. The exact location would depend on land purchase negotiations, geotechnical investigations, a hydrogeology evaluation, and other evaluations to verify viable intake structure options. **Figure 2.2** shows the intake location alternatives under consideration. Two intake types are under consideration: 1) riverbank

Figure 2.1: Proposed MR&I Service Areas and Major Components



filtration, which would draw groundwater under the influence of surface water from beneath the riverbed, or 2) surface intake, which would draw surface water directly from the river.

Figure 2.2: Intake Location Alternatives



Regardless of intake location or type, the intake would withdraw a maximum of 13 cubic feet per second (cfs) for a 6.7 mgd WTP, and would operate as necessary for efficient WTP operation, up to a continuous 24 hours per day, except during maintenance.

The maximum footprint required for the intake site would be approximately five acres for short-term construction disturbance, with a maximum 1.5 acres of that area for the permanent aboveground structures and facilities (**Table 2.7**). The maximum length of riverfront required would be approximately 1.1 miles (5,800 feet) and new access routes may be necessary.

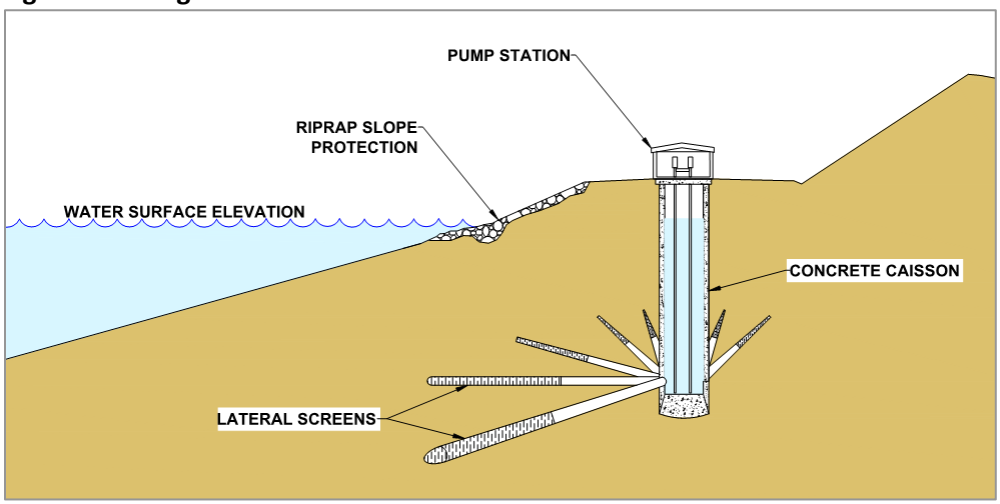
Preferred Intake Location and Type

The preferred intake location is south of St. Xavier on the east bank of the Bighorn River, near Highway (Hwy) 91 (a.k.a. Good Luck Road) ("Preferred Intake Site" in **Figure 2.2**). An estimated two miles of permanent, graveled road and 4.5 acres of short-term construction disturbance, maximum, are anticipated in order to develop new access routes to this location.

The preferred intake type is riverbank filtration, drawing groundwater under the influence of surface water from alluvial sand and gravel layers under the Bighorn River. Riverbank filtration is preferred because it provides natural filtration of sediment, debris, and contaminants prior to intake, resulting in reduced chemical use during pretreatment and reduced need for disinfection. In turn, this generates less sludge and makes it easier to meet SDWA rules. Raw water from riverbank filtration is more consistent in quality and temperature and typically has minimal color, odor, turbidity, and algal issues, resulting in less facility maintenance. The use of riverbank filtration is not intrusive to the river bottom or subject to damage and blockage by ice and debris in the river. It is not susceptible to invasive plant infestation and has no impact on fisheries or aquatic life.

The preferred intake structure would consist of a vertical, reinforced concrete caisson placed to a depth below the bottom of the surface water of the Bighorn River (**Figure 2.3**). A number of collector well screens would radiate out from the base of the caisson like spokes on a wheel into the surrounding soils. Water would flow into the central caisson through these horizontal screens, where it would be collected and pumped to the ground surface via turbines (located in a pump station, constructed above the caisson). This intake type minimizes aboveground disturbance and does not require construction in the river.

Figure 2.3: Diagram of Vertical Caisson with Radial Collector Wells



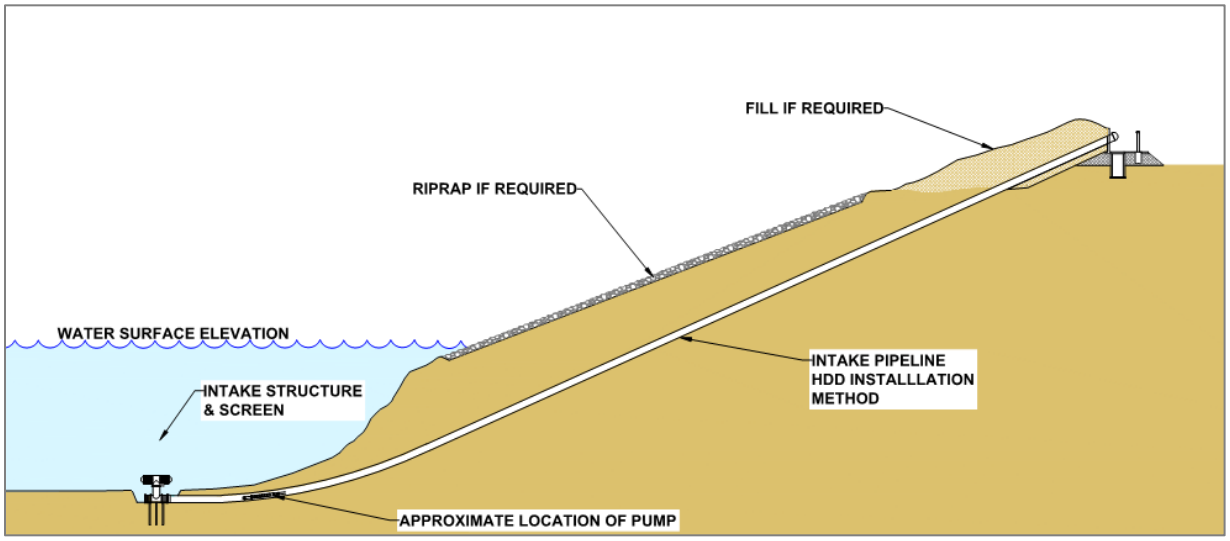
Alternative Intake Locations and Types Remaining Under Consideration

Eight alternate intake locations remain under consideration (Sites 1 through 8 in **Figure 2.2**). The sites range in the length of riverfront that would be required from approximately 0.3 miles (1,400 feet) to 1.1 miles (5,800 feet). The length of access road required ranges from less than 0.1 miles (less than 530 feet) to two miles (10,560 feet).

Aside from the intake location, the type of intake is also under consideration. Riverbank filtration is the preferred type, but a surface water intake is still under consideration. A surface water intake would consist of a screened inlet at the end of a pipe(s) within three feet of the river bottom (**Figure 2.4**). If a surface intake would be selected, mitigation measures would be implemented to minimize impacts to fish, aquatic life, and recreational use of the river (see Section 0, Environmental Commitments).

Other than the preferred structure, several intake structure options are viable. Options for riverbank filtration include angled wells or a vertical concrete caisson with one or more infiltration galleries. Options for surface water intake structures include a vertical concrete caisson with horizontal intake piping or a sloped tube intake. These structures are described in detail in the *Master Plan* (p. 181-186).

Figure 2.4: Example of Surface Water Intake: Sloped Tube Intake



Water Treatment Plant

The proposed WTP would be near the town of St. Xavier, on land owned by the Tribe. The final location of the WTP would depend on land negotiations, geotechnical investigations, and other evaluations. Several WTP location alternatives are under consideration (**Figure 2.5**). The WTP would produce a maximum 6.7 mgd of treated water that would be pumped to a nearby storage tank (called the St. Xavier Regional Reservoir, see *Storage Tanks*Storage).

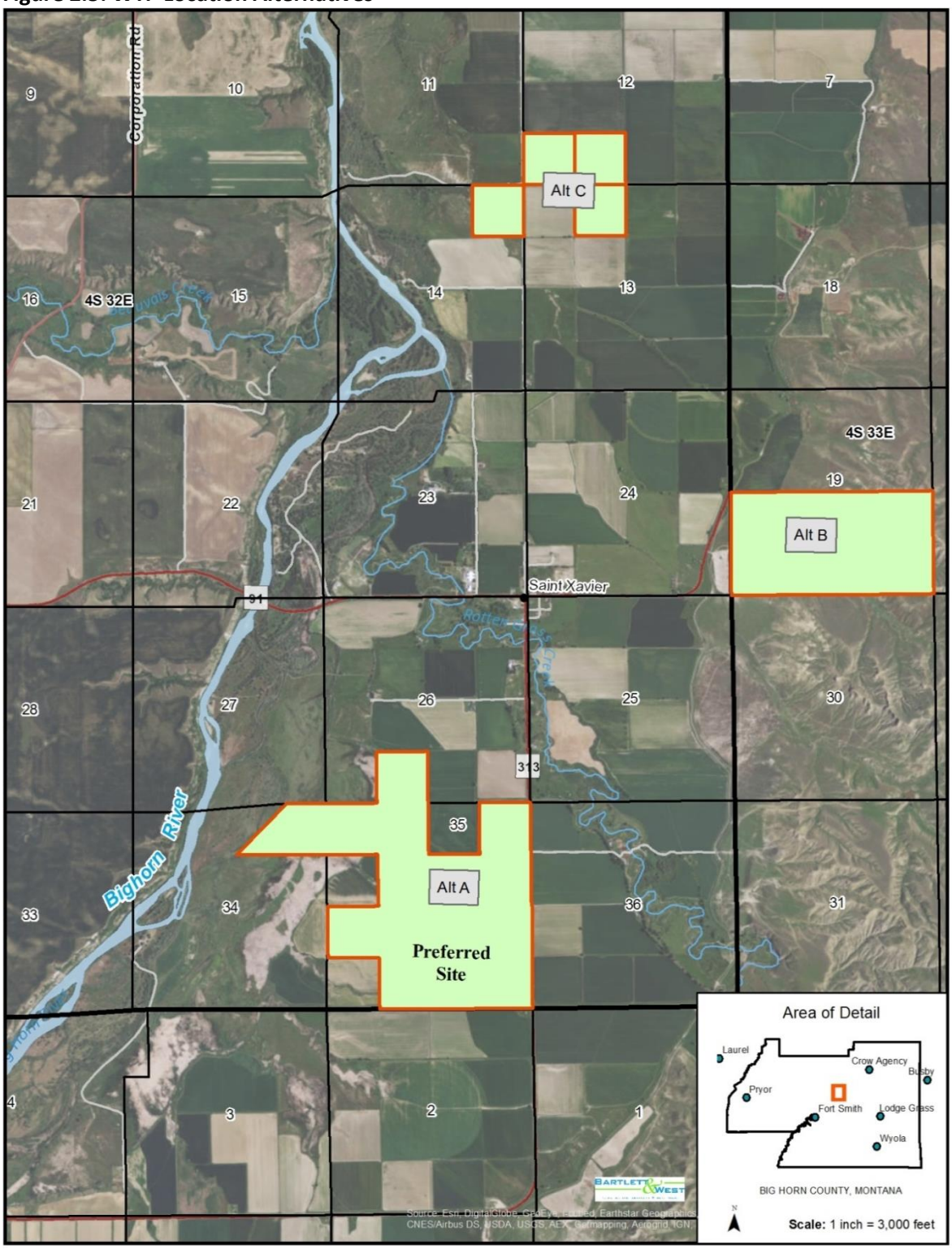
The footprint associated with the WTP site would be in the range of approximately 40 to 60 acres for both short-term construction disturbance and the area occupied by permanent WTP facilities (**Table 2.7**). The two options for construction of the WTP facility are:

- Construct the building to house all equipment up to the full 6.7 MGD while purchasing the equipment in phases.

- Construct the building to house equipment up to 4.5 MGD and expand the building footprint at a later date.

The 40 to 60 acre footprint would be the same regardless of the WTP construction phasing.

Figure 2.5: WTP Location Alternatives



A conceptual site plan is shown in **Figure 2.6**, which includes the WTP building, sludge drying beds/storage lagoons, recovery ponds, and septic drain fields. The WTP site would include a parking lot and access road and potentially the treated water storage tank described above. These facilities and acreage footprint would be required at the WTP site regardless of location, water treatment process, or method of waste stream disposal.

Figure 2.6: Conceptual WTP Site Plan

In the preferred treatment process, solid wastes called sludge would be produced every day. On-site lagoons and recovery basins would be constructed to receive the sludge from the treatment process. The lagoons and basins would allow solids to settle out and evaporation to occur, while some water would be recycled to the WTP for further treatment. Information on treatment plant chemical requirements is provided in the *Pilot Results Report* (Bartlett & West and CTWRD 2016a). Sludge

generated during water treatment has the potential to be re-used as a soil amendment or would be disposed of at an approved off-site facility.

In addition to solid wastes, the WTP would produce a waste stream at the end of the preferred treatment process; these residual liquids are expected to contain approximately five times the concentration of chemical components as compared to raw water. During full capacity operation (6.7 mgd), the treatment plant is expected to produce up to 1.2 mgd (1.8 cfs) of liquid wastewater. Several options, described below, are under consideration for the disposal of the waste stream.

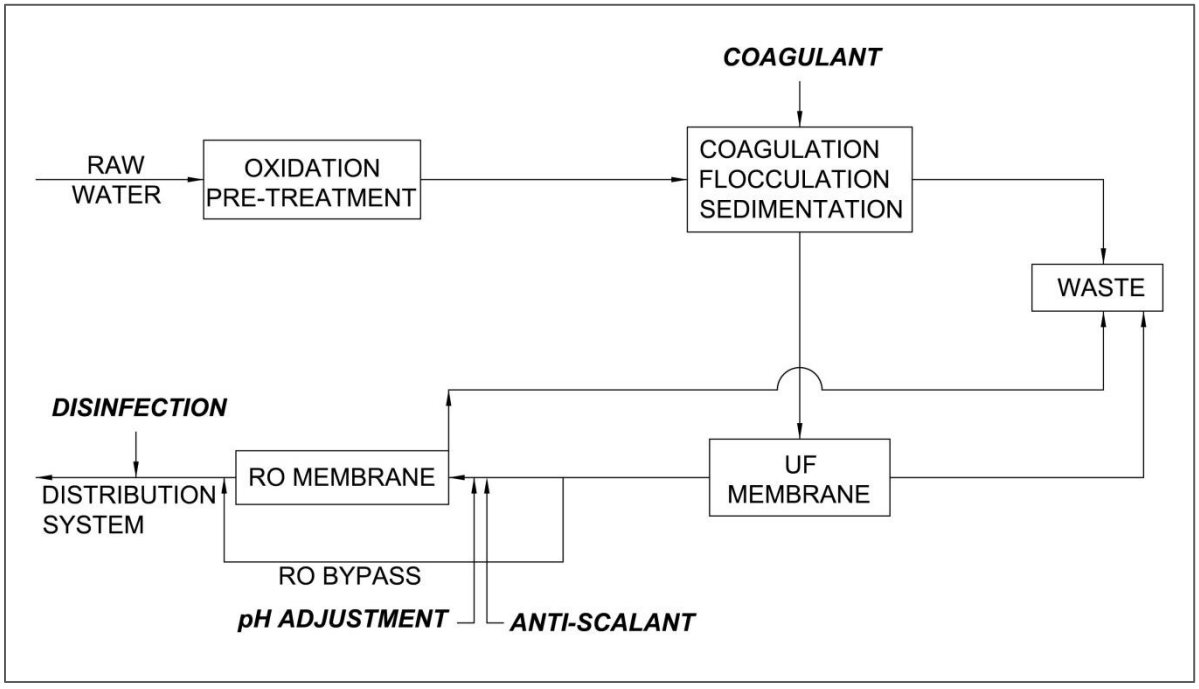
Preferred WTP Location, Treatment Process, and Waste Stream Disposal

The preferred WTP location is the site to the south of St. Xavier ("Preferred Site/Alt A" on **Figure 2.5**). It is preferred because it is tribally owned and its location is accessible to a highway, existing power, and the Bighorn River.

The preferred water treatment process (also known as a "treatment train") includes the following main steps, which are illustrated in a flow schematic in **Figure 2.7**:

1) **Pretreatment Oxidation, Coagulation, Sedimentation**: Breaks down contaminants (such as iron, manganese or taste and odor causing compounds) into a more removable state and reduces the amount of suspended solids from the water before sending it through a filter (step 2).
2) **Micro/Ultra Filtration**: Filters water to further remove suspended solids, organics, pathogens, and other particulates.
3) **Nanofiltration/Reverse Osmosis Softening**: Softens the water, removes broken down contaminants (see step 1), and improves taste and odor.
4) **Chlorine Disinfection**: Disinfects the filtered water by killing waterborne pathogens.

Figure 2.7: Flow Schematic of Selected Water Treatment Process



Treatment steps are indicated within boxes. The inflow of raw water begins in the upper left corner. The flow continues as indicated by arrows to the right, then down (with a branch in the flow), then to the left, with the treated water outflow in the lower left corner. Chemical additions are indicated in bold, italicized text. UF=ultrafiltration; RO=reverse osmosis

The preferred method for disposing of the wastewater stream is to discharge into the Bighorn River. The proposed discharge outlet would consist of a pipeline exiting the riverbank into the deepest portion of the river bottom, capped with a perforated pipe. The perforated pipe would help to speed up the dilution of the waste stream once it is mixed with the river water. Discharges into the Bighorn River would require approval and permitting from EPA. No additional acreage for evaporation ponds would be needed for this method. This option is preferred because it is the simplest and least expensive disposal option.

Alternative WTP Location and Wastewater Disposal Options Remaining Under Consideration
Two alternate WTP locations remain under consideration ("Alt B" and "Alt C" on **Figure 2.5**). All three sites, the preferred site and the two alternates, are near St. Xavier, east of the Bighorn River, meet the minimum size required for the facilities, and have access to the river. The sites north and south of St. Xavier are on cultivated agricultural land within two miles of the river and are tribally owned, whereas the site east of St. Xavier is on rangeland, is about one mile further from the river, and is fee land.

Multiple options exist for the disposal of the wastewater stream. Other than discharging to the river, other options include, in order of preference:

1) Further treatment of a portion of the liquid waste stream. The treated portion of the liquid wastes would be discharged into the Bighorn River and the remaining, untreated portion would be sent to evaporation ponds or lagoons. As with the preferred disposal method, this disposal method would require approval by the EPA, an additional 60 acres (120 acres total for the WTP) would be needed for the untreated portion of the liquid waste stream;
2) Sending all liquid wastes to evaporation ponds or lagoons, an additional 190 acres (250 acres total for the WTP) would be needed; or
3) Deep well injection of all liquid wastes. The possibility of deep well injection would depend on geotechnical investigations and other further evaluations.

These options are described in more detail in the *Master Plan* (p. 365-368) and would be further evaluated during the design phase, if the preferred disposal method is not approved.

Pipeline

Approximately 750 miles of pipeline would be used to distribute water to the three service areas of the Reservation (**Figure 2.1**). The proposed system would include transmission main pipelines and distribution pipelines. The pipelines would be primarily polyvinyl chloride and ductile iron pipe and would vary in diameter between 1.5 inches and 24 inches, with the majority being between two and eight inches in diameter. The pipelines would be buried to a minimum depth of six feet or below the known frost depth, whichever is deeper. The main transmission pipelines would be generally aligned to roads or other existing features such as fence lines or section lines to reduce the cost for acquiring easement access and for efficient construction and maintenance. Distribution pipelines are smaller diameter pipes (typically less than six-inch diameter) that convey flow from regional storage tanks to points of use within each service area (i.e., rural service connections or community tanks).

Pipeline alignments may be adjusted during the design phase, depending on easement negotiations and other site-specific engineering and environmental considerations. Main transmission pipeline easements would be 50 feet wide for permanent easements and 100 feet wide for temporary construction easements. Distribution pipeline easements would be 30 feet wide for permanent easements and 50 feet wide for temporary construction easements.

Approximately 5,300 acres would be disturbed for pipeline construction if all distribution and service lines were installed; this entire area would be reclaimed in the long-term, with a minor permanent acreage needed for aboveground pipeline markers and pipeline accessory structures (See *Pipeline Accessory Structures and Service* Connections and **Table 2.7**). Pipelines would cross roads, railroads, utility lines, rivers and streams, irrigation canals and other facilities. (See **Appendix C** for descriptions of typical construction and trenching steps.)

Pump Stations

Pump stations would be needed to deliver water to some areas. The Proposed Action Alternative includes 13 pump stations to serve the main transmission pipeline and 34 to serve the distribution pipelines (**Figure 2.1**). Final site locations of the pump stations would be determined during the design phase based on engineering, realty, environmental, and other considerations. Approximately 20 to 25 of the distribution pump stations would be located near the ends of pipeline branches that serve a very small number of users. The feasibility of serving these residences would be further assessed during final design, but have been included as part of the proposed action. Pumps would be located in aboveground buildings or underground prefabricated steel vaults. Either option would occupy an area of approximately 50 feet by 50 feet (less than 0.10 acre).

Storage Tanks

Seven regional storage tanks (**Table 2.3**) and three new community tanks (**Table 2.4**) would be used to store water and provide pressure to the system when pump stations are not pumping. The regional tanks would be larger than community tanks, would provide water for emergency water use, and would equalize storage during times of peak water use. New community tanks in Crow Agency, Pryor, and Lodge Grass would provide back-up storage to meet the average-day water demand plus additional capacity to meet fire flow demands within those respective communities. Community storage requirements for Wyola, St. Xavier, and Fort Smith would be provided by the regional tanks located in or near those communities; a separate tank dedicated to community storage would not be built in these communities.

Table 2.3: Regional Storage Tanks

Region	Capacity (gallons)
Pryor	514,414 (in two tanks)
Lodge Grass	594,968
St. Xavier	732,571
Crow Agency	977,933
Wyola	138,909
Ft. Smith	195,057

Table 2.4: Community Storage Tanks

Community	Capacity (gallons)
Crow Agency	629,340
Pryor	242,760
Lodge Grass	325,140

The storage tanks would range in height from 30 to 200 feet. **Figure 2.1** shows the proposed locations, which would be finalized during the design phase based on engineering, realty, environmental, and other considerations. An area of 0.5 to three acres would be required for the construction and easement of each tank. Tank sites would be graveled and fenced for security.

Pipeline Accessory Structures and Service Connections

Several types of pipeline accessory structures would be installed along the length of the pipeline. These structures include pressure reducing valves, flow control valves, air release valves, clean-out assemblies, and flush hydrants (further detail is provided in the *Master Plan*, Sections 6.11, p. 227-239). These structures serve various functions in operating and maintaining the pipeline system. These structures would be installed in buried concrete vaults or manholes for operator accessibility, with a small area of aboveground features, estimated to be less than 0.5 acres total for all structures combined. The structures would be contained within the pipeline or facility easements, typically on section lines or fence lines so maintenance activities would not interfere with land uses.

Preliminary system design includes water service connections to all 1,415 existing rural residences. The maximum amount of water a user would receive if all users were to take water at the same time over an entire day is 720 gallons per day (gpd). For the communities, the usage rate would be measured in gallons per capita per day (gpcd), as opposed to per service unit for rural users. The peak day usage rate for communities is designed at 450 gpcd. This rate accounts for MR&I system water demands by all water use sectors within the community including residential, commercial, and industrial.

Water meters would be provided for all users of the system to track water usage, prepare water bills, promote water conservation, and facilitate detection of leaks. Service connections for the proposed project would include master meters for communities and industrial connections and individual meter boxes for each rural user and livestock connections (**Table 2.5**).

Table 2.5: Estimated Service Connection Summary

Service Area	Rural Connections	Master Meters	Livestock Connections
Big Horn Valley	660	6	184
Little Big Horn Valley	480	3	180
Pryor Extension	275	1	116
Total	1,415	10	480

Source: *Master Plan*

For rural users, a service line would be extended from the distribution pipeline into the user's yard near the user's structure. Up to 100 feet length of pipe would extend from the meter box to make the service connection into their structure and existing plumbing. For urban users, service meters would be installed as either an interior meter located within the user's basement or as part of a community master meter. A remote meter readout device would be installed to allow the meter to be read without entering the user's structure.

The proposed project would provide a supplemental supply of water to serve approximately 48,000 cattle on the Reservation at 16.5 gpd per animal, for a total of approximately 792,000 gallons. This estimate is based on supplying water to half of the current cattle population of the Reservation. For planning and cost estimating purposes, it was assumed that 480 livestock connections would be provided, or one connection for every 100 head of cattle served. Rural users with large livestock or feedlot operations would have an opportunity to sign up for multiple service units during a sign-up campaign in advance of final design, although the additional service units are not guaranteed. The quantity of water and the water connections is expected to be used by other livestock and wildlife. For livestock users, a meter box assembly would be installed along with a yard hydrant on the downstream

side of the meter box. Livestock users would be responsible for providing a watering tank, cross connection control devices, and flow limiting valves.

SCADA and Electrical

A SCADA system would be used for monitoring and operation of the proposed project. Sensors throughout the system would convey information to the central control facility at the WTP, where trained personnel would operate the SCADA. Extensions to the electrical system would be needed to operate the SCADA and for some of the equipment at the intake and WTP. Both single-phase 120-volt and three-phase 240 or 480-volt power would be required; most are anticipated to be overhead lines, however, some may be underground depending on site conditions (**Table 2.6**). Standard overhead powerline height is a minimum clearance of 18 feet. Powerline routes would be finalized during the design phase based on engineering, realty, environmental, and other considerations.

Table 2.6: Electrical Extension Distance per Service Area

Service Area	Miles of Extension
Big Horn	25-50
Little Big Horn	50-75
Pryor Extension	75-100
Total	**150-225**

Source: *Master Plan*, p. 262

2.4.2 Operations, Maintenance, & Replacement

As construction of MR&I system facilities are completed, the United States would convey title of those facilities to the Tribe for OM&R as defined in the Settlement Act. Routine OM&R of MR&I system facilities, and replacements, additions, and extraordinary maintenance are critical to providing a reliable high-quality water supply over the 50-year design life of the proposed project. OM&R would require up to 28 permanent, full time staff with oversight by a five-member Board of Directors (Bartlett & West 2015d).

The Tribe intends to charge a monthly water bill to help pay for the annual costs for OM&R of the MR&I system, as authorized by the Settlement Act (Section 406(i)). Funds from the MR&I system OM&R Account in the Crow Settlement Fund would be used to assist the Tribe in paying MR&I system OM&R costs. A preliminary pricing study concluded that affordable rates can be established for water users and generate the remaining revenue necessary to pay annual OM&R costs (Bartlett & West 2015c). Final decisions regarding the rate schedule, along with the use of the OM&R fund, would be developed in conjunction with the MR&I system *Operation, Maintenance, and Replacement Plan*, which would be completed at a later date.

Facilities needed for OM&R include an administration building, permanent storage facilities, and maintenance shop, along with equipment such as operator pickup trucks, service vehicles, and excavators. The proposed location for the administration building is in Crow Agency (**Figure 2.8**). The site would include parking, a septic drain field, a water line extension from existing systems, and a permanent storage/maintenance yard, which together would occupy an area of approximately four acres. A permanent facility near St. Xavier would be used for construction, operations, and permanent storage for tools and equipment. The St. Xavier site would include two storage buildings and one construction operations building (**Figure 2.9**). The footprint of the St. Xavier facility would be

approximately 5.5 acres during its construction. After construction, the facility would permanently occupy 5.0 acres (**Table 2.7**). The proposed locations for these facilities would be finalized during the design phase based on engineering, realty, environmental, and other considerations.

Figure 2.8: MR&I Administration Building Site Layout

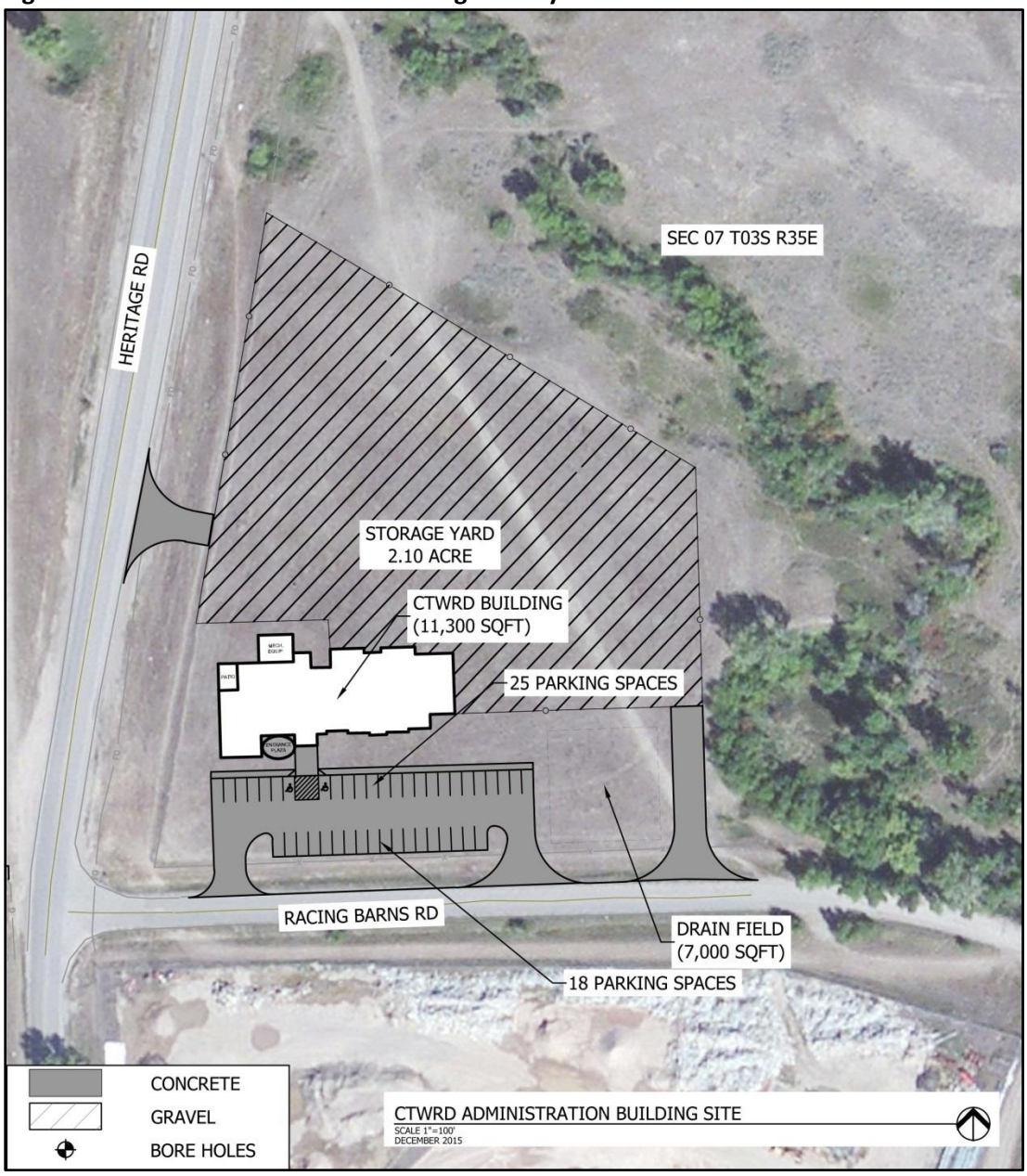
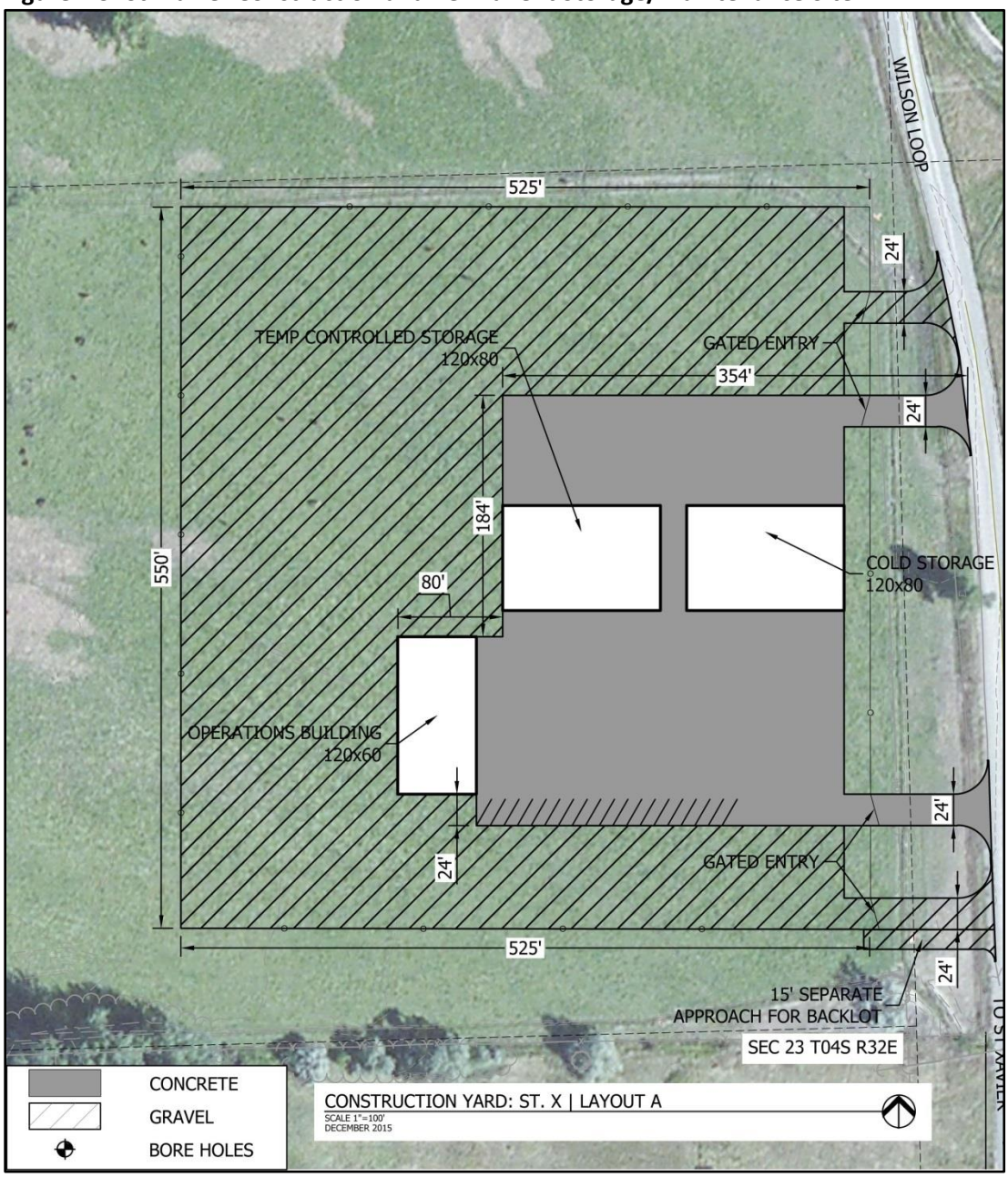


Figure 2.9: St. Xavier Construction and Permanent Storage/Maintenance Site



2.4.3 Community Upgrades

Community upgrades would be implemented as needed in communities that would not be reached by the regional pipe network for several years. Pryor, Wyola, and Lodge Grass upgrades would include replacing existing pipelines and associated accessory structures, installing new service lines to users, and rehabilitating or replacing their water source. Rehabilitation or replacement of the water source may include replacing or upgrading parts of a well such as a pump, valves, or equipment; drilling a new well(s); or installing a chemical feed system in the interim where there is inadequate equipment. The need for drilling new wells would be evaluated as a site-specific NEPA action. Once the MR&I system reaches the communities, the existing source would be physically disconnected from the system but

could be used for other purposes and serve as a backup water source in cases of emergency. Crow Agency would also receive upgrades including replacing existing pipelines and associated accessory structures and installing new service lines to users. Community upgrades would occur within the limits of existing community water systems, which are mainly within city limits and previously disturbed areas. Construction of these facilities would follow the steps as described for pipelines, service lines, and structures in **Appendix C**.

2.4.4 Project Construction

Phasing and Priorities

The length of time to design and construct the proposed project has been estimated at approximately 15 to 20 years, with construction estimated for completion in 2030. Given the size and types of work required for the proposed project, construction phasing would be necessary. Design, permitting, and construction planning activities would continue throughout project construction. Some projects would be constructed concurrently, and construction would be done year-round, as appropriate. Construction phasing would provide that only those areas slated for immediate assembly would be disturbed, thereby limiting the length of time that construction impacts would last at any one site.

Construction of the MR&I system has been divided into 23 major projects. These projects have been prioritized based on logistical progression, need, and Tribal direction. Construction would begin with the intake structure and the WTP and end with the Pryor extension and industrial extensions.

Staging and Storage

Five permanent staging and storage areas would be needed to support construction of the proposed project and future upgrades, replacements, and maintenance. Of these, one site has been included with the permanent administration facilities at Crow Agency (**Figure 2.8**) and one site is part of the warehouse facilities at St. Xavier (**Figure 2.9**) (see Section 2.4.2). The other three staging sites are located near the communities of Pryor, Wyola and Lodge Grass (see **Table 2.7**). The Wyola and Pryor staging sites would measure 3.5 and 4.0 acres, respectively, and be co-located with the community water storage tanks. The staging area in Lodge Grass is expected to measure 3.0 acres.

Disturbance and Reclamation Areas

Total short-term construction-related disturbance for the proposed project would be approximately 5,800 to 6,200 acres if all pipelines and facilities were installed (**Table 2.7**). About 60-75% of this disturbance would occur on currently or previously disturbed lands, such as cultivated fields, developed areas, road rights-of-way, etc., as estimated from aerial imagery of the proposed alignment. Construction would be phased and therefore the total surface disturbance would not occur at the same time.

The Crow Tribe Water Resources Department (CTWRD) has had preliminary discussions regarding the possibility of utilizing a central borrow area for materials should the need arise. The Tribe is currently negotiating an agreement with the Tribal Roads Department to utilize their existing borrow area along the Crow Agency Cut-Across Road (BIA Hwy 1). An agreement is expected within the next year. The site being discussed has a BIA mining plan and permit and has undergone previous NEPA review as part of that process. If the Tribe cannot reach an agreement with the Tribal Roads Department and the Tribe pursues a different borrow source, additional NEPA evaluation may be needed.

Approximately 97 to 99 percent of the area disturbed by construction would be reclaimed, which would involve redistributing topsoil and replacing vegetation, leaving a maximum range of 70 to 300 acres permanently disturbed from aboveground proposed project facilities and developed surfaces (e.g., parking areas, graveled access road, etc.) (**Table 2.7**).

Table 2.7: Estimated Maximum Project Surface Disturbance

Project Component	Description	Disturbance Acreage[1]	
		Short-term	Long-term
Intake	Aboveground structure	4	1.5
	Access road	4.5	3.5
Water Treatment Plant	WTP building, sludge ponds, septic drain field	40 to 60	40 to 60
	Evaporation ponds, if needed	0 to 190	0 to 190
Pipeline	Transmission – Approx. 119 miles, 100-foot wide construction easement, 50-foot wide permanent	1,400	Less than 0.5
	Distribution – Approx. 625 miles, 50-foot wide construction easement, 30-foot wide permanent	3,800	Less than 0.5
Service Connections	Rural Connections – Service lines 100 feet per rural user, 30-foot wide, maximum 1,415	100	Less than 0.5
	Livestock connections – 480	N/A	Less than 0.5
	Bulk users/master meters – 10	N/A	Less than 0.5
Pump Stations	Total of 47, each 50ftx50ft (2500 square ft), short-term disturbance within pipeline easement	N/A	2.5
Storage Tanks	Ten tanks, 0.5 to 3 acres each for construction; Two tanks co-located with construction yards, acreage accounted there (see Construction Staging/Storage Yards)	4 to 24	2 to 8
SCADA and Electrical	Approx. 150 to 225 miles of electrical line extension, 20-foot wide construction area	400 to 600	Less than 0.5
Administration Building Site	Crow Agency construction support/maintenance yard, administration building, parking, septic	3.5	3.5
St. Xavier Facility	St. Xavier construction/maintenance yard, two storage buildings, one operations building	5.5	5.0
Construction Staging/Storage Yards	Five sites, approx. 3.5 acres each; One site co-located with administration building and one site co-located with St. Xavier facility, acreage accounted there (see Administration Building and St. Xavier Facility, respectively)	10.5	10.5
Total Acreage		**5,800 to 6,200**	**70 to 300**

[1]Estimated to the nearest half acre for smaller components; estimated to the nearest hundred acres for larger components.

2.4.5 Environmental Commitments

This section presents environmental commitments (e.g., conservation measures and/or mitigation measures) that have been developed as an inseparable component of this proposed project (**Table 2.8**). These environmental commitments would be implemented to (1) prevent, minimize, or offset the occurrence of or potential for adverse environmental effects and (2) ensure compliance with applicable

Federal, Tribal, and State regulations designed to protect fish and wildlife resources, important habitats and sensitive areas, cultural and paleontological resources, human health and safety, and the public interest. They include both short-term measures and practices to minimize temporary impacts of construction activities, as well as long-term measures that would affect proposed project operations over time.

Should this proposed project be constructed, Reclamation, BIA, and the CTWRD will ensure these commitments are implemented prior to and/or during construction of the proposed project. Appropriate environmental commitments would be incorporated into the designs, construction contracts, and specifications of the proposed project. An IERT, with multi-agency representation, would be assembled to review environmental compliance for site-specific needs in the field, as deemed appropriate (see **Appendix D** for the IERT review process).

Table 2.8: Required Mitigation Measures for the Proposed Action

To Minimize Impacts in General
Construction activities would comply with applicable Federal, Tribal, State, and local laws and regulations. Appropriate construction and operation permits, licenses, and easements would be obtained prior to construction. Permits anticipated for the proposed project include, but are not limited to, those outlined in **Table 1.1**.
New pipeline, to the extent possible, would be placed just outside and parallel to the rights-of-way of existing roads, pipelines, or other utilities and/or would be aligned to fence lines or section lines for convenient and efficient access for construction and maintenance.
Valve boxes would be underground at the nearest fence or easement.
If established survey bench marks must be removed or should any monuments be dislodged or damaged during construction, the National Geodetic Survey (Attn: N/CG 162, Rockville, Maryland 20852) would be contacted.
Disturbed agricultural land and wetlands would be reclaimed to their previous condition following construction to avoid jeopardizing the eligibility of land in farm subsidy programs and retain compliance with NRCS Wetland Conservation provisions (if applicable).
Site-specific SWPPP and SPCC plans would be implemented and erosion control structures would be installed to control and prevent storm water runoff, sediment discharge, erosion, and spills into drainages according to MDT standards (MDT 2015a).

To Minimize Impacts to Socioeconomics and Environmental Justice
Landowners would be reimbursed for surface damages caused by construction according to the normal use of the land, such as crop damage, hay loss, and rangeland damage.
Household fees would be kept as affordable as possible for water users, using mechanisms such as affordability thresholds, conservation actions, and bill averaging, according to the CTWRD Water Code and Rules and Regulations.

To Minimize Impacts to Public Health and Safety
Site-specific Spill Prevention Containment and Countermeasures (SPCC) plans would be prepared and implemented as required to prevent, properly contain, and direct the clean-up of spills of fuels, oils, lubricants, and hazardous materials used for construction or operation activities.
Hazardous waste and solid waste storage, handling, and disposal procedures would follow EPA regulations, as required.

Construction and human wastes would be collected in appropriate containers and disposed at approved facilities. Dump grounds, trash piles, and potential hazardous waste sites would be avoided.
If preexisting contaminated soils are encountered during construction, the EPA would be notified.
The Tribe would develop and implement a safety plan for work crews. Visual inspection for factors such as open trench stability, slope stability, confined space, and other potentially hazardous working conditions would be identified according to Occupational Safety and Health Administration (OSHA) regulations. A safety inspector would monitor for implementation of safety measures.
One-Call would be contacted to locate and flag buried utility lines prior to soil-disturbing activities.

To Minimize Impacts to Air Quality, Climate Change, Noise and Traffic
Standard construction industry measures would be implemented to minimize fugitive dust emissions during construction activities.
Contractors would be required to adhere to local, county, and state regulations and ordinances regarding movement of equipment, oversized or overweight loads, and frost law restrictions.

To Minimize Impacts to Surface Waters, Wetlands and Floodplains
Proposed project structures such as pipelines, the WTP, pump stations, and buildings would be sited to avoid surface waters, wetlands and floodplains when practicable.
Boring and/or directional drilling techniques would be used where technically and economically feasible to avoid or minimize adverse effects to perennial streams, rivers, and wetlands. Entrance/exit points of bores would be set back from the stream or wetland edge a minimum of 20 feet plus required bending radius of the pipe. During bores, the volume and pressure of driller's mud would be monitored to detect possible leaks.
Trenched crossings of intermittent streams would be done only during low-flow periods and preferably when the streambeds are dry.
Pipelines would be installed at depths of six feet or more below channel beds at waterway crossings to prevent exposure from erosion during periods of high flow.
The shortest practicable alignment would be used to minimize disturbance in crossing streams.
Instream flows would be maintained during stream crossing construction. Spoil, debris piling, construction materials, and any other obstructions would be removed from stream crossings to preserve normal water flow.
Temporarily diverted water would be returned to natural flow patterns when construction is complete.
Erosion control measures would be employed as appropriate at stream crossings at all times: (a) Care would be exercised to preserve existing trees along the streambank. (b) Stabilization, erosion controls, restoration, and re-vegetation of all streambeds and embankments would be done as soon as a stream crossing is completed and maintained until stable. (c) Riparian woody shrubs and trees would be replanted where and as necessary to preserve the shading characteristics of the watercourse and the aesthetic nature of the streambank.
When pipeline construction through a wetland basin is unavoidable, existing basin contours would be restored to pre-project conditions and trenches would be sufficiently compacted to prevent any drainage along the trench or through bottom seepage. Wetlands would be crossed during dry conditions (e.g., winter months), when practical.
For jurisdictional wetland acreages where avoidance or minimization efforts would not be sufficient to prevent loss of wetlands, appropriate Clean Water Act (CWA) permitting and compensation measures would be used to ensure no net loss of wetland acreage, including the restoration or creation of mitigation wetlands.

To Minimize Impacts to Surface Waters, Wetlands and Floodplains
Construction waste materials and excess or unneeded fill associated with construction would be disposed of on uplands, non-wetland areas.
Storage facilities for petroleum products, other fuels, and chemicals would be located and protected to prevent accidental spills from entering waterways.
Refueling of construction vehicles would be done in designated areas away from water bodies and drainages.
Erosion and sediment control structures would be installed as necessary on exposed and erodible surfaces, during soil-disturbing activities, and prior to predicted precipitation events.
If some or all of the wastewater stream were discharged back into the Bighorn River, a diffuser would be installed at the end of the discharge pipe to increase the rate of mixing and dispersion. Wastewater stream discharges in the Bighorn River would need to be approved by the EPA and would meet regulatory limitations and requirements (e.g., NPDES permit).
The proposed project would be designed to avoid construction in 100-year floodplains and/or minimize interference with the above ground movement of floodwaters.
A certified wetland scientist would delineate all areas exhibiting wetland characteristics within and adjacent to the construction easement, in accordance with the 1987 *USACE Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* (USACE 2010).

To Minimize Impacts to Soils and Geology
Vehicle and equipment use would be restricted within the construction easement to minimize soil compaction.
Topsoil would be segregated from subsoils and stored on-site to be used for reclamation and seedbed preparation. Topsoil materials would be protected from erosion, contamination, and disturbance.
Excavations would be backfilled using on-site material unless the material does not meet backfill specifications. Offsite fill and surface materials such as gravel would be sourced at the nearest feasible and culturally cleared borrow location.
Temporary (e.g., silt fences, straw bale dikes, mulch, jute netting) and long-term (e.g., diversion terraces, riprap, matting, water bars) erosion and sediment control structures would be installed would be installed consistent with MDT *Erosion and Sediment Control Best Management Practices Manual* (MDT 2015a).
During reclamation of temporarily disturbed areas, de-compaction techniques would be used as needed to prepare soils for seeding.
Areas requiring revegetation would be seeded during the first appropriate season after redistribution of topsoil, but no more than two growing seasons. If reseeding cannot be accomplished within 10 days of topsoil replacement, erosion control measures would be implemented to limit soil loss.
Proposed facility sites with permanent aboveground structures would be evaluated for prime or unique farmland in consultation with the NRCS to determine appropriate measures to avoid or mitigate effects.

To Minimize Impacts to Vegetation and Land Use
Pipeline alignments and project facilities would be sited or routed to minimize disturbance and fragmentation of natural habitats or sensitive resources when possible, using direct routes, and minimizing areas of surface disturbance.
Site-specific pre-construction surveys would be done within native communities targeted for new construction as recommended by the IERT. To the extent possible, construction would avoid:

To Minimize Impacts to Vegetation and Land Use
- Native habitats, previously undisturbed areas; - Shelterbelts, riparian woodlands, woody draws, or woodland vegetation; - Native prairie; and - Populations of rare plants (federally and state recognized species) and culturally significant plants.
Areas requiring revegetation (e.g., pastureland, native prairie, wetlands, parks, lawns, etc.) would be seeded or planted during the first appropriate season after redistribution of topsoil, but no more than two growing seasons. Timing would follow local NRCS guidelines according to season and seed mix.
Seeding would be done by broadcast, drill, or hydroseed methods, according to local NRCS guidelines.
Seed mixes would be native species and may include a cover crop, according to local NRCS guidelines, unless landowner desires otherwise or the area being seeded previously had non-native vegetation (e.g., non-native pastureland, lawns, etc.).
Following construction, the pipeline easement and other areas of temporary disturbance would be reclaimed by replacing soils, grading, and seeding according to site-specific conditions to stabilize the soil in the long-term.
Construction contractors would follow Reclamation's *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species* (DiVittorio et al. 2012).
The BIA will complete noxious weed surveys and treatment according to their established guidelines, with periodic evaluation by the IERT.

To Minimize Impacts to Fish and Wildlife Species and Their Habitats
Pipeline alignments and project facilities would be sited or routed to minimize disturbance and fragmentation of natural habitats or sensitive resources when possible, using direct routes, following existing disturbances, and minimizing areas of surface disturbance.
To the extent possible, construction would avoid: - Wetlands and riparian areas; - Federal, State, and Local wildlife areas, refuges, easements; - Designated critical habitats; - Migratory bird habitats during the nesting brood rearing season; - Known raptor nest sites; - Eagle communal roost areas or forage, perch, roost trees; - Siting aboveground, long-term infrastructure within 0.5 miles of active eagle nests; and - Prairie dog colonies.
Black-footed ferret surveys would be completed when project activities are planned to occur within one mile of black-tailed prairie dog complexes greater than 80 acres in size. Surveys would occur as close to the initiation of the project activity as possible, but not more than one year prior, and would follow processes and procedures outlined in the Black-footed Ferret Survey Guidelines (USFWS 1986).
Prior to completing work in prairie dog towns or complexes greater than 80 acres, the appropriate USFWS office would be contacted to determine the status of black-footed ferret reintroductions and Endangered Species Act (ESA) consultation requirements.
The Tribe would remain in compliance with the Black-footed Ferret Safe Harbor Agreement (#MT-001, signed on October 16, 2015) and Incidental Take Permit Number TE18695B-0, granted under the authority of sections 10(a)(1)(A) and 10(a)(1)(B) of the ESA. According to these agreements, new land uses (including utility development, such as water and power lines) proposed within the 78,853 acre Conservation Zone (see **Figure 3.5**) during the 10-year term of the agreement, would be reviewed by the Tribe and the USFWS to determine if the proposed change in land use would decrease prairie dog or

To Minimize Impacts to Fish and Wildlife Species and Their Habitats
ferret habitat and, if so, determine the appropriate compensation measures. Significant decreases in prairie dog habitat could be offset by including additional prairie dog habitat contiguous with the Conservation Zone, resulting in no net loss of adequate prairie dog habitat, or relocation/reintroduction of ferrets to areas with adequate habitat.
Construction around wildlife habitats would be timed to avoid migratory bird nesting and wildlife parturition according to the following approximate dates, which may be adjusted based on conditions in a given year according to input during the IERT review. - January 1 to July 31: Avoid work near known raptor nest sites or conduct survey (see below). - January and February: Avoid work within 0.5 mile of identified bald eagle communal roost areas and within 0.25 mile of active bald eagle forage, perch, or roost trees. - February 1 to July 15: Easement clearing actions involving the removal of trees or grassland vegetation would be scheduled to avoid the nesting season. Potential nesting habitat would be cleared and grubbed prior to the spring nesting period, and maintained in that condition, to prevent nesting at the site during the season of construction. - February 1 to August 15: Avoid work within 660 feet or direct line-of-sight of active eagle nests.
In areas not cleared prior to spring nesting (February 1 to July 15), surveys for nesting birds would be done within five days of construction. If nests are found during the survey or during construction, work would stop and the USFWS would be notified for guidance on how to proceed.
For construction activities proposed to be done between January 1 and July 31, raptor nest surveys would be completed prior to disturbance, as deemed necessary during IERT reviews and based upon site-specific conditions.
If a bald or golden eagle, or previously undocumented eagle nest were identified and encountered during construction, all ground-disturbing activities in the immediate area would be stopped and the USFWS Montana Field Office and Office of Law Enforcement would be notified immediately for instructions on how to proceed.
Project power lines would be: a) Buried to avoid hazards to raptors and minimize impacts to birds and bats. b) If power lines are not buried, the lines would be designed and located to avoid raptor collisions and/or electrocutions, as described in *Reducing Avian Collisions with Power Lines: State of the Art in 2012* (APLIC 2012) and *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006). Measures pertinent to the proposed project may include: - Provision of 60-inch separation between energized conductors and grounded hardware; insulation of energized parts and hardware where such spacing is not possible; - Use of anti-perching devices as appropriate; - Avoidance of steel pole use where practical; and - Appropriate use of visual markers on wires in areas where powerlines may occur adjacent to or cross wetlands/waterways, raptor nests, leks, or concentrated avian prey areas such as prairie dog towns or ground squirrel colonies.
Reclamation would be required to meet the requirements in the Streamflow and Lake Level Management Plan, such as standard instream flows, regardless of the MR&I system (SLLMP, Sect. 2.D).
Work in streams identified as a fishery would be avoided during the spawning period (April 1 to June 1), or would be crossed later in the summer or fall when flows are low or the stream is dry, or directionally bored.
Areas potentially hazardous to wildlife would be adequately protected (e.g., fenced, netted) to prevent access by wildlife.

To Minimize Impacts to Fish and Wildlife Species and Their Habitats
The MR&I intake structure would avoid or minimize entrainment and impingement of fish and aquatic life through one of the following strategies: a) Use of riverbank filtration would avoid direct surface water intake; b) Use of surface water intake would be designed to comply with USFWS/Corps requirements for the Bighorn River as follows: - Intakes shall be screened and maintained with a ¼ inch or smaller mesh size opening. - Johnson intake screens, if used, shall have ⅛ inch or less wire spacing. - Intake velocities shall not exceed ½ foot/second with 20 feet of overhead water. - Intake velocities shall not exceed ¼ foot/second where 20 feet of overhead water cannot be achieved. - The intake shall be placed at a maximum practicable depth in relation to extreme, low water elevations. - Intakes shall be marked so they are observable during day and night hours, as appropriate.
If some or all of the liquid waste stream were discharged back into the Bighorn River, the discharge pipe would be placed in the deepest portion of the river bottom and would be capped with a perforated pipe diffuser to increase the rate of mixing, according to the NPDES permit.

To Minimize Impacts to Visual Resources
Project-specific siting and routing of aboveground facilities to preserve the viewshed and minimize visual obstruction would be determined on a case-by-case basis during IERT review.
Pump station housing and portions of electrical lines could be installed underground if site conditions are appropriate.
Aboveground storage tanks could be painted light shades of tan, green, blue, white or similar colors to blend with the sky or surrounding landscape.

To Avoid Impacts to Historic Properties and Culturally Sensitive Areas
Cultural resource inventories, including Class I and Class III surveys, would be done prior to ground-disturbing activities (including at borrow sites); under the direction of an archaeologist that meets the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738-9); and in consultation with the THPO. - Each site-specific Class III report would be submitted to the THPO for concurrence and to obtain further guidance for mitigation and necessary permits. - Adverse effects to historic properties would be avoided so far as is technically feasible, using avoidance, modification of routes, or archeological excavation.
Other sensitive resources or sites determined to be culturally significant in consultation with the THPO, such as specific trees or wildlife habitat, would be avoided during project siting, design of facilities, and construction activities, unless otherwise permitted or approved.
The Tribes would be consulted concerning the locations of unmarked burials or cemeteries. Such burials or cemeteries would be avoided to the extent possible. If a burial site or cemetery cannot be avoided or is encountered during construction, Reclamation would comply with the Native American Graves Protection and Repatriation Act (NAGPRA).
If unrecorded cultural resources or traditional cultural properties are encountered during construction, ground-disturbing activity within the area would be stopped immediately and the site secured. The CTWRD would immediately notify THPO, Reclamation, and the BIA and a qualified cultural resource specialist shall evaluate the discovery and make a recommendation as to the National Register eligibility

of the resource. Applicable stipulations of the National Historic Preservation Act (NHPA) and NAGPRA would be followed. Activities in the area would resume only when compliance has been completed.
If human remains are discovered during construction, the CTWRD would immediately halt construction and secure the site. THPO, Reclamation, the BIA and law enforcement officials would be notified and a determination would be made as to the disposition of the remains, following all legal procedures. Activities in the area would resume only when compliance has been completed.
Collection of artifacts or remains would be prohibited, under any circumstances.

To Minimize Impacts to Paleontological Resources
THPO would be consulted to identify areas where significant fossils are likely and whether paleontological surveys would be required. If required, paleontological surveys would be completed prior to construction. Based upon survey data and under the direction of THPO, routes may be revised to avoid damaging significant fossil locations.

2.5 COMPARISON OF EFFECTS OF ALTERNATIVES

Table 2.9 summarizes the major effects, both beneficial and adverse, that would potentially occur to key resources as a result of the Proposed Action Alternative compared to the No Action Alternative. Chapter 3 contains an in depth evaluation and discussion of potential effects.

Table 2.9: Comparison of Effects of Proposed and No Action Alternatives

Resource	Description	No Action	Proposed Action
Socio-economics Region-wide	*Population*	Could decline if unreliable, limited water supplies cause relocations	Capacity for sustained growth, anticipated 38% rural population growth
	Operation of businesses, government, schools, hospitals, etc.	Continued uncertainty, limited production and growth	Stability and growth
	Local tax and business revenues	No change or decrease	Increase
	Agricultural sector	No change or decreased livestock health and production; decreased number of producers/ranches	Improved livestock health and production; variety of opportunities (grazing access, management options, feedlots, finishing), retain and attract younger generations
	Recreation, Tourist attractions	No change or decrease	Potential business expansions (casino or rural outfitters/lodging along Bighorn River), sustained events such as Crow Fair and Rodeo
	Rural development	No change, limited	Increase, expansion in area
	Retention of workers, Job creation	No change or decrease	Increase

Resource	Description	No Action	Proposed Action
	Property values	No change or decrease	Increase
	Private investment	Deterrent; no change or decline	Attraction; growth of new business and industry
	Overall economy	Decline, vulnerable to downturns	Stability, growth, diversity; Revenue generation
Socio-economics Household	*Incomes, Wages, Standards of Living*	No change	Increased, improved
	Construction Jobs	No effect	Up to 12 on pipeline, Horizontal Directional Drilling (HDD) crews; total of about 50 individuals when combined with Crow Irrigation Project (CIP) crews
	OM&R Staff	No change	Up to 28 permanent, full time
	Appliance, pipes maintenance and replacement; Softening	No change	Reduced costs; 25-70% increases in efficiency
	Water system OM&R	No effect	Affordable rates
Environmental Justice	*Water quality and supply*	Individuals and communities at disadvantage	Equal Reservation-wide
	Tribal and individual incomes	Limited, disadvantaged	Increased; Tribal preference
	Tribal economy, economic opportunities	High adverse effects; Individuals and communities at disadvantage	Beneficial effects; Improved stability and growth Reservation-wide
	Health and safety	High adverse effects	Improved Reservation-wide
Public Health and Safety	*Drinking water quality*	No change or decreased; SDWA deficiencies	Improved – estimated 50% reduction in contaminant concentrations; Compliance with SDWA standards
	Health risks and illness	Continued adverse effects	Reduced gastrointestinal, chronic disease
	Healthcare costs	No change or increased	Reduced
	Fire safety	Inadequate water storage in communities	Adequate fire flow storage, 1,000 gpm for two hours for Pryor, Wyola; 2,000 gpm for two hours for Crow Agency, Lodge Grass; Low Risk
	Emergency services	Inadequate water storage; Continued outages during peak use and emergencies; Insecure/unreliable system	Storage and system redundancy to eliminate outages; Secure/reliable system

Resource	Description	No Action	Proposed Action	
	Public infrastructure and utilities	No change	Temporary disruptions during pipeline construction; About 970 road crossings, 40 railroad, 480 irrigation	
	Construction Waste	None	Temporary; Collected and disposed appropriately	
	WTP Chemical, Waste volumes	No change	Storage, handling, recovery, disposal according to EPA	
			Riverbank filtration intake: Comparatively less	**Surface water intake:** Comparatively more
			WTP wastewater disposal in river: lower solids volume	**WTP wastewater disposal in ponds:** higher solids volume
	Hazardous Waste Sites	No effect	No effect	
Water Resources	*Existing supplies (groundwater and Little Bighorn River)*	Increased use of 1-3 mgd by 2060.	Decreased use of 1-2 mgd; Potential increased groundwater recharge; increased Little Bighorn River flow up to 0.5%	
	Bighorn River supply	No effect	Withdrawal of up to 0.9% typical instream flow	
	Bighorn River water quality	No change	Water quality standards attained following EPA regulations	
			WTP wastewater disposal in river: Localized decrease within 160 meters of discharge	**WTP wastewater disposal in ponds, deep well:** No effect
	Project area ground water quality	Potential decrease	**WTP wastewater disposal in river:** No effect	**WTP wastewater disposal in ponds, deep well:** Potential leaching, localized decreases
	Project area surface water quality	No change	Potential improvements if livestock watering moves from riparian areas to pasture taps	
	Temporary sedimentation, contamination of surface waters	No change	Increased chances from 5,800 to 6,200 acres surface disturbance during construction, periodic maintenance	
	Surface runoff	No change	Increase of 70 to 300 acres impermeable or semi-impermeable surfaces	
	Perennial stream modification	No effect	No effect, approximately 250 crossings would be bored	
	Intermittent stream modification	No effect	Short term trenching disturbance of approximately 610 crossings	

Resource	Description	No Action	Proposed Action	
	Bighorn River modification	No effect	**Riverbed filtration intake:** No effect	**Surface water intake:** Short term disturbance to riverbed and bank
Fisheries	*Temporary sedimentation in surface waters*	No change	Potential localized increases during construction and periodic maintenance	
	Instream flows	Withdrawal of 0.2% typical instream flows of both Little Bighorn River and Bighorn River	Withdrawal of up to 0.9% of typical Bighorn River instream flow	
	Bighorn River entrainment and impingement	No effect	**Riverbed filtration intake:** No effect	**Surface water intake:** Possible, screens and approach velocity to minimize
	Bighorn River water quality	No change	**WTP wastewater disposal in river:** Localized effects within 160m of discharge	**WTP wastewater disposal in ponds, deep well:** No effect
	Aquatic invasive species spread	No change	Possible during trenched crossings of perennial streams	
			Riverbed filtration intake: No effect	**Surface water intake:** Possible
Geology and Soils	*Disturbance of surficial geology*	No change	Likely excavation of ledge or bedrock near foothills, mountains	
	Soil compaction, erosion, mixing	No change	5,800 to 6,200 acres surface disturbance during construction; 25-40% new disturbance	
	Long term disturbance	No effect	70 to 300 acres permanent	
	Prime farmland	No effect	No effect	
Vegetation & Land Use	*Vegetation surface disturbance*	No change	5,800 to 6,200 acres surface disturbance from construction	
	Native vegetation	No change	25-40% of above acreage, permanent loss	
	Special-status plants	No change	No effect through avoidance	
	Spread of noxious weeds	No change	Possible; minimal using preventative or treatment measures	
Cultural Resources	*Disturbance or destruction of cultural sites*	No effect	No effect; Prevented through surveys, avoidance, monitoring	
	Paleontological Sites	No effect	Possible; surveys and avoidance as required	
	Trust resources	Water right not exercised	Water right put to beneficial use	

Resource	Description	No Action	Proposed Action
Wetlands	*Temporary, direct disturbance*	No change	Pipeline routed around or trenched through about 180 wetlands totaling at least 30 acres
Floodplains	*Flood zones and regimes*	No effect	No effect; use of up to 0.9% of typical Bighorn River flow
	Construction	No effect	Potential; intake and discharge structures
Wildlife	*Direct mortality, injury*	No change	Possible infrequent construction vehicles collisions, overhead power lines; Measures followed to minimize
	Displacement due to human activity	No change	Possible, temporary during construction in native areas; No permanent, measureable effects
	Temporary habitat degradation, loss	No change	5,800 to 6,200 acres during construction; 25-40% in native areas
	Permanent habitat degradation, loss	No change	70 to 300 acres permanent buildings or above ground features
	Threatened and endangered species	No change	No effect; potential habitat avoidance, construction buffers, and consultation commitments applied
	Special-status Species	No change	Possible; Habitat avoidance, construction buffers and timing limitations applied
Aesthetic/ Visual Resources	*Above-ground Structures*	No effect	47 pump stations, 18ft high; 10 storage tanks, 30-200ft high; other small structures
	Buildings – Administrative, Maintenance	No effect	Crow Agency and St. Xavier, 18ft high, near town
	Overhead electrical lines	No effect	Estimated 150-225 miles
	Pipeline, below-ground structures	No effect	Temporary until reclaimed
Air Quality, Noise, and Traffic	*Criteria Pollutant Emissions*	No change	Undetectable increase in Carbon Monoxide (CO) and PM10 emissions from construction traffic
	Traffic Congestion	No change	Additional 5 to 50 vehicles/day during construction; Increase in Annual Average Daily Traffic (AADT) in operation $\geq$1%.
	Noise	No change	Localized increase during construction
Climate Change	*Effects of the Project on Climate Change*	Changes in global climate and regional weather patterns would continue	Undetectable increase in vehicle emissions (Greenhouse Gas) during construction and operation
	Effects of Climate Change on the Project	Existing water sources may be more susceptible	Use of Bighorn River and system efficiency may improve adaptability

3.0 Affected Environment and Environmental Consequences

3.1 INTRODUCTION

This chapter describes each resource that may affect or be affected by the proposed project. The purpose of this chapter is to provide an understanding of the probable environmental consequences by first presenting the existing or baseline condition of each resource and then analyzing the anticipated environmental effects of implementing the proposed action or alternatives.

Organization of the Chapter

This chapter is organized by issue/resource. Each section begins with a brief introduction that explains why the resource is important relative to the proposed project or alternatives. The limits of the physical area analyzed for baseline conditions and effects for each resource are defined (see "Affected/Analysis Area" below) and applicable laws or regulations are summarized. The existing or baseline conditions are described using quantities and trends when data is available, followed by the potential effects resulting from the no action alternative and the proposed action alternative. If effects differ depending on project component alternatives, the differing effects or range of effects are discussed.

Effects may be direct or indirect, positive (beneficial) or negative (adverse), and long-term (permanent, long-lasting) or short-term (temporary). Measures that would be implemented to reduce, minimize or eliminate impacts are discussed under each resource. Cumulative impacts, which result from other past, present, or reasonably foreseeable future actions that are not part of the proposed project, are discussed at the end of each resource section.

Affected/Analysis Area

The affected area encompasses the communities, land, water, and other aspects of the physical and social environment that may be impacted by the proposed project. The boundaries of the affected area for each resource extend to where effects can be reasonably measured and have meaning for the project proposal. Specifically, two boundaries have been used as the extent of the affected area for the analysis of most resources; these are the project area and Reservation boundaries:

- The ***project area*** is the maximum physical footprint of the proposed project (refer to **Figure 2.1**). It includes the acreage of the proposed locations for the intake, WTP, and pump stations; the construction easement for the proposed pipeline routes; temporary and permanent storage and staging yards; and community upgrade facilities. (See Section Project Components2.4.1, Project Components, for details on proposed locations and estimated dimensions of each project component.) The project area boundary is the maximum outer limit of direct, soil-disturbing activities associated with the proposed project. It is pertinent for fixed resources, such as vegetation, soils, and cultural resources.
- The ***Reservation boundary*** is defined as the exterior boundary of the Crow Indian Reservation (refer to **Figure 1.1**). The proposed project would occur within this boundary, in portions of both Big Horn and Yellowstone counties. The Reservation boundary provided a boundary for non-fixed resources, such as socioeconomics, environmental justice, and climate change.

For each resource, the specific analysis area is defined in the introduction of individual resource discussions. The analysis area and effects analyzed represent the maximum project development that is expected to occur. The actual geographic extent and population served by the proposed project could be smaller depending on participation in the proposed project.

3.2 SOCIOECONOMICS & ENVIRONMENTAL JUSTICE

On the Reservation, water supply affects socioeconomics on two levels, at a broader Reservation-wide level related to increased water demands and economic growth, and at a household level, related to the affordability of paying for water treatment. The residents of the Reservation are currently disadvantaged due in part to inadequate water systems and limited economic and community development opportunities. As a disadvantaged population, environmental justice for the Tribe is assessed partially in this section and partially in Section 3.3, Public Health and Safety.

The socioeconomic analysis focuses on the entire Reservation, since all residents of the Reservation are the intended recipients of socioeconomic benefits of the proposed project. The Reservation boundary also defines the reasonable extent of impacts to local businesses and local economy. Certain statistics and analyses include the city of Hardin, which is outside the Reservation but within Big Horn County, since the proposed action alternative includes the option of service to Hardin in the future.

3.2.1 Social and Economic Regulations

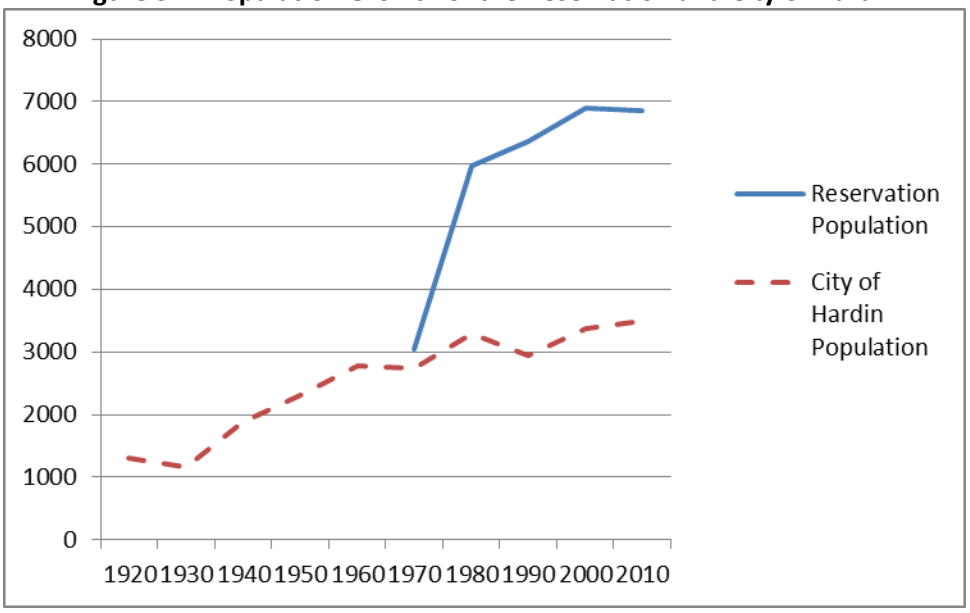
Executive Order (EO) 12898 (1994) (Environmental Justice) requires that measures must be taken to avoid disproportionately high adverse impacts on minority or low-income communities by pursuing fair treatment and meaningful involvement of minority and low-income populations. Fair treatment means that minorities and low-income groups would not bear a disproportionate share of negative human health or environmental impacts. Meaningful involvement means that affected populations have the opportunity to participate in the decision process and their concerns are considered.

3.2.2 Population and Projected Growth of the Reservation and Service Area

The 2.3 million acre Reservation is primarily rural with a number of dispersed small towns. The population of the entire Reservation was estimated at 6,520 from 2010 to 2014 (US Census Bureau 2014a), and the population density of Big Horn County, which comprises the majority of the Reservation, was approximately 2.6 people/square mile. The six communities on the Reservation are Crow Agency, Reservation headquarters (population 1,821); Fort Smith (population 47); Lodge Grass (population 278); Pryor (population 665); Saint Xavier (population 6); and Wyola (population 159) (U.S. Census Bureau 2014a). The nearby city of Hardin has an estimated population of 3,720 people.

From 1970 to 2010, the Reservation population showed an upward trend, with an increase of 3,814 residents (an increase of 55.6 percent) (**Figure 3.1**) (US Census Bureau 2010). Nearby Hardin has also steadily grown; during the same time period, the city added 772 residents (**Figure 3.1**) (Bartlett & West 2014, Master Plan, p. 16-17). These trends indicate population growth is likely to continue in the potential service area of the proposed project.

Figure 3.1: Population Growth of the Reservation and City of Hardin



Based on several different analyses used to forecast the future population on the Reservation, the conclusion of the Master Plan was 9,050 persons for the 2060 population (See Bartlett & West 2014, Master Plan, p. 17-23 for assumptions and results of modeling and average growth rate projection analyses). Of this estimate, the rural population is expected to grow from an estimated 3,617 to 5,004, or 38 percent, over the life of the proposed project. This estimate is based partly on anticipated rural development, resulting from reliable water supplies and recreational housing along the Bighorn River. If rural growth would not occur, the estimated 2060 Reservation population would be an estimated 7,663 persons. The 2060 projected population of Hardin was estimated at 4,819. The projected 2060 populations were used to determine total water needs, which in turn were used during design of project alternatives (Bartlett & West 2014, Master Plan, p. 17-26).

3.2.3 Reservation Employment, Education, Economy and Businesses

Employment and Education

The total civilian labor force for the Reservation is estimated at 3,091. The number of people with an employed status is estimated at 2,243 or about 73 percent. The top industries are public administration (19 percent); educational services, health care and social assistance (18 percent); agriculture, forestry, fishing and mining (11 percent); and retail trade (eight percent) (US Census Bureau 2014b).

Of those individuals on the Reservation reporting education data (based on 4,377 individuals), those with a high school diploma or equivalency represented approximately 34 percent of the 18 to 24 age group and 31 percent of the 25 and older group (**Table 3.1**). Those individuals with some college or an associate's degree represented 33 percent of the 18 to 24 age group and 38 percent of the 25 and older group. Those individuals that have attained a bachelor's degree or higher included less than one percent of the 18 to 24 age group and 16 percent of the 25 and older group (**Table 3.1**).

Table 3.1: Education Levels on the Reservation

Age Group	Education Level	Reported Number	Percent (%)
18-24	Less than high school graduate	278	33
	High school graduate (including equivalency)	283	34
	Some college or associate's degree	277	33
	Bachelor's degree or higher	5	0.6
25+	Less than high school graduate	538	15
	High school graduate (including equivalency)	1080	31
	Some college or associate's degree	1346	38
	Bachelor's degree or higher	581	16

Source: U.S. Census Bureau 2014b, 5-Year American Community Survey 2010-2014

Agriculture

Agriculture has been a significant part of the Reservation economy, including both livestock and crop production. It is the primary means of income for approximately 360 total persons and an estimated 74 American Indians on the Reservation, employing approximately 13 percent of the population. Livestock production is primarily cattle, horses, and bison. Crop production includes wheat, barley, hay, corn, and oats (Montana Research and Analysis Bureau 2013). Irrigation in the Reservation's three main river valleys supports additional crops including alfalfa, irrigated pasture, and sugar beets. Between 2002 and 2007, the number of farms on the Reservation increased from an estimated 377 to 492. Cattle numbers nearly doubled in this timeframe increasing from an estimated 57,297 to 95,383. Data is not available for the Reservation on the market value of agricultural products sold, though data is available for Bighorn County as a whole. Crop sales were $41,363,000 in 2007 for Bighorn County, an increase of 44 percent since 2002. Livestock sales totaled $53,492,000 in 2007, an increase of 56 percent since 2002 (USDA-NASS 2007).

Natural Resources and Industrial Development

In the past decade, the Tribe has focused on establishing the legal and financial infrastructure to support development of small businesses, industry, and natural resources on the Reservation (Montana Research and Analysis Bureau 2013). The Reservation lies in the Powder River Basin, a coal-rich region that straddles the Montana-Wyoming border, and includes several active coal mines, mainly within the eastern one-third of the Reservation (McCulloch 2012). The Tribe has historically received about two thirds of its budget income from the Absaloka coal mine, which mines an average of 5.5 million tons per year (Gardener 2013). If the Tribe's coal resources and related industrial developments continue to be developed, it has the potential to contribute millions in revenue and create additional jobs (Bartlett & West 2014, Master Plan, p. 30). However, coal development has recently slowed region-wide due to increase regulations and declining markets, including on the Reservation (Lutey 2016). This has resulted in budget cuts for the Tribe and jobs furloughs (Johnson 2016). While coal is expected to remain an important energy source nationwide, the future of the Reservation's coal economy is unclear (Lutey 2016; Johnson 2016).

Recreation and Tourism

Recreation and tourism account for a large portion of the revenue in Bighorn County, estimated at approximately $34 million in 2004 (ITRR 2004a). Of those visiting the Reservation, a majority (estimated at 61 percent) were in the area primarily for fishing (ITRR 2004b). The Bighorn River has a world-renowned trout fishery created by the construction of the Yellowtail Dam in the mid-1960s. Fishing on

the Bighorn River was at a peak of 125,000 angler-days in the late 1990s with an average $13 million in annual revenue. While still a major attraction, a drop in trout populations caused a drop in fishing to roughly 70,000 angler-days in 2007, according to Montana Fish, Wildlife, and Parks (MTFWP) (Maffly 2007). Overall, recreation and tourism related revenue remains an important part of the local economy.

The Apsaalooke Nights Casino opened in May of 2011 and replaced the former Little Bighorn Casino. The plan for the casino is to eventually build a hotel and events center. The Apsaalooke Nights Casino currently employs 70 people with the possibility to expand by 25 or more employees. (Bartlett & West 2014, Master Plan, p. 30)

Other major attractions within the Reservation adjacent to or near the project area are the Bighorn Canyon National Recreation Area, located south of Fort Smith; the Little Bighorn Battlefield National Monument, located southeast of Crow Agency; the annual Crow Fair and Rodeo, which includes one of the largest powwows in the United States, held in Crow Agency; and the historical Bozeman Trail which crosses the Bighorn River near Fort Smith (refer to Section 3.8, Cultural Resources, for more information on historical sites).

3.2.4 Minority and Low-Income Populations / Household Economy

Data from several analysis areas were used to establish a baseline of the existing distribution of minorities and low-income populations within and surrounding the project area. The analysis levels include: Crow Reservation (including portions of Big Horn and Yellowstone counties); Big Horn County as a whole (which includes Hardin); Yellowstone County as a whole (which includes the Billings metropolitan area); and the state of Montana. See **Figure 1.1** for reference.

The American Indian population on the Reservation was estimated at 80 percent of the total population, compared to 64 percent for Big Horn County, four percent for Yellowstone County, and about seven percent in the state (**Table 3.2**) (US Census Bureau 2014c). Approximately 70 percent of over 13,260 enrolled tribal members live on the Reservation (Montana Research and Analysis Bureau 2013).

Table 3.2: Minority and Low-Income Populations and Household Data, 2010-2014 5-Year Average

Subject	Montana	Big Horn County	Yellowstone County	Reservation (Project Area)
Total Population	1,006,370	13,079	151,965	6,520
Percent Minority	11	67	9	82
Percent American Indian	7	64	4	80
Percent below Poverty Level	15	29	13	31
Per Capita Income	$25,977	$16,279	$28,918	$14,515
Median Household Income	$46,766	$42,650	$51,743	$43,100
Average Household Size	2.4	3.7	2.4	4.4

Source: U.S. Census Bureau 2010-2014

According to Census data (2010-2014), an estimated 31 percent of the population on the Reservation was below the federal poverty level, compared to 29 percent of the Big Horn County population, 13 percent of Yellowstone County, and 15 percent of the state population (**Table 3.2**).

Per capita income is comparable to the general population in Big Horn County, but is approximately $14,000 less than Yellowstone County and $12,000 less than the state per capita income levels (**Table 3.2**). Median household income for the Reservation between 2010 and 2014 was $43,100 compared to Big Horn County at $42,650, Yellowstone County at $51,743, and the state median household income of $46,766 (US Census Bureau 2014c) (**Table 3.2**). In a separate analysis, the Tribe reported the median household income in 2008 for tribal members as $26,250, which was below the state median household income of $40,627 in that year (Crow Tribe 2008).

The unemployment rate on the Reservation according to the U.S. Census Bureau between 2010 and 2014 was 27 percent compared to nearly seven percent for the state of Montana. This rate included all of the labor force living on the Reservation. According to the U.S. Bureau of Indian Affairs, the unemployment rate for tribal members on the Reservation was 47 percent in 2005 (Montana Research and Analysis Bureau 2013).

Poverty levels and minority populations on the Reservation are significantly greater than the state and Yellowstone County, but comparable to Big Horn County.

3.2.5 Direct, Indirect, and Cumulative Effects

No Action Alternative

Under the No Action Alternative, social and economic conditions are anticipated to continue as is or slightly decrease due to projected population growth. If population continues to grow on the Reservation and nearby Hardin, water availability and system capacities would be increasingly strained. The severity of these effects would depend on the rate and amount of population growth, though even with no growth the current water supply is not enough for the existing population. Unsatisfactory water availability and quality may cause a population decline if households choose to relocate to other areas with more reliable and desirable water conditions. Relocations would have a negative impact on the local economy and would likely affect cultural and family cohesion for tribal members.

Continued instability in water supply and water quality would mean continued uncertainty for the local and regional economy. Schools, government, hospitals, businesses, and recreation/tourist attractions using water would continue to operate with unreliable water supplies. Uncertain water supply limits production and growth, thereby limiting direct and indirect (tax) revenues for existing entities and local government. The agricultural sector, particularly ranching, would continue to be negatively affected by water quality and supply, since livestock experience lower production rates and reduced health due to poor quality water. Growth in this sector would be limited to existing conditions or be reduced if land and livestock do not continue to attract younger generations of ranchers. Current conditions would likely limit the economic growth and physical locations of certain recreational and tourist attractions, such as desired expansion to the existing casino, cultural events such as the Crow Fair and Rodeo, and rural outfitters and lodging businesses along the Bighorn River. Indirectly and more broadly, uncertainty in water supply affects job creation, retention of existing workers, property values, and private investment in the area by businesses and industry. Revenue generated from water sales to commercial, industrial and agricultural users would not occur.

At a household level, no additional water supply or delivery expenses would be incurred as a result of the No Action Alternative. However, household costs would continue to be incurred for water softening

and for maintenance and replacement of water appliances and pipes because of water quality and hardness issues.

The No Action Alternative would limit economic benefits to the Tribe, and some Reservation communities would remain disadvantaged by their unreliable and poor water quality and supply. Disproportionately high adverse impacts would likely therefore occur to the Reservation as a whole, which is a minority and low-income population, and to individual disadvantaged communities within the Reservation.

Proposed Action Alternative

The proposed project would be expected to primarily affect the socioeconomics of the Reservation at two levels, the Reservation/regional level, and the individual household level.

Effects to Reservation-wide Economy and Commercial Water Users

At the broader Reservation-wide or region-wide level, a reliable and clean water supply would provide opportunities for future economic and population growth. The proposed project has been designed to provide capacity for anticipated future population growth of communities within the Reservation and the adjacent town of Hardin.

Studies have shown that with the development of rural water systems, private investments increased, property values improved, and property tax revenues increased (GAO 1999; Pajl et al. 2009). A study of 87 communities that received Federal water/sewer project grants found that all of the communities saw increased job creation and retention in local businesses. This growth diversified the local economies, making them less vulnerable to economic downturns (GAO 1999; Bagi 2002). A stable water supply is expected to benefit community schools, government, hospitals, businesses, and local industries on the Reservation in a similar manner. By stabilizing the water supply, local communities would become more attractive to new businesses and industry, thus providing the potential for improving local and regional economies. Revenues of current industries and businesses of the Reservation would also be strengthened, including agriculture, coal mining, recreation, tourism, and the casino and other smaller businesses (GAO 1999).

The construction of a regional MR&I system would not only serve existing rural residences and businesses, but would provide the opportunity to extend to areas that are currently unserved or underserved due to lack of a good water source. Specifically, rural residents would no longer need to haul water and it would be possible for recreational businesses (such as fishing outfitters) and recreational housing along the Big Horn River to expand.

Agriculture, specifically livestock production, would directly benefit from the proposed project due to improved access to rangeland limited by water source; improved options for rangeland management such as prescribed grazing; ability to expand herds; and opportunities for feedlot or finishing operations (GAO 1999). Farms and cattle numbers show an increasing trend on the Reservation. Studies indicate that ranchers who switched from individual water supplies to a regional water system saw an increase in livestock health and production (e.g., higher weight gains, higher daily milk yields, reduced mortality) due to lower levels of total dissolved solids, sulfate, and sodium (GAO 1999; Pajl and DeBoer 2007; Pajl et al. 2009). Temporary reductions in farm revenue are possible as a result of project construction disturbance, but would be offset by reimbursement for crop and hay loss until the impacted acreages are reclaimed.

Economic Effects to Individuals and Households

The proposed project would have a positive economic impact on individuals and households, both long and short-term. Increases of economic activity into the area would benefit individuals and households by indirectly increasing incomes and improving standards of living. For those with income dependent in part on water supply, such as farmers, ranchers, and recreation-based business owners, the proposed project is expected to directly increase household income and individual business revenues over the long-term (GAO 1999).

The proposed action would directly provide employment opportunities of local, Native American preference. In the long-term, the MR&I system would require up to 28 permanent full time staff in administration, WTP operation, and rural distribution OM&R (Bartlett & West 2015d). Several of the staff positions would require specific skills and training, which typically corresponds with higher wages. In the short-term, construction of the proposed project would require work crews for its various phases and thus has the potential to create jobs or increase household income for qualified local Native Americans and Native American-owned businesses. Construction of the MR&I system would require an estimated 20 to 50 crew members, with roughly 12 crew members dedicated solely to the MR&I system and the remaining crew members working on both the CIP Rehabilitation and Improvement Project currently in progress on the Reservation and the MR&I system (Bartlett & West, pers. comm., 2015). The availability of construction jobs would last the duration of the proposed project, anticipated to be 15 to 20 years. Since construction workers would primarily be local, they may use local businesses (restaurants and gas stations) that would potentially cause small increases in revenue for those businesses and associated sales taxes on the local or county level for the duration of the proposed project construction.

Reservation households would likely save money related to costs for personal water softening and less frequent repair and replacement of appliances and clothing. Reduced water hardness from the treated water would decrease encrustation in pipes and appliances. This would result in an estimated 25 percent increase in efficiency and 50 percent longevity in water heaters; 30 to 40 percent increased longevity in washers, dishwashers, and water faucets; and 70 percent increased longevity in toilets (Bartlett & West and CTWRD 2015). Clothing fabrics last longer and take less time to launder when washed in soft water (Bartlett & West and CTWRD 2015). The MR&I system would provide centralized water softening rather than residents purchasing and maintaining home softeners. A study of comparable systems determined that households that switched to a rural water system saved on average $31.91 per year from reduced use of softening salt (Pajl and DeBoer 2007).

The Tribe plans to charge a monthly water bill to water users to help pay for the annual costs to operate and maintain the MR&I system. Because the Settlement Act granted federal funding for construction, the water rate would not include the cost of construction. The charges would not be a fee for the actual water, but rather represent the cost of treating and funding the long-term maintenance of the system. The Tribe is requiring that fees be affordable for water users. The lower household and per capita incomes on the Reservation, along with the higher poverty rates, underscore the importance of affordable water bills.

Typically, water affordability is measured by the percentage of median household income spent annually on water service. There is no single, generally accepted threshold for determining affordability for water rates either on a community-wide basis or on an individual customer basis. However, it is clear from past studies and regulatory guidance that local considerations need to be accounted for (Bartlett & West 2015c).

In an initial pricing study for the proposed project, Bartlett & West (2015c) defined "affordable" as the water user's ability to pay a water bill without affecting their ability to pay for other essential goods and services. Based upon the unique social and economic demographics of the Reservation, as well as numerous recent publications on affordability thresholds for low-income households, the following two affordability thresholds were proposed:

- System-Wide Affordability Threshold – Maximum water bill not to exceed one percent of Reservation-wide median household income and would apply to all customers with household incomes greater than established Poverty Guidelines. An estimated 71 percent of water users would meet the criteria for this threshold.
- Low-Income Affordability Threshold – Maximum water bill not to exceed one percent of Poverty Level income, or one percent of Reservation-wide median household income, whichever is less, and would apply to all customers with household income less than established Poverty Guidelines. An estimated 29 percent of water users would meet the criteria for this threshold.

The preliminary water pricing study used these affordability thresholds, along with the estimated amount of revenue needed to pay the amount of total annual OM&R costs that exceed the interest revenue from the OM&R account, as well as several other assumptions, to develop conservative price estimates for the proposed project. A price of $1.55 per 1,000 gallons was estimated for households below the poverty level and a price of $2.09 per 1,000 gallons for all other water users. Average monthly water bills for low-income households would range from $8.53 in Fort Smith to $21.59 in Crow Agency. Average monthly water bills for households living above poverty level would range from $11.48 in Fort Smith to $29.06 in Crow Agency (Bartlett & West 2015c). The range in water bills is directly proportional to the average household size and the average amount of water consumed. This analysis indicates that, on average, affordable rates can be established for all water users that would generate the revenue necessary to cover the required share of annual OM&R costs.

A more detailed rate study would be conducted later in the design of the proposed project. This in-depth study would account for seasonal variation in water bills throughout the year and other strategies for assisting low-income households, such as conservation actions and bill averaging (Bartlett & West 2015c). This study would be completed once the selected water treatment process moves into the design phase and after the CTWRD Water Code and Rules and Regulations are complete, which would outline the authority of setting water rates.

Effects on Environmental Justice – Disadvantaged Populations

The Reservation largely consists of an American Indian population at an economic disadvantage compared to surrounding communities. The proposed MR&I system would benefit the local Reservation economy by improving water quality and water availability, providing an attraction for new businesses and industry. The proposed project would potentially result in bringing new development to rural areas that currently do not have a reliable water source. These actions would result in overall long-term economic benefits throughout the Reservation.

The proposed project would also provide a direct economic benefit to a number of individual tribal members, households, and Indian-owned businesses. The Tribal Employment Rights Office (TERO) has implemented an ordinance for the Reservation that requires employment and contracting preference is given to Native Americans, especially those that live locally. The TERO ordinance would be applicable to the proposed project.

The Tribe intends to apply affordability criteria to help guide establishment of water rates. This criteria specifically avoids or mitigates disproportionately high adverse impacts on minority or low-income populations on the Reservation.

Beneficial impacts are expected to occur to minority or low-income populations due to project development. Attempts to inform, solicit comments, and ensure the meaningful involvement of the Tribe and general public in the decision making process of this proposed project are detailed in Chapter 5.0 , Consultation and Coordination.

Cumulative Effects to Socioeconomics

The proposed project would provide a measureable, positive increase in the local economy, potentially on individual household income and prosperity in the short- and long- term, and would contribute to other foreseeable projects affecting socioeconomics on the Reservation. These projects include coal development, oil and gas development opportunities, and other water projects related to the Settlement Act.

3.3 PUBLIC HEALTH & SAFETY

Water quality is a major environmental health concern on the Reservation (Eggers et al. 2011). The public is concerned about using the Bighorn River to supply the proposed MR&I system due to the potential for chemicals, sediment, and other upstream pollution sources. This section also evaluates environmental justice as it relates to the Tribe bearing disproportionate negative human health or environmental impacts. The management of sludge solids from the WTP is discussed in this section, whereas the management of discharge water is assessed in Section 3.4, Water Resources and Surface Water Quality.

The public health and safety analysis focuses on the Reservation, since all residents of the Reservation are the intended recipients of health and safety benefits of the proposed project.

3.3.1 Public Health Regulations

The EPA administers many public health and safety laws on tribal land. The Resource Conservation and Recovery Act (RCRA) provides guidelines for hazardous and solid waste management, including generation, treatment, and disposal programs and facilities (USEPA 2015a). The CWA of 1977 (as Amended, 33 U.S.C. Section 1251) is intended to restore and maintain the chemical, physical, and biological integrity of the nation's waters by reducing direct pollutant discharges into waterways, financing municipal wastewater treatment facilities, and managing runoff (Sections 401 and 402). The CWA also sets limits on the use and disposal of sewage sludge (Section 405). The SDWA authorizes the EPA to set national health based standards for drinking water to protect against natural and man-made contaminants (USEPA 2015b).

Under the SDWA the EPA sets legal limits of certain contaminants in drinking water at two levels, primary and secondary (**Table 3.3**, **Table 3.4**). The legal limits reflect both the level that protects human health and the level that water systems can achieve using the best available technology. The EPA sets water-testing schedules and methods that public water systems must follow for compliance. The SDWA also directs the EPA to periodically review the health effects and occurrence of currently unregulated

contaminants to determine if they should be regulated; the list published every five years is called the Drinking Water Contaminant Candidate List.

Table 3.3: Primary Drinking Water Standards

Contaminant Category	Maximum Contaminant Level (MCL)	Health Risks Associated with Contaminant
Microorganisms	0	Gastrointestinal illnesses, water-borne diseases.
Disinfectants	0.8-4 mg/L	Eye/nose irritation, stomach discomfort, anemia, nervous system effects in children and fetuses.
Disinfectant by-products	0-0.8 mg/L	Increased risk of cancer, anemia, liver, kidney or central nervous system problems.
Inorganic chemicals	0-10 mg/L	Increased cholesterol, decreased blood sugar, skin damage, circulatory system problems, increased cancer risk, increased risk of developing benign intestinal polyps, increased blood pressure, intestinal lesions, kidney and liver damage, allergic dermatitis, gastrointestinal distress, nerve damage, thyroid problems, bone disease, delays in physical or mental development, deficits in attention span and learning abilities, infant death, hair/fingernail loss, numbness in fingers or toes.
Organic chemicals	0-10 mg/L	Increased risk of cancer, anemia, decrease in blood platelets, weight loss, cataracts, skin changes, immune deficiencies, nervous system, blood, eye, liver, kidney, spleen, cardiovascular, reproductive, circulatory, stomach, intestinal, adrenal gland and thymus gland problems.
Radionuclides	0	Increased risk of cancer and kidney toxicity.

Source: USEPA 2009

Table 3.4: Secondary Drinking Water Standards

Contaminant	Maximum Contaminant Level (MCL)	Noticeable Effects Above the Limit
Aluminum	0.05 to .02 mg/L	Colored water
Chloride	250 mg/L	Salty taste
Color	15 (color units)	Visible tint
Copper	1.0 mg/L	Metallic taste; blue-green staining
Corrosivity	Noncorrosive	Metallic taste; corroded pipes/ fixtures staining
Fluoride	2.0 mg/L	Tooth discoloration
Foaming agents	0.5 mg/L	Frothy, cloudy; bitter taste; odor
Iron	0.3 mg/L	Rusty color; black staining; bitter metallic taste
Manganese	0.05 mg/L	Black to brown color; black staining; bitter metallic taste
Odor	3 threshold odor number	“rotten-egg”, musty or chemical smell
pH	6.5-8.5	Low pH: bitter metallic taste; corrosion High pH: slippery feel; soda taste; deposits

Contaminant	Maximum Contaminant Level (MCL)	Noticeable Effects Above the Limit
Silver	0.10 mg/L	Skin discoloration; graying of the white part of the eye
Sulfate	250 mg/L	Salty taste
Total dissolved solids	500 mg/L	Hardness; deposits; colored water; staining; salty taste
Zinc	5 mg/L	Metallic taste

Source: USEPA 2015c

EO 12898 (1994) (Environmental Justice) requires that measures must be taken to avoid disproportionately high adverse health or environmental impacts on minority or low-income communities.

3.3.2 Existing Drinking Water Quality

Existing Sources

Drinking water quality is a primary concern on the Reservation because of known contaminants in existing surface and groundwater sources (Eggers et al. 2011). Currently, most communities on the Reservation use groundwater wells as the primary water source; only Crow Agency uses surface water from the Little Bighorn River for municipal water supplies (**Table 3.5**). Rural residents typically obtain their water from groundwater wells. Most groundwater wells were developed to reach the shallowest level of groundwater, and are therefore more susceptible to contamination from local agricultural practices and septic systems; these shallow wells also have large fluctuation in water levels. Historical data and recent sampling indicate groundwater in the area has high levels of total dissolved solids (TDS), total hardness, alkalinity, sulfate, iron and manganese (Bartlett and West 2015b, p. 65-69; Bartlett & West and CTWRD 2015b). Water from deeper geological formations varies in both quality and quantity (DOWL HKM 2009). Existing water systems have had numerous deficiencies related to water quality and compliance with the SDWA. These reports are summarized in **Appendix A**.

Table 3.5: Existing Water Sources and Approximate Yield and Usage

Community	Water Source	Water Source Yield (gallons/day)	Peak Usage (gallons/day)
Crow Agency	Little Bighorn River	1,150,000,000	690,000[1]
Fort Smith	Groundwater wells	650,000	Unavailable
Lodge Grass	Groundwater wells	380,000	150,000
Pryor	Groundwater wells	30,000-60,000	Unavailable
St. Xavier	Groundwater wells	Unavailable	Unavailable
Wyola	Groundwater wells	50,000	Unavailable
Yellowtail Dam Government Camp	Groundwater wells	Unavailable	140,000 (average, peak unavailable)

[1]460,000 GPD from BIA WTP and 230,000 GPD from Tribal WTP; Source: Bartlett & West 2013

Bighorn River Water Quality

Bighorn River surface water quality is suitable for treatment, but varies by distance from the Yellowtail Dam. The quality declines downstream due to the increase in watershed area. In general, water quality

in the Bighorn River is classified as “hard” to “very hard” with a low organic content. The river experiences turbidity spikes from spring run-off/snowmelt events within the watershed that increase in magnitude with distance downstream from the Dam. At times, the source water has exceeded the Secondary Drinking Water Regulation maximum contaminant levels (MCLs) for TDS, sulfates and aluminum. Uranium and arsenic have been historically detected in the source water below their respective MCLs, though recent sampling efforts did not detect these elements. Groundwater under the influence of the Bighorn River has slightly elevated concentrations of iron, manganese, total hardness and silica, and slightly decreased concentrations of TOC compared to surface water within the Bighorn River (Bartlett & West 2014, Master Plan, p. 65-76; Bartlett & West and CTWRD 2015b).

3.3.3 Existing Water Supply Infrastructure and Fire Safety

Eight public water systems, along with existing rural connections, currently service the project area. Crow Agency and the city of Hardin operate full scale WTPs on the Little Bighorn River and Bighorn River, respectively. The other Reservation communities typically treat groundwater by pumping water from the wells, injecting chlorine as disinfectant, and storing the disinfected water for distribution. Rural users, farmers, and ranchers commonly have individual wells that are privately operated and maintained. The eight public systems provide storage capacity ranging from 40,000 to 1,000,000 gallons, servicing between 40 to over 1,500 connections (Bartlett & West 2014). Some facilities are in good condition, while others need improvements. Fire protection is less than adequate for Pryor, Crow Agency, Lodge Grass, and Wyola. Fire flows (1,000 gpm for two hours) are needed to meet industry standards. Some systems do not have enough storage capacity to provide for emergency backup (Bartlett & West 2014).

3.3.4 Existing Hazardous Waste and Pollution

Existing hazards in the vicinity of the project area include hazardous waste generators regulated by RCRA, Brownfield sites, and Superfund sites. Brownfield sites are property that may be contaminated with a hazardous substance or pollutant. The EPA has a program to assess, clean up, and rehabilitate these sites (USEPA 2015e). A Superfund site is a site where an environmental program has been established to address an abandoned hazardous waste site (USEPA 2015f).

There are eight hazardous waste generators within the project area, and an additional four within two miles of the project area (USEPA 2015g). The generators within the project area include the Yellowtail Dam, the Bighorn Canyon National Recreation Area, a private ranch, a gas station in Wyola, abandoned bulk containers in Lodge Grass, Bighorn County Electric Cooperative, the BIA Pryor Drum site, and an operating coal mine east of Hardin. Sites within two miles of the project area include hospitals, a power plant (Hardin Generating Station) and a laundromat within Hardin city limits.

Three Brownfield sites are near the project area, one located in Lodge Grass and two in Hardin (USEPA 2015g). Other existing environmental hazards include a toxic release site of lead in 2006 at the Bighorn Canyon National Recreation Area near Fort Smith (USEPA 2015g) and numerous oil and gas wells in Big Horn and Yellowstone counties (MBOGC 2015). The nearest Superfund site is in the city of Billings, about five miles from the northwest Reservation boundary (USEPA 2015g).

3.3.5 Existing Infrastructure and Utilities

Several types of public and private infrastructure and utility lines are present in the project area and may be crossed or intersect with the proposed project pipeline or associated facilities. These include buried public and private utilities (power lines, water lines, sewer lines, drainfields); paved interstate and state highways; gravel and paved county roads; railroads; and CIP facilities (irrigation canals, wasteways, drains).

3.3.6 Direct, Indirect, and Cumulative Effects

No Action Alternative

Without the implementation of the Settlement Act, communities and rural residents would continue to use existing water systems for water needs on the Reservation and become more dependent on groundwater sources. These small community systems would likely continue to struggle with reliability and compliance with current and future EPA Drinking Water Standards. Cumulatively, the concurrent CIP Rehabilitation and Improvement may lead to an increase in irrigated acreage of farmland, which has the potential to further degrade water quality in the shallow aquifers used as water sources. Public health would continue to be adversely affected by poor water quality and potential contamination. Inadequate water storage would continue to put communities at risk during emergencies and fires. The Reservation, as a minority and low-income population, may experience disproportionately high adverse health and safety impacts from the No Action scenario.

Proposed Action Alternative

Effects to Drinking Water

The proposed project would provide a measureable positive increase to the public health and well-being of the Reservation in the short- and long- term by providing a safe and reliable source of clean water. The proposed water treatment process would comply with current and future primary SDWA standards, along with goals of attaining many secondary SDWA standards and other desired parameters (Refer to Table 2.2a, p. 9, Bartlett & West and CTWRD 2015a and Sections 2.2.3 and 2.4.1, *Water Treatment Plant*). A review of several rural water systems found that conversion to regional systems consistently produced substantially improved water quality, with typically at least 50 percent reductions in the concentrations of sodium, iron, manganese, chloride, sulfate, nitrate, and total dissolved solids (Pajl and DeBoer 2007, p. 36).

Health improvements of a population served by a rural water system, though difficult to measure monetarily, can include fewer gastrointestinal illnesses and a reduced risk of serious illness or death in infants (GAO 1999). A number of other health risks and diseases would be reduced by having a consistent supply of water that meets primary and many secondary SDWA standards. Potential exposure to pesticides and other pollutants in the drinking water supply would be measurably reduced with the proposed project. This would reduce the potential adverse cumulative human health risk from exposure to chemicals and pollutants in drinking water over time across the Reservation service areas. Reduction in illnesses and chronic disease leads to reductions in health care costs as well (GAO 1999). In general, this would have a beneficial impact on public health as it relates to illnesses and other health issues associated with unsafe drinking water.

Effects on Fire Safety and Emergency Services

The proposed project would be designed to address current problems with fire risks and emergency services. Fire flows in Pryor, Crow Agency, and Lodge Grass would be provided through on-site storage. Fire control in communities and rural areas would be improved through a sufficient supply of water.

The operation of the MR&I system as one consolidated system would help to more efficiently maintain and manage the Reservation water supply, which would be critical in case of a natural disaster or emergency. Improved water security (i.e., reliability) during times of emergency have been shown in other community water systems that consolidated into regional systems (Pajl and DeBoer 2007, p. 11).

Effects on Environmental Justice – Human Health and Environment

The proposed project would address disadvantaged communities within the Reservation and the population of the Reservation as whole. On a community level, the MR&I system would help to equalize Reservation communities. Currently, some communities are disadvantaged, which has partly to do with inadequate or inconsistent water quality and supply. The MR&I system would ensure safe and reliable water is provided to each community, including a sufficient supply of water for fire flows to Pryor, Crow Agency, and Lodge Grass through on-site storage. More broadly, the MR&I system would increase the proportion of the Reservation with access to improved quality water, improving overall quality of life and current disadvantages of the population as a whole.

Effects to Infrastructure and Utilities

The proposed pipeline or associated facilities would cross, intersect, or parallel various public and private services infrastructure. The estimated number of crossings of major infrastructure for the proposed pipeline route is provided in **Table 3.6**. Contractors would be required to coordinate with utility companies, landowners, and rural water users to flag locations of buried lines prior to construction. Construction would accommodate each site-specific issue to avoid or minimize disruption of services. Options include re-routing and avoidance, adjusting alignments, and bored and cased crossings. Permits would be obtained as necessary from appropriate jurisdictions and requirements and conditions would be followed.

Table 3.6: Major Infrastructure Crossed by the Proposed MR&I Pipeline Route

Crossing Type	Estimated Number of Crossings
Four-Lane Road	24
State Highway	191
County Road (paved or gravel), Township Road, City Street	751
Farm Approach, Driveway, Trail, Etc.	4
Railroad	43
Irrigation Components (Canals, Drains, Laterals, etc.)	481

Effects of Construction Waste, WTP Wastes, and Hazardous Waste Assessment

The proposed project is not located within or near hazardous sites or facilities. The proposed project would have no effect on existing hazardous waste sites, nor would any of those sites have an effect on the MR&I system.

The proposed project would require the use of fuels, oils, and lubricants for construction vehicles and equipment. Construction crews would generate human wastes and refuse. Site-specific SPCC plans would be prepared for all construction activities. Standard precautionary measures would be implemented, including spill prevention, re-fueling in designated areas away from water bodies and drainages, collection of waste in appropriate containers, and disposal at approved facilities. The Tribe would develop and implement a safety plan for work crews. Visual inspection for factors such as open trench stability, slope stability, confined space, and other potentially hazardous working conditions would be identified according to OSHA regulations. A safety inspector would monitor for implementation of safety measures. With the use of these measures, the proposed project would minimize the risk of spills and maintain safe environmental and working conditions.

During operation, the proposed water treatment process would require the use of chemicals and would produce residual wastes at each step of treatment. The amount and type of chemicals used and waste produced would vary in part on the type of intake used. Compared to a surface water intake, riverbank filtration would require less chemical use and would result in lower volumes of sludge. The amount of waste produced and managed would also vary based on the method of disposal of the wastewater stream from the water treatment process. The greater the portion of the waste stream contained in evaporation ponds, the more solids would need to be recovered, managed, and disposed. Regardless of amounts, the storage, handling, recovery, and disposal of chemicals and solid sludge wastes would follow EPA regulations, as required, to avoid potential impacts to the environment or public health. Sludge also has the potential to be treated and used as a biosolids soil amendment following EPA regulations and approval which would be a benefit to local farmers.

Cumulative Effects to Public Health and Safety

The proposed project would provide a measureable positive improvement to public health, safety, and well-being of the Reservation in the short- and long- term by providing a safe and reliable source of water. The project would contribute to other past, current, and foreseeable public health and safety initiatives on the Reservation, such as those available through the IHS, other federal public health programs, and emergency planning initiatives.

3.4 WATER RESOURCES

Concerns that have been raised over the effects of the proposed project to water resources include reduced flow in the Bighorn River, reduced surface water quality, and sedimentation. This section assesses water quality in terms of meeting standards for aquatic life, whereas Section 3.3, Public Health and Safety, assesses drinking water quality. This section analyzes stream and river crossings and Section 3.8, Wetlands & Floodplains, assesses potential wetlands affected by the proposed project.

The analysis area for water resources includes the proposed project water source which would be the Bighorn River, its upstream tributaries, and downstream reaches. The analysis area also includes a broad assessment of surface waters intersecting with the proposed or alternative facilities, their immediate downstream reaches, and groundwater sources intersecting the project area.

3.4.1 Water Regulations and Water Quality Standards

The CWA of 1977 (as Amended, 33 U.S.C. Section 1251) sets the basic structure for regulating discharges of pollutants to waters of the United States. The CWA gives the EPA authority to establish water quality

standards, control discharges into surface and ground waters, develop waste treatment management plans and practices, and issue permits for pollutant and wastewater discharges (Sections 401 and 402) and for discharges of dredged or fill material (Section 404). The CWA makes it unlawful to discharge any pollutant from a point source into any navigable water of the U.S. without a permit obtained through the NPDES program. Construction activities causing the disturbance of earth require a Storm Water Pollution Prevention Plan (SWPPP) in conjunction with EPA's Construction General Permit.

The CWA provides for the delegation by EPA of many permitting, administrative, and enforcement aspects of the law to state and tribal governments. The Tribe is in the process of establishing water quality standards and developing a groundwater and surface water monitoring plan. Until the EPA adopts such standards, federal water quality standards are applicable to tribal waters and the EPA maintains permitting authority.

For the purposes of this EA, reference to state surface water quality standards have been used, as they have been applied to waters on the Reservation, though the EPA maintains jurisdiction. The Water Quality Act is the basis for water quality protection in the state of Montana (Title 75, Ch. 5). The Administrative Rules of Montana define water quality standards and require the classification of waters in the state according to beneficial uses each body of water should support, according to Section 303(d) of the CWA (**Table 3.7**). The MTDEQ would also have a role in Section 404 decisions, through State program general permits and water quality certification.

Table 3.7: Classifications and Designated Beneficial Uses for Streams, Rivers, and Reservoirs

Rule	Classifications	Beneficial Uses
17.30.623	B-1	Suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.
17.30.624	B-2	Suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.
17.30.625	B-3	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, furbearers; and agricultural and industrial water supply.

Source: Admin. Rules of Montana

3.4.2 Existing Water Resources and Water Rights

Surface Waters

The three major drainages of the project area are within the Yellowstone River sub-basin of the Missouri River basin (**Table 3.8; Figure 3.2**) (MTDEQ 2015b). The Bighorn River flows north through the Reservation from the Montana-Wyoming state line and empties into the Yellowstone River. The Little Bighorn River flows generally north through the Reservation and flows into the Bighorn River near the city of Hardin. Pryor Creek is a smaller perennial river, with many small intermittent tributaries. It flows north directly to the Yellowstone River. Few depressional water features are present in the project area, as most surface runoff flows overland and collects in these major drainages systems. A small portion of the proposed pipeline route would cross into the upper reaches of the Tongue River and Rosebud Creek drainages (**Table 3.8; Figure 3.2**).

Table 3.8: Hydrologic Units within the Project Area

Major Drainage	Subregion (Hydrologic Unit Code 8)	Watersheds (Hydrologic Unit Code 10)
Bighorn River	Lower Bighorn (10080015)	Soap Creek (1008001501)
		Rotten Grass Creek (1008001502)
		Grapevine Creek-Bighorn River (1008001503)
		Beauvais Creek (1008001504)
		Woody Creek (1008001505)
		Two Leggins Creek-Bighorn River (1008001506)
		Whitman Coulee-Bighorn River (1008001507)
Little Bighorn River	Little Bighorn (10080016)	Owl Creek (1008001602)
		Lodge Grass Creek (1008001603)
		Middle Little Bighorn River (1008001604)
		Lower Little Bighorn River (1008001605)
		Upper Little Bighorn River (1008001601)
Pryor Creek	Pryor (10070008)	Upper Pryor Creek (1007000801)
		Middle Pryor Creek (1007000802)
		Lower Pryor Creek (1007000803)
Tongue River	Upper Tongue (10090101)	Badger Creek-Tongue River (1009010103)
Rosebud Creek	Rosebud Creek (10100003)	Headwaters Rosebud Creek (1010000301)

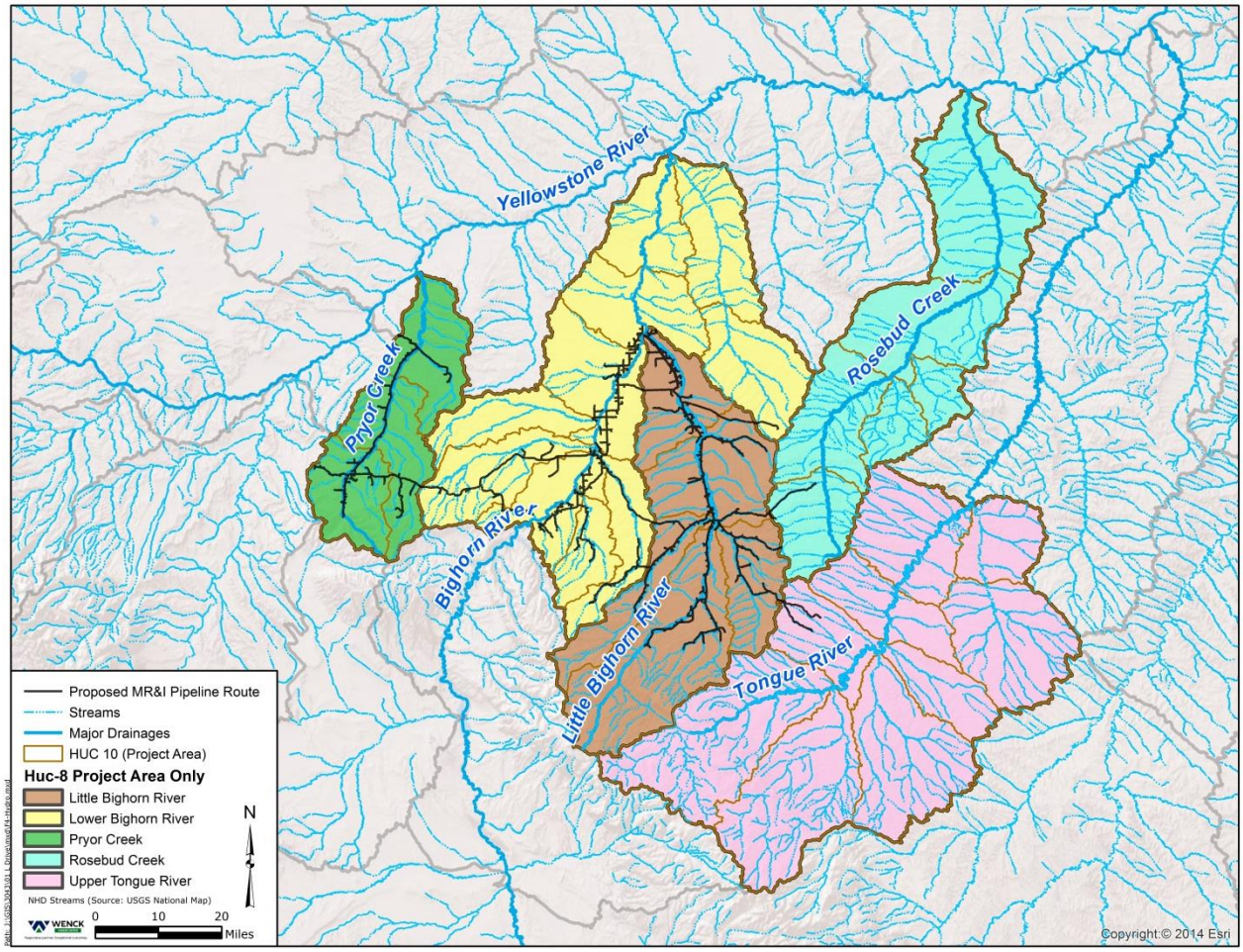
Source: MTDEQ 2015b

Reclamation controls releases from Yellowtail Dam to the Bighorn River. Instream flow targets range from a minimum flow of 1,500 cfs (1,085,950 Acre-Feet per Year (AFY)) to the optimum instream flow of 2,500 cfs (1,809,917 AFY) (as defined in the Streamflow and Lake Level Management Plan (SLLMP), Sect. 4.C.1 to 4.C.3, and further described in Section 3.5.1 pertaining to the fishery). Reclamation is also charged with releasing water in the amount equal to all new development in the reach from the Afterbay Dam to the downstream measuring point (SLLMP, Sect. 2.D).

According to average daily monitoring records, Bighorn River instream flows have ranged from 1,500 to 5,000 cfs about 80 percent of the time since construction of the dam (Reclamation 2015). More specifically, the minimum instream flow (1,500 cfs) has been met about 90 percent of the time, the standard instream flow (2,000 cfs) has been met nearly 75 percent of the time and the optimum instream flow (2,500 cfs) has been met about 60 percent of the time (Reclamation 2015). A record low of 1,300 cfs has occurred only twice in the history of records for Yellowtail Dam and Bighorn Lake. This occurred during October 27, 2002 through June 9, 2003 and again during May 1, 2004 through September 15, 2004. These lows were a result of attempting to balance the impact of inadequate water supplies during the severe drought of the early 2000s (Felchle, T., Supervisory Civil Engineer, Reclamation, pers. comm., 2016). Instream flows have exceeded 5,000 cfs less than 10 percent of the time, and flows over 8,000 cfs are extremely rare events. In 1967 during the filling of the Yellowtail Dam, a significant precipitation event occurred, which caused inflows into Bighorn Lake to increase dramatically. To control the unusually large runoff into Bighorn Lake, releases out of Yellowtail Dam to the Bighorn River were increased to the maximum-recorded release of 24,721 cfs on July 8, 1967. The next highest release was in 2011, when 15,461 cfs was released. The safe channel capacity of the Bighorn River is considered to be 20,000 cfs measured just below the Afterbay Dam and 25,000 cfs as

measured at the mouth of the Bighorn River before entering the Yellowstone River. Lowland flooding could occur below these levels, but lives and property are expected to not be at risk.

Figure 3.2: Hydrologic Units of the Project Area



Groundwater

Water-bearing geological formations are present in the project area. Surficial groundwater formations are typically associated with major streams and tributaries and are not connected to deeper groundwater formations due to impermeable geological strata (Moulder et al 1960). Deeper groundwater sources are present in bedrock formations, primarily from the Madison Group, a deep limestone formation that provides water to some private wells in the Reservation (*Master Plan*, p. 77-78; MGWIC 2015).

Water Rights

The Tribe has quantified water rights to 500,000 AFY of the natural flow of the Bighorn River for current developed uses and new development within the Reservation. In addition to the natural flow, the Tribe is entitled to an allocation of up to 300,000 AFY of water stored in Bighorn Lake. Up to 150,000 AFY of the allocation may be used or diverted as authorized by the Tribe, provided that no more than 50,000 AFY is used outside the Reservation. Up to an additional 150,000 AFY may be used by the Tribe in case of a shortage of the Tribe's natural flow right of 500,000 AFY in the Bighorn River (Settlement Act, Section 408).

A SLLMP for the Bighorn River and Bighorn Lake became effective as part of the Compact, as developed by the Tribe, the Secretary of the Interior, and the State (Article III, Sect. A.7.). The SLLMP establishes terms and conditions for use of the Tribal Water Right.

3.4.3 Existing Surface Water Quality

State water quality designations (as defined in Section 3.4.1, **Table 3.7**) for surface waters in the project area are as follows:

- B-1 (supports cold-water fishery): Pryor Creek to Interstate 90, Little Bighorn River above and including Lodge Grass Creek drainage near Lodge Grass, Bighorn River above Williams Coulee
- B-2 (marginal support of cold-water fishery): Bighorn River mainstem from Williams Coulee to Yellowstone River; Little Bighorn drainage below Lodge Grass Creek (ARM 17.30.611).

No waters within the Reservation boundaries are currently listed as impaired for not meeting standards for water quality (MTDEQ 2014a, Appendix B, p. 47).

Major influences on the water quality of streams for the area are geology, land use, runoff, groundwater discharge from agricultural areas, and drought (Peterson et al. 2004). Foremost concerns are high concentrations of nutrients, chemicals, and sediment and their effect on aquatic life.

Compared to the Yellowstone River basin as a whole, the Bighorn River has a higher median concentration of dissolved solids, higher nitrate concentrations, and degraded aquatic communities. As such, the water quality of the Yellowstone River is degraded after its confluence with the Bighorn River. Coliform bacteria concentrations also frequently exceed federal guidelines in the Bighorn River, with noticeably higher concentrations around agricultural operations within the watershed and increases during months of irrigation, most likely due to flood irrigation practices (Peterson et al. 2004). Pesticides and other chemicals are often detected from water quality samples taken in the Bighorn River and have been detected in groundwater resources sampled in the basin (Peterson et al. 2004).

3.4.4 Direct, Indirect, and Cumulative Effects

No Action Alternative

Existing sources of contamination, such as erosion of geological formations, runoff, and irrigation returns, would continue to affect the quality of surface waters and groundwater of the project area whether or not the Settlement Act was implemented. Without the proposed project, water would continue to be drawn from the Little Bighorn River and groundwater sources to supply the Reservation water demands. Communities and individuals may drill additional wells or withdraw more water from current sources to meet potential population growth demands. Though data is incomplete, the population's current usage is at least 980,000 gpd, but likely in the range of one to two mgd considering unreported communities and rural residents (refer to **Table 3.5**). The anticipated water demand for the Reservation population in 2060 is 4.5 mgd, and up to 6.7 mgd if the nearby but off-reservation city of Hardin is included. Even if the population does not grow to the highest anticipated levels (see discussion in Section 3.2.2), the lower population growth estimates would require water in the range of one to three mgd, which would need to be withdrawn from current or new sources to meet demands.

Proposed Action Alternative

Temporary Construction Effects

Construction of the proposed project has the potential to result in temporary indirect effects to water resources from sedimentation and spills. A maximum range of 5,800 to 6,200 acres of soils and vegetation would be disturbed for the construction of proposed project facilities and pipelines if all distribution lines were installed (**Table 2.7**). Surface disturbance has the potential to liberate sediment, which could migrate to natural waterways during heavy precipitation events. Spills occurring during refueling of construction vehicles would have the potential to add chemical contamination to waterways. To avoid or mitigate these effects, project facilities would be sited with appropriate buffers from waterways. Site-specific SWPPP and SPCC plans would be implemented and erosion control structures would be installed to control and prevent storm water runoff, sediment discharge, erosion, and spills into drainages according to MDT standards (MDT 2015a). Refueling and chemical or fuel storage would occur in designated areas away from waterways. Following construction, the pipeline easement and other areas of temporary disturbance would be reclaimed by replacing soils, grading, and seeding according to site-specific conditions to stabilize the soil in the long-term. With the use of these measures, effects to water resources would be avoided or minimized.

Installation of portions of the proposed pipeline route may encounter groundwater, especially near streams and rivers. The average depth to the water table throughout the Reservation was an estimated 6.8 feet below land surface, according to the United States Geological Society (USGS) (Bartlett & West 2014). In these areas, the pipeline trench would require dewatering. Dewatering techniques would be outlined in site-specific SWPPP and SPCC plans and would follow applicable state and federal regulations to avoid or minimize impacts to water resources.

The proposed pipeline route would cross numerous drainages and streams (**Table 3.9**). To reduce direct impacts to flowing water and potential modification of streambeds, the pipeline would be bored and cased (i.e. HDD) under these features when technically and economically feasible. HDD requires driller's mud for lubrication, which typically consists of water, bentonite clay, and drill cuttings. If this fluid is released from the borehole into a flowing stream, it would likely result in a temporary increase in local turbidity until the sediment dissipates or settles. Heavy soils (e.g. clays) typically present in the beds of streams and drainages would help to limit the possibility of fluid release. Geotechnical studies would be conducted when necessary to determine soil characteristics and potential limitations. During the bore, the volume and pressure of driller's mud would be continuously monitored to detect possible leaks. With these mitigation measures in place, the probability of releases would be reduced and temporary impacts to water resources would be minimized.

Table 3.9: Natural Drainages Crossed by the Proposed MR&I Pipeline Route

Stream Type	Estimated Number of Crossings
Intermittent	610
Perennial	250
Total	*860*

Source: USGS National Hydrography Dataset (Bartlett & West 2015a)

When an HDD crossing is not practicable, drainages would be trenched. Trenched crossings would be used primarily for intermittent streams or upland drainageways and would preferably be done when the drainage is dry or at low-flow. To minimize disturbance, the shortest practicable alignment would be

used. Instream flows would be maintained or temporarily diverted and depositing construction materials or soils in the drainageway would be avoided. Temporarily diverted water would be returned to natural flow patterns when construction is complete, with no long-term effects to hydrology. Erosion control measures would be used as appropriate at stream crossings, retaining natural erosion control of existing vegetation when possible, and revegetating the streambed and banks after construction. Pipelines would be installed at depths of six feet or more below channel beds at waterway crossings to prevent exposure from erosion during periods of high flow. With the use of these measures, effects to water resources would be avoided or minimized and would be of temporary duration.

Effects of Intake Structure Installation

The preferred type of intake, riverbank filtration, would avoid direct disturbance to the Bighorn River riverbed and surface waters. Potential temporary effects to nearby waterways would be minimized as described above for boring under waterways, and the aboveground site on the riverbank would be reclaimed and revegetated.

If a surface water intake would be used, permits for work in the Bighorn River would be obtained prior to design and construction. Construction in the riverbed would be limited in area and duration as practicable. Open trench excavation would be required during installation of the structure and pipe and would follow the measures described above for trenched crossings of drainageways to minimize temporary sedimentation and interruptions in water flow, as well as site-specific measures identified in permits. After construction, the intake site would be reclaimed as described above to prevent long-term effects to water resources.

Construction of an infiltration gallery, if used, would involve excavation of an open trench along the riverbank and installation of a diversion headworks and ditch in the riverbank. Permits would be obtained and followed to minimize impacts as described above.

Effects of MR&I Operation to Water Supply

The Bighorn River's water supply provides the only surface water source that would fully supply water for the Reservation-wide MR&I system. The Tribe has water rights for the Little Bighorn, Pryor Creek, Rosebud Creek, and the Tongue River basins. However, these basins are short of water and existing water rights have priority over new Tribal developments (i.e., the proposed project) (DOWL HKM 2009). The Tribe would permanently dedicate 250,000 AFY of their water right to instream flow of the Bighorn River for the water supply purposes (SLLMP, Sect. 2.A).

The Bighorn River intake would use a maximum of 13 cfs for MR&I continuous operation, regardless of location or type. Reclamation is required to release water from the Yellowtail Dam to meet the requirements in the SLLMP, such as instream flow targets, regardless of additional use for the MR&I (SLLMP, Sect. 2.D). The proposed intake would withdraw a maximum of approximately 0.9 percent of the minimum instream flow of 1,500 cfs which is met about 90 percent of the time, and less than 0.5 percent of the Bighorn River optimum flow of 2,500 cfs which is met about 60 percent of the time (see discussion in Section 3.4.2). During severe droughts, instream flows have been their lowest at 1,300 cfs; maximum MR&I withdrawal would represent one percent of the flow at this level. Because MR&I diversion is such a small percentage of instream flow, even during low flow conditions, it is not anticipated to cause adverse effects to water supply.

The town of Crow Agency currently obtains surface water from the Little Bighorn River for its municipal water source. Other communities and rural residents across the Reservation use groundwater sources. Upon completion of the MR&I system, water intake for these current facilities would be discontinued. The volume of water currently obtained from groundwater and the Little Bighorn River, estimated to be in range of one to two mgd (refer to **Table 3.5**), would shift to the Bighorn River. Reduced withdrawals would have a positive effect on groundwater aquifers in the project area, allowing more water to be available for recharge or other lower priority uses. Reduced diversion for drinking water from the Little Bighorn River would also have a positive but small effect; average available instream flow at Crow Agency would increase up to 0.5 percent, assuming peak usage of 1.1 cfs would be discontinued. This small change would not likely result in detectable effects to water quality or hydrological parameters.

Effects of MR&I Operation to Water Quality

During MR&I operation, the water treatment process would result in a waste water stream containing approximately five times the concentration of contaminants in the raw water, and would be produced continuously at an estimated rate ranging from 0.6 to 0.9 mgd (1.0 to 1.4 cfs) at full capacity (with Hardin). Based on known contaminants in the Bighorn River, the major contaminants in the wastewater stream would include total dissolved solids, sulfate, iron, manganese, aluminum, calcium carbonate and total organic carbon.

Several options are under consideration to dispose of this byproduct; potential effects to surface water quality and other water resources of the project area would differ depending on which disposal option is chosen. Under each scenario, design and operation would be done according to EPA and other regulatory limitations and requirements, depending upon approval and granting of an NDPES or other permit. Therefore, while the effects of some of the options cannot be quantified because of unavailable data at this time, effects would not be outside of permit stipulations and therefore would not prevent attainment of water quality standards or cause water resource impairments.

The preferred method would be direct discharge into the Bighorn River downstream of the water intake. Other options include 1) advanced treatment of a portion of the waste stream through an additional membrane to achieve a lower concentration of residuals, discharge of that portion into the Bighorn River, with the remainder going to evaporation ponds or lagoons; 2) containment of the entire waste stream in evaporation ponds or lagoons; or 3) deep well injection of the entire waste stream.

The two disposal alternatives that involve discharge into the Bighorn River would result in localized decreases in water quality near the discharge location. Preliminary modeling using worst-case scenario assumptions (including maximum discharge volume, maximum contaminant concentration, low river flow of 1500 cfs, and no diffuser on the discharge outlet) found that the discharge plume would rise to the surface within 50 meters (about 160 feet) downstream and would spread up to three feet from the centerline of the plume by the time it reached ambient conditions (Bartlett & West 2015b) (See Water Resources, Project Record, for further details of the assumptions and models used.). In multiple scenarios modeled, the discharge concentration would reach ambient conditions within a range of 60 to 160 meters (about 200 to 530 feet) downstream. To mitigate water quality impacts, diffusers would be installed at the end of the discharge pipe to increase mixing and dispersion. With the use of diffusers, contaminant concentrations would reach ambient conditions within an even shorter distance.

Localized reductions in water quality from the proposed discharge would not change state water quality designations of the Bighorn River and are not expected to have measurable effects downstream. The

mixing zone would at most reach up to 160 meters (about 530 feet) downstream. Past that point, contaminant levels would be indistinguishable from levels upstream of the discharge point. The nearest water treatment plant is the city of Hardin, which is approximately 26 miles downstream from the discharge location. Increases in concentrations of contaminants in Hardin's source water would be undetectable.

If all or a portion of the wastewater stream were contained in evaporation ponds rather than discharged, and depending on participation by Hardin, an area of approximately 40 to 190 acres of land would be needed. The site would be chosen partly based on soil and groundwater characteristics, with the goal to avoid highly permeable soils and high groundwater tables. To prevent leaching of the waste and effects to groundwater quality, liners would be installed in the ponds according to EPA standards and permit specifications, if granted.

Deep well injection of the wastewater stream would have the potential to adversely affect groundwater quality if the waste came in contact with groundwater aquifers. To avoid this result, deep well injection sites would be chosen based on impermeability of layers above, below, and surrounding the site and distance from groundwater aquifers. To prevent effects to groundwater supplies, EPA permit specifications would be followed, if granted.

Other Effects of MR&I Facilities and Operation

A maximum range of approximately 70 to 300 acres would be permanently disturbed from buildings, aboveground structures, and developed impermeable or semi-impermeable surfaces (e.g., parking areas, graveled access road, etc.) (**Table 2.7**). Surface runoff would increase as a factor of this area with the potential to cause erosion or alter hydrology of nearby surface waters. To prevent or minimize these effects, project facilities would be designed to handle anticipated storm water by contouring, slope design, and placement of downspouts, catch basins, and culverts, etc.

Periodic repair and maintenance of the pipeline involving soil-disturbing activities or work within drainageways would potentially result in temporary effects such as sedimentation or alterations in hydrology. Erosion control, dewatering, diversion, the use of buffers, and reclamation would be used as described above under *Temporary Construction Effects* according to site-specific needs to limit these effects.

The use of the MR&I system for livestock watering would potentially result in positive impacts to downstream water quality in surface waters of the project area. If a livestock connection/watering tank was available, the use of riparian areas as a water source would likely occur less frequently and sedimentation and nutrient loading would be reduced. The magnitude of these effects would depend on the number of livestock users that tie into the system, their current water source, and herd size.

Completion of the MR&I system may spur development which has the potential to require large volumes of water. Water demands for future bulk water users were considered during design of the proposed project and are addressed in Chapter 2. Industrial water use or economic activity has the potential to result in degraded return flows to surface waters of the project area. The effects of these activities would be regulated under appropriate jurisdictions, but are too speculative to analyze as part of the proposed action.

Cumulative Effects to Water Resources

Past and present impacts to the watersheds of the project area have included reduced quantity and quality of surface waters and altered flows. The natural flow of rivers and streams within the project area have been interrupted by diversion into the existing CIP irrigation system and other private irrigation systems, which cumulatively reduce the quantity of water available for instream flow. In the case of the Bighorn River, the water is impounded by the Yellowtail Dam and release is strictly controlled, affecting natural flow regimes. Many factors have cumulatively contributed to the current poor water quality in streams of the project area, including natural geology, runoff and irrigation return flows from agricultural land, and sedimentation (Section 3.4.3).

The proposed action would result in localized decreases in water quality downstream of the wastewater discharge location in the Bighorn River, if that disposal option is used. Past the mixing zone of the discharge, contaminant levels would reach ambient conditions. Therefore, cumulative reductions in water quality as a result of the proposed action would be undetectable.

The rehabilitation and improvement of the existing CIP began in 2014 and is expected to continue for the next 10-20 years. These repairs and updates are expected to measurably improve water quality in surface waters of the project area by reducing erosion from damaged irrigation canals, by improving water use and delivery efficiency, and by providing opportunities for improved agricultural practices. CIP improvement projects within the Bighorn River watershed would improve quality of the water available for the MR&I system, particularly if the intake drew directly from river (rather than the preferred riverbank filtration). The volume of water required for the MR&I would be one percent or less of the current flow of the Bighorn River, even during rare low flow conditions, and thus is not anticipated to have a noticeable effect on water volumes required for CIP diversion. As required in the SLLMP (Sect. 2.D), releases from Yellowtail Dam must maintain pre-project instream flow conditions.

One foreseeable future project that would affect water resources in the project area is a proposed flood mitigation and restoration project on a four-mile segment of the Little Bighorn River. The project would better protect the town of Crow Agency from flooding, but is not anticipated to affect or be affected by the MR&I system.

3.5 FISHERIES & AQUATIC LIFE

Because of the renowned trout fishery in the Bighorn River and other valuable fisheries within the project area, a summary of fisheries resources will be presented for all rivers and streams in the project area, with a more in depth review of the trout fishery of the Bighorn River.

Aquatic invasive species are also evaluated in this section at the county and project area level. Though aquatic invasive species can spread between the project area and surrounding counties, the most immediate area of concern would be within Bighorn and Yellowstone counties.

3.5.1 Fisheries & Aquatic Species Regulations and Instream Flow Requirements

The Fish and Wildlife Coordination Act (FWCA) of 1958 (P.L. 85-624, as amended) and 40 CFR 1502.25 states that fish and wildlife conservation shall receive equal consideration and be coordinated with federal actions. Actions that would fall under the jurisdiction of the FWCA include discharges of pollutants or dredged and fill material into a body of water or wetlands. Water development projects

such as impoundments and diversions would also be covered under the jurisdiction of the FWCA (FEMA 2015a).

The National Invasive Species Act was enacted in 1996 to coordinate efforts to prevent the spread of aquatic nuisance species and to regulate ballast water. It also authorized funding for research on aquatic nuisance species prevention and control. EO 13112 (1999) directs federal agencies to prevent and control the spread of both terrestrial and aquatic invasive species. Federal actions must analyze and incorporate all reasonable measures to minimize the risk of introduction and spread of invasive species where appropriate.

Within the Reservation boundary, the State of Montana has the authority to manage fishing in Bighorn Reservoir, Afterbay Dam, and the Bighorn River proper. The Tribe is responsible for management of all other waters within the Reservation boundary (MTFWP 2013a). The Aquatic Invasive Species Act of Montana (MCA 80-7-10) would potentially be applicable for activities on the Bighorn River. This law authorizes the use of check stations to prevent the movement of invasive species from infested to uninfested areas of the state and sets up "Invasive Species Management Areas" where certain restrictions apply to vessels or equipment exposed to state waters.

Reclamation controls releases from Yellowtail Dam to the Bighorn River with the following instream flows to maintain its fishery, as defined in the SLLMP (listed below). Instream flows have first priority use over all other uses.

- Optimum Instream Flow: A minimum flow target of 2,500 cfs (equivalent to 1,809,917 AFY). Under current conditions, this flow level provides good spawning, rearing and cover conditions for fish in all major side channels. Optimum Instream Flow shall be provided as consistently as possible as determined by the monthly plans.
- Standard Instream Flow: A minimum flow target of 2,000 cfs (1,447,934 AFY). Under current conditions, this flow level provides adequate spawning and rearing conditions for fish in most side channels but cover for adult fish is limited. Standard Instream Flow shall be provided when water is not available to meet Optimum Instream Flow.
- Minimum Instream Flow: During low flow periods, the minimum flow target is 1,500 cfs (1,085,950 AFY). Under current conditions, this flow level protects main channel habitat for fish but not important side channels. Fish populations will decline at this flow level. Minimum Instream Flow shall be provided when water is not available to meet Optimum or Standard Instream Flow or for other special circumstances. (SLLMP, Sect. 4.C.1 to 4.C.3)

3.5.2 Existing Conditions

Project Area Fisheries

Rivers and streams in the project area (refer to Section 3.4.2, Surface Waters) support aquatic communities comprised of native species and popular, introduced sport fisheries (**Table 3.10**). Pryor Creek, the Little Bighorn River, and other tributaries are warm-water systems supporting species adapted to relatively warm temperatures and high turbidity. The tailwaters of the Bighorn Reservoir in the Bighorn River provide habitat for a mixture of cold-water and warm-water species. Mountain streams in the Bighorn and Pryor mountains and headwater reaches throughout the project area provide cold-water habitat for native Yellowstone cutthroat trout, a species of concern whose range has been reduced due to changing habitat and introduction of exotic species (MTFWP 2013b). Mountain

streams in the Bighorn and Pryor mountains also provide habitat for rainbow trout, brown trout and brook trout.

Table 3.10: Fish Species of the Project Area

Stream/Reach Grouping	Native Species	Introduced Species
Bighorn River from Yellowtail Dam to Hardin and other drainages in project area	Burbot**, Channel Catfish, Emerald Shiner, Fathead Minnow, Goldeye, Lake Chub, Longnose Dace, Longnose Sucker, Mountain Sucker, Mountain Whitefish, River Carpsucker, Sauger*, Shorthead Redhorse, Western Silvery/Plains Minnow, White Sucker	Bluegill, Brook Trout, Brown Trout, Common Carp, Green Sunfish, Largemouth Bass, Northern Pike, Pumpkinseed, Rainbow Trout, Smallmouth Bass, Walleye, Yellow Perch
Bighorn River below Hardin and other drainages in project area	Brassy Minnow**, Stonecat	Black Bullhead, Black Crappie
Small drainages in project area only	Flathead Chub, Rock Bass, Sand Shiner, Yellowstone Cutthroat Trout*	Spottail Shiner, White Crappie, Yellow Bullhead
Bighorn River below Hardin	Bigmouth Buffalo, Freshwater Drum, Smallmouth Buffalo	N/A

*Species of Concern, **Potential Species of Concern; Source: MTFWP 2015a

The Yellowtail Dam was completed in 1967 as a means of controlling flooding and providing irrigation water. Its creation dramatically altered the fisheries potential of the Bighorn River. Historically the river supported a warmwater assemblage of riverine species, with native cutthroat trout in side-channels (MTFWP 2013a). The release of cold, clear, nutrient rich water now supports a world class tailwater fishery for rainbow and brown trout from Fort Smith to Hardin. Downstream of Hardin the fishery transitions into smallmouth bass, walleye, sauger, burbot, and channel catfish (MTFWP 2013a).

The Bighorn River's trout fishery peaked in the late 1990s with reports of 11,000 catchable trout per mile (Maffly 2007). However, drought and lack of outflows from the dam starting in the 21st century have reduced the number of trout per mile to 3,000. The 13-mile stretch of river beyond the dam holds the highest number of trout, with concentrations diminishing rapidly as the water warms farther from the dam (Maffly 2007). The warm-water resistant brown trout are found all the way to Two Leggins Creek.

Aquatic Invasive Species

No aquatic invasive plants that are listed as noxious in Montana have been documented in Yellowstone or Big Horn counties (MTDA 2015, Kartesz 2015). Though not listed as noxious, watercress (*Nasturtium officinale*) is an aquatic invasive and has been recorded in Yellowstone County (University of Montana-Missoula 2015).

Other than several non-native, introduced fish (discussed above), the only other vertebrate or invertebrate aquatic invasive species documented in the project area is the New Zealand Mudsnail (*Potamopyrgus antipodarum*), which is recorded in the Bighorn River below the Yellowtail Dam (Project Record, Aquatic Invasive Analysis).

Current Impacts to Fisheries

Management of the Bighorn River fishery is accomplished through adjustment of outflow and retention of water at the Yellowtail Dam. Criteria for water releases from the Yellowtail Dam were developed specifically to support the trout fishery downstream (MTFWP 2013a). According to average daily monitoring records, minimum instream flows have been met about 90 percent of the time, standard flows have been met nearly 75 percent of the time, while optimum flows have been met about 60 percent of the time (refer to discussion in Section 3.4.2, *Surface Waters*). At minimum flows, main channel habitat for trout are protected, but not important side channels, and thus populations decline at this flow level. In general, fluctuations of instream flows and availability of side channel habitat also affects numerous native fish species; low flows reduce habitat and high flows increase habitat.

The creation of the dam has also reduced spring flows and increased sedimentation, which has plugged side-channel habitat (Godaire 2010). Side-channels provide spawning habitat and a safe place for juvenile trout to winter (Hunter 1991). Furthermore, brown and rainbow trout encroach in native Yellowstone cutthroat habitat. For these reasons, restoration efforts are on-going to implement structures to keep the introduced species out of historical cutthroat areas and create side-channel habitat needed to improve the populations of the native trout species (MTFWP 2013b).

Many of the larger streams and rivers of the project area have portions of their flow diverted into the CIP and private irrigation systems, which are known to affect fish in a number of ways (MFWP 2013b). According to MTFWP biologists, reduced water quality from irrigation returns is the most significant impact to the fishery of the Bighorn River; however these impacts have not been quantified (Ken Frazer, Fisheries Manager, MTFWP, pers. comm., 2014). Conversely, entrainment in diversion structures and warming associated with irrigation withdrawals are not currently concerns and have little to no measureable impact on fish populations in the project area (Ken Frazer, pers. comm., 2014).

The project area currently has no surface waters listed as impaired, however, high concentrations of nutrients, chemicals, and sediment are typical and are known to affect aquatic life (refer to Section 3.4.3, Existing Surface Water Quality). The Bighorn River has a higher median concentration of dissolved solids, higher nitrate concentrations, and degraded periphyton and invertebrate aquatic communities (that fish use for food) compared to the Yellowstone River basin as a whole (Peterson et al. 2004).

3.5.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

Current impacts to fisheries in the project area would continue whether or not the proposed project was constructed. Impacts include instream flow regulation, sedimentation, habitat degradation, and water quality degradation. If the proposed project is not constructed, water intake volumes from the Little Bighorn River and the Bighorn River into existing community systems at Crow Agency and Hardin, respectively, may need to be increased to supply growing demands. The anticipated 2060 peak daily water demand would increase from current levels by approximately 280,000 gpd for Crow Agency and 2.2 mgd for Hardin. Withdrawals of these volumes would represent about 0.2 percent of the typical flow of the Little Bighorn River and 0.2 percent of the flow of the Bighorn River. These increases are not anticipated to be large enough to have a measureable effect on fisheries or aquatic resources.

Proposed Action Alternative

Temporary Sedimentation from Construction

The proposed pipeline route would cross about 860 intermittent and perennial streams across the project area if all distribution lines were to be constructed (**Table 3.9**, Section 3.4.2). Temporary effects on fisheries would potentially occur from reduced water quality resulting from increased sedimentation during construction work. To minimize such impacts to fisheries, pipeline trenching and other facility construction would be avoided in streams identified as a fishery during the spawning period April 1 to June 1. These streams would be crossed later in the summer or fall when flows are low or the stream is dry (or HDD would be used). To ensure sedimentation impacts are avoided or localized to the immediate proposed project work area, site-specific construction best management practices (BMPs) would be implemented for proposed project SWPPPs and would include practices for control of water runoff and drainage, sediment discharge, erosion, and prevention of spills according to MDT standards (MDT 2015a).

Most streams in the area have a naturally high and seasonally-fluctuating sediment load to which fish and other aquatic life have adapted. The exception is the tailwater trout fishery below the Yellowtail Dam on the Bighorn River. The first crossing in the Bighorn River would be at the proposed water treatment plant near St. Xavier, about 20 miles from the Afterbay Dam and downstream of the 13-mile stretch of prime trout habitat immediately below the dam. All crossings of the Bighorn River would be HDD to limit potential effects.

The preferred type of intake, riverbank filtration, would avoid direct disturbance to the Bighorn River riverbed and surface waters. However, if a surface water intake or infiltration gallery would be used, open trench excavation would be required within the riverbed and along the riverbank. On the Bighorn River, state laws may be applicable to ensure protection of streambeds (refer to Section 1.8), which would pertain to construction work within the river channel. Permits would involve incorporating comments from MTFWP biologists and conservation district personnel to minimize impacts to fish and other aquatic life. Design, construction, and reclamation would be done according to issued permits. Measures discussed above and in Section 3.4.4 would be followed to minimize impacts to aquatic resources as a result of temporary sedimentation and alterations in water flow.

Effects of Intake Operation

The intake for the MR&I water treatment plant would continuously withdraw water from the Bighorn River up to a maximum rate of 13 cfs. This amount is less than 0.5 percent of the optimum flow of 2,500 cfs and 0.9 percent of minimum flow (1,500 cfs), which is met 90 percent of the time (see discussion in Section 3.4.2). Cover for adult fish is limited in standard flow conditions; at minimum flows, side channel habitat is unprotected and fish populations will decline. Reclamation is obliged to meet flow targets regardless of the Settlement Act (SLLMP, Sect. 2.D). Therefore, most of the time releases from the dam and effects of less than optimum flows to fisheries would occur independent of the small percentage of use that the proposed project represents. During periods of severe drought, Reclamation has had to reduce flow to under 1,500 cfs; the MR&I maximum intake would be one percent of the lowest flow recorded. Even at this level, the proposed project's effects on fish populations are unlikely to be measurable.

The preferred intake type is riverbank filtration, which would draw groundwater under the influence of surface water from sand and gravel layers under or adjacent to the Bighorn River. One of the reasons a riverbank filtration intake is preferred is because this type of intake would avoid impacts to the river

bottom, fish, and aquatic life during construction and operation. A surface water intake, if used, would consist of a screened inlet at the end of a pipe(s) within three feet of the deepest part of the river bottom, and would be marked to be observable during day and night hours. The screens would have ¼ inch or smaller mesh size opening (or ⅛ inch or less wire spacing for Johnson intake screens, if used). Intake velocities would not exceed ¼ foot per second since less than 20 feet of overhead water is expected. These measures would be implemented to mitigate fish entrainment and impingement on the intake screen, following USFWS and USACE criteria.

The degree of potential impacts to the trout fishery and other fish and aquatic life as a result of proposed intake withdrawals or surface intake screens would depend in part on intake location. The preferred intake would be near St. Xavier; several locations are possible in that area in the range of 14 to 17 miles from the Afterbay Dam. One location being considered is 1.2 miles upstream of the Afterbay Dam, several are under consideration below Ft. Smith about three to eight miles below the dam, and one location is being considered downstream of St. Xavier about 26 miles below the dam. The highest number of trout are within 13 miles downstream of the Afterbay Dam; therefore, an intake within this portion of the river would be more likely to have measurable effects. Intakes downstream of this stretch would be of minimal concern to the cold water fishery.

Effects of Discharge

The water treatment process would result in wastewater containing approximately five times the concentration of contaminants in the raw water obtained from the Bighorn River. The preferred method of disposal would be to return all or a portion of the wastewater to the Bighorn River near the WTP and downstream of the intake. The proposed discharge outlet would consist of a pipeline exiting the east bank into the deepest portion of the river bottom, capped with a diffuser to increase mixing and dispersion. The wastewater would be produced continuously at an estimated maximum rate ranging from approximately 0.6 to 0.9 mgd (1.0 to 1.4 cfs). The major contaminants in the return water stream would include TDS, sulfate, iron, manganese, aluminum, calcium carbonate and total organic carbon.

If discharged into the river, a localized decrease in water quality would occur near the discharge location. Preliminary modeling using worst-case scenario conditions without the use of diffusers indicate the discharge plume would spread up to three feet from the centerline of the plume by the time it reached ambient conditions within a range of 60 to 160 meters (about 200 to 530 feet) downstream (Bartlett & West 2015). (See Section 3.4.4 and Project Record for further details of the assumptions and models used.)

The reduced water quality within the discharge plume has the potential to affect fish and other aquatic life within the localized area of the plume. Sediment, nutrient levels, and other water quality parameters are known to affect the Bighorn River trout fishery and other fish populations in the Bighorn. Of the contaminants that are expected to be in the discharge, the high concentrations of TDS have a potential to impact aquatic life such as fish. TDS can be toxic to fish species such as trout as well as other aquatic organisms (Weber-Scannell and Duffy 2007). Increases in TDS have been shown to impact species such as cutthroat trout in a Nevada lake (Dickerson and Vinyard 2011). The use of a diffuser would help to mitigate the water quality impacts by reducing the plume length and thus reducing the exposure of fish and aquatic life to discharge contaminants above ambient conditions. The location of the discharge outlet near the WTP at St. Xavier, or further downstream based on intake location, would avoid the highest potential for effects on trout, since it would be downstream of the prime trout habitat.

Spread of Aquatic Invasive Species

The majority of project construction would not occur within waterways and thus would have limited opportunity to affect the dispersal of aquatic invasive species or noxious weeds that spread via waterways. Construction of the preferred riverbed filtration intake and HDD crossings of perennial streams would avoid direct contact with waterways. In the case that a surface water intake or infiltration gallery would be used for the intake, which would involve excavation in the Bighorn riverbed, and in locations where the pipeline would be trenched across drainages, there may be opportunities for construction activity to spread aquatic species downstream from the project area or via equipment from one location to another. To minimize these opportunities, construction contractors would follow Reclamation's *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species* (DiVittorio et al. 2012).

The intake and discharge of water in the Bighorn River would have no effect on aquatic invasive spread. Intake options would filter water through the riverbed, aggregate material, or a surface intake screen. Most aquatic organisms would not be able to physically pass through these filters. If plant propagules or early developmental stages of aquatic organisms are able to pass through the intake, they would be removed in filtration or treatment stages of the water treatment process.

Cumulative Effects to Fisheries

The main factor affecting Bighorn River fish populations and aquatic life in general is poor water quality, which is due to the cumulative effects of past and current actions that release contaminants and sediment into the river, including mining, agriculture (including flood irrigation and the existing CIP), and livestock production. Warm water temperatures also adversely affect trout populations in the Bighorn River. Sufficient instream flow is the other major requirement in sustaining the fishery for both trout and other fish. Releases from Yellowtail Dam, which take into account many cumulative factors upstream and downstream of the project area, determine instream flow. Diversion to the existing CIP and other private irrigation systems removes water from the river, though the amount diverted is not thought to be a large enough influence to affect fish populations compared to the effect of releases from the dam (Ken Frazer, Fisheries Manager, MTFWP, pers. comm., 2014). The maximum amount of water required to supply the proposed water system would be between 0.5 to 0.9 percent of standard instream flow, compared to the average irrigation diversion in the Bighorn River, which amounts to about 6 percent of standard flow.

The Tribe has undertaken the rehabilitation and improvement of the existing CIP, a project which began in 2014 and is expected to continue for the next 10 to 20 years. These repairs and updates are expected to measurably improve water quality in the Bighorn River and other larger rivers and streams of the project area. The CIP improvement work is therefore expected to have beneficial cumulative effects to fisheries throughout the project area.

Other foreseeable development in the area that would contribute incrementally to impacts to fisheries includes a proposed power plant at the Afterbay Dam. Potential impacts from this project is mortality from turbines or "gas bubble trauma." The magnitude of these effects on fish populations would be evaluated in conjunction with development of that project.

3.6 GEOLOGY & SOILS

Ensuring proper management and reclamation of disturbed soils and surficial bedrock is a key concern. The geology of the Reservation as a whole is presented, while the analysis of soils was limited to the maximum area that would potentially be disturbed during new construction, which has been defined as the project area.

3.6.1 Soil Regulations

The 1981 Farmland Protection Policy Act (FPPA) requires examination of the effects of federally funded projects prior to the acquisition of farmlands classified by the NRCS as Prime, Prime if Irrigated, or Statewide/Locally Important Farmlands.

3.6.2 Existing Conditions

Geology

The project area lies in the unglaciated Missouri Plateau section of the Great Plains physiographic province (Vigil et al. 2000). The Reservation is characterized as a mature landscape consisting of flat to rolling plains divided by rivers with dispersed isolated mountains (Vigil et al. 2000). There is about 11,000 vertical feet of sedimentary rock exposed in the Reservation including rocks from the Precambrian to Tertiary time. These rocks are resting on Precambrian metamorphic and igneous rocks that can be seen in the Bighorn Mountains (Klauk 2013).

Two bedrock formations of the Cretaceous age, the Cloverly formation and the Parkman sandstone, underlie the region that includes the Reservation. The seas that repeatedly covered Montana in the geologic past were comparatively shallow, but gradual subsidence of the region allowed sediments to accumulate. The thickness of sedimentary rock over Precambrian formations ranges from 4,000 feet along the Sweet Grass area in west-central Montana to 15,000 feet in the Montana portion of the Williston Basin east of the project area (Mapel et. al 1975).

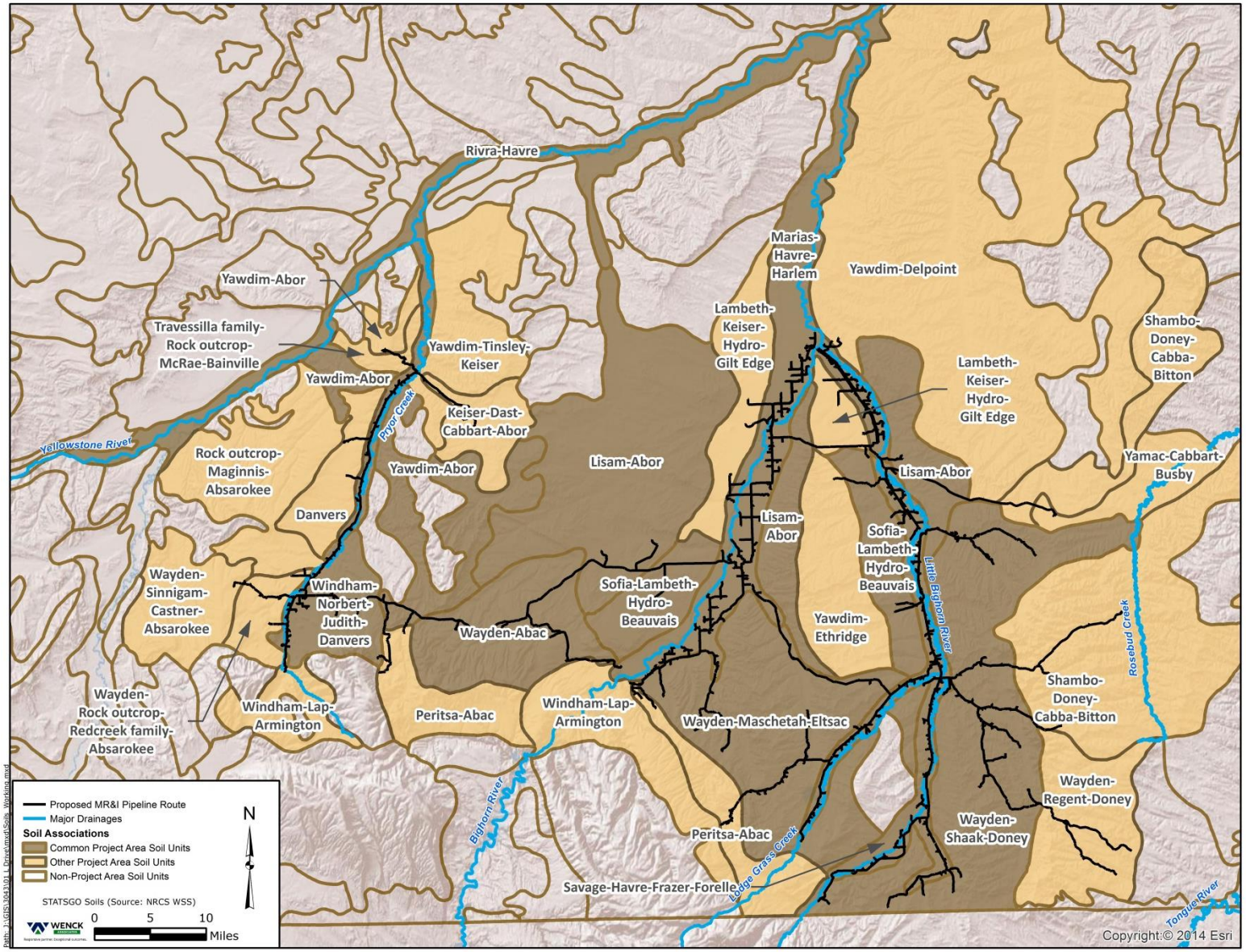
The surficial geology of the project area is over 60 percent Mesozoic sedimentary rocks, predominately shale, sandstone, mudstone, and siltstone. The remaining approximately 40 percent of the project area is alluvial terrace deposits and alluvium consisting of unconsolidated gravel, sand, silt and clay. These deposits are from the Pleistocene and the Holocene, respectively (USGS 2015; Vuke et al. 2007a, 2007b).

Soils

Four broad soil associations together account for approximately 60 percent of the project area (**Figure 3.3**) (USDA-NRCS 2013). The remaining 40 percent of the project area is comprised of associations that each cover less than six percent of the area. In general, the soils of the project area are derived from alluvial or colluvial sources and are used for cropland and rangeland.

The Marias-Havre-Harlem association covers a similar acreage of about 1420 acres (27 percent of the project area). This unit extends along the Bighorn River and its confluence with the Little Bighorn River (**Figure 3.3**). In general, soils of this area are very deep, well-drained clays and loams that formed in the layered alluvium of the floodplain and stream terraces. They tend to be calcareous and can also be saline. Slopes are nearly level with a range from zero to 15 percent. These soils are mainly used for irrigated and non-irrigated crops.

Figure 3.3: Soil Associations of the Project Area



The Savage-Havre-Frazer-Forelle association covers about 980 acres (19 percent of the project area) along the floodplain of the Little Bighorn and the lower reaches of Lodge Grass Creek (**Figure 3.3**). Soil textures are loams, silty clay loams, and sandy loams. They are deep to very deep, well-drained soils that formed in alluvium on alluvial fans, stream terraces, floodplains, and drainageways. Slopes range from zero to 30 percent. The soils are used mainly for dryland crops but in some areas, including the project area, they are used for irrigated crops and rangeland.

The Wayden-Shaak-Doney association covers approximately 450 acres (9 percent of the project area) on the hills and slopes to the east of the Little Bighorn River (**Figure 3.3**). These soils are moderately deep to deep, well-drained soils with potentially rapid runoff that formed in soft alkaline shales, calcareous loamy alluvium, and semi-consolidated sedimentary beds. These soils are uplands, plains, escarpments, and hills with slopes ranging from zero to 90 percent. They are used mainly for rangeland and dryland production of small grains.

The Wayden-Maschetah-Eltsac association covers another 430 acres (8 percent of the project area) on hills and slopes between the Bighorn River and Lodge Grass Creek (**Figure 3.3**). They are moderately deep to very deep soils that are well-drained with medium to rapid runoff. The soils formed from soft alkaline and semi-consolidated shale and calcareous silty wind-blown or alluvial deposits. These soils are found on sedimentary uplands and plains with slopes ranging from zero to 70 percent and are used mainly for rangeland and production of small grains or dryland crops.

Soils along Pryor Creek include two majors associations. Windham-Norbert-Judith-Danvers soils cover about 290 acres (six percent) and Rivra-Havre soils cover 160 acres (three percent) of the project area (**Figure 3.3**). The soils in these associations are typically clays or silty to gravelly clay loams. They are generally very deep, well-drained soils that formed in alluvium and colluvium derived from various bedrock types such as limestone and shale. These soils are along the transition from stream terraces to alluvial fans to hills and foothills; therefore, slopes range from zero to 85 percent. These soils are mainly used as rangeland on native grassland, though in small areas, such as in the project area, they are used as dryland and irrigated cropland.

Several major soil associations are found on the sedimentary hills, ridges, and plains between Pryor Creek to the west and the Bighorn River Valley to the east (**Figure 3.3**). The Wayden-Abac association covers about 300 acres (six percent) of the project area, while the Yawdim-Abor, Sofia-Lambeth-Hydro-Beauvais, and Lisam-Abor associations each cover about 90, 160, and 210 acres in the project area, respectively; these acreages combined account for about nine percent of the project area. These soils are mostly shallow, well-drained, and are slowly or very slowly permeable. They formed in alluvium and colluvium derived from shale or sandstone with slopes from zero to 70 percent. These soils are mainly used as rangeland.

3.6.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative were implemented, current disturbances to soils and surficial bedrock layers from other actions would continue to occur within the proposed project area. Current disturbances include cultivation of dryland and irrigated cropland, maintenance of state and county roads, and maintenance of existing utility systems. Past and current disturbance to soils in terms of developed (i.e.,

roads, utility corridors, portions of towns, farmyards) and tilled acreage is estimated at 47 percent of the project area (see **Table 3.13**).

Proposed Action Alternative

Effects to Surficial Geology

There are several locations within the extent of the proposed MR&I system where subsurface rock would need to be excavated. Ledge or bedrock is likely to be encountered along distribution lines in proximity to the Big Horn, Pryor, and Wolf Mountains and along the transmission pipeline from St. Xavier west to Pryor. Isolated areas of boulders or cobble may be encountered in areas of glacial till or alluvium. To quantify rock present and aid in foundation design, subsurface investigations would be performed at proposed tank sites and limited investigations may be performed along the pipeline alignment. Rock would be removed using chain trenchers and backhoes, or similar special heavy equipment, to break up and remove the rock; blasting would not be used. In rock cut areas, the pipeline would be installed on imported bedding material from local, approved borrow pits.

Effects to Soils

Construction of the majority of the proposed project components would result in disturbance and excavation of soils. Potential disturbances would include compaction, mixing of soil horizons, contamination from spills, and increased susceptibility to erosion. If all distribution lines and facilities were installed, the area of potential temporary construction disturbance would total approximately 5,800 to 6,200 acres. In practice, the construction easements exceed the actual width or area of disturbance necessary for construction; disturbance would be limited to the space necessary to maintain a safe work area for equipment and construction workers. Proposed project components and pipeline routes would be designed and sited, as much as practicable, where soils have been previously disturbed, such as within rights-of-way along roads, within city limits, and within cultivated agricultural fields. However, a considerable portion of the proposed project, estimated at between 25 to 40 percent, would require disturbance of native soils (Bartlett & West, 2015, pers. comm.). With proper site reclamation as described below, construction-related ground surface disturbances for site-specific projects would typically be limited to a timeframe of one to two growing seasons.

Compaction of soils may occur from the use of heavy equipment within construction easements. During reclamation of temporarily disturbed areas, de-compaction techniques would be used as needed to prepare soils for seeding. Compaction of soils would be permanent underneath structure foundations and padding the pipelines.

Equipment refueling has the potential to result in a spill and localized chemical contamination of soils. Site-specific SPCC plans would be prepared and implemented for all construction activities, which would outline spill prevention measures and clean-up and reporting procedures. Refueling would occur in designated areas. With the use of these measures, effects to soils would be avoided or minimized.

Excavation of pipeline trenches, foundations for structures, and borrow pits would permanently disturb soil horizons in localized areas. Excavation and grading extents would be limited as practicable to minimize soil disturbance. Topsoil would be segregated from subsoils and stored on-site to be used for reclamation and seedbed preparation. Excavations would be backfilled using on-site subsoils unless the material does not meet backfill specifications. If necessary, offsite fill and surfacing materials such as gravel would be sourced at the nearest feasible approved borrow location. Of the total potentially disturbed acreage, approximately 97 to 99 percent of the area would be reclaimed, leaving a maximum

range of about 70 to 300 acres permanently disturbed from aboveground project facilities. Areas reclaimed would include pipeline construction easements, service lines, overhead electric line easements, and portions of areas surrounding facilities and buildings. Reclamation would involve contouring subsoils/fill and applying stored topsoils. Areas requiring revegetation (non-cultivated areas) would be seeded or planted during the first appropriate season after redistribution of topsoil, but no more than two growing seasons, to minimize the time soils are exposed to erosion. If reseeding cannot be accomplished within 10 days of topsoil replacement, erosion control measures would be implemented to limit soil loss.

Soils exposed during and after construction and reclamation would be vulnerable to wind and water erosion until vegetation is established. Erosion control structures, such as fiber rolls, straw waddles, fiber mats, silt fences, or a combination of methods would be installed as necessary according to site-specific needs consistent with MDT *Erosion and Sediment Control Best Management Practices Manual* (MDT 2015a). Site-specific SWPPP plans would be prepared and implemented for all construction activities, which would outline measures and practices to control storm water runoff, sediment discharge, and erosion. With the use of these measures, erosion would be minimized.

Construction of the majority of the proposed project, including the transmission and distribution pipelines, would not involve the conversion of farmland to non-agricultural use, and therefore compliance with the FPPA would not be a factor. Proposed facility sites with permanent aboveground structures, such as the WTP and storage tank sites, would be evaluated for designations as prime or unique farmland in consultation with the NRCS to determine appropriate measures to avoid or mitigate effects.

Cumulative Effects to Geology and Soils

Past and present impacts to soils in the project area are primarily related to agriculture and development. A significant portion of the project area acreage has been cultivated for crops or developed for roadways; thus, the top soil layers have been disturbed and mixed. Agricultural activities, including cultivation and ranching, affect soil properties such as compaction, salinity, and productivity. Flood irrigation in the area has exposed soils to wind and water erosion, displacing them over time and resulting in sedimentation in waterways. Rehabilitation and improvement of the expansive CIP system began in 2014 and will continue for the next 10-20 years. The CIP project is expected to result in beneficial cumulative effects to soils in the project area by reducing erosion and sedimentation, but with the potential to bring new lands under cultivation or irrigation. These past and current activities have contributed to cumulative changes in soil properties and cumulative amounts of sedimentation, affecting the majority of the acreage of soils in the project area. Construction of the MR&I system would contribute incrementally to temporary and permanent soil disturbance in the project area.

3.7 VEGETATION & LAND USE

Vegetation and land use were identified as key issues for the proposed project since the proposed action would require new construction, potentially disturbing native plant communities. Protected or culturally significant plants of the project area were also analyzed in this section. Exposed soils from ground disturbance are a prerequisite for many noxious weeds or invasive plants, which can readily spread by seed or vegetatively into open areas. The analysis of existing vegetation and land use was limited to the footprint of the project area. Species searches were at the county or Reservation level.

3.7.1 Vegetation Regulations

The 1973 ESA mandates protection of species federally listed as threatened or endangered and their associated habitats. Federal agencies must use their authorities to conserve listed species and ensure their actions do not jeopardize the continued existence of listed species. Candidate species receive no statutory protection. EO 13112 (1999) directs federal agencies to prevent and control the spread of terrestrial and aquatic invasive species. Federal actions must analyze and incorporate reasonable measures to minimize the risk of introduction and spread of invasive species where appropriate.

The Reservation does not have an endangered species law different from the federal government, though it does grant protection to those species designated by the Crow Tribal Fish and Game Commission (CLOC 12-5-108). Lists of Crow Tribal Fish and Game Commission designated species were not available. The Crow Tribal Culture Department discusses the importance of plants for cultural practices in a report by Reed (2002). The report recommends that culturally important plants be protected from destruction, contamination, and eradication. No species lists are provided but the report recommends protection of medicinal plants and roots, ceremonial foods, trees (particularly those identified as potential final resting places), and willows along waterways (Reed 2002).

The Montana Natural Heritage Program (MNHP) tracks species of concern in Montana. Plant or animal species listed under this program are considered rare, threatened, and/or have declining populations and are at risk of extirpation in Montana. A species of concern is not a statutory or regulatory classification.

The Montana County Noxious Weed Control Law (MCA 7-22-21) prohibits the propagation of noxious weeds, which are designated on statewide and county-wide levels. This law also requires reestablishment of beneficial plant cover after construction of roads, utilities, pipelines, and other development on easements or rights-of-way to prevent noxious weed spread.

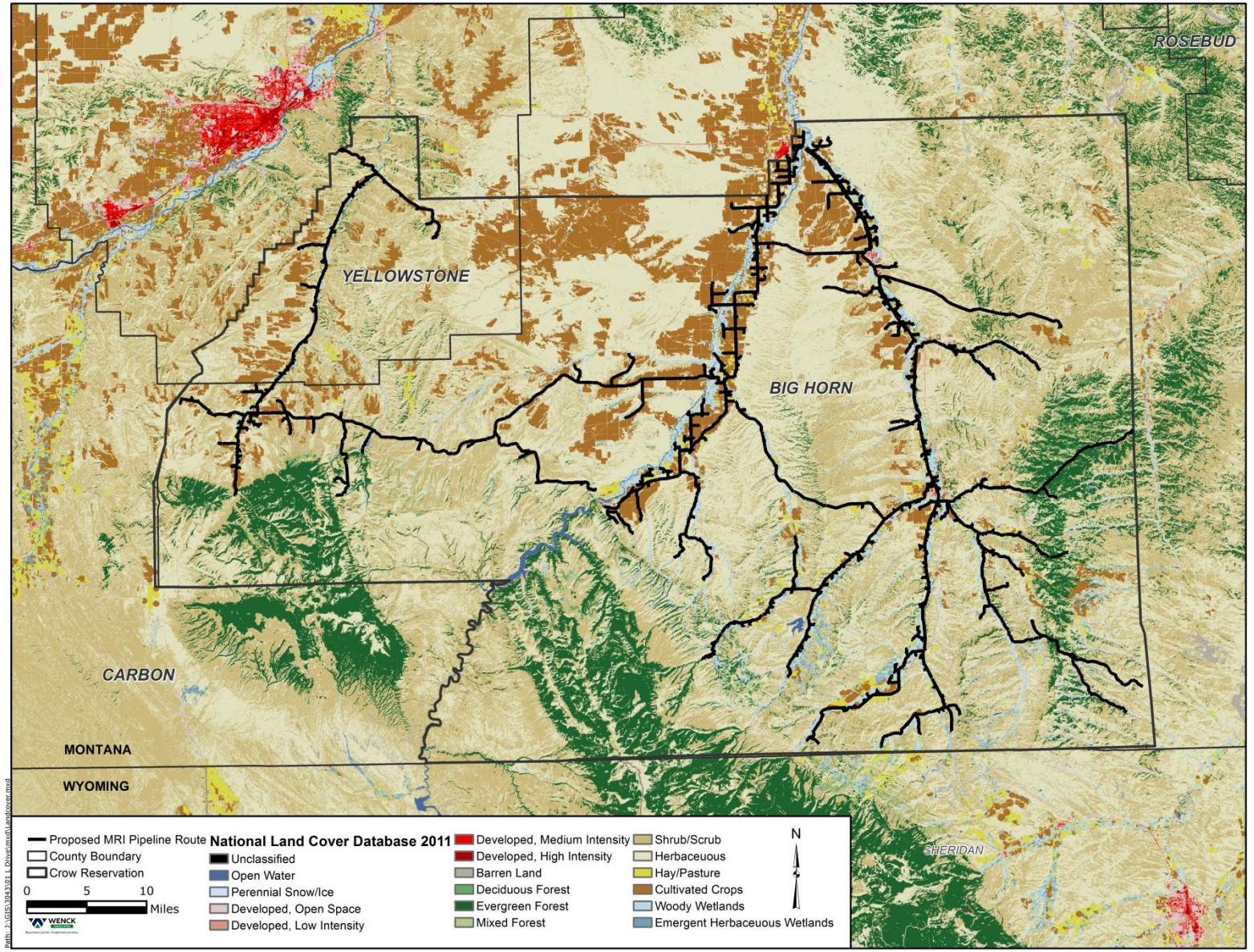
3.7.2 Existing Conditions

Native Plant Communities and Land Use

The Reservation is within the Montana Central Grasslands and Pryor-Big Horn Foothills of the Northwestern Great Plains ecoregion, generally characterized as unglaciated semiarid rolling plains (Woods et al. 2002). Low precipitation and high summer temperatures restrict vegetation productivity throughout this ecoregion, causing most of the area to be used for rangeland.

The proposed project would be primarily within grassland, shrubland, agricultural, and developed cover types (NLCD 2011) (**Figure 3.4**). Agricultural production is typically near irrigation water sources, such as along the major drainages of the Bighorn and Little Bighorn rivers. Outside of these river valleys, rolling hills and high benches of native grassland and sagebrush shrubland are used extensively for cattle grazing and limited dryland small grain production (USDA-NASS 2014). Trees are restricted to canyons and open woodlands in the semiarid foothills of the Pryor Mountains in the southwest, the Bighorn Mountains in the south-central and the Wolf Mountains in the eastern portions of the Reservation (See also Section 3.11.1, Visual Resources). Riparian forests and wetlands are present along major drainages and floodplains.

Figure 3.4: Land Cover Classifications Within and Surrounding Project Area



Federally-Listed Species

No plants are listed as threatened or endangered under the ESA within the project area (USFWS 2016).

State Species of Concern

A query of the MNHP indicates 20 plant species of concern historically occurred in Big Horn and Yellowstone Counties (MNHP 2015a) (**Table 3.11**). Most of the plants have a global ranking of three to five, indicating that these species are common elsewhere but are at the edge of their population range in Montana; however, several species are endemic to the region, meaning they are found nowhere else. Habitats of the species are various, including wetlands, grasslands or shrublands, foothills, or sparsely vegetated outcrops. No exact locations or population acreages of these plants are available for the project area.

Table 3.11: Plant Species of Concern That May Occur within the Project Area

Scientific Name	Common Name	Global/ State Status*	Potential Habitat	Potential Distribution
Ammannia robusta	Scarlet Ammannia	G5 S2	Wetland and riparian habitats	A few extant populations and a historical collection present in northeastern Montana. May occur in additional wetlands in Montana east of the Continental Divide.
Astragalus aretioides	Sweetwater Milkvetch	G4 S2S3	Foothills and montane zone (about 4400-7800 feet) on exposed ridges and slopes in thin soil usually derived from limestone or calcareous sandstone	Known in Montana only from exposed ridges and outcrops in the Pryor Mountains / Bighorn Canyon area.
Astragalus barrii	Barr's Milkvetch	G3 S3	Sparsely vegetated knobs and buttes, usually with dry, fine-textured, often calcareous soils	Historic populations are present in Montana in the southeastern portion of the state.
Bacopa rotundifolia	Roundleaf Water-hyssop	G5 S3?	Wetland and riparian habitats	Known in Montana from only a few observations in the central and eastern portions of the state.
Carex gravida	Heavy Sedge	G5 S3	Moist green ash woodlands and wetlands.	Found at a few widely scattered locations in eastern Montana, and is not generally abundant where it occurs.
Cleome lutea	Yellow Beeplant	G5 S1S2	Open, often sandy soil of sagebrush steppe in the valleys.	Rare in Montana, where it is currently known from only a small area in the south-central portion of the state.
Dalea enneandra	Nine-anther prairie clover	G5 S2S3	Gravelly-soiled grasslands and slopes on the plains	In Montana, known from a few poorly documented occurrences in the eastern half of the state.
Erigeron allocotus	Big Horn Fleabane	G3 S3	Low elevation rock outcrops and ridges	A regional endemic of Montana and Wyoming. In Montana, it is known only from the Pryor Mountain Desert - Bighorn Basin area of Carbon and Big Horn Co.
Eupatorium maculatum	Spotted Joe pye-weed	G5 S1S2	Wetland and riparian habitats	Widespread species known in Montana from a few occurrences in the south-central part of the state.

Scientific Name	Common Name	Global/ State Status*	Potential Habitat	Potential Distribution
Grayia spinosa	Spiny Hopsage	G5 S2	Dry shrublands	Less than a dozen small occurrences have been documented primarily in the Pryor Mountain Desert in Montana, with some records from southwest Montana.
Ipomoea leptophylla	Bush morning-glory	G3G5 S1S2	Dry grasslands	Known in Montana from only a few collections in the southeastern part of the state, only one of these collections was in the last two decades.
Lomatium nuttallii	Nuttall Desert-parsley	G3 S2	Rocky pine woodlands, especially on mid and lower slopes along drainages.	The few populations are present in the upper Tongue River drainage of Montana and are disjunct from the main range of the species in southeastern Wyoming and adjacent Nebraska and Colorado.
Physaria didymocarpa var. *lanata*	Woolly Twinpod	G5T2 S2S3	Grassland/shrublands	Only a few known occurrences in Montana, including two potentially large populations
Rorippa calycina	Persistent-sepal Yellow-cress	G3 SH	Wetland and riparian habitats	Regional endemic currently known only from four Montana records. The species was last observed in Montana more than 30 years ago.
Senecio eremophilus	Desert Groundsel	G5 S1S2	Mesic grassland habitats	Known from at least five occurrences, including two historical collections. Little data are available for this species in Montana.
Sporobolus compositus	Tall Dropseed	G5 SH	Forests and grasslands	Known in Montana from three collections; a 1939 collection near Ekalaka, a 1957 collection from Fort Keogh Livestock and Range Laboratory and a 1980 collection from Bighorn County.
Stipa lettermanii	Letterman's Needlegrass	G5 S1S3	Low elevation talus and grasslands.	Documented from several locations in the southern portion of the state.
Sullivantia hapemanii	Wyoming Sullivantia	G3 S2S3	Calcareous rock walls and boulders at springs, waterfalls and streambanks, or where there is seepage from limestone or dolomite.	Regional endemic known in Montana only from a few, clustered locations.
Symphyotrichum molle	Soft Aster	G3 S1S3	Information on potential habitat is unknown.	Known in Montana from one collection from the Bighorn Mtns.
Viburnum lentago	Nannyberry	G5 S2S3	Present in riparian forests and woodlands	Three known occurrences in eastern Montana.

Source: MNHP 2015a

*The international network of Natural Heritage Programs employs a standardized ranking system to denote global (G) or state (S) status. Species are listed on a scale from 1 to 5, 1 being the highest risk of extinction or extirpation and 5 being common, widespread, and abundant. Modifier "H" denotes species that were historically known from records usually greater than 40 years old.

Culturally Significant Vegetation

A number of native plants are culturally important to the Tribe and are used for food, medicinal, and religious or spiritual purposes. Culturally significant plants that may be present within the project area in grassland or wetland habitats include: arrowleaf balsamroot (*Balsamorrhiza sagittata*); Buffaloberry (*Shepherdia argentea*); cattail (*Typha* sp.); chokecherry (*Prunus virginiana*); purple coneflower (*Echinacea angustifolia*); dandelion (*Taraxacum officinalis*); flax (*Linum* sp.); sage (*Artemisia* sp.); sweetgrass (*Hierochloe odorata*); wild onion (*Allium* sp.); common yarrow (*Achillea millefolium*); yucca (*Yucca glauca*); and willow (*Salix* sp.) (Snell 2006).

Noxious Weeds

Table 3.12 summarizes state and county-listed noxious weeds that potentially occur in Big Horn or Yellowstone counties based on current distribution data (MTDA 2015, Montana Weed Control Association 2015, Kartesz 2015). No lists specific to the Reservation were available. Of these, the noxious weeds known to be problematic in the project area include: Canada thistle; houndstongue; dalmatian toadflax; sulfur cinquefoil; leafy spurge; whitetop; field bindweed; spotted knapweed; and saltcedar (HKM 2007, p. 36; Bockness 2014). No acreage estimates are available for these species in or surrounding the project area.

Table 3.12: Potential Noxious Weeds in Project Area

Priority	Description of Priority Status	Listed Plant Species*	County Distribution
1A	Weeds are either not present or have a limited presence in Montana	Dyer's woad (*Isatis tinctoria*)	Yellowstone
1B	Weeds have a limited presence in Montana	Knotweed complex (*Reynoutria japonica, R. sachalinensis*)	Yellowstone
		Purple loosestrife (*Lythrum salicaria*)	Yellowstone
2A	Common in isolated areas of Montana	Orange Hawkweed (*Hieracium aurantiacum*)	Yellowstone
		Perennial pepperweed (*Lepidium latifolium*)	Big Horn
		Blueweed (*Echium vulgare*)	Yellowstone
2B	Abundant in Montana and widespread in many counties	**Canada thistle (*Cirsium arvense*)**	Big Horn, Yellowstone
		Field bindweed (*Convolvulus arvensis*)	Big Horn, Yellowstone
		Leafy spurge (*Euphorbia esula*)	Big Horn, Yellowstone
		Whitetop (*Cardaria draba*)	Big Horn, Yellowstone
		Russian knapweed (*Rhaponticum repens*)	Big Horn, Yellowstone
		Spotted knapweed (*Centaurea stoebe*)	Big Horn, Yellowstone
		Diffuse knapweed (*Centaurea diffusa*)	Big Horn, Yellowstone
		Dalmatian toadflax (*Linaria dalmatica*)	Big Horn, Yellowstone
		St. Johnswort (*Hypericum perforatum*)	Big Horn, Yellowstone
		Sulfur cinquefoil (*Potentilla recta*)	Big Horn, Yellowstone
		Common tansy (*Tanacetum vulgare*)	Big Horn, Yellowstone
		Houndstongue (*Cynoglossum officinale*)	Big Horn, Yellowstone
		Yellow toadflax (*Linaria vulgaris*)	Big Horn, Yellowstone
		Saltcedar (*Tamarix* spp.)	Big Horn, Yellowstone
		Hoary Alyssum (*Berteroa incana*)	Yellowstone

Priority	Description of Priority Status	Listed Plant Species*	County Distribution
3	Regulated, but not listed as noxious in Montana. May not be intentionally spread or sold other than as a contaminant in agricultural products.	Cheatgrass (*Bromus tectorum*)	Big Horn, Yellowstone
		Russian olive (*Elaeagnus angustifolia*)	Big Horn, Yellowstone
County Designated	Each county weed district can declare additional non-native plants to be noxious within the county.	Poison hemlock (*Conium maculatum*)	Big Horn, Yellowstone
		Western water hemlock (*Cicuta douglasii*)	Yellowstone
		Puncturevine (*Tribulus terrestris*)	Yellowstone
		Common teasel (*Dipsacus fullonum*)	Yellowstone
		Common mullein (*Verbascum thapsus*)	Big Horn, Yellowstone
		Common Burdock (*Arctium minus*)	Big Horn, Yellowstone

*Species in bold are known within project area (Bockness 2014). Adapted from MTDA 2015 and Montana Weed Control Association (2015) based on county level species distribution maps (Kartesz 2015).

3.7.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative was selected, current disturbances to native and semi-natural vegetation from other actions would continue to occur within the proposed project area. Current disturbances include cultivation of dryland and irrigated cropland, livestock grazing of native grassland, maintenance of state and county roads, and maintenance of existing utility systems. Past and current disturbance to vegetation in terms of developed (i.e., roads, utility corridors, portions of towns, farmyards) and tilled acreage is estimated at 47 percent of the project area. Another 39 percent of the project area is native grassland and shrubland, the majority of which is used as rangeland for livestock (see **Table 3.13**).

Proposed Action Alternative

Effects to Native Vegetation

The proposed project would result in crushing or trampling of vegetation and vegetation removal within construction easements. The maximum area of temporary construction disturbance would total approximately 5,800 to 6,200 acres. In practice, construction easements exceed the actual width or area of disturbance necessary for construction; disturbance would be limited within the easement to the space necessary to maintain a safe work area.

An estimated 25 to 40 percent of the project area would require disturbance of native vegetation (Bartlett & West, 2015, pers. comm.). Removal of vegetation and soil disturbance in native, previously undisturbed areas would represent a permanent impact since restoration to a native community is difficult to achieve with typical reclamation and reseeding methods. Disturbance of native vegetation would also contribute to habitat fragmentation. These long-term impacts would be minimized by limiting new construction, as practicable, to areas that have previously been disturbed, such as within rights-of-way along roads, within city limits, and within cultivated agricultural fields (**Table 3.13**). Previously disturbed areas typically have some degree of invasion by non-native species and have vegetation communities of lower quality. Removal of vegetation in previously disturbed areas would be considered a short-term impact; reclamation and natural colonization of adjacent vegetation and on-site propagules would restore the existing low quality perennial vegetation present in these areas.

Table 3.13: Estimated Percent Disturbance by Land Cover

Land Cover	Percent of Project Area
Disturbed	
Developed	26
Cultivated Crops	14
Pasture/Hay	7
*Native/Natural Vegetation**	
Grassland/Herbaceous	26
Scrub/Shrub	13
Wetlands/Riparian	12
Forest	<1
Barren Land	<1

Source: NLCD 2011. *Note: The estimated disturbance of native vegetation overestimated since the NLCD data is not fine-scaled enough to account for small or narrow disturbed areas through native vegetation within which proposed project facilities and the pipeline routes would be sited.

Where removal of vegetation is unavoidable, naturally and semi-naturally vegetated areas disturbed by proposed project activities (e.g., pastureland, native prairie, wetlands) would be seeded during the first appropriate season after redistribution of topsoil, but no more than two growing seasons. If reseeding cannot be accomplished within 10 days of topsoil replacement, erosion control measures would be implemented to limit soil loss. The preferred seed mixture would be comprised of native species and may include a cover crop, according to local NRCS guidelines, unless landowner desires otherwise. Areas used for row cropping that are disturbed by the proposed project would be returned to their original condition (e.g., bare ground) following pipeline installation unless otherwise directed by the landowner. Developed areas disturbed by the proposed project (e.g., parks, lawns, etc.) would be returned to their original condition. Seed would be planted using a drill, hydroseed, or broadcast methods according to local NRCS guidelines.

Effects to Special-Status Species

Though several rare plant species have the potential to occur in the project area, the likelihood is low that they would be impacted by the proposed project. If any rare plants were to occur, they would be present in natural or native habitats, whereas the majority of construction disturbance would occur in previously disturbed areas such as road ditches that have low quality, often non-native, perennial vegetation. Pre-construction surveys within native communities targeted for new construction would be done as recommended by the IERT to identify rare plant populations. Routes and designs would be modified accordingly to avoid impacts to rare plants.

Most culturally significant plants are common grassland or wetland plants, which are not anticipated to be significantly impacted by construction or operation of the proposed project. Prior to site-specific construction, the THPO would be consulted to identify any trees or other sites that may have cultural importance. These culturally significant areas would be avoided to the extent possible.

Effects to Noxious Weeds and Invasive Species

Noxious weeds are likely to be present in portions of the project area and have the potential to spread as a result of project construction or maintenance activities. If existing populations of noxious weeds or invasive plants are present at a specific site, construction equipment has the potential to spread seeds or root fragments during clearing and grubbing activities. Seeds may adhere to equipment and be spread to other sites when equipment is moved. Soil-disturbing activities would potentially expose

buried seed banks of noxious weeds and provide an environment of bare soils in which noxious weeds typically colonize. The effects of noxious weed or invasive species spread would be long-term, depending on the species and effectiveness of control efforts. The majority of proposed project construction would not occur within waterways and thus would have no opportunity to affect the dispersal of species that spread via waterways.

Several measures implemented at key stages of the proposed project would effectively minimize or prevent noxious weed outbreaks or invasive species spread. Pre-construction noxious weed surveys and subsequent treatment would be completed by the BIA, as appropriate to the site. Construction contractors would follow Reclamation's *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species* (DiVittorio et al. 2012) which includes measures for both terrestrial and aquatic species. Areas requiring revegetation would be seeded or planted during the first appropriate season after redistribution of topsoil, but no more than two growing seasons, to minimize the time disturbed soils are exposed and to reduce the potential for invasive weed species from becoming established. Seedbed preparation may include removal or treatment of noxious weeds or infested topsoil, according to site-specific needs.

Cumulative Effects to Vegetation and Land Use

Past and present impacts to vegetation and land use in the project area are primarily related to farming and agriculture. Over half of the project area acreage has been cultivated or developed, and therefore, permanently converted from natural land cover types and native vegetation communities. The ongoing rehabilitation and improvement of the CIP is planned to affect large acreages of land within the project area with the potential for newly farmed or irrigated lands. The proposed project would potentially result in additional new land development once a consistent source of potable water is available. The majority of land conversion for development would likely occur near existing, developed communities where there is a source of drinking water from the proposed project. Therefore, the proposed project would potentially contribute to the cumulative acreage of converted native land cover.

Though comprehensive records of the type and extent of noxious weeds and other invasive species are unavailable for the project area, presumably there are populations that occur in the area. Past, current, and future introductions have resulted and will continue to result from human activities across the landscape such as agriculture and transportation. The construction activities associated with this proposed project would represent incremental opportunities for the spread of noxious weeds or invasive species through the disturbance of extant populations and soil-disturbance. Several mitigation measures and practices would prevent or ensure these opportunities are kept to a minimum.

3.8 CULTURAL & TRUST RESOURCES

Cultural resources encompass sites, objects, or practices of archaeological, historical, cultural and religious significance that are protected under various laws and regulations. The location of the proposed project on the Reservation and the intention of the proposed project to benefit the Tribe dictates that it must proceed with particular sensitivity to Apsáalooke culture and heritage. The analysis of cultural resources was focused within the project area, where potential impacts to cultural or sacred sites would potentially occur from construction activities.

3.8.1 Cultural and Trust Regulations

Section 106 of the NHPA of 1966, as amended (16 U.S.C. 470a, et seq.) and its implementing regulations (36 CFR Part 800) requires that federal actions take into account the effect of a proposed action on cultural resources included in or potentially eligible to the National Register of Historic Places (NRHP). Federal agencies must consult with Historic Preservation Officers who are responsible for administering programs at the state or tribal level. The Crow THPO maintains Tribal register of cultural places, properties composed of religious sites, traditional cultural properties, burial sites, archeological sites, districts, buildings, and structures significant to the history, life ways, and customs of the Apsáalooke (Crow THPO 2014). The THPO also issues associated permits for excavation and construction projects within the exterior boundaries of the Reservation (Crow THPO 2014).

The NAGPRA requires that Native American cultural items be returned to lineal descendants and/or culturally affiliated Indian tribes. Cultural items include human remains, funerary objects, sacred objects, and objects of cultural patrimony. NAGPRA also establishes procedures for the inadvertent discovery of Native American cultural items on federal or tribal lands and makes it a criminal offense to traffic in Native American human remains without right of possession or if cultural items were obtained in violation of the act. NAGPRA applies to all projects, regardless of the funding source.

Indian Trust Assets (ITAs) are "legal interests in property or resources held in trust by the United States for Indian tribes or individual Indians" (Indian Trust Policy issued July 2, 1993). The Secretary of the Interior is the trustee for the United States on behalf of Indian tribes. ITAs include land, minerals, timber, ethnobotanical resources, hunting and fishing rights, water rights, and in-stream flows. ITAs may be located on or off-Reservation lands. During the NEPA process, Reclamation, as a representative of the Secretary of the Interior, must evaluate whether the proposed project may affect ITAs. This policy reaffirms the legal trust relationship and the government-to-government relationship between the Secretary of the Interior and Indian tribes.

The 2009 Paleontological Resources Preservation Act (P.L. 111-011 Title VI Subtitle D) directs federal agencies to manage, protect, and preserve paleontological resources. Though this law does not apply on Reservation lands, paleontological resources on the Reservation are treated as an ITA because of their potential commercial value.

3.8.2 Existing Conditions

Historic and Cultural Sites

Numerous historic and culturally important sites are near the project area. Several of the more recognized sites include the Little Bighorn Battlefield, the Bozeman Trail, Fort C.F. Smith, Bad Pass Trail, and Fort Smith Medicine Wheel (NPS 2015a, 2015b). The Little Bighorn Battlefield, now designated a National Monument, is two miles southeast of Crow Agency. It is the location of the 1876 fight between the U.S. Army's 7th Cavalry under Lt. Col. Custer and Lakota and Cheyenne warriors (NPS 2015a).

The Bozeman Trail crosses the Bighorn River near the town of Fort Smith within the boundaries of the project area. It was used from 1864 until 1866 to connect the Oregon Trail to the recently discovered gold-strike country in the north, allowing settlers access to what would become Montana. However the trail crossed through what was then the territory of several Indian tribes, and numerous fights occurred. The historic Fort C.F. Smith was built by the U.S. Army to help guard the Bozeman Trail. In 1868, U.S.

military forces signed a treaty with Lakota war chief Red Cloud and withdrew their forces, effectively closing the Bozeman Trail (NPS 2015b).

Bad Pass Trail runs along the western edge of Bighorn Canyon from the mouth of the Shoshone River in Wyoming to the mouth of Grapevine Creek near the town of Fort Smith (NPS 2015b). This trail had been used by native peoples for 10,000 to 12,000 years and more recently by trappers, traders, ranchers, and settlers. Fort Smith Medicine Wheel is a spiritual location on a bluff overlooking the Bighorn River, used by the Tribe and other Native Americans (NPS 2015b).

A Class I Cultural Resource Inventory literature and file search has been completed for the existing CIP irrigation facilities, an important part of the political, economic, and social history of the Reservation (Fandrich 2007). The irrigation system is routed primarily in the valleys and floodplains of the Bighorn River, Little Bighorn River, and Pryor Creek. The entire irrigation system has been recommended as eligible for listing in the NRHP under Criterion A (properties associated with significant events), and some individual structures and components are recommended eligible for listing in the NRHP under Criterion C (properties with distinctive method of construction) (Fandrich 2007).

Historic buildings, railroads, homesteads/ranches, and Native American cultural and archeological sites are located throughout the project area.

Traditional Religious and Sacred Sites

The Tribe retains many of its traditional beliefs, culture, and knowledge (Reed 2002). Many of the religious and sacred sites of the Apsáalooke are located outside the present-day boundaries of the Reservation, since the Reservation is only a small portion of the original extent of Apsáalooke territory, having been ceded and reduced by various treaties and policies of the US government. Religious or sacred sites that are tied to particular locations and are considered "Prestigious Historical/Sacred Sites" by the Crow THPO include rock art, fasting sites, siege sites, camp sites (teepee rings), mourning sites, and final resting places (scaffolds, lodges, large rocks or boulders, larger trees along waterways, rock ledges) (Reed 2002).

Paleontological Resources

Paleontological resources are defined in the Paleontological Resources Preservation Act of 2009 as "any fossilized remains, traces, or imprints or organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth…," excluding archeological and cultural resources. The distribution of paleontological resources is directly related to the distribution of sedimentary geological units exposed on the ground surface, and this relationship allows prediction of fossil potential on a formation-wide scale (BLM 2015). The Potential Fossil Yield Classification (PFYC) system was developed by the Bureau of Land Management (BLM) to classify geological units based on the relative abundance of fossils and their sensitivity to adverse impacts (BLM 2007).

The majority of the project area (approximately 85 percent) is classified as low to moderate potential for paleontological resources (Classes 1 through 3) (**Table 3.14**). These portions of the project area are in major river and stream valleys with alluvial sediments that are not fossiliferous and adjacent rolling topography of sedimentary geology where fossil content varies. About four percent of the project area is classified as high potential for paleontological resources, concentrated in geological formations with exposed bedrock south and west of Pryor and northwest of Fort Smith along Highway 91 (Pryor-St.

Xavier Cutoff Road). About 11 percent of the project area has very high potential for paleontological resources, concentrated along the eastern edge of the Reservation in formations and outcrops of the Wolf Mountains from south of Wyola to Crow Agency (**Table 3.14**) (BLM 2011, BLM 2015).

Table 3.14: Potential Fossil Yields within the Project Area

PFYC Class	Potential for Paleontological Resources	Estimated Acres within Project Area	Percentage of Project Area
Class 0	Open Water	<5	<1
Class 1	Very Low	0	0
Class 2	Low	3310	63
Class 3a	Moderate	1010	19
Class 3b	Unknown	120	2
Class 4	High	200	4
Class 5	Very High	580	11

Modified from BLM 2015, p. 3-128 to 3-129.

Paleontological localities are areas of known paleontological resources with defined boundaries, usually associated with excavation and data recovery efforts (BLM 2015). From data compiled from the BLM (2015), three paleontological localities have been documented in Big Horn County and 25 are present in Yellowstone County.

3.8.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative was selected, undiscovered cultural, historical, religious, and paleontological sites and resources would not be disturbed from construction activities associated with the implementation of the Settlement Act. Current disturbances in the project area, such as continued cultivation of cropland and maintenance activities along roads and utility corridors, would continue to occur and have the potential to affect previously undiscovered cultural resources by disturbing soils and bringing buried cultural artifacts to the surface. New development within the project area from other activities, of which no large projects other than routine maintenance is foreseen at this time, would be required to follow existing laws and regulations discussed above.

Proposed Action Alternative

Effects to Cultural and Religious Sites or Artifacts

Potential effects to cultural resources include disturbance or destruction of previously undiscovered cultural resources during soil disturbance or excavation during construction. Effects would be direct and permanent. To prevent potential disturbance, a Class III Cultural Resource Inventory would be completed prior to any on-the-ground activities to identify any cultural, historical, or sacred sites within proposed areas of disturbance or excavation (including borrow sites) and would include site-specific mitigation recommendations. Each site-specific Class III report would be submitted to THPO for concurrence and to obtain further guidance for mitigation and necessary permits. Adverse effects to historic properties or culturally significant sites, as determined by the THPO, would be avoided so far as is technically feasible. Measures would include avoidance, modification of routes, or archeological excavation.

If unrecorded cultural resources or burial sites are discovered during construction activities, work would be stopped immediately, the site secured, and the THPO, Reclamation, and BIA would be notified. Work would not resume until there is authorization to proceed. The Apsáalooke consider human remains and burial sites sacred (Reed 2002); disturbing or removing any remains would be avoided. Proposed project workers would be prohibited from collecting artifacts or disturbing cultural resources in any area, under any circumstances.

Effects to Trust Resources

The proposed project is being initiated and completed by the Tribe with the broad purpose of benefitting the Tribe and its members. The proposed project would utilize tribal water rights and water resources to address poor water systems and increase the proportion of the Reservation with access to improved quality drinking water. The Tribe as a whole, and individual members, would benefit economically from the MR&I system.

Since the proposed project involves soil-disturbing activities, there is potential for encountering paleontological materials, a potential ITA, during construction actions. It is unlikely that paleontological resources would be discovered in the majority of the project area, but construction activities in the areas of high and very high potential may result in disturbance to paleontological resources. THPO would be consulted to identify areas where significant fossils are likely and whether paleontological surveys would be required. If required, paleontological surveys would be completed prior to construction. Based upon survey data and under the direction of THPO, routes may be revised to avoid damaging significant fossil locations.

Cumulative Effects to Cultural and Trust Resources

With the implementation of established mitigation measures, the proposed project would avoid or minimize impacts to cultural and paleontological resources and thus, would not measurably contribute to cumulative effects to these resources from other past, present, and reasonably foreseeable future actions. The proposed project would contribute to positive cumulative effects to trust water resources from other past, present, and future actions on the Reservation.

3.9 WETLANDS & FLOODPLAINS

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register 1980). Wetlands are relatively fixed features, so impacts to them are typically direct or through direct hydrological connections. The analysis for wetlands identifies those wetlands within or intersecting the project area boundary.

Floodplains can be defined as any land area susceptible to being inundated by floodwaters from any source (FEMA 2014). Floodplains were analyzed at the county level.

3.9.1 Wetland and Floodplain Regulations

Wetlands are federally regulated by the CWA and EO 11990, Protection of Wetlands 1977. Unless a permit is obtained, the CWA makes it unlawful to discharge any pollutant (including dredge or fill) into a navigable water, which includes some types of wetlands. The USACE administers the Section 404 permit application process. Under EO 11990, each federal agency must minimize the destruction, loss, or

degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands. Each agency must avoid wetland impacts unless there is no practical construction alternative or the proposed action includes all practical measures to minimize harm to wetlands, which can include creation or restoration to mitigate impacts.

States and tribes can approve, condition, or deny federal permits under Section 401 of the CWA that may result in a discharge to State or Tribal waters, including wetlands. This stipulation allows states and tribes to ensure that a federal permit would comply with their own water quality standards and that the activity would not 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 or tribal specific concerns (MTDEQ 2010).

Floodplains are governed by the Federal Emergency Management Agency through the National Flood Insurance Program (NFIP), created by Congress in 1968. The NFIP is intended to mitigate future flood losses nationwide through community enforced building and zoning ordinances and to provide access to federally-backed flood insurance protection for property owners (FEMA 2015b).

3.9.2 Existing Conditions

Wetlands

National Wetland Inventory maps developed by the U.S. Fish and Wildlife Service identify an estimated 177 individual wetlands within the project area totaling 34 acres (**Table 3.15**). This mapping, while not of sufficient resolution for wetland permitting or design criteria, provides information on potential wetland functional types and classifies the wetlands using a hierarchical system based on hydrologic, geomorphic, chemical, or biological factors (Cowardin et al. 1979).

Table 3.15: Wetland Types and Total Acreage within the Proposed MR&I Project Area

Wetland Type and Sub-Type	Number	Total Area (acres)
Palustrine		
Freshwater Emergent Wetland	104	21
Freshwater Forested/Shrub Wetland	20	3
Freshwater Pond	39	5
Riverine	14	5
Totals	**177**	**34**

Source: USFWS 2015

Palustrine wetlands are the most widespread in the project area, comprising more than 90 percent of the wetlands present within the project boundary and covering a combined area of about 29 acres (**Table 3.15**). Palustrine wetlands are vegetated and frequently referred to as marsh, swamp, or pothole. Within the project area, palustrine wetlands are typically associated with the fringes of river systems, mostly along the Little Bighorn River. Palustrine wetlands are also present along the Bighorn River, Pryor Creek, and Corral Creek (a tributary to Rosebud Creek).

Riverine wetlands occupy the main stream channels throughout the project area, numbering an estimated 14 individual segments and an area of about five acres (**Table 3.15**). Riverine wetlands are natural wetlands associated with conduits that at least periodically convey running water; they do not

include the adjacent areas dominated by trees, shrubs, persistent emergents or mosses. Riverine wetlands within the project boundary are present along the Bighorn River, Little Bighorn, and Corral Creek.

Floodplains

Though the majority of the Reservation has not been zoned by Federal Emergency Management Agency (FEMA), adjacent portions of Bighorn County with similar topography have been mapped, as well as the city of Lodge Grass. In those adjacent portions, the bottomlands along the Bighorn and Little Bighorn Rivers and their larger tributaries have been designated Zone A, 100-year flood zones. Smaller tributaries and upland areas are designated Zone C, areas of minimal flooding (Project Record, Floodplain Analysis; FEMA 2015c). Within the project area, 100-year flood zones presumably occur along all the major streams. Therefore, portions of the pipeline route along major rivers, as well as the proposed and alternative WTP and intake locations, may be within floodplains.

3.9.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative was selected, potential disturbances to wetlands and floodplains from other actions would continue to occur within the proposed project area. Approximately 12 percent of the project area is wetland/riparian (see **Table 3.13**). Current disturbances, such as continued cultivation of cropland and maintenance activities along roads and utility corridors, would continue to occur and have the potential to affect wetlands and floodplains by affecting hydrological regimes. New development within the project area from other activities, of which no large projects other than routine maintenance is foreseen at this time, would be required to follow existing laws and regulations for wetlands and floodplains as discussed above.

Proposed Action Alternative

Effects to Wetlands

Direct, temporary disturbance to wetlands has the potential to occur from construction activities. Indirect effects would occur if proposed project construction or operation affected the hydrologic regimes of wetlands within or hydrologically connected to the project area. Indirect impacts would also occur if construction activities spread noxious weeds, increased sediment discharge, caused spills, or otherwise impacted water quality; these topics and mitigation measures are discussed in Section 3.7.3, Vegetation and Section 3.4.4, Water Resources.

A general review of presence/absence of wetlands would be completed prior to on-the-ground activities and if possible, during the planning and design of each proposed project phase. A certified wetland scientist would delineate all areas exhibiting wetland characteristics within and adjacent to the construction easement, in accordance with the 1987 *USACE Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* (USACE 2010).

Using the results of each site-specific survey, wetlands would be avoided where practicable, adjusting pipeline routes and facility sites. In cases where routing around a wetland requires considerable materials and cost, the pipeline would either be trenched or bored. Trenching would result in direct, short-term disturbance of soils and vegetation, lasting about one growing season for each segment of

pipeline installed. If trenched, existing basin contours would be restored to pre-project conditions and trenches would be sufficiently compacted to prevent any drainage along the trench or through bottom seepage. Wetlands would be crossed during dry conditions (e.g., winter months), when practical. HDD, dewatering, storm water management, and erosion control methods would be implemented as necessary, following BMPs according to MDT standards (MDT 2015a). Construction waste materials and excess or unneeded fill associated with construction would be disposed of on upland, non-wetland areas. Mitigation measures for jurisdictional wetlands would be approved and permitted by the USACE. However, all wetland impacts, whether jurisdictional or not, would be addressed through these measures. For jurisdictional wetland acreages where avoidance or minimization efforts would not be sufficient to prevent loss of wetlands, compensation measures would be used to ensure no net loss of wetland acreage, including the restoration or creation of mitigation wetlands. With the use of these measures, effects to wetlands would be avoided or minimized.

Wetlands within or adjacent to the project area that are surficially connected by natural drainage to jurisdictional waters (i.e., perennial streams and rivers) fall under the jurisdiction of the USACE under Section 404 of the CWA (USACE 2014). Short-term trenching disturbance would not affect the hydrologic regimes of these wetlands. However, the operation of the proposed intake has the potential to indirectly impact riverine wetlands hydrologically connected to the Bighorn, if present at the chosen intake location. At less than one percent of the Bighorn River's typical range of instream flow, the water required for the MR&I system is not expected to be of sufficient magnitude to affect riverine wetlands.

Effects to Floodplains

The proposed project would not result in any changes in flood zone designations. The amount of water required to supply the MR&I system is estimated at a maximum 13 cfs, between an estimated 0.5 and 0.9 percent of the Bighorn River's typical range of flow. Instream flows of the Bighorn River are regulated by releases from Yellowtail Dam, which reduce flood risks in the area and would compensate for the minor reduction in flow from the MR&I intake. Therefore no short-term or long-term effects to flooding regimes and thus, adjacent floodplains, are expected to occur due to the proposed project.

Cumulative Effects to Wetlands and Floodplains

The proposed project would implement avoidance and mitigation measures through delineation surveys, proposed project design, conservation measures, and permitting, as described above, which would result in minimal impacts to wetlands and floodplains. Thus, the proposed project is not anticipated to measurably contribute to cumulative effects to wetlands or floodplains in the project area from other past, present, and reasonably foreseeable future actions.

3.10 WILDLIFE

The proposed project is in a rural setting with large areas of natural habitat used by wildlife. Therefore an evaluation of the project's effects to habitat is warranted, particularly in relation to potential impacts to federally-protected species. The public had concern for increased wildlife mortality on roads during construction phases of the proposed project. Evaluation of wildlife resources included resident and migratory species and habitats within the Reservation, specific to the project area when possible.

3.10.1 Wildlife Laws and Regulations

The ESA mandates protection of species federally listed as threatened or endangered and their associated habitats. All federal agencies must use their authorities to conserve listed species and ensure that their actions do not jeopardize the continued existence of listed species. Candidate species receive no statutory protection until they are listed as threatened or endangered under ESA.

The Reservation does not have an endangered species law different from the federal government, though it does grant protection to those species designated by the Crow Tribal Fish and Game Commission (CLOC 12-5-108). Additionally, the Crow Tribal Culture Department has a policy that animals used in religious rights and ceremonies or used as ceremonial food must be protected from injury and extinction (Reed 2002). Lists of Crow Tribal Fish and Game Commission designated species were not available. As a result, MTFWP resources were utilized to obtain information on any rare or species of concern in the area, though state-level wildlife regulations do not apply on the Reservation.

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711), Executive Order 13186, and Crow Tribal Law (CLOC 12-7-110 and 111). The MBTA prohibits the taking, killing, possession, and transportation (among other actions) of migratory birds, their eggs, parts, and nests, except when permitted by regulations. EO 13186 requires all federal agencies support the conservation intent of migratory bird conventions and integrate bird conservation principles into their activities. It is important to note that though while EO 13186 emphasizes the preservation of migratory bird habitat, destruction of habitat is not included in the definition of "take" in the MBTA and is therefore not unlawful under the MBTA.

Bald and golden eagles are federally protected under the MBTA, the Bald and Golden Eagle Protection Act (BGEPA) and Crow Tribal Law (CLOC 12-7-110). The BGEPA prohibits anyone without a permit from taking bald or golden eagles, including their parts, nests, or eggs.

3.10.2 Existing Wildlife and Habitat

Typical Native Wildlife and Habitat

The Reservation includes a mix of wildlife habitats. Areas with human disturbance, including major and arterial roads and population centers, provide poor wildlife habitat. Several types of natural and semi-natural wildlife habitat can be found across the Reservation landscape. The major habitats include big sagebrush steppe; Great Plains mixed grass prairie; Great Plains riparian streams, rivers, and floodplains; Great Plains ponderosa pine woodland and savanna; and agricultural lands (See also Section 3.7.2, Native Plant Communities and Land Cover). Typical wildlife in these systems include elk, deer, pronghorn, big horn sheep, badgers, mountain lions, black bear, fox, coyote, rodents, rabbits, beaver, bats, song birds, grassland birds, waterfowl, owls, raptors, grouse, golden eagles, snakes, frogs, and toads (Luna & Vance 2010; Vance and Luna 2010; Vance et al. 2010a, 2010b). Several other ecological systems form inclusions or overlap with these systems that have many of the same wildlife species (see Project Record, Wildlife Analysis).

Federally-Listed Species and Federally-Designated Critical Habitat

One federally-listed endangered species may occur in the project area, the black-footed ferret (*Mustela nigripes*). The listed species and designated critical habitat within the Reservation was most recently confirmed by the USFWS in April 2016 (USFWS 2016).

Black-footed Ferret

Black-footed ferrets are intimately tied to prairie dogs (*Cynomys* sp.), which are their primary source of food and shelter (Hillman and Clark 1980). Throughout their range, they have only been found in association with large prairie dog complexes (black-tailed, Gunnison's, and white-tailed), and are therefore limited to the same open habitat: grasslands, steppe and shrub-steppe (Miller et al. 1996). Prairie dogs are an important food source; one study found prairie dog remains in 91 percent of analyzed black-footed ferret scats (Hillman and Clark 1980). Alternate prey such as ground squirrels, rabbits, voles and mice are probably eaten opportunistically. Ferrets do not dig their own burrows and rely on abandoned prairie dog burrows for shelter. Only large complexes (several thousand acres of closely spaced colonies) can support and sustain a breeding population of ferrets. It has been estimated that approximately 99 to 148 acres of prairie dog colony is needed to support one ferret, and females with litters have never been found on colonies less than 121 acres (Miller et al. 1996). Adult ferrets are not known to migrate long distances, although individuals may exhibit semi-nomadic behavior, moving between prairie dog complexes within a 100-acre range. If there are low population densities of prairie dogs, it is unlikely that ferrets would be in the area. No specific information on ferret reproductive biology is available for Montana, but in other portions of their range, copulation occurred in March and early April. Gestation is between 42 and 45 days (Foresman 2012).

Black-footed ferrets have been extirpated from most of their former range, which included the project area. All known current populations are a result of the reintroduction of captive bred black-footed ferrets (Miller et al. 1996). Under the authority of section 10(j) of the ESA, reintroduction of a non-essential, experimental population of ferrets was attempted on the Reservation in October of 2015.

As part of the reintroduction effort, the Tribe entered into a 10-year Programmatic Safe Harbor Agreement (SHA) (#MT-001, signed October 16, 2015) and received an incidental take permit (Permit) (TE18695B-0) under sections 10(a)(1)(A) and 10(a)(1)(B)of the ESA. The SHA is a voluntary agreement between the Tribe and the USFWS with the purpose of contributing to the recovery of the species. The SHA designated the entire Reservation as a Management Zone, including a 78,853 acre Conservation Zone (**Figure 3.5**) near Pryor, MT.

Under the ESA, "take" of black-footed ferrets is prohibited unless otherwise permitted; "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (section 3(19) of the ESA). The Tribe's Permit allows for unlimited take of black-footed ferrets which may result from any otherwise lawful activity on all lands within the Management Zone of the SHA, subject to the terms and conditions of the Permit and the SHA.

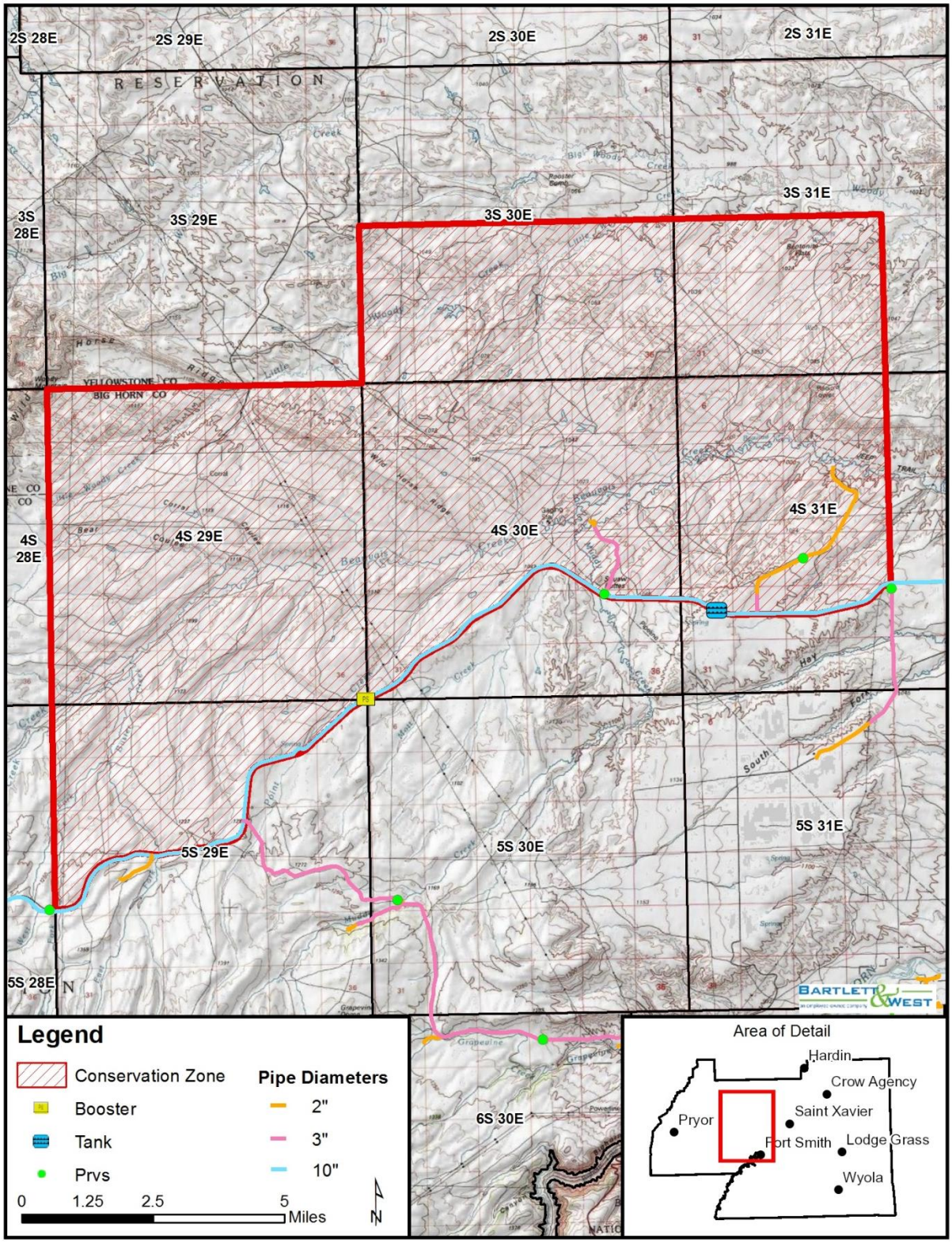
No federally-designated critical habitat has been established for the black-footed ferret.

Migratory Birds and Eagles

Migratory birds and bald and golden eagles migrate or reside in southeastern Montana, including the project area. Migratory birds pass through or breed and nest in Montana beginning as early as February 1st, but primarily from April 15th to July 15th. The bald eagle is a year round resident but also migrates regionally in Montana, preferring to nest in large trees or on cliffs in proximity to large, perennial water bodies (MTFWP 2014a). Montana has a productive bald eagle population, increasing at a rate of about 10 percent per year. About 63 breeding territories were estimated in 2008 for the Bighorn Recovery Zone which includes the project area (Hammond 2010). Golden eagles are found year round throughout

Montana. They prefer to nest on cliffs or in large trees, typically hunting in open prairie or sagebrush steppe (MTFWP 2014b).

Figure 3.5 Black-footed Ferret Conservation Zone



Habitat and Species in Need of Conservation

MTFWP has identified community types and geographic areas of wildlife habitat considered to be in greatest need of conservation. The project area includes portions of seven community types of greatest conservation need. These include Intermountain Valley Rivers and Streams, Prairie Rivers and Prairie Streams, Conifer-Dominated Forest and Woodland, Deciduous-Dominated Forest and Woodland, Lowland/Prairie Grassland, Montane Grassland, and Sagebrush Steppe and Sagebrush-Dominated Shrubland (MTFWP 2015).

Portions of the project area also overlap with four Tier 1 Focal Areas (MTFWP 2015). Two of the focal areas are aquatic and include the Bighorn River and Pryor Creek. The other two focal areas are terrestrial. The Lower Bighorn River Focal Area includes the Bighorn River and its floodplain downstream of the confluence with Beauvais Creek and upstream of the confluence with the Little Bighorn River, along with adjacent grasslands and shrublands. The Pryors-Big Horns Focal Area includes the Bighorn River, its floodplain, and its tributaries upstream of the confluence with Beauvais Creek to the Yellowtail Dam; the upper reaches of Pryor Creek and Little Bighorn River; the Pryor and Big Horn Mountains; and rolling mixed grass prairie and sagebrush grassland throughout the area.

Montana Species of Greatest Conservation Need (SGCN) are native animals breeding in the state that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Several SGCN potentially inhabit the project area (**Table 3.16**).

Table 3.16: Potentially Occurring Species of Greatest Conservation Need in Project Area

Family	Species
Fish	Sauger, Yellowstone Cutthroat Trout
Amphibians	Great Plains Toad, Northern Leopard Frog, Plains Spadefoot
Birds	American Bittern, Baird's Sparrow, Black Tern, Black-backed Woodpecker, Black-billed Cuckoo, Blue-gray Gnatcatcher, Bobolink, Brewer's Sparrow, Brown Creeper, Burrowing Owl, Cassin's Finch, Chestnut-collared Longspur, Clark's Nutcracker, Evening Grosbeak, Ferruginous Hawk, Golden Eagle, Great Blue Heron, Greater Sage-Grouse, Green-tailed Towhee, Lewis's Woodpecker, Loggerhead Shrike, Long-billed Curlew, McCown's Longspur, Mountain Plover, Northern Goshawk, Peregrine Falcon, Pinyon Jay, Red-headed Woodpecker, Sage Thrasher, Sharp-tailed Grouse, Sprague's Pipit, Veery, White-faced Ibis, Yellow-billed Cuckoo
Mammals	Black-tailed Prairie Dog, Dwarf Shrew, Fringed Myotis, Hoary Bat, Little Brown Myotis, Merriam's Shrew, Pallid Bat, Preble's Shrew, Spotted Bat, Swift Fox, Townsend's Big-eared Bat
Reptiles	Greater Short-horned Lizard, Milksnake, Snapping Turtle, Spiny Softshell, Western Hog-nosed Snake

Source: MTFWP 2015

Culturally Significant Wildlife

The Apsáalooke people consider many mammals and birds of the plains to be sacred, the most sacred being the American bison (Reed 2002), of which there are no longer free-roaming herds. Many other species important to the Tribe are common in the project area, including deer, badger, coyote, eagles, hawks, and other grassland birds. The Apsáalooke are also known for their large horse herds, a traditional symbol of wealth (Fandrich 2007).

3.10.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative was selected, current disturbances to wildlife from other actions would continue to occur within the proposed project area. Current disturbances affect the quality and availability of habitat for wildlife, having removed or reduced the quality of native vegetation. Past and current disturbance to native habitat in terms of permanent conversion to developed (i.e., roads, utility corridors, portions of towns, farmyards) and tilled acreage is estimated at 47 percent of the project area. Another 39 percent of the project area is native grassland and shrubland, the majority of which is used as rangeland for livestock, which can affect the amount of forage, quality, and structure of native habitat (see **Table 3.13**). The project is within an area where farming, recreation, and other regular and intermittent human uses occur. Collisions with vehicles and existing powerlines likely occur, causing mortality to wildlife. Existing activities and human presence likely cause temporary and seasonal displacement, exposure to predators, mortality, reduced reproduction, and behavioral responses in resident and migratory wildlife using the project area.

Proposed Action Alternative

Effects to Terrestrial and Avian Species and Habitat

The proposed project would have potential temporary and permanent effects to terrestrial wildlife, including migratory birds and eagles. Impacts during construction include collision with construction vehicles causing injury or mortality. Vehicle collisions are expected to be infrequent and would not result in significant or population level impacts to wildlife populations or individual species. Proposed project construction would also potentially cause displacement from habitat due to construction activity, noise, visual interference, or human presence. Displacement would be temporary, limited to the duration of each site-specific project, generally one or two reproductive seasons. However, depending on the species and the timing, displacement would potentially cause increased exposure to predators and mortality, nest abandonment, decreased reproductive rates, interference with communication, or other behavioral or stress responses. Less mobile species (i.e. small mammals, amphibians, reptiles, ground-nesting birds) would be more likely to be directly impacted, whereas more mobile species (i.e. medium to large mammals, waterfowl and raptors) would be more likely to be displaced. Because the project is within an area where farming, recreation, and other regular and intermittent human uses occur, construction activities would be similar to existing conditions and unlikely to cause permanent, measureable declines to populations of any wildlife species of the area.

Both temporary and permanent disturbance to wildlife habitat would occur from the proposed project. Construction in previously disturbed or developed areas such as road rights-of way or agricultural fields would be considered temporary. Some of these areas currently have natural or semi-natural vegetation communities that provide various degrees of wildlife habitat. Construction would remove vegetation and soils from these areas, but the reclamation process would re-establish vegetation and provide similar quality habitat within one to three growing seasons. Construction in undisturbed, native habitat would result in a permanent loss of habitat or permanent reductions in quality of habitat. The reclamation process would re-establish vegetation and habitat in these areas as well, but it would not be possible to restore the quality or diversity of native areas. Most construction would occur within previously disturbed areas; however, the location of the water treatment intake, portions of the transmission and distribution pipelines, and locations for some of the pump stations and storage tanks

may require disturbance of native areas. Construction in currently native areas would directly reduce the acreage of available native habitat on the landscape.

Additional mitigation measures would be applied as part of the proposed project to reduce potential impacts to wildlife. Noise and traffic disturbance during construction would be controlled as much as possible. Construction vehicles would be confined to established roadways as much as practicable and necessary precautions would be taken while moving or operating equipment. Areas potentially hazardous to wildlife would be adequately protected (e.g., fenced, netted) to prevent access by wildlife. Construction or modification of overhead powerlines would follow the techniques outlined by the Avian Power Line Interaction Committee (APLIC) to minimize avian collisions (APLIC 2012, APLIC 2006).

Effects to Federally-Listed Wildlife

During surveys completed by BIA, 82 prairie dog towns have been documented within one mile of the Project ROW, five of which were large enough to support the life requirements of a single ferret (surveys conducted by BIA in 1994, 2001 and 2003) (BIA 2015). All five areas are located in the Pryor Extension Service Area, which overlaps with the Black-footed Ferret Conservation Zone (see **Figure 3.5**).

The USFWS has designated reintroduced populations of ferrets as non-essential, experimental populations under section 10(J) of the ESA (56 FR 41473-41489). For the purposes of consultations under section 7 of the ESA, the USFWS considers non-essential experimental populations located outside of a National Wildlife Refuge or unit of the NPS the same as a species proposed for listing (USFWS 2012) and thus, only sections 7(a)(1) and 7(a)(4) of the ESA apply. Section 7(a)(1) requires that Federal agencies use their authorities to conserve listed species and section 7(a)(4) requires that Federal agencies *confer* (rather than *consult*) with the USFWS on actions that are likely to jeopardize the continued existence of a proposed species. The results of the conference are in the form of optional conservation recommendations.

By definition, a “non-essential, experimental population” is not essential to the continued existence of the species. Therefore, the proposed action would not jeopardize the continued existence of the species and conference with the USFWS under Section 7(a)(4) is not required.

In order to detect and avoid adverse effects to ferret populations, and to meet the obligations under Section 7(a)(1), field visits and black-footed ferret surveys would be completed on lands within the project area (including a one-mile buffer) which have suitable prairie dog habitat (complexes with greater than 80 acres of prairie dog towns). Surveys would be completed according to USFWS guidance and coordinated through the IERT process, in conference with the appropriate USFWS office (USFWS 1989, 1993; BLM 1984). Additionally, new land uses proposed during the term of the Tribe’s SHP would be identified and reviewed by the Tribe and the USFWS to determine if the proposed use would decrease prairie dog or ferret habitat, and if so, would determine appropriate compensation measures. Compensation measures which have been identified include offset of lost acreages by including additional prairie dog habitat contiguous with the Conservation Zone, resulting in no net loss of adequate prairie dog habitat. If sufficient additional habitat does not exist, the Tribe may elect to trap remaining ferrets for reintroduction elsewhere with adequate habitat.

Effects to Special-Status Species

Though several wildlife species of concern, including migratory birds, eagles, and culturally significant wildlife, have the potential to occur in the project area, there is low likelihood that population-level

effects would result from project actions. No large numbers of wildlife are expected to be affected; and no significant adverse impacts are anticipated for any one species or species group. The majority of construction disturbances would occur in previously disturbed areas that do not provide critical habitat for any of these species. Pre-construction surveys would ensure no known nests or habitat necessary for any of these species would be affected by the project. Timing limitations on construction would be implemented to minimize disturbance. Prior to site-specific construction, the Crow THPO would be consulted to identify any wildlife habitat that may have cultural importance.

In order to fully comply with the MBTA and in good faith protect Montana bird species, strategies recommended by the USFWS would be implemented to avoid impacts to migratory birds. Typical strategies include construction timing limitations, removal of nesting habitat prior to construction, and nest surveys. By implementing these conservation measures, no impacts to migratory birds are expected to occur and only minor impacts to their habitat may occur during construction of the proposed project.

The response of bald and golden eagles to human activities can be highly variable and is affected by scope and proximity. The recommended measures for minimizing disturbances to eagles include seasonal restrictions as well as visual and distance buffers around nest, foraging and roost sites to minimize disturbance (MBEWG 2010). The recommended primary seasonal restriction is from approximately February 1 through August 15 for construction and maintenance within direct line-of-sight of an active nest. Eagles exhibit greater sensitivity to disturbance when activities occur within full view of the bird; therefore new construction would be limited to areas where visual buffers around nests can be retained. A distance buffer of 0.25 miles is recommended for any construction of infrastructure such as roads and trails to reduce stress (MBEWG 2010). Construction or modification of overhead powerlines would follow the techniques outlined by APLIC to minimize potential collisions (APLIC 2012, APLIC 2006). If a bald or golden eagle, or previously undocumented eagle nest were identified and encountered during construction, all ground-disturbing activities in the immediate area would be stopped and the USFWS Montana Field Office and Office of Law Enforcement would be notified immediately for instructions on how to proceed. With implementation of these measures, no impacts to eagles are expected.

Cumulative Effects to Wildlife

The proposed project would have temporary and localized impacts to wildlife and terrestrial habitat, but those impacts are not expected to result in measureable, population-level effects. With the implementation of measures to further minimize potential effects, the proposed project would not incrementally contribute to cumulative effects on wildlife from other past, present, and reasonably foreseeable future actions.

3.11 AESTHETIC/VISUAL RESOURCES

Aesthetic and visual resources of the project area were addressed since the setting of the Reservation is rural with a mostly undeveloped natural landscape and many natural landforms. Though not a primary concern, the effect of aboveground structures on scenic quality was noted by the public. The proposed project would serve the entire Reservation, and therefore in the following analysis, the entire viewshed was considered.

3.11.1 Existing Visual Resources and Scenic Quality

The prominent landscape features of the Reservation include three mountain ranges, three river valleys, and Bighorn Canyon (**Figure 1.1**). The Pryor Mountains extend across the southwest corner of the Reservation and south into Carbon County. The headwaters of Pryor Creek begin in these mountains and flow in a northeasterly direction, joining the Yellowstone River outside of the Reservation boundaries to the northeast of the city of Billings. The northern end of the Bighorn Mountains are parallel and east of the Pryor Mountains, along the southern boundary of the Reservation, and extend southeastward into Wyoming. The steep, rugged canyon walls of Bighorn Canyon line Bighorn Lake, formed from Yellowtail Dam, at the north edge of the Bighorns. The Bighorn River continues northeasterly from the dam through the center of the Reservation. The Little Bighorn River is a tributary of the Bighorn River, flowing northwesterly across the east half of the Reservation, joining the Bighorn on the northern boundary. The Wolf Mountains run north-south to the east of the Little Bighorn along the eastern boundary of the Reservation.

The mountains provide topographic relief and a scenic view from many vantage points, whereas the river valleys are relatively flat and consist of agriculture, farms and ranchland. Between the mountains and valleys, the viewshed consists of foothills, plateaus, rolling grasslands and shrublands, badlands outcrops, and numerous drainages. Small communities are located along river and stream corridors. Scenic vistas and cultural and historic sites are located in various places throughout the Reservation. Opportunities for unobstructed views are abundant.

3.11.2 Direct, Indirect, and Cumulative Effects

No Action Alternative

If the No Action Alternative was selected, viewsheds and scenery would not be interrupted/diminished from construction associated with the implementation of the Settlement Act. Disturbances to viewsheds in the project area include the past conversion of large areas of native prairie and floodplains to cultivated cropland, the development and construction of buildings in towns and farmyards, and the construction of roads, highways, and overhead powerlines. Past and current disturbance to viewsheds in terms of developed (i.e., roads, utility corridors, portions of towns, farmyards) and tilled acreage is estimated at 47 percent of the project area (see **Table 3.13**)

Proposed Action Alternative

Effects to Viewsheds

The proposed project would have temporary or long-term effects to viewsheds in the project area based on whether facilities are above or below ground. Of the eight major components of the MR&I system (see Section 2.4.1), several would be installed underground, including the intake along the Bighorn River, the pipeline network, pressure reducing valves, and most service connection facilities. Pump stations would either be within underground steel vaults or aboveground buildings typically about 18 feet high. Storage tanks would be elevated or on the ground surface, with a range in height from 30 to 200 feet to the top of the tank, and typically located at high points of the topography. Maintenance buildings would be aboveground and 18 feet high. Most electrical lines are anticipated to be overhead, though site conditions may require portions of underground lines.

During construction of underground facilities and pipelines, soil excavation and vegetation removal would cause temporary disruption to views and scenery. Vegetation would reestablish within one to three growing seasons after reclamation and would restore visual impacts.

Construction of aboveground facilities would result in long-term additions to the landscape. The height and location of each structure would determine whether there would be a noticeable effect on visual resources. It is not anticipated that pump station buildings or maintenance buildings would have a noticeable effect. At less than 20 feet high, they would be relatively hidden from view or would easily blend with surroundings. The maintenance buildings are planned within or near the towns of Crow Agency and St. Xavier.

Overhead electric lines may interrupt viewsheds across the project area. Approximately 25 to 50 miles would be required in the Big Horn Valley service area, 50 to 75 miles in the Little Bighorn service area, and 75 to 100 miles in the Pryor Extension service area. Specific impacts cannot yet be identified since exact routes would be determined during later stages of the project, however with the number of miles of line anticipated, there would likely be some areas where the line would interrupt scenery. The majority of the line in the Little Bighorn and Pryor Extension service areas, which comprise over 80 percent of the line for the project, would be single-phase 120-volt power. Single-phase lines typically have poles lower in height and are less visually obstructive compared to the three-phase 240 or 480-volt power primarily required in the Bighorn Valley service area. The lines in the Bighorn Valley service area would be concentrated in developed areas of farmland and along roads, whereas the lines in the Little Bighorn and Pryor service areas would generally cross open, undeveloped lands.

Storage tanks would be aboveground structures that have the potential to result in long-term impacts to viewsheds. These structures are typically high in the landscape to minimize pump stations. Seven new structures are planned for the regional tanks; the three community tanks for the system would involve replacement or upgrade of existing tanks in Crow Agency, Lodge Grass, and Pryor. Visual and aesthetic impacts of new storage tanks were evaluated through a desktop analysis using a combination of aerial imagery, three-dimensional imagery, and topographic maps (see Visual Resources Analysis, Project Record) and are described in **Table 3.17**. Three of the proposed structures would be within city limits or agricultural areas; these include the St. Xavier, Ft. Smith, and Wyola regional tanks. The other four tanks would potentially interrupt scenic views in relatively undeveloped areas.

Table 3.17: Viewshed Impacts

		Direction of View toward Structure				
Site	**Location**	**North**	**South**	**East**	**West**	**General Comments**
Lodge Grass Regional Tank	8 miles west of Lodge Grass on BIA Rd Rt. 73 (Good Luck Road)	View blocked due to buttes and mountains.	View blocked due to buttes and mountains.	Visible as far as Lodge Grass 8 miles away since topography is gentle.	Visible for approximately 2 miles before the road turns northwest around some hills.	Could result in visual impacts as seen traveling from Lodge Grass.

Site	Location	Direction of View toward Structure				General Comments
		North	South	East	West	
Crow Agency Regional Tank	6 miles west of Crow Agency on Montana Hwy 1 (Crow-St. Xavier Cutoff Road)	View blocked due to topography.	View blocked due to topography.	Visible as far as Crow Agency 6 miles away due to gentle topography	Visible for several miles before the Crow-St. X Cutoff Road turns north/northeast	On top of ridgeline and could result in visual impacts. Approximate elevation is 3,400 feet.
Pryor Regional Tanks (two tanks)	11 miles east of Pryor on Montana Hwy 91	View blocked, located in saddle between two hills.	View blocked, located in saddle between two hills.	Only visible from the east and southwest, may be able to be seen from Pryor Creek	Only visible from the east and southwest, may be able to be seen from Pryor Creek	No towns nearby, most visual impacts would be for motorists along the road.
	10 miles west of St. Xavier on Montana Hwy 91	Visible	Visible	Visible	Visible	Ground tank (un-elevated). On a ridge surrounded by gently sloping topography. Visibility to nearest few miles.
St. Xavier Regional Tank	2 miles north of St. Xavier	Visible	Visible	Visible	Visible	No residences within the viewshed. Closest road is Montana Hwy 313, but cropland reduces scenic quality.
Ft. Smith Regional Tank	Within Fort Smith at the intersection of Montana Hwy 313 and Ok-A-Beh Road.	Visible	Visible	Visible	Visible	Scenic quality is limited due to existing roads and residences.
Wyola Regional Tank	Northeastern city limits of Wyola	Visible	Visible	Visible	Visible	Not developed, but scenic views reduced due to town and road (Old Hwy 87).

Measures to preserve aesthetic/visual resources would be project-specific and would be determined during IERT review. Most facilities are currently planned along existing roads and near developed areas

such as towns and farmyards, since the system would serve residents. Options exist for modifying routes of pipelines and electric lines in such a way that minimizes viewshed impacts and suits local residents, which would be determined on a case-by-case basis. Pump station housing and portions of electrical lines would be installed underground if necessary if site conditions are appropriate. Storage tanks are currently planned along existing paved roads. Although motorists would see many of these structures, impacts have been limited by avoiding construction on undisturbed hills and ridges or siting in such a way that minimizes visual obstruction. Tanks could also be painted light shades of tan, green, blue, or similar colors to blend with the sky or surrounding landscape.

Cumulative Effects to Visual Resources

Past and present impacts to visual resources in the project area are primarily related to farming, agriculture, and localized residential development in towns and along the Bighorn River. The proposed project is concentrated near these developed areas since the MR&I system would be serving these areas. However, the project also parallels roads that cross expanses of open, undeveloped land with scenic views. The proposed project would potentially result in new visual impacts to the landscape with the addition of the reservoir tanks and electric lines. These impacts would be minimized through proposed project-specific siting and other conservation measures as described above. Aside from this proposed project, there are no foreseeable future actions that would affect visual resources across large acreages of land within the project area.

3.12 AIR QUALITY, NOISE & TRAFFIC

An evaluation of temporary increases in noise and traffic and reductions in air quality due to construction activities from the proposed project is necessary to ensure no impacts occur to local residents. The analysis was limited by the availability of data from the nearest air and traffic monitoring stations.

3.12.1 Air Quality, Noise, and Traffic Regulations

The EPA regulates air quality on the Reservation through implementation of the federal Clean Air Act (CAA). The EPA established NAAQS for six criteria pollutants to protect the public from the health hazards associated with air pollution. These six criteria pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter of two sizes [less than 10 microns in diameter (PM_{10}) and less than 2.5 microns in diameter ($PM_{2.5}$)] (USEPA 2015h). **Table 3.18** lists the federal standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA 2015h).

The New Source Review (NSR) permitting program administered through the EPA requires potential stationary sources of air pollutants to review and obtain, if necessary, an air permit prior to commencing construction of operations (USEPA 2015i).

Noise and traffic laws tend to be the primary responsibility of state and local governments. No noise laws were found for the Tribe or the State of Montana. The Noise Control Act of 1972 (42 U.S.C. §4901 et. seq.) established a national policy that encourages eliminating noise at levels that jeopardize human

health and welfare with a focus on regulating major noise sources in commerce. The EPA is directed to coordinate the programs of all federal agencies relating to noise research and noise control.

Table 3.18: Federal Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		primary and secondary	Rolling 3 month average	0.15 $\mu g/m^3$	Not to be exceeded
Nitrogen Dioxide		primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	Annual	53 ppb	Annual Mean
Ozone		primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	primary	Annual	12 $\mu g/m^3$	annual mean, averaged over 3 years
		secondary	Annual	15 $\mu g/m^3$	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 $\mu g/m^3$	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Abbreviations: parts per million (ppm), micrograms per cubic meter ($\mu g/m^3$)
Source: USEPA 2015h

3.12.2 Existing Conditions

Air Shed and Air Quality

The project area is designated as a Class II attainment area for federal air quality standards, which is an air quality jurisdiction subject to more stringent limits than NAAQS. The MTDEQ operates a network of monitoring stations around the state that continuously measure pollutions levels; none are within the boundaries of the Reservation. The nearest monitoring stations upwind of the project area are in the city of Billings, approximately 40 miles west of the city of Hardin and nine miles west of the nearest proposed transmission pipeline for the MR&I system (Air Quality Stations #30-111-0066 and #30-111-0085). In general, air quality at these stations is good; the average air monitoring measurements have been below NAAQS for criteria pollutants (MTDEQ 2014a). Although individual maximum measurements at one of these stations (#30-111-0066) have exceeded federal standards for sulfur dioxide, a violation of air quality standards occurs only if the annual arithmetic mean concentration for a calendar year exceeds the standard (MTDEQ 2014a). There is also a monitoring station (#30-087-0001) on the

neighboring Northern Cheyenne Reservation east of the project area, which currently has no standards violations.

The EPA designates a nonattainment area for a specific pollutant that does not meet federal air quality standards. Montana has thirteen non-attainment areas (MTDEQ 2011). Historically, the city of Billings was the nearest nonattainment area to the project area because of excess SO_2 emissions. The EPA mandated that the State of Montana develop a State Implementation Plan (SIP) to outline specific measures to reduce SO_2 concentrations to meet state and federal standards. Currently, the city of Billings emits 20,000 tons of SO_2 per year, which is under the 36,000 tons allowed by the SIP (MTDEQ 2011).

The CAA mandates that particular areas of national significance have more stringent air quality standards. Referred to as Class I attainment areas, these areas include national parks greater than 6,000 acres, national monuments, national seashores, and federal wilderness areas larger than 5,000 acres designated prior to 1977. The nearest Class I attainment area (non-mandatory) is the Northern Cheyenne Reservation, which shares a portion of the east border of the Reservation, about 15 miles from the nearest transmission pipeline in the project area. The nearest mandatory Class I area is Yellowstone National Park about 70 miles southwest of the project area.

Noise and Traffic

Noise levels are not monitored on the Reservation. Ambient noise in Hardin and Crow Agency would consist of continuous vehicle traffic and residential noises such as horns, alarms, small motors, and pets. Similar ambient noises would be present, but less continuous, in the smaller communities throughout the Reservation. Rural ambient noise levels would be intermittent and dependent on time of the year and proximity to human residences, highways, roads, and agricultural fields. Natural noises would also contribute to ambient conditions, including wind, birdsong, and other wildlife calls. In general, the open topography and lack of trees across most of the project area would allow sound to carry for miles.

Annual average daily traffic (AADT) counts were reviewed for the WTP location along with other facility locations. The proposed location for the WTP is off Hwy 91, near St. Xavier. AADT counts were not available for Hwy 91, however Montana Hwy 313 travels north/south through St. Xavier and had a 2014 AADT of zero to 950 vehicles (MDT 2015b). The 2014 AADT for Interstate 90 (I-90) travelling north/south through Crow Agency was between 6,020 to 8,610 vehicles, and between 950 to 2,280 vehicles for US Hwy 212 travelling eastward from Crow Agency (MDT 2015b). Counts were unavailable for rural areas or county roads within the project area.

3.12.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

Under the No Action Alternative, air quality, noise and traffic levels within the project area would continue at similar levels as existing conditions.

Proposed Action Alternative

Effects to Air Quality, Noise and Traffic

During construction, the proposed project would result in temporary, intermittent increases in noise and traffic and releases in fugitive emissions of PM_{10} and CO. Emission sources would include engine exhaust

and windblown dust generated from truck and vehicle traffic during construction activities. At any given time, several construction crews could be working at several different locations across the project area, though at certain stages crews might also be concentrated in one area. Traffic associated with construction crews would range from 5 to 50 vehicles per day, but would typically be less than 10 vehicles per site per day. Heavy and unusual emissions from construction equipment would not be expected because of the dispersed work areas in a rural setting. Construction noise including heavy equipment operation and human voices would likely be heard above ambient conditions, but would not be at levels harmful to human health.

Several practices would limit the effects of noise and emissions to the immediate project area. Road dust during construction would be controlled as needed by enforcing speed limits and watering the road or using other non-hazardous dust control materials during dry conditions. Construction vehicles would be confined to established roadways as much as practicable and necessary precautions would be taken while moving or operating equipment. Noise levels from project features (e.g., booster pump stations, well pump houses, treatment plant, storage tanks) would be minimized through appropriate facility site location and design. Construction would generally be limited to daytime hours. Additional dust and pollution control measures would be implemented as determined by the site-specific SWPPP.

The operation of a WTP and associated facilities is not subject to EPA NSR permitting as an air pollution emissions source (USEPA 2015i). Indirectly, operation of the MR&I system would include intermittent noise, traffic, and fugitive emissions from maintenance and operator vehicles. The traffic from operator vehicles at the WTP would increase AADT near St. Xavier by about one percent and employees commuting to work at the administrative office would increase the AADT near Crow Agency by less than one percent. Since maintenance and operator vehicles are currently used for existing water treatment facilities in the project area, the transition to the region-wide MR&I system would not result in a change from current levels. Therefore, based on existing air quality in the region and the control of noise, traffic, and temporary fugitive emissions during construction, the proposed project would not lead to measureable increases in criteria pollutants or disruptive levels of noise and traffic in the project area.

Cumulative Effects to Air Quality, Noise, and Traffic

The proposed project would have no measurable impacts to air quality, noise and traffic in the project area and therefore would not contribute to cumulative effects on air quality from other past, present, and reasonably foreseeable future actions.

3.13 CLIMATE CHANGE

Changes in precipitation patterns from climate change would potentially affect Bighorn River flows and operation of Yellowtail Dam. U.S. Department of the Interior Secretarial Order No. 3289 requires Reclamation to “consider and analyze potential climate change impacts when undertaking long-range planning exercises” (USDOI 2009). Climate change is analyzed in two ways: 1) how climate change may be affected by the proposed project and 2) how the proposed project may be affected by climate change.

It is important to note that climate change projections have geographic and temporal variation (Reclamation 2011). Climate studies and models are an amalgamation of various climate-related data, resulting in a generalized average of climatic variables. As such, each of these variables carries with it an inherent uncertainty. This uncertainty tends to increase with time; estimates of climate projected out

100 years have a lower confidence than projections for the next 10 to 20 years. Even with this uncertainty, climate studies and models provide a functional planning tool to evaluate potential future activities.

3.13.1 Existing Climate

Climate within the project area is semi-arid (Reclamation 2013). Average annual temperatures measured at Hardin range from eight to 34 degrees Fahrenheit in January to 56 to 91 degrees in July. Mean average temperature in the project area is about 50 degrees. Precipitation averages 12 inches annually, with annual snowfall averaging approximately 22 inches (WRCC 2015a).

Primarily because of its mid-continental location, the Yellowstone River basin's weather is characterized by fluctuations and extremes. The interaction between air masses originating in the Gulf of Mexico, the northern Pacific Ocean, and the Arctic regions is largely responsible for the seasonal climate regimens within the project area (Zelt et al. 1999). In the Yellowstone River Basin, 40 to 45 percent of the annual precipitation falls during April through June with snowfall comprising a substantial part of the remainder in most years (Zelt et al. 1999). This causes the greatest volume of flow of Montana's rivers to occur during the spring and early summer months with the melting of the winter snowpack. Heavy rains falling during the spring thaw constitute a serious flood threat and sometimes result in flash flooding, though damaging floods have not occurred since 1964 (WRCC 2015b).

3.13.2 Future Climate

Temperature

The Great Plains Region has experienced warming since the beginning of the 20th century and the warming trend is expected to continue into the 21st century (Reclamation 2013; Reclamation 2011).

Precipitation

Modeling changes in hydrologic regimes are sensitive to the location and the period of analysis. Therefore, predictions for hydrologic changes in the project area are evaluated generally within the region for this EA, as specific studies in the proposed project area are limited, and may result in inaccurate conclusions. It is assumed that variability in precipitation and temperature would still occur on an annual basis.

Across the Missouri River Basin, temperature and hydraulic regime changes are expected to affect hydrology most by influencing snowpack development. Typically, peak runoff occurs twice during the year. The first peak in runoff occurs in early spring supplied by lowland snowmelt. The second is a major peak during early summer supplied by mountain snowmelt. This is significant to the project area because, with precipitation being equal, warmer temperatures would likely cause reduced snowpack development during the winter, more runoff during the winter season, and earlier spring peak flows associated with winter snowmelt (Reclamation 2013). Potential precipitation increases or decreases would offset or amplify this effect, resulting in significant effects to future water supplies.

In general, models and studies appear to indicate that precipitation will increase throughout the Missouri River Basin due to warming (Reclamation 2013). However, timing of water availability would change. Warming may result in more winter runoff to manage. During the winter runoff season, storage opportunities are limited by flood control considerations. Increased winter runoff would not necessarily

translate into increased storage of water. Conversely, storage capture of snowmelt generally occurs during late spring and early summer seasons. Reductions in runoff during this season would likely translate to reductions in storage capture and subsequent reductions in water supply during the warm season (Reclamation 2013).

Contributors to Climate Change

Intergovernmental Panel on Climate Change (IPCC) scientists and experts conclude that most of the observed changes in climate are very likely due to observed increases in anthropogenic greenhouse gas (GHG) concentrations, which trap heat in the atmosphere (IPCC 2014). Carbon dioxide (CO_2) is an example of a GHG that occurs naturally and is emitted to the atmosphere through natural processes and human activities. Other GHGs are synthesized and emitted solely through human activities (e.g., fluorinated gases). The principal GHGs identified by the EPA that enter the atmosphere because of human activities are CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. CO_2 is the primary GHG emitted through human activities. The EPA collects data on and encourages limiting or reducing emissions of anthropogenic sources of GHGs to the earth's atmosphere (USEPA 2015j).

In 2005, the State of Montana accounted for approximately 0.6 percent of total GHG emissions in the US (CCS 2007). However, Montana has a higher per capita intensity of GHG emissions compared to the national average. This is due to the strong fossil fuel production industry, large agricultural industry, large distances for transportation, and low population base.

No data is available for current emissions on a project area-specific or regional basis. However, statewide contributors to emissions that would occur in the project area include agricultural emissions from methane and nitrous oxide due to manure management, fertilizer, and livestock, which accounted for an estimated 26 percent of statewide emissions. Other emissions that would occur in the project area include fuel emissions from transportation, accounting for 20 percent of statewide emissions, residential and commercial fuel use at six percent of statewide emissions, and electricity use, the generation of which accounts for 26 percent of statewide emissions (CCS 2007). Fossil fuel production in the natural gas, oil, and coal industries, which occurs near the project area in Billings, accounted for 11 percent of the state's emissions (CCS 2007).

3.13.3 Direct, Indirect, and Cumulative Effects

No Action Alternative

Under the No Action Alternative, changes in the global climate and regional weather patterns would continue. Insufficient data is available to determine how existing water supplies may change under future climate conditions. It is likely the Little Bighorn River, which supplies Crow Agency, would be susceptible to changes in precipitation and spring runoff regimes. Groundwater reserves, which supply the other communities and rural residents, may become over-utilized if recharge rates are not able to keep up with anticipated increased demand in a warmer climate.

Proposed Action Alternative

Effect of the Project on Climate Change

Temporary direct emissions of GHGs would occur during project construction. Combustion emissions would include SO_2, NO_2, CO, volatile organic compounds, and GHGs from engine exhaust. Traffic associated with construction crews would range from five to 50 vehicles per day, but would typically be

less than 10 vehicles per site per day (Bartlett & West, pers. comm., 2015). Contractors would be required to maintain equipment exhaust systems to factory or better specifications to minimize emissions. Emissions would be temporary during the construction period of site-specific project work, and would not produce a significant source of GHG emissions within the project area.

Operation of the MR&I system would include GHG emissions from OM&R vehicles. Additionally, operation of the WTP and MR&I facilities would consume energy likely produced by fossil fuels. This would contribute to the overall GHG production in the region. However, since the existing water treatment infrastructure throughout the area currently uses electricity and OM&R vehicles, operation of the proposed project is not anticipated to increase electricity and OM&R vehicle use compared to the existing conditions. Emission reduction strategies may be employed for the project, such as the use of low carbon fuels and fuel-efficient vehicles for the OM&R fleet.

The proposed project would include vehicle emissions during construction and operation. However, the amount generated would not be a significant source of GHGs, and therefore would not measurably contribute to climate change.

Effect of Climate Change on the Project

Increased evapotranspiration in the region due to climate change would potentially result in increased water demands for residential purposes and livestock in the project area. However, the most significant effect of warmer temperatures on the proposed project would be changes in precipitation regimes and shifts in runoff, which would affect the potential water available in the Bighorn River for the MR&I water supply. If major decreases in water availability were to occur, there would likely be significant effects to the MR&I system water supply. However, within the project area, the Bighorn River would be the least sensitive to increased spring runoff and decreased summer flows; the Yellowtail Dam holds runoff and water is released in a relatively more continuous flow throughout the growing season, making the continuity of the water supply less susceptible to fluctuations from natural precipitation regimes. Reclamation would be required to release additional water from this reservoir to meet the water demands of the area (SLLMP, Sect. 2.D).

Cumulative Effects Related to Climate Change

The proposed project would include vehicle emissions during construction and operation. However, the amount generated would not be a significant source of GHGs, and therefore would not measurably contribute to climate change. Potential increases in water use efficiency as a result of the proposed project would be expected to provide greater ability to respond to the anticipated results of climate change in the region, such as changes in water availability.

4.0 List of Preparers

The efforts of an interdisciplinary team comprising experts and technicians in various fields were required to complete this study (**Table 4.1**).

Table 4.1: List of Preparers

Affiliation	Name	Title	Project Role	Years of Experience
Bureau of Reclamation	Christina Gomer	Environmental Specialist	Coordination of NEPA, contributing author	8
	David Trimpe	Environmental Specialist	ESA content review	7
	Dan Stremcha	Supervisory Civil Engineer	Project and Engineering review	25
	Dani Fettig	Project Engineer and Coordinator	Project leader, Engineering review	10
	George Shannon	Archaeologist	Paleontological and cultural resources review	29
Bureau of Indian Affairs	Robin Stewart	Environmental Protection Specialist	Environmental review	1.5
	Jarvis Gust	Natural Resources Manager	Environmental review	15
	Augustine (John) Hill	Natural Resource Officer	Environmental review	8
	Melissa Passes	Regional Environmental Specialist	Environmental review	16
	Jennifer Macey	Archaeologist	Paleontological and cultural resources review	6
Crow Tribal Water Resource Department	Titus Takes Gun	Director	Coordination	8
	Tamra Old Coyote	Pilot Plant Operator	Planning and design review	4
	Danetta Half Holds (transferred)	IT Specialist	Scoping Coordination	12
	Winters Red Star	GIS Specialist	GIS Data and Mapping	8
	Chelsea Rowland	Land Management	Public Meetings	1
	Natasha Morning	Research Assistant	Public Meetings	1

Affiliation	Name	Title	Project Role	Years of Experience
Bartlett and West	Colin Nygaard	Project Manager	Project Management and Coordination	10
	Jarrett Hillius	Lead Project Engineer	Project Design, Water Resources	6
	Greg Gere	Project Manager	Quality control/Quality assurance	34
	Chris Maus	Project Engineer	Scoping Coordination, Water Resources, Public Health and Safety, Technical Assistance	4
	Xuejiao Rich	GIS Specialist	Map Production	4
Wenck Associates, Inc.	Sara Simmers	Natural Resource Specialist, Botanist	Principal author, Document coordination	9
	Dan Ackerman	Wildlife Biologist, Natural Resource Specialist	Threatened and Endangered Species	9
	Luke Toso	Natural Resource Specialist, Botanist	Contributing author, Water Resources, Wetlands, Floodplains, Vegetation, Climate change, Paleontological Resources, Visual Resources, GIS Analysis	5
	Alicia (Dowdy) Konsor	Natural Resource Specialist, Environmental Scientist	Contributing author, Socioeconomics, Environmental Justice, Public Health and Safety, Air Quality, Noise, Traffic, Fisheries, Wildlife	10
	Andrew Rehmann	Environmental Scientist	Socioeconomics, Public Health and Safety, Fisheries, Invasive Species, Geology, Soils, Technical assistance	5
	Chris Knodel	Environmental Engineer	Water Quality, Climate Change	12
	Amy Denz	Environmental Scientist	Quality control/Quality assurance	19

5.0 Consultation and Coordination

This chapter summarizes the involvement of the public, the Tribe, and government agencies during the development of the EA.

5.1 SCOPING & PUBLIC INVOLVEMENT

Public involvement and agency coordination are required as part of the NEPA process, to the extent practicable (40 C.F.R. §§ 1501.4(b), 1506.6(b)). Involvement begins with scoping to help determine the relevant issues for analysis in the EA. For this project, public scoping activities included mailings, website development, community notices, four public input meetings, and one agency input meeting. Several informational meetings with the tribal legislature were also conducted, which are summarized in Section 5.2, Tribal and Agency Coordination.

The official scoping period spanned from September 18 to October 31, 2014. One mailing was sent to interested agencies on September 23, 2014 to inform them about the proposed project and provide notice of upcoming agency meetings. Copies of the mailing materials and list of recipients are included in **Appendix E**. A project website, hosted on Reclamation's website, was developed to inform the public about the proposed project, provide updates about public meetings and progression of the environmental documents, to give background on the regulatory and NEPA process, and to provide an online comment form. The website was activated in late September 2014. An online press release was posted on September 19, 2014. Screenshots of the website and online press release are included in the Project Record.

Community notices included newspaper notices, posters, and flyers, which informed the public of upcoming public meetings and the timeline for the scoping comment period. The first newspaper legal notice was published on September 18, 2014 in the Big Horn County News and the second was published on October 21, 2014 in the Billings Gazette. Posters were placed at six post office locations in the Reservation communities of Crow Agency, Fort Smith, Lodge Grass, Garryowen, St. Xavier, and Pryor. Flyers accompanied the posters, allowing interested persons to take information with them if desired. Copies of these materials are available in the Project Record.

Four public input meetings and one agency meeting were held in September and October 2014 to solicit interaction and comments from the public regarding key issues. The public meetings were held September 22 in St. Xavier, September 23 in Crow Agency, September 30 in Pryor and October 20 in Crow Agency, all from 6:00 p.m. to 8:00 p.m. local time. The agency meeting was held September 30 in Billings from 1:00 p.m. to 3:00 p.m local time. The meetings were an open house format. A slideshow presentation was provided by the project team consultants, which provided an overview of the proposed project, a brief overview of issues, and a general summary of the environmental review process. Maps and photos of the project were displayed. Meeting attendance and other handouts provided at the meetings are recorded in the Project Record.

Public comments received during the scoping period are included in the Project Record. Comments and the rationale for issue determinations are summarized in **Appendix E**. Verbal comments during the

public meetings are also included. Reclamation used these comments, along with other interagency and interdisciplinary discussion, to identify the set of key issues to analyze in depth. Other potentially relevant resources that were determined not to be key issues are listed in the Project Record along with the rationale for why they were determined not to be pertinent.

5.2 TRIBAL AND AGENCY COORDINATION

5.2.1 Tribal Consultation

Reclamation and BIA have a government-to-government relationship with federally-recognized tribes. This unique relationship is affirmed in treaties, Supreme Court decisions, and EOs, and provides that Reclamation and other federal agencies consult with tribes regarding policy and regulatory matters. EO 13175 (2000) sets forth the criteria agencies should follow when formulating and implementing policies and also requires establishment of a consultation process for interactions with Indian tribes in the development of regulatory policies that have tribal implications. Section 106 of the NHPA also requires federal agencies to consult with tribes for undertakings that may affect properties considered to have traditional religious and cultural significance.

The Tribe and Reclamation entered into an agreement (Contract R12AV60002) to cooperatively plan and review the proposed project. For all practical purposes, the Tribe, Reclamation, and BIA have participated in NEPA activities as cooperating agencies.

The CTWRD and the Tribe's engineering consultants provided several presentations about the proposed MR&I project to tribal government. Informational slideshow presentations were given to the Tribal Legislature during their regularly scheduled meetings on December 18, 2013 and July 15, 2014. On March 31, 2015, the CTWRD and their engineers hosted the Crow Water Summit, a one-day workshop for the Tribe's Executive and Legislative branches to provide updated information about the current scope, schedule, and costs of the proposed MR&I project.

Planning, reviews, and consultations have been coordinated by the Interdisciplinary team and through the Project Management Committee. The Draft EA prepared by the Tribe's consultants is a product of inter-agency consultation and public participation.

5.2.2 Federal and State Agency Consultation

In addition to the scoping process, several federal agencies provided information or assistance in preparing this EA related to federal laws and regulations: Reclamation (lead agency, federal trust land); BIA (cooperating agency, federal trust land); U.S. Fish and Wildlife Service (informal Section 7 consultation under ESA); USACE (Section 404 permit); and U.S. EPA (Section 401 permit and NPDES permit). The Project Record includes copies of all correspondence with these agencies.

5.3 DRAFT EA DISTRIBUTION

As part of the Council on Environmental Quality Regulations on the NEPA, Reclamation is circulating the Draft EA to agencies, organizations, and individuals that have contributed information on the project or inquired about the proposed project. Those receiving the Draft EA have 30 days to comment. Their

comments should be as substantive as possible. Reclamation will publish comments and responses in the Final EA.

5.3.1 Distribution List

The distribution list for the Draft EA is included in **Appendix F**.

5.3.2 Draft EA Comments/Responses

Draft EA comments and responses will be summarized in the Final EA. Copies of all responses will be included in the Project Record.

6.0 References

APLIC (Avian Power Line Interaction Committee). 2006. Suggested Practices for Avian Protection on Powerlines: the State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA. 227 p. Available at: http://www.aplic.org.

———. 2012. Reducing Avian Collisions with Power Lines: State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C. 184 p. Available at: http://www.aplic.org.

ARM (Administrative Rules of Montana). 17.30.611. Water Use Classification, Yellowstone River Drainage. Retrieved from http://www.mtrules.org/gateway/Subchapterhome.asp?scn=17%2E30.6, accessed 01/07/2014. (Department 17 Environmental Quality, Chapter 30 Water Quality, SubChapter 6 Surface Water Quality Standards and Procedures).

Bagi, Faqir S. 2002. Economic Impact of Water/Sewer Facilities on Rural and Urban Communities. Rural America. Volume 17, Issue 4. Winter 2002.

Bartlett & West. 2013. Surveys of Existing Reservation Water Systems. Unpublished data. Crow Reservation, Montana.

———. 2014. Crow MR&I Master Plan. Billings, Montana. 467 p.

———. 2015a. MR&I River and Stream Crossings Summary. Obtained by Xuejiao Rich, Senior GIS Technician, Bartlett & West, from USGS National Hydrography Dataset.

———. 2015b. Preliminary Dilution Model for MR&I Effluent Discharge. Completed by Chris Maus, Engineer, Bartlett & West. Methodology, assumptions, model results, and supporting documents.

———. 2015c. Crow MR&I Preliminary Pricing Report. 19 p.

———. 2015d. Potential Staffing for MRI Water System. 2 p.

Bartlett & West and CTWRD (Crow Tribe Water Resources Department). 2015a. Crow MR&I System, Water Treatment Plant Alternative Analysis Report, June 2015 – Revised July 2015. 301 p.

———. 2015b. Crow MR&I System, Water Sampling Report. August 2015. 69 p.

———. 2016a. Final Crow MR&I System Pilot Results Report, March 2016. 59 p.

———. 2016b. Crow MR&I System Final Alternative Analysis Report, March 2016. 22 p.

BIA (U.S. Department of Interior Bureau of Indian Affairs). 2015. Prairie Dog Towns within Crow Reservation: GIS Database. Billings, MT.

BLM (U.S. Department of the Interior Bureau of Land Management). 1984. Handbook of Methods for Locating Black-Footed Ferrets. January 1984. Wyoming BLM. Available online at: https://ia801608.us.archive.org/11/items/handbookofmethods46clar/handbookofmethods46clar.pdf

———. 2007. Potential Fossil Yield Classification System for Paleontological Resources on Public Lands. Available online at: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/im_attachments/2008.Par.69083.File.dat/IM2008-009_att1.pdf.

———. 2011. Paleontological Resources Potential Fossil Yield Classification. Billings & Pompeys Pillar National Monument Planning Area, Map 35. Billings Field Office. Available at: http://www.blm.gov/pgdata/etc/medialib/blm/mt/field_offices/billings/rmp/drmp/maps.Par.82646.File.dat/Map_35_Potential%20Fossil%20Yield%20Classification.pdf.

———. 2015. Billings and Pompeys Pillar National Monument Proposed Resource Management Plan and Final Environmental Impact Statement (PRMP/FEIS). Billings Field Office, Montana. Available online at: http://www.blm.gov/mt/st/en/fo/billings_field_office/rmp/prmp_feis.html.

Bockness, S. 2014. Big Horn County Weed Coordinator. Personal communication regarding noxious weed abundance in Big Horn County and within the project area. February 26, 2014.

CCS (Center for Climate Strategies). 2007. Montana Greenhouse Gas Inventory and Reference Case Projections 1990-2020. Principal Authors: Alison Bailie, Stephen Roe, Holly Lindquist, Alison Jamison. Available online at: http://deq.mt.gov/ClimateChange/default.mcpx. 92 p.

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.

Crow THPO (Tribal Historic Preservation Office). 2014. Crow Tribe Tribal Historic Preservation Office Website. Available at: http://crowthpo.org. Copyright 2013-2014.

Crow Tribe. 2008. 2008 American Indian Health Profile: Crow Reservation. Crow Tribal Health Department. Montana-Wyoming Tribal Leaders Council.

CTWRD (Crow Tribe Water Resources Department). 2013a. Accountability Report: Crow Indian (Apsaalooke) Reservation Municipal, Rural and Industrial Water System. 7 p.

———. 2013b. Rural Household Water Survey.

Dickerson, B. and G. Vinyard. 2011. Effects of High Levels of Total Dissolved Solids in Walker Lake, Nevada, on Survival and Growth of Lahontan Cutthroat Trout. Transactions of the American Fisheries Society 128:507-515.

DiVittorio, J., Grodowitz, M., and Snow, J. 2012. *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species.* U.S. Department of the Interior, Bureau of Reclamation, Technical Memorandum No. 86-68220-07-05. Available at:

http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf

DOWL HKM 2009. Crow Indian Reservation Municipal, Rural and Industrial (MR&I) Water System Engineering Report. 81 p.

Eggers, M., Old Coyote, T., Crow Environmental Health Steering Committee, Ford, T., Camper, A. 2011. Community Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana. Presentation, Harvard University Ecostewards. June 6, 2011. Pine Creek, Montana.

Fandrich, B. 2007. The Crow Irrigation Project: A Class I Overview of Irrigation on the Crow Reservation. Final Draft. Ethnoscience, Inc., Billings, Montana.

FEMA (Federal Emergency Management Agency). 2014. Definitions-Floodplain. Accessed 03/11/2015 at: http://www.fema.gov/national-flood-insurance-program/definitions.

———. 2015a. Fish & Wildlife Coordination Act, 1956. Description and Intent and Summary of Requirements. Accessed online 12/1/2015 at: https://www.fema.gov/fish-wildlife-coordination-act-1956.

———. 2015b. The National Flood Insurance Program: Overview. Accessed online 12/15/2015 at: https://www.fema.gov/national-flood-insurance-program.

———. 2015c. Current FEMA Issued Flood Maps, Bighorn County, Montana. Flood Map Service Center Webpage. Accessed 03/11/2015 at: https://msc.fema.gov/.

Gardener, S. 2013. A Montana tribe encourages coal mining, for its own well-being. Featured in: Marketplace Morning Report. Marketplace Website: http://www.marketplace.org/topics/sustainability/coal-play/montana-tribe-encourages-coal-mining-its-own-well-being. Accessed August 2013.

Godaire, Jeanne E. 2010. Bighorn River Side Channel Investigation: Geomorphic Analysis. Technical Report No. SRH-2010-1. U.S. Dept. of the Interior Technical Services Center. Denver, CO. February 2010. 73 p.

Hammond, C. 2010. Montana Bald Eagle Status Report 2009. Montana Fish, Wildlife and Parks. In Cooperation with the Montana Bald Eagle Working Group. Available at: http://fwpiis.mt.gov/content/getItem.aspx?id=43851.

Harris, J. 2013a. United States Supreme Court, Montana V. United States, 450 U.S. 544 (1981). Case Law (Federal, State, and Tribal). Available at: Crow Laws Website, updated July 2013, http://crowlaws.org/case_law_federal_state_and_tribal. Accessed February 2016.

———. 2013b. Crow Law and Order Code, adopted 2005. Available at: Crow Laws Website, updated July 2013, http://crowlaws.org/crow_law_and_order_code. Accessed February 2016.

Hillman, C. N., and Clark, T. W. 1980. *Mustela nigripes*. American Society of Mammalogists, Lawrence, KS.

HKM (HKM Engineering, Inc). 2007. Engineering Evaluation of Existing Conditions, Crow Irrigation Project. Volumes I-IV. Updated August 2007. Final Report. Billings, Montana.

Hunter, Christopher J. 1991. Better Trout Habitat: A Guide to Stream Restoration and Management. Montana Land Reliance, Washington, DC.

IHS (Indian Health Service). 2015. Sanitation Tracking and Reporting System (STARS). Website: http://www.ihs.gov/dsfc/index.cfm?module=data, accessed 3/9/15, and 4/22/2015.

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. Available from: http://www.ipcc.ch/report/ar5/syr/.

ITRR (Institute for Tourism and Recreation Research). 2004a. Niche News: Big Horn County Visitor Characteristics. Available at: http://www.itrr.umt.edu/nichenews/BigHornCounty.pdf.

———. 2004b. Crow Country Resident Attitudes: Exploring Tourism Development Potential, Montana CTAP 2003-2004. Available at: http://www.itrr.umt.edu/research/CrowCTAP04.pdf.

Johnson, C. 2016. Crow Tribe furloughs expected to affect about 100 employees. Billings Gazette. January 8, 2016. Available at: http://billingsgazette.com/news/state-and-regional/montana/crow-tribe-furloughs-expected-to-affect-about-employees/article_a943c337-7e9a-5fa9-bf1f-ded5a4609dbc.html.

Jones, S.L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. Available online: http://www.fws.gov/mountain-prairie/species/birds/spraguespipit/SpraguesJS2010r4.pdf (Accessed April 2015).

Kartesz, J.T. 2015. The Biota of North America Program (BONAP). *North American Plant Atlas.* (http://bonap.net/napa). Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP). (in press)]. US County Level Species Maps. Accessed online 10/20/2015 at: http://www.bonap.org/genera-list.html.

Klauk, Erin. 2013. Geology and Physiography of the Crow Reservation. Accessed February 2015 at: http://serc.carleton.edu/research_education/nativelands/crow/geology.html.

Luna, T. and Vance, L.K. 2010. Great Plains Mixedgrass Prairie – Northwestern Great Plains Mixedgrass Prairie. Montana Field Guide. Retrieved on October 19, 2015, from http://FieldGuide.mt.gov/displayES_Detail.aspx?ES=7114.

Lutey, T. 2016. Four Montana counties will shoulder brunt of coal economy losses. Billings Gazette. February 21, 2016. Available at: http://billingsgazette.com/news/four-montana-counties-will-shoulder-brunt-of-coal-economy-losses/article_7e54bf6a-c879-5041-b6d9-c64827cbe94d.html.

Maffly, B. 2007. Battle on the Bighorn: Holding back water for Bighorn Lake recreation could doom the world-class fishery downstream. *Montana Outdoors,* July – August 2007. Available at: http://fwp.mt.gov/mtoutdoors/HTML/articles/2007/bighornriver.htm.

Mapel, W. J., Sarnecki, J. C., Bohor, B. R., Roby, R. N., Sokaski, M., McIntyre, G. 1975. Status of Mineral Resource Information for the Crow Indian Reservation, Montana. Administrative report BIA-7. 93 p. Available online at: http://www1.eere.energy.gov/tribalenergy/guide/pdfs/crow_7.pdf.

MBEWG (Montana Bald Eagle Working Group). 2010. Montana Bald Eagle Management Guidelines: An Addendum to Montana Bald Eagle Management Plan, 1994, Montana Fish, Wildlife and Parks, Helena, Montana.

MBOGC (Montana Board of Oil and Gas Conservation). 2015. Well list for Big Horn County. Accessed 11/13/2015 at: http://www.bogc.dnrc.mt.gov/WebApps/DataMiner/Wells/Wells.aspx.

McCulloch, R. 2012. Mines and Exploration in Montana – 2012. 2012 Montana Mining Report, Montana Bureau of Mines and Geology. 13 p. Available online: http://www.mbmg.mtech.edu/pdf/2012ActiveMines.pdf.

MDT (Montana Department of Transportation). 2015a. Erosion and Sediment Control Best Management Practices Manual. January 2015. 218 p.

———. 2015b. Statewide Traffic Count Site Map. Accessed online 12/1/2015 at: http://www.mdt.mt.gov/publications/datastats/traffic_maps.shtml.

MGWIC (Montana Groundwater Information Center). 2015. County Well Data. Available online at: http://mbmggwic.mtech.edu/sqlserver/v11/menus/menuData.asp?pagename=zipper. Accessed February 2015.

Miller, B., Reading, R.P, and Forrest, S. 1996. Prairie night: black-footed ferrets and the recovery of endangered species. Smithsonian Institute Press. Washington D.C.

MNHP (Montana Natural Heritage Program). 2015a. Montana Plant Species of Concern Report for Big Horn County. Accessed 02/2015 online at: http://mtnhp.org/SpeciesOfConcern/?AorP=p.

———. 2015b. Animal species of concern digital spatial data. Available online: http://mtnhp.org/. (Accessed March 2015).

Montana Research and Analysis Bureau. 2013. Crow Reservation Demographic and Economic Information. 8 p.

Montana Weed Control Association. 2015. Montana County Listed Weeds. Updated January 2015. Available at: http://mtweed.org/county-listed-noxious-weeds/.

Moulder, E.A., Klug, M.F., Morris, D.A., and Swenson, F.A. 1960. Geology and Ground-Water Resources of the Lower Little Bighorn River Valley Big Horn County, Montana. Geology Survey Water-Supply Paper 1487. Available at: http://pubs.usgs.gov/wsp/1487/report.pdf.

MSE-HKM (MSE-HKM Engineering). 1999. Needs Assessment: MR&I Water System, Crow Reservation, Montana. July 1999. 69 p.

MTDA (Montana Department of Agriculture). 2015. Montana Noxious Weed List. Effective July 2015. Available at: http://agr.mt.gov/agr/Programs/Weeds/.

MTDEQ (Montana Department of Environmental Quality). 2010. Wetland policy and legislation-Montana state laws. Accessed online February 2015 at: http://deq.mt.gov/wqinfo/wetlands/MontanaPolicyLegislation.mcpx.

———. 2011. Citizens Guide to Air Quality in Montana: Understanding Air Quality. Website: http://deq.mt.gov/airmonitoring/citguide/understanding.mcpx, accessed 11/3/2015.

———. 2014a. Montana 2014 Final Water Quality Integrated Report. Appendix A: Impaired Waters and Appendix B: Waters in Need of TMDLs [303(d) List] and TMDL Priority Schedule. Available at: http://deq.mt.gov/wqinfo/cwaic/reports.mcpx. 126 p.

———. 2014b. Air Quality Monitoring Network Plan. Available online at: http://deq.mt.gov/airmonitoring/nwHome.mcpx.

———. 2015a. Drinking Water Watch, Public Water Supply Systems Search. Accessed online 12/15/2015 at: http://sdwisdww.mt.gov:8080/DWW/index.jsp.

———. 2015b. Mapping DEQ's Data: Watershed Geospatial data. Available online at: http://svc.mt.gov/deq/wmadst/. Accessed February 2015.

MTFWP (Montana Fish, Wildlife, and Parks). 2013a. Montana Statewide Fisheries Management Plan, 2013–2018. From p. 413-419 of 478 p. Available at: http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/default.html.

———. 2013b. Yellowstone Cutthroat Trout Conservation Strategy for Montana. 213 p. Available at: http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/.

———. 2014a. Bald Eagle - *Haliaeetus leucocephalus*. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Available at: http://fieldguide.mt.gov/detail_ABNKC10010.aspx.

———. 2014b. Golden Eagle — *Aquila chrysaetos*. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Available at: http://FieldGuide.mt.gov/detail_ABNKC22010.aspx.

———. 2015a. MFISH – Search. Montana Fisheries Information System Database. Accessed online 12/1/2015 at: http://fwp.mt.gov/fishing/mFish/.

———. 2015b. Montana's State Wildlife Action Plan. Montana Fish, Wildlife & Parks, 1420 East Sixth Avenue, Helena, MT 59620. 441 p. Available online: http://fwp.mt.gov/fishAndWildlife/conservationInAction/swap2015Plan.html.

NLCD (National Land Cover Database). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

NPS (National Park Service). 2015a. Little Bighorn Battlefield National Monument. Website: http://www.nps.gov/libi/index.htm, accessed 11/9/2015.

———. Bighorn Canyon: History and Culture: Places. Website: http://www.nps.gov/bica/learn/historyculture/places.htm, accessed 11/9/2015.

Pajl, M. and DeBoer, D. E. 2007. Social/Physical Impacts and Water Consumption Characteristics of South Dakota's Rural Water Systems. Water and Environmental Engineering Research Center, South Dakota State University, Brookings, SD. 177 p.

Pajl, M. J., DeBoer, D. E., Taylor G., Adamson D. 2009. Economic Impact of South Dakota's Regional Water Systems. 10 p.

Peterson, D. A., Miller, K.A., Bartos, T.T., Clark, M.L., Porter, S.D., and Quinn, T.L. 2004. Water quality in the Yellowstone River Basin, Wyoming, Montana, and North Dakota, 1999–2001: Reston, Virginia, U.S. Geological Survey Circular 1234.

Reclamation (Bureau of Reclamation, U.S. Department of Interior). 2011. SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water. Denver, Colorado. 226 p.

———. 2012. Final Value Planning Study: Crow Indian (Apsáalooke) Reservation Municipal, Rural and Industrial Water System. A1R-2023-RO2B-100-00-0-0. Bureau of Reclamation, Denver, CO. 37 p.

———. 2013. Literature Synthesis on Climate Change Implications for Water and Environmental Resources. Third Edition. Technical Memorandum 86-68210-2013-06. Denver, Colorado. September 2013. 352 p.

———. 2014. Design, Estimating, and Construction Advisory Team Review Report: Crow Tribe Municipal, Rural and Industrial Water System. Great Plains Region, Billings, Montana. 45 p.

———. 2015. Great Plains Region Hydromet System for Bighorn Lake (Yellowtail), Bighorn River near Fort Smith, Montana. Accessed online February 2016 at: http://www.usbr.gov/gp/hydromet/bhr.html.

Reed, G., Jr. 2002. Crow Cultural Affairs Department. Culture and History Resources Report, *In* Crow Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report. For use with the "Montana Statewide Revised Draft/Final Oil and Gas Environmental Impact Statement and Amendments of the Powder River and Billings Resource Management Plan (January 2002)".

Snell, A.H. 2006. A Taste of Heritage: Crow Indian Recipes & Herbal Medicines. University of Nebraska Press.

USACE (U.S. Army Corps of Engineers). 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

———. 2014. Personal communication with Kathy Juhas, Billings Regulatory Office, on April 22, 2014.

US Census Bureau. 2010. 2010 Census Interactive Population Search Website: http://www.census.gov/2010census/, accessed February 10, 2015. Data retrieved for Crow Reservation and Off-Reservation Trust Land, Crow Agency CDP, Fort Smith CDP, Lodge Grass town, Pryor CDP, St. Xavier CDP, Wyola CDP, Hardin city, selected years.

———. 2014a. American Community Survey 2010-2014 5-Year Estimates. American Factfinder Website: http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none, accessed 12/4/2015. Data retrieved for Big Horn County, Crow Reservation CCD, Crow Agency CDP, Fort Smith CDP, Lodge Grass town, Pryor CDP, Saint Xavier CDP, Wyola CDP, and Hardin city.

———. 2014b. American Community Survey 2010-2014 5-Year Estimates. American Fact Finder Website: http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none, accessed 12/4/2015. Advanced Search, State/County/or Place: Crow Reservation CCD, Montana. Table DP03, Selected Economic Characteristicshttp://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP03&prodType=table. Table S1501, Educational Attainment.

———. 2014c. American Community Survey 2010-2014 5-Year Estimates. American Fact Finder Website: http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none, accessed December 2015. Data retrieved for Crow Reservation CCD, Bighorn County, Yellowstone County, and Montana for following tables: B02001, Race; B19301, Per Capita Income in the Past 12 Months; DP05, ACS Demographic and Housing Estimates; S1101, Households and Families; S1703, Poverty Status in the Past 12 Months; S1901, Income in the Past 12 Months; and S2301, Employment Status.

USDA-NASS (U.S. Department of Agriculture, National Agricultural Statistics Service). 2007. Census of Agriculture, Bighorn County, Montana. 2 p.

———. 2014. Cropscape - Cropland Data Layer. Published crop-specific data layer. Accessed online February 2015 at: http://nassgeodata.gmu.edu/CropScape/.

USDA NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service) Soil Survey Staff. 2013. Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/.

USDOI (U.S. Department of the Interior). 2009. Secretarial Order No. 3289. Addressing the impacts of climate change on America's water, land, and other natural and cultural resources. September 14, 2009.

USEPA (U.S. Environmental Protection Agency). 2009. National Primary Drinking Water Regulations. EPA 816-F-09-004. 6 p. Available at: http://nepis.epa.gov/Exe/ZyPDF.cgi/P1005EJT.PDF?Dockey=P1005EJT.PDF.

———. 2015a. Summary of the Resource Conservation and Recovery Act. Accessed online 3/11/15 at: http://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act.

———. 2015b. Water: Laws and Executive Orders. Accessed online 3/11/15 at: http://water.epa.gov/lawsregs/lawsguidance/index.cfm.

———. 2015c. Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. Accessed online 12/9/2015 at: http://www.epa.gov/dwstandardsregulations/secondary-drinking-water-regulations-guidance-nuisance-chemicals.

———. 2015d. Region 8 Public Drinking Water Watch. Accessed online 12/15/15 at: https://sdwisr8.epa.gov/Region8DWWPUB/.

———. 2015e. Brownfield Overview and Definition. Accessed 11/13/2015 at: http://www2.epa.gov/brownfields/brownfield-overview-and-definition.

———. 2015f. Superfund Basic Information. Accessed online 4/28/2015 at: http://www.epa.gov/superfund/about.htm.

———. 2015g. EJSCREEN: Environmental Justice Screening and Mapping Tool. Accessed online 11/13/2015 at: http://ejscreen.epa.gov/mapper/.

———. 2015h. National Ambient Air Quality Standards (NAAQS). Webpage: http://www3.epa.gov/ttn/naaqs/criteria.html, http://www.epa.gov/air/criteria.htmlaccessed 11/2/2015.

———. 2015i. New Source Review (NSR) Permitting. Webpage: http://www2.epa.gov/nsr, accessed 11/2/2015.

———. 2015j. Climate Change: Emissions: Overview of Greenhouse Gases. Website accessed 11/10/2015 at: http://www.epa.gov/climatechange/ghgemissions/gases.html.

USFWS (U.S. Fish and Wildlife Service). 1989. Black-Footed Ferret Survey Guidelines for Compliance with the Endangered Species Act. 8 p. Accessed online April 2016 at: http://www.fws.gov/montanafieldoffice/Endangered_Species/Survey_Guidelines/Ferret_Survey_Guidelines.pdf.

———. 1993. Proceedings of the Symposium on the Management of Prairie Dog Complexes for the Reintroduction of the Black-footed Ferret. Biological Report 13, July 1993.

———. 2012. Endangered Species Program Webpage, About Us | Frequently Asked Questions | Species Status Codes. Last updated: August 28, 2012. Accessed online 5/16/2016 at: http://www.fws.gov/endangered/about/listing-status-codes.html.

———. 2015. National Wetlands Inventory. Accessed online February 2015 at: http://www.fws.gov/wetlands/.

———. 2016. Threatened, Endangered and Candidate Species for the Crow Indian Reservation. As of 4/20/2016. Accessed online 4/23/2016 at: http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/Reservations/Crow_Reservation_sp_list.pdf.

USGAO (U.S. General Accounting Office). 1999. Rural Water Projects: Identifying the Benefits of the Proposed Lewis and Clark Project. No. GAO/RCED-99-115. 33 p.

USGS (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. Primary authors: Peterson DA, Gregory KB. US Geological Survey, Water Resources Investigations Report 00-4190.

———. 2003. Ground-Water Resources along the Little Bighorn River, Crow Indian Reservation, Montana. US Geological Survey, Water Resources investigations Report 03-4052.

———. 2015. Montana geologic map data. Mineral Resources On-line Spatial Data Website. Accessed February 2015 at: http://mrdata.usgs.gov/geology/state/state.php?state=MT

University of Montana - Missoula. 2015. Invaders Database System. Accessed 10/21/2015 online at: http://invader.dbs.umt.edu/.

Vance, L.K. and Luna, T. 2010. Great Plains Ponderosa Pine Woodland and Savanna — Northwestern Great Plains - Black Hills Ponderosa Pine Woodland and Savanna. Montana Field Guide. Retrieved on October 19, 2015, from http://FieldGuide.mt.gov/displayES_Detail.aspx?ES=4280.

Vance, L.K., Luna, T. and Cooper, S.V. 2010a. Big Sagebrush Steppe — Inter-Mountain Basins Big Sagebrush Steppe. Montana Field Guide. Retrieved on October 19, 2015, from http://FieldGuide.mt.gov/displayES_Detail.aspx?ES=5454.

Vance, L.K., McIntyre, C. and Luna, T. 2010b. Great Plains Riparian - Northwestern Great Plains Riparian. Montana Field Guide. Retrieved on October 19, 2015, from http://FieldGuide.mt.gov/displayES_Detail.aspx?ES=9326.

Vigil, J., R. Pike, and D. Howell. 2000. A Tapestry of Time and Terrain: The Union of Two Maps – Geology and Topography. U.S. Geological Survey
Geologic Investigations Series 2720. Available online at: http://pubs.usgs.gov/imap/i2720/

Vuke, S., E. Wilde, and R. Bergantino. 2007a. Geologic Map of the Hardin 30' x 60' Quadrangle, Montana. Montana Bureau of Mines and Geology, Butte, MT. Available online at: http://www.mbmg.mtech.edu/pdf_100k/hardin-gm57.pdf.

Vuke, S., E. Wilde, D. Lopez, and R. Bergantino. 2007b. Geologic Map of the Lodge Grass 30' x 60' Quadrangle, Montana. Montana Bureau of Mines and Geology, Butte, MT. Available online at: http://www.mbmg.mtech.edu/pdf_100k/lodgeGrass-gm56.pdf

Weber-Scannell, P. and L. Duffy. 2007. Effects of Total Dissolved Solids on Aquatic Organisms: A Review of Literature and Recommendation for Salmonid Species. American Journal of Environmental Sciences 3 (1): 1-6

Woods, A. J., Omernik, J. M., Nesser, J. A., Shelden, J., Comstock, J.A., and Azevedo, S.H. 2002. Ecoregions of Montana, Second Edition (color post with map, descriptive text, summary tables, and photographs. Map scale 1:1,500,000. Available at: ftp://ftp.epa.gov/wed/ecoregions/mt/mt_front_1.pdf.

WRCC (Western Regional Climate Center). 2015a. Western Regional Climate Center Website: Data for station 243915, Hardin, Montana. Accessed online 11/5/2015 at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt3915.

———. 2015b. Climate of Montana. Accessed online 12/8/15 at: http://www.wrcc.dri.edu/narratives/montana/.

Zelt, Ronald B., Greg Boughton, Kirk A. Miller, Jon P. Mason, and Laura M. Gianakos. 1999. Environmental Setting of the Yellowstone River Basin, Montana, North Dakota, and Wyoming.

Water-Resources Investigations Report 98-4269. U. S. Geological Survey (USGS). Available online: http://pubs.usgs.gov/wri/wri984269/envsett.html.