Crow Tribe Water Resources

CROW MR&I SYSTEM

PILOT WATER TREATMENT PLANT

ENVIRONMENTAL ASSESSMENT

JUNE 2015

CROW TRIBE

BARTLETT & WEST

Table of Contents

1.0 Purpose and Need 1

1.1 Introduction 1
1.2 Purpose and Need for Action 2
1.3 Decisions to be Made 2

2.0 Proposed Action and Alternatives 3

2.1 No Action Alternative 3
2.2 Pilot Plant Alternative (Preferred Alternative/Proposed Action) 4
2.2.1 Project Location and Components 5
2.2.2 Pilot Testing/Studies 11
2.2.3 Other Treatment Options Not Piloted 12
2.2.4 Decommissioning and Reclamation 12

3.0 Affected Environment and Environmental Consequences 13

3.1 Summary of Effects of No Action Alternative 14
3.2 Soil Resources 14
3.2.1 Existing Soils of the Project Area 14
3.2.2 Direct, Indirect and Cumulative Effects to Soils from the Pilot Plant Alternative 16
3.2.3 Conservation Measures 16
3.3 Water Resources 17
3.3.1 Existing Surface and Ground Water Sources and Water Quality 17
3.3.2 Direct, Indirect and Cumulative Effects to Water Resources from the Pilot Plant Alternative 18
3.3.3 Conservation Measures 19
3.4 Wetlands 20
3.4.1 Existing Wetlands 20
3.4.2 Direct, Indirect, and Cumulative Effects to Wetlands from the Pilot Plant Alternative 20
3.4.3 Conservation Measures 20
3.5 Vegetation and Land Use 20
3.5.1 Existing Vegetation and Land Use 20
3.5.2 Direct, Indirect and Cumulative Effects to Vegetation and Land Use from the Pilot Plant Alternative 21
3.5.3 Conservation Measures 22
3.6 Fish and Wildlife 23
3.6.1 Existing Fisheries and Wildlife 23
3.6.2 Direct, Indirect and Cumulative Effects to Fisheries and Wildlife from the Pilot Plant Alternative 24
3.6.3 Conservation Measures 25
3.7 Historic Properties and Culturally Sensitive Areas 25
3.7.1 Existing Cultural Resources 26
3.7.2 Direct, Indirect and Cumulative Effects to Cultural Resources from the Pilot Plant Alternative 26
3.7.3 Conservation Measures 26
3.8 Paleontological Resources 27
3.8.1 Existing Paleontological Resources 27
3.8.2 Direct, Indirect and Cumulative Effects to Paleontological Resources from the Pilot Plant Alternative 27

3.9 Environmental Justice 27
3.9.1 Existing Hazards to Minority and Low Income Populations 27
3.9.2 Direct, Indirect and Cumulative Effects to Minority and Low Income Populations from the Pilot Plant Alternative 28
3.10 Indian Trust Assets 28
3.10.1 Direct, Indirect and Cumulative Effects to Trust Assets from the Pilot Plant Alternative 28

4.0 Compliance with Environmental Statutes 28

Federal 28
Tribal 29
State 30

5.0 Consultation and Coordination 30

6.0 List of Preparers 30

7.0 References 31

Tables

Table 2-1: Summary of Project Components, Maximum Disturbance Dimensions, and Activities 7
Table 3-1: Summary of Effects to Resources 13
Table 3-2: Summary of 2014 Grab Sample Data at Observation Well 18
Table 3-3: Noxious Weed Species Listed in Big Horn County, Montana 21
Table 3-4: Threatened, Endangered and Candidate Species in Bighorn County 24
Table 6-1: List of Preparers 30

Figures

Figure 1-1: General Location of Project Area 1
Figure 2-1: Pilot Plant Exhibit 6
Figure 2-2: Aquifer Testing Facility Map 9
Figure 2-3: Flow Schematic of MR&I Pilot Plant 11
Figure 3-1: Soil Units of the Project Area 15

Appendices

Appendix A EPA Discharge Permit
Appendix B Water Treatment Plant Alternative Process Design Report
Appendix C Decommissioning and Reclamation Plan
Appendix D Public Notice Documentation

1.0 Purpose and Need

1.1 Introduction

The Crow Indian Reservation, the largest of the seven Indian reservations in Montana, is located in south-central Montana, bordered by Wyoming to the south and the Northern Cheyenne Indian Reservation to the east (Figure 1-1). The reservation encompasses approximately 2,300,000 acres, of which approximately 404,172 acres are owned by the Crow (Apsáalooke) Tribe (Tribe). The reservation is primarily rural with a number of dispersed small towns. Towns include Crow Agency (reservation headquarters), Fort Smith, Hardin, Lodge Grass, Pryor, St. Xavier, and Wyola.

The reservation includes the northern end of the Bighorn Mountains, Wolf Mountains, and Pryor Mountains. The Bighorn River is the largest hydrologic feature on the reservation. The Bighorn River flows north through the center of the reservation. The Little Bighorn River, a tributary, joins the Bighorn River just outside the town of Hardin, Montana, and the Bighorn River continues north to its confluence with the Yellowstone River. Part of the western reservation boundary runs along the ridgeline separating Pryor Creek and the Yellowstone River, and the city of Billings is approximately 10 miles northwest of this reservation boundary.

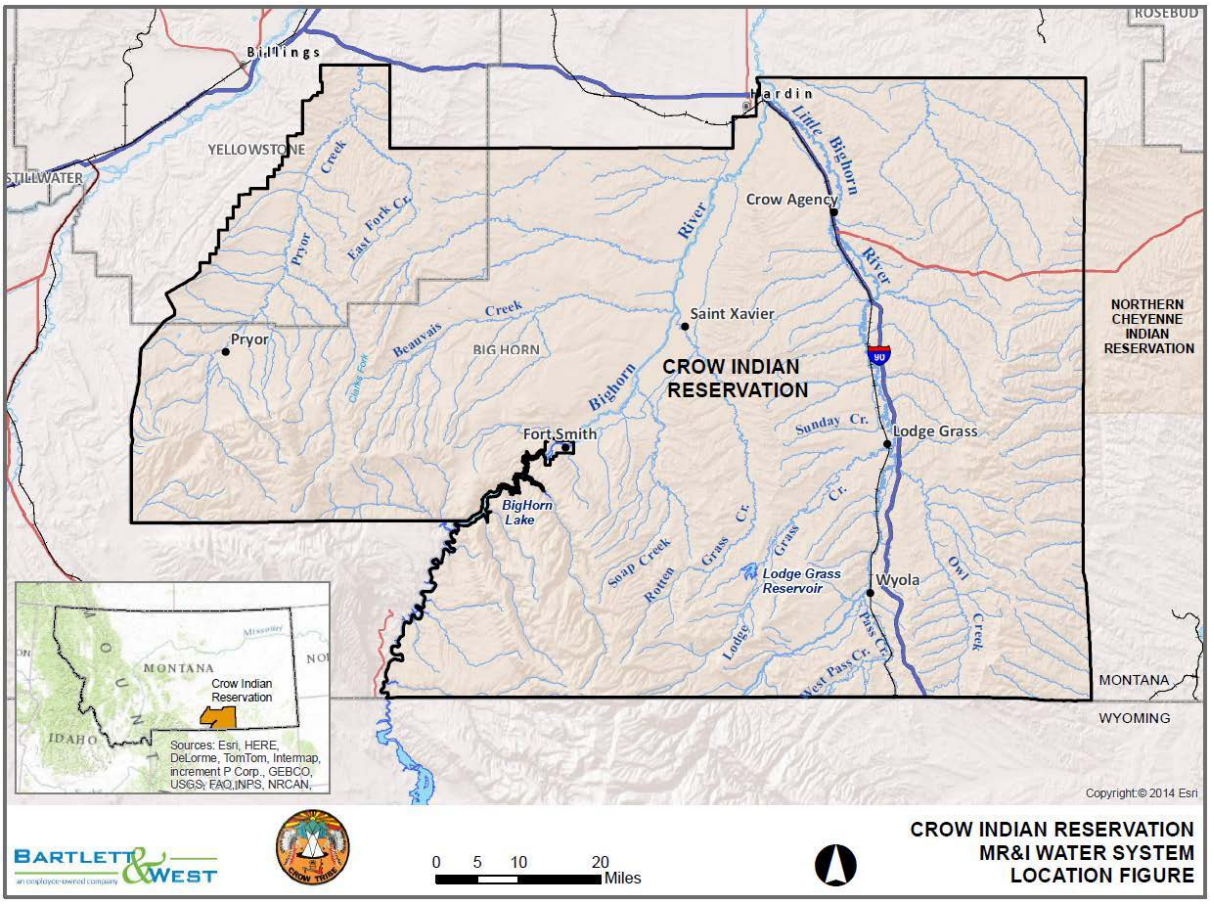

Figure 1-1: General Location of Project Area

Currently, communities on the reservation meet their drinking water needs via surface water or ground water wells and rural residents are served by ground water wells. Many of these ground water sources are

believed to be influenced by surface water and have had numerous deficiencies documented by the Indian Health Service's Sanitation Deficiency System and in Community Data Sheets and Sanitary Surveys completed by the U.S. Environmental Protection Agency (EPA) and Montana Department of Environmental Quality (MTDEQ). In a review of this data, MSE HKM (1999) summarized these deficiencies, which vary from lack of enough water to serve existing populations to noncompliance with federal drinking water standards including chlorine contact time, turbidity removal, and testing frequencies. High levels of *E. coli* bacteria have been recorded at the Crow Agency water treatment facility intake, indicating an elevated risk of *Cryptosporidium* contamination (Eggers et al. 2011). The water quality of rural wells ranged from poor to good. Testing of these rural wells indicated levels of alkalinity, hardness, sodium adsorption, sulfate, nitrogen, and, in some instances, uranium that were higher than regulatory drinking water standards (MSE HKM 1999). Very high levels of total dissolved solids and positive coliform tests were found in more than 50% of the wells investigated and multiple wells had manganese levels higher than EPA standards (Eggers et al. 2011). Additionally, large areas of the reservation are uninhabitable because the groundwater is either too low in quality or quantity to provide a reliable source of water.

A report titled "Crow Indian Reservation Municipal, Rural, and Industrial Water System Engineer Report" was prepared by DOWL-HKM (July 2008; updated December 2009) to support the, then proposed, federal legislation to approve a settlement for the Tribe's reserved water rights. This document provided a preliminary assessment of the water demands of the reservation and described a potential water delivery and treatment system to improve the Tribe's domestic water supplies that could meet current and future needs. Based in part upon the DOWL-HKM report, Title IV of the Claims Resolution Act of 2010 (Public Law 111-291) authorized $246,381,000 for the design and construction of a Municipal, Rural, and Industrial Water System (MR&I System) on the Reservation. The Tribe intends to construct a reservation-wide water system capable of reliably distributing up to 4.5 million gallons per day (MGD) of high quality water.

1.2 Purpose and Need for Action

To help facilitate the design of the MR&I System, information is needed to demonstrate the ability of various water treatment techniques to effectively treat the proposed source water and produce water which would meet the water quality needs of the Tribe.

The Tribe has identified a need to produce water which would:

1) Meet EPA drinking water quality standards (both primary and secondary);
2) Produce 4.5 MGD with the option to expand to 6.7 MGD;
3) Be cost effective to the Tribe and, ultimately, the water users.

By gathering the needed information, the Tribe would be able to more thoroughly compare the available treatment methods in order to select a preferred treatment process for full-scale operation which would meet their needs, and provide the Tribe an opportunity to optimize equipment and minimize costs.

1.3 Decisions to be Made

Public Law 111-291, which authorized the design and construction of the MR&I System, also identified the Bureau of Reclamation (Reclamation) as the lead federal agency with responsibility for:

- Providing funding and technical oversight of the project, including ensuring that the project meets applicable industry standards;
- Considering the equitable distribution of water and improving the cost effectiveness of the project;
- Protecting and conserving trust assets of the Tribe and of Tribal members, including providing

oversight of the expenditure of appropriated federal project funds to best serve the interests of the Tribe and its members; and
- Making decisions regarding the project as part of environmental review under the National Environmental Policy Act (NEPA) of 1969 (as amended, 42 U.S.C. Section 4221-447).

Because the proposed action would cross lands held in trust by the federal government for the Tribe, the Bureau of Indian Affairs (BIA), the federal agency responsible for decision-making related to these trust lands, is a cooperating agency with responsibility for:

- Protecting and conserving trust assets of the Tribe and of Tribal members, including providing oversight of the expenditure of appropriated federal project funds to best serve the interests of the Tribe and its members;
- Deciding whether to issue a surface use agreement (SUA) to the Crow Tribe Water Resources Department (CTWRD) under 25 CFR 162 to facilitate legal access and implementation of the Tribe's proposed action;
- Deciding whether to issue a right-of-way (ROW) request for utility and access under 25 CFR 169 to facilitate the Tribe's legal access to the proposed project location.

BIA decision-making for SUA and ROW requests is established by the BIA's responsibility under 209 DM 8, 230 DM 1, 3 IAM 4 (release No. 00-03), 10 BIAM 4, as amended.

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 take an action. The responsible official for making the federal decision is the Regional Director, Great Plains Region, Reclamation.

If appropriate, this Environmental Assessment will culminate in a Finding of No Significant Impact 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.

2.0 Proposed Action and Alternatives

2.1 No Action Alternative

Under the No Action Alternative, the Tribe would proceed with design of the MR&I System after evaluating and refining the available treatment alternatives using theoretical and laboratory testing methods, such as graphical/flow chart modeling and bench-scale testing, and without the use of on-the-ground pilot studies.

Graphical/flowchart modeling uses several pieces of information to predict the quality of water expected to be produced by specific water treatment methods or equipment. The first step in graphical/flowchart modeling is to periodically collect raw water (water in its natural state, prior to any treatment) samples from the proposed source water. Raw water samples provide baseline information on the presence and amount of various materials in the source water. The second modeling step is to estimate the efficiency of various treatment methods and equipment at removing unwanted materials from the raw water. The efficiency of removing the unwanted materials is estimated using manufacturer provided data. Typically, manufacturers calculate the efficiency of their equipment based upon an average of the equipment's past

performance. Some manufacturers use little or no raw water information in their efficiency calculations, while other manufacturers use a computer system where customers input their raw water data to get a more specific efficiency estimate. The final step is to calculate the amount of water each treatment method or equipment is capable of producing after the treatment process is complete, including water which would meet the desired quality standards (commonly known as "finished water") and water that is not intended for distribution and consumption (commonly known as "waste water"). These output results are highly dependent upon the raw water data and efficiency data. Inaccurate information related to chemical doses, mixing speeds, contact time, useful lifetime of media/filters, interactions between processes, efficiency data, and variations in raw water (due to conditions such as seasonal temperature fluctuations, changes in contaminant levels as a result of spring season or irrigation season runoff, etc.) can produce inaccurate output results. If one component of the treatment process does not perform as expected, the error would be carried through to all following processes, compounding the errors.

Bench-scale testing is a small, laboratory scale method of studying the effectiveness of different water treatment chemicals, in a range of doses, in removing unwanted materials from the raw water source. The output from bench-scale testing is an estimate of the amount of unwanted material(s) removed from the raw water at a singular step in a series of water treatment steps. Bench-scale testing is essentially a snapshot of each treatment process, rather than a film that illustrates the chain of treatment process. Because bench-scale testing only provides a snapshot in time, this method does not fully characterize the removal of unwanted material for processes that build upon each other. For example, if the chemical dose, mixing speed, or contact time is not representative of the full treatment process, the results would not be indicative of the full scale treatment plant.

While graphical/flow chart modeling and bench-scale testing methods have the benefits of being relatively low cost and able to provide results in weeks, rather than months, there also are disadvantages to these methods, particularly when their results are not validated and further refined through a pilot plant study process. If the Tribe proceeded with design of the MR&I System without verifying the calculated or estimated efficiency of the treatment method alternatives through an on-the-ground pilot study, the Tribe could incur startup delays, significant retrofitting costs, and an inability to meet drinking water standards once the project reaches full-scale operation. Thus, this alternative would not meet the purpose and need for the project because it would not provide the level of information necessary to be reasonably certain the MR&I System would be able to produce water which would meet EPA drinking water standards. While the No Action Alternative does not meet the purpose or need, it is presented here for purposes of comparison and as a baseline with which to compare the environmental effects of the Proposed Action (see Section 0).

2.2 Pilot Plant Alternative (Preferred Alternative/Proposed Action)

This alternative would include graphical/flow chart modeling and bench-scale testing, followed by an on-the-ground pilot plant study. Pilot plant testing is the standard industry preferred method for testing water treatment processes because pilot studies can characterize interactions between different processes and allow testing of treatment processes that are difficult to accurately determine through graphical/flow diagrams or bench-scale tests. A pilot plant study builds upon theoretical methods to create the most complete understanding of treatment processes to allow for accurate design of a full scale treatment facility which can meet the Tribe's needs.

The proposed pilot plant would treat the proposed source water for the MR&I System (Bighorn River - ground water under the influence of surface water) to demonstrate the varying effectiveness of each proposed technology, to provide a basis for comparing alternatives from a performance perspective, and to

allow optimization of equipment to ensure all EPA limits and standards are met (EPA discharge permit, filed for and approved by the EPA on February 18, 2015, see Appendix A). Pilot plant construction is expected to begin in summer 2015. The pilot plant study would be operated for three months during variable and seasonal source water conditions and decommissioning of the plant would be completed by the end of 2015.

2.2.1 Project Location and Components

The pilot plant would be located in the NE ¼ of Section 23, Township 4 South, Range 32 East on lands owned by the Tribe (Figure 2-1). The location would be approximately ¼ mile west and ¾ mile north of St. Xavier, Montana.

Raw source water would be drawn from an intake well on the east bank of the Bighorn River near St. Xavier, Montana and pumped to a treatment plant building via a supply pipeline installed on the ground surface (Figure 2-1). There are two potential pipeline routes that differ in how they cross the NE ¼ of Section 23, although the west end of both routes is identical.

The selection of a pipeline route is based on land access availability through the NE ¼ of Section 23. The preferred route (the northern of the two) runs east-west approximately through the center of the north half of Section 23. It is on allotted land currently, but the Tribe is in negotiations to purchase the land. If this route is used, an SUA between the Tribe and the BIA would be required. The alternate route (the southern of the two routes) parallels the preferred route about 1/8 mile south on a combination of tribal trust land and fee land. It runs north-south from the pilot plant, east-west through the middle of Section 23 and diagonally back to join the preferred route (Figure 2-1). To cross the fee portion of this route, an easement would be required between the Tribe and the fee owner.

Allotted lands: lands that are held in trust by the federal government for the use of individual Indians or their heirs.

Tribal trust land: lands that are held in trust by the federal government for the use of the communal/entire Tribe.

Fee land: lands that are held by an owner, whether Indian or non-Indian.

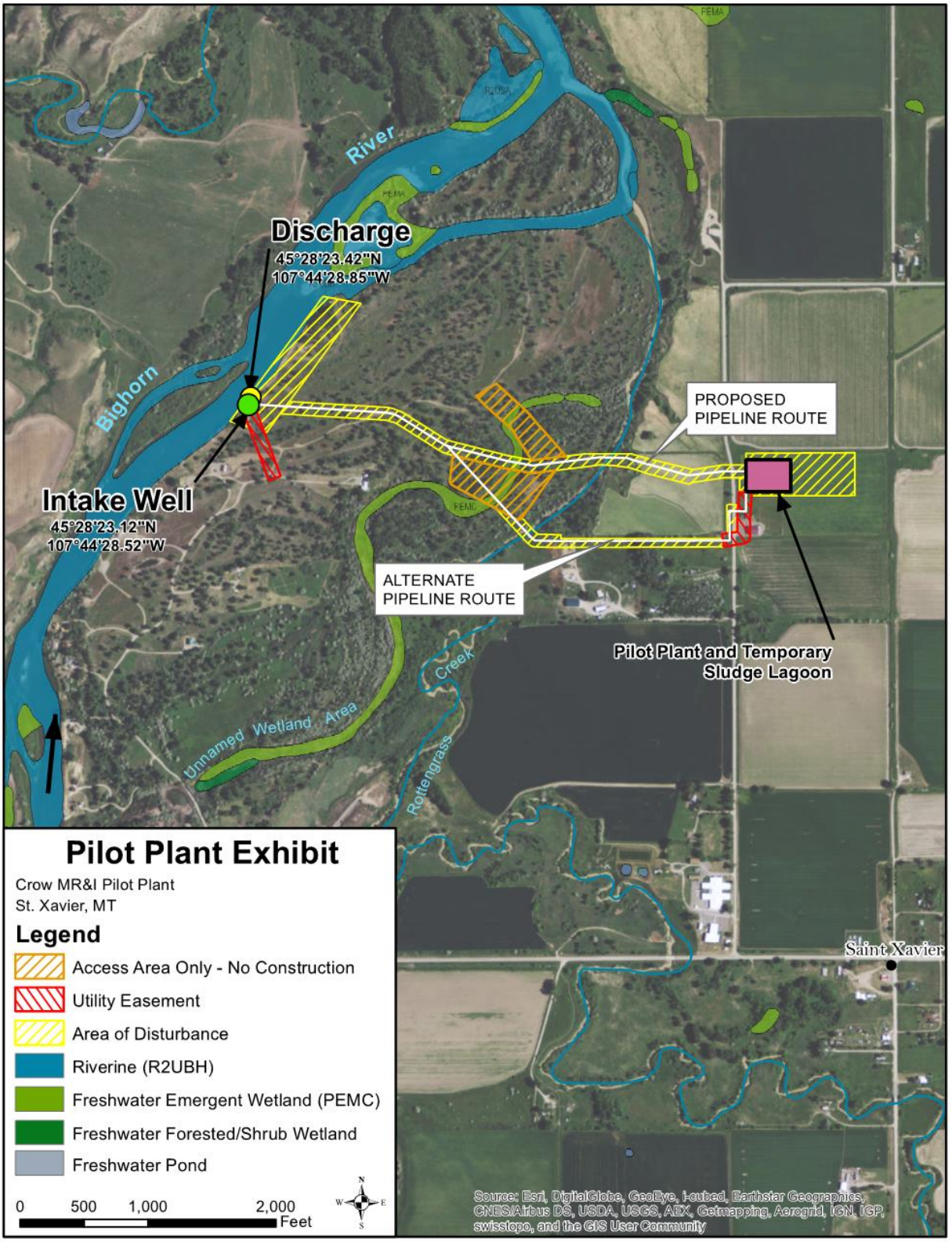

Figure 2-1: Pilot Plant Exhibit. Proposed location of pilot plant and other project components, areas of access and disturbance, and utility easements. Also denoted on the map in blue text is Rottengrass Creek and an unnamed wetland drainage channel.

The Pilot Plant Alternative would include the following components and associated construction work activities, which are further described in the following sub-sections and in Table 2-1:

- Aquifer test wells;
- Intake;
- Supply pipeline;
- Utility easements;
- Treatment plant;
- Discharge pipeline and outlet; and
- Sludge ponds.

The maximum area of surface disturbance would be approximately 55 acres if the preferred pipeline route was used or 57 acres using the alternate pipeline route. Within the "area of disturbance" and "access areas," (Figure 2-1), a skid steer may be used to move materials for installation of various project components. No access roads would be created. All gravel used in the project would be from a location presented to and approved by the BIA prior to obtaining and placing.

Table 2-1: Summary of Project Components, Maximum Disturbance Dimensions, and Activities

Project Component	Location	Width (feet)	Length (feet)	Area (acres)	Cause of Disturbance
Aquifer Test Wells	Eastern bank of Bighorn River	Irregular	Irregular	29.9	Drill rigs gaining access to observation/supply well locations, drilling and development of observation/supply wells, aquifer testing
Intake	Eastern bank of Bighorn River	---	---	---	Disturbance due to the intake would be part of the aquifer test well work
Supply Pipeline ROW	*Preferred Route* Running east from intake well to pilot plant	50	4136	4.75	Skid steer traffic, foot traffic, constructing pipe on the ground surface
	Alternate Route Running east and south from intake well to pilot plant	50	4823	5.54	Skid steer traffic, foot traffic, constructing pipe on the ground surface
Utility Easements	Easement to intake well	50	570	0.65	Installation of electrical service by Big Horn County Electric
	Easement to pilot plant	50	507	0.58	Installation of electrical service by Big Horn County Electric
Treatment Plant	Pilot plant structure	28	36	0.02	Excavation/cut and fill, construction of pilot plant structure
	Parking area	100+ irregular	300+ irregular	0.77	Smoothing area surrounding pilot plant structure, surfacing
	Buffer area	Irregular	Irregular	3.6	Excavation/cut and fill as determined necessary, but area to be limited

Table 2-1: Summary of Project Components, Maximum Disturbance Dimensions, and Activities

Project Component	Location	Width (feet)	Length (feet)	Area (acres)	Cause of Disturbance
Discharge Pipeline ROW and Outlet	*Preferred Route* Running west from pilot plant to river	50	4146	4.76	Skid steer traffic, foot traffic, constructing pipe on the ground surface
	Alternate Route Running northwest from pilot plant to river	50	4833	5.55	Skid steer traffic, foot traffic, constructing pipe on the ground surface
Sludge Ponds	East of Pilot plant	615	150	2.1	Excavation of sludge ponds, including earth moving equipment and material storage
Access Area	Northern area	Irregular	Irregular	3.23	Potential disturbance due to skid steer traffic
	Southern area	Irregular	Irregular	5	Potential disturbance due to skid steer traffic

Aquifer Testing and Intake Well

Prior to operation of the pilot plant, aquifer testing would occur near the eastern bank of the Bighorn River. This testing would include development of the intake well, drilling of seven observation wells, placement of two drive point streambed piezometers, and placement of a stilling well (Figure 2-2). These facilities would be used to monitor aquifer drawdown and hydraulic connectivity of groundwater and surface water. The stilling well would monitor river stage prior to, during, and after aquifer testing.

Installation of the intake well would involve drilling a 10-inch wide borehole and advancing a 14-inch wide steel well casing and 10-inch wide steel casing plus screen 30 feet below ground surface into the water table. As the 14-inch casing is removed, a gravel filter pack would be placed behind it, followed by coated bentonite chips until the static water level is reached, then non-coated bentonite chips above that level. Following well installation, water would be pumped until it ran clear and turbidity measurements became relatively consistent. Installation of the monitoring well would include drilling a six-inch wide borehole, advancing a six-inch wide steel casing (which would be removed during well construction), and installation of a two-inch polyvinyl chloride (PVC) screen and a filter pack consisting of silica sand topped with coated bentonite chips below the water table and non-coated bentonite chips above. Piezometers would be placed into the streambed of the Bighorn River by driving 3/4-inch diameter screened points 1.5-2 feet below the streambed surface. The piezometers would be removed once aquifer testing is complete. A stilling well would be installed within the Bighorn River by attaching a PVC pipe (housing a transducer) to a steel fence post and driving the post into the streambed. The stilling well would be removed immediately after testing.

Access to the intake well site would be via an existing access road on fee land. Verbal approval has been obtained from the landowners; an executed agreement is being developed concurrently for access and development of the intake well.

Figure 2-2: Aquifer Testing Facility Map. Location of proposed observation wells, drive point streambed piezometers, and stilling well. Also indicates location of existing boreholes. (NewFields 2015)

<u>Supply Pipeline</u>

For either pipeline route option, three-inch diameter PVC Yelomine would rest on the ground surface with the exception of three areas: the Mission Loop road crossing, Rottengrass Creek, and an unnamed wetland.

The Mission Loop road crossing, immediately west of the proposed pilot plant, would be shallow trenched at approximately two feet wide by two feet deep for a total length of 50 feet. Placement and removal of the

pipes is expected to take one day and interruptions to traffic are expected to be minimal. There would be no disturbance to normal traffic flow during the time when the pilot plant is in operation. No changes to the roadway would occur, although resurfacing would be completed, as needed. The gravel surface would be monitored and repaired during the project to maintain the road crossing to its existing condition.

The pipeline would also cross an unnamed wetland area and Rottengrass Creek in the N ½ of Section 23, over which the pipeline would be suspended from two posts on either side of the features so as not to disturb surface soils or vegetation. The pipeline suspended over the unnamed wetland and Rottengrass creek would be conveying raw ground water to the pilot plant. As such, if a break in the suspended line were to occur, the water leaked would not contain any chemicals or substances that would be damaging to the wetland or creek. If a leak were to occur, it would be detected due to loss in supply pressure and the line would be checked and any necessary corrective action taken.

Power Supply

Power to the supply well and the pilot treatment facility would be supplied via Big Horn County Electric or by on site generators. If Big Horn County Electric provided power service, three temporary utility easements would be required (indicated on Figure 2-1). Two of the easements are adjacent to each other and provide utilities to the intake (area denoted near intake) but are considered two easements because of different land ownership; the third easement, located next to the treatment plant, is on Tribal land. All three easements would be for either buried or overhead electrical services, to be determined by Big Horn County Electric based on the existing power supply. If on site generators were utilized, operation, maintenance, and fueling would be done in accordance with a site specific spill prevention plan or storm water pollution prevention plan (to be determined based on the particular generators used). Maintenance and fueling would be done by trained individuals and in designated areas.

Treatment Plant, Discharge Pipeline and Outlet, and Sludge Ponds

The pilot plant treatment process would create two outputs: finished water and sludge waste. The clean, treated water would be discharged to the Bighorn River via a two-inch diameter PVC Yelomine pipeline running parallel to the supply pipeline, also laid on the ground surface. The location of the discharge pipeline would follow whichever supply pipeline route was selected, indicated on Figure 2-1. The discharge pipeline would be installed across Mission Loop road and would be suspended across Rottengrass Creek and the unnamed wetland area following the same procedures and monitoring as the supply pipeline (See above sub-heading “Supply Pipeline”). Potential leaks in the discharge pipeline would be detected from loss in pressure and would be fixed as necessary.

The structure used to discharge finished water into the Bighorn River would consist of the pipe laid on the ground surface and extending 12 inches (horizontally) from the normal low water line of the riverbank. The pipe would be supported by two t-posts, which would be driven into the riverbank a minimum of 24 inches. Discharge would occur above the water surface, but in sufficiently deep water to prevent erosion and sedimentation along the river bank or river bed.

The sludge waste would be held onsite in a temporary sludge lagoon next to the pilot plant (Figure 2-1). The outdoor lagoon would collect the backwash and sediment produced (34 gpm) during the flocculation/sedimentation treatment processes. This waste would be held in the lagoon and water from the waste would be allowed to evaporate and/or infiltrate into the soil. After the pilot study, the remaining sludge would be evaluated and disposed of either though incorporation into the existing soil or at the nearest appropriate landfill. The lagoon would be backfilled and returned to the original land use, unless otherwise requested by the landowner.

2.2.2 Pilot Testing/Studies

The treatment methods proposed for pilot testing include: oxidation, coagulation/flocculation and settlement in a plate settler, ultrafiltration, low pressure reverse osmosis membranes, and biological media filtration. These methods were chosen based on raw water quality and anticipated treatment needs to meet desired effluent quality (For further detail, refer to *WTP Alternative Process Design Report* by Bartlett & West June 15, 2015, Appendix B). The flow schematic shown in Figure 2-3 illustrates each treatment step, indicated within boxes, along with additions of treatment chemicals and the flow of water throughout the process. The testing of these particular treatment processes are described in more detail below.

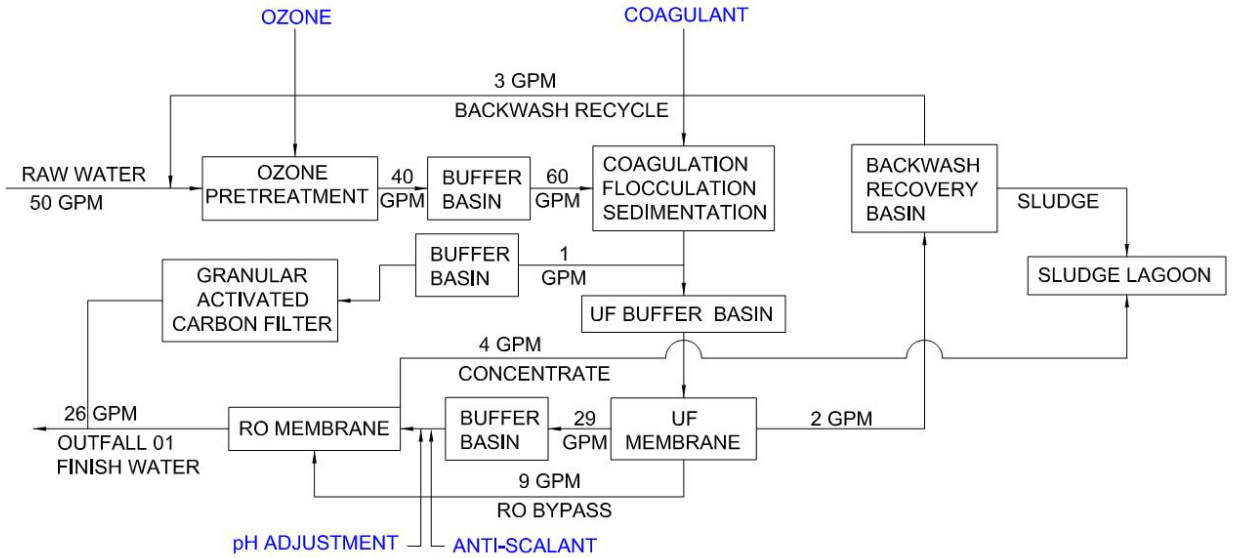

Figure 2-3: Flow Schematic of MR&I Pilot Plant. Treatment steps are indicated within boxes. The inflow of raw water begins in the upper left corner. The flow continues as indicated by arrows to the right, then down (with a branch in the flow), then to the left, with the treated water outflow in the lower left corner. Estimated inflow/outflow rates in gallons per minute (GPM) are shown between applicable treatment steps. Chemical additions are indicated in blue text. UF=ultrafiltration; RO=reverse osmosis

Pretreatment oxidation is the first step in the treatment process. During bench-scale testing, sodium hypochlorite and permanganate would be tested to determine which is a more effective oxidant. The more effective chemical of the two, along with ozone, would be used during the pilot study. The pilot testing of oxidants would determine if oxidation is a necessary component of the overall treatment process and whether it aids in the removal of iron, manganese, and undesirable tastes and odors.

Secondly, a plate settler would be used to perform coagulation, flocculation, and settlement of solids. A plate settler is recommended, rather than a sediment basin, due to footprint size and retention times necessary for settlement. Different coagulates (alum and ferric chloride) would be tested during bench-scale testing and the chemical shown to be most effective would be pilot tested. Pilot testing would demonstrate the level of effectiveness of the plate settler to remove iron, manganese, and turbidity.

Following the plate settler, the flow would split to feed the biological media filtration and ultrafiltration processes. Biological media filtration would be used to remove iron, manganese, and total organic carbon. Constituents would be removed from the water via adsorption by the activated carbon media and the biological growth media cap. The remaining portion of water would pass through ultrafiltration.

Ultrafiltration, the third process in the treatment chain, would be utilized to remove iron, manganese, total organic carbon, turbidity, and microorganisms. The removal of constituents is achieved through filtering water through a membrane. The level of removal depends upon the size of the constituents and the membrane pore size. Ultrafiltration and microfiltration both were considered for piloting, but ultrafiltration was decided upon because its smaller membrane pores would result in a greater removal efficiency and better removal of viruses. Ultrafiltration would be included as a pre-filtration process for the final treatment step.

The final step of treatment would be reverse osmosis and would target removal of hardness, total dissolved solids, alkalinity, sulfate, iron, manganese, aluminum, total organic carbon, and dissolved organic carbon. Reverse osmosis needs ultrafiltration upstream in the treatment process to increase the performance of reverse osmosis, as well as to protect the membranes by removing all larger particulates. Nanofiltration also was considered, but reverse osmosis was preferred due to the lower life cycle costs on similar projects.

Disinfection testing would be done in small contained units separate from the pilot treatment train to avoid the possibility of sodium hypochlorite or ammonia entering the water to be discharged to the Bighorn River. The disinfection options potentially tested in the pilot study include ozone, free chlorine, and chloramines.

2.2.3 Other Treatment Options Not Piloted

Lime softening is not part of the pilot study because the physical footprint and equipment required to do so would be prohibitive. In addition, lime softening would produce large quantities of sludge to be handled. Lime softening would be bench-scale tested to allow for partial comparison to reverse osmosis softening.

Ultraviolet radiation for oxidation or disinfection was considered, but traditionally is not pilot tested because calculations yield the same results.

The feasibility and availability of equipment resulted in other treatment processes being dropped from consideration for the pilot study. Further discussion about other treatment methods and flow schematics not proposed for piloting are included in the *WTP Alternative Process Design Report* by Bartlett & West (June 15, 2015, Appendix B).

2.2.4 Decommissioning and Reclamation

Details of proposed decommissioning and reclamation actions are provided in the *Decommissioning and Reclamation Plan* in Appendix C and summarized below.

Following completion of the pilot plant study, the intake supply and observation wells would be capped in place. The supply and discharge pipelines, pilot plant building, and associated equipment would be removed from the ground surface and salvaged. The solid waste material from the sludge lagoons would be evaluated to determine if material can be incorporated into the soil or if the material should be excavated and hauled to the nearest appropriate landfill. Any disturbed soils, including the area of the pilot plant structure, sludge ponds, and other minor disturbed areas would be backfilled and recontoured approximately to original contours and returned to original land use, unless otherwise requested by owner. Disturbed features of surface hydrology and vegetation would be restored according to BIA requirements and Natural Resource Conservation Service (NRCS) recommendations, or landowner request, and monitored.

3.0 Affected Environment and Environmental Consequences

This section describes the existing conditions of nine environmental resources, as well as the potential effects of each alternative on those resources. Effects may be direct or indirect, positive (beneficial) or negative (adverse), and long term (permanent, long-lasting) or short term (temporary). Cumulative effects and measures that would be implemented to reduce, minimize or eliminate impacts (conservation measures) are discussed for each resource. A summary of impacts by resource issues for each alternative is provided in Table 3-1. The analysis of effects to each resource is described in terms of the maximum area which could potentially be disturbed under each alternative.

Several environmental factors would not be affected and are excluded from analysis. Factors excluded from this section include geology, visual resources/viewsheds, noise, air quality, floodplains, and social and economic conditions.

Table 3-1: Summary of Effects to Resources

	Proposed Action		
Resource	**Preferred Pipeline Route**	**Alternate Pipeline Route**	**No Action**
Soil and Vegetation Surface Disturbance	Surface disturbance due to pipe-laying and equipment access would be 55 acres. The disturbance would be limited to compaction of soils, flattening of plants, and removal of as few trees as possible.	Surface disturbance due to pipe-laying and equipment access would be 57 acres. The disturbance would be limited to compaction of soils, flattening of plants, and removal of as few trees as possible.	No effect.
Soil Excavation	Limited to eight acres in area for the pilot plant, sludge pond, and Mission Loop Road crossing.	Limited to eight acres in area for the pilot plant, sludge pond, and Mission Loop Road crossing.	No effect.
Surface and Groundwater	Limited groundwater removal during well development and aquifer testing. During operation, intake well would extract groundwater at 60 GPM and Bighorn River would receive treated drinking water at 26 GPM.	Limited groundwater removal during well development and aquifer testing. During operation, intake well would extract groundwater at 60 GPM and Bighorn River would receive treated drinking water at 26 GPM.	No effect.
Wetlands	No effect.	No effect.	No effect.
Land Use	Temporary use (one growing season) of eight acres of intermittent farmland for pilot plant/sludge lagoon site.	Temporary use (one growing season) of eight acres of intermittent farmland for pilot plant/sludge lagoon site.	No effect.
Fish and Wildlife	No effect to fisheries. Indirect wildlife habitat disruption and displacement would be minimal and last a maximum five months.	No effect to fisheries. Indirect wildlife habitat disruption and displacement would be minimal and last a maximum five months.	No effect.
Cultural	No effect.	Impacts to an identified cultural resource would be avoided by pipeline route and design aboveground with no surface disturbance. No effect.	No effect.
Paleontological	No effect.	No effect.	No effect.
Environmental Justice	No negative health or environmental effects to minority or low income populations are anticipated.	No negative health or environmental effects to minority or low income populations are anticipated.	No effect.
Indian Trust Assets	Positive effects to property and resources of Tribe. Precursor to full	Positive effects to property and resources of Tribe. Precursor to full	Poorly informed decision making

Table 3-1: Summary of Effects to Resources

Resource	Proposed Action		No Action
	Preferred Pipeline Route	Alternate Pipeline Route	
	scale drinking water treatment facility to benefit the Tribe and their assets. Informed decision making resulting in cost savings and reduced impacts to resources.	scale drinking water treatment facility to benefit the Tribe and their assets. Informed decision making resulting in cost savings and reduced impacts to resources.	with potential for significant costs to Tribe, startup delays of full scale plant, broader impacts to resources.

3.1 Summary of Effects of No Action Alternative

No effects would occur to soils, vegetation, water resources, wetlands, land uses, fish and wildlife, cultural resources, paleontological resources, or minority or low income communities as a result of the No Action Alternative. Effects from other existing natural disturbance regimes, human-induced disturbances, or management actions would continue to impact these resources. The No Action Alternative would likely result in a negative impact to Trust benefits and assets of the Tribe. The No Action Alternative represents poorly informed decision making which would likely result in significant costs for the Tribe or startup delays during full scale construction and operation. The lack of information and ability to plan may also result in greater impacts to the environment and resources on a broader scale, including Indian Trust Asset (ITA) resources, because of the more extensive project area and wider-ranging implications of the full scale plant.

3.2 Soil Resources

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.

3.2.1 Existing Soils of the Project Area

The project area is comprised of five soil units (Figure 3-1) (USDA-NRCS 2015). The boundary delineated on Figure 3-1 is considerably larger than the project/disturbance area due to the limitations of the NRCS soil mapping application. The soil types are Alluvial land, Haverson and Glenberg soils, Haverson and Lohmiller wet soils, Kyle silty clay, and Riverwash. The Riverwash soil is along a small section of the riverbank that would not be disturbed by the project. The other four soils are further described below.

A majority of the supply and discharge piping would cross Haverson and Glenberg soils. The ability to perform shallow excavations in these soils can be somewhat limited due to the soil's flooding potential and the tendency to create dusty conditions, both of which results in unstable excavation walls. The tendency of these soils to erode in windy conditions is classified as moderate to considerable and the tendency to erode in water is classified as moderate. Haverson and Glenberg soils are moderately corrosive to concrete and highly corrosive to steel. These soils are designated "Prime if Irrigated" according to the NRCS (USDA-NRCS 2015). This area is currently not farmed or irrigated.

Rottengrass Creek and the unnamed wetland area to the west have soils classified as wet Alluvial land. The intake and discharge pipelines would cross through these soil bands. This material presents a high probability of steel corrosion. The wind erodibility of the soil is not classified and is low to moderately erodible by water. The Alluvial land is classified as somewhat limited for shallow excavations. This

classification is based on the depth to the saturation zone, possibility of flooding, being dusty, and having unstable excavation walls.

If the alternate pipeline route is used, the pipeline would cross an area of soils classified as Haverson and Lohmiller wet soils. Soils of this classification are somewhat limited for shallow excavations due to depth of saturated zone, being dusty, and having unstable excavation walls. Wind erodability of the soil is low and moderate due to water. This soil is highly corrosive to concrete and steel.

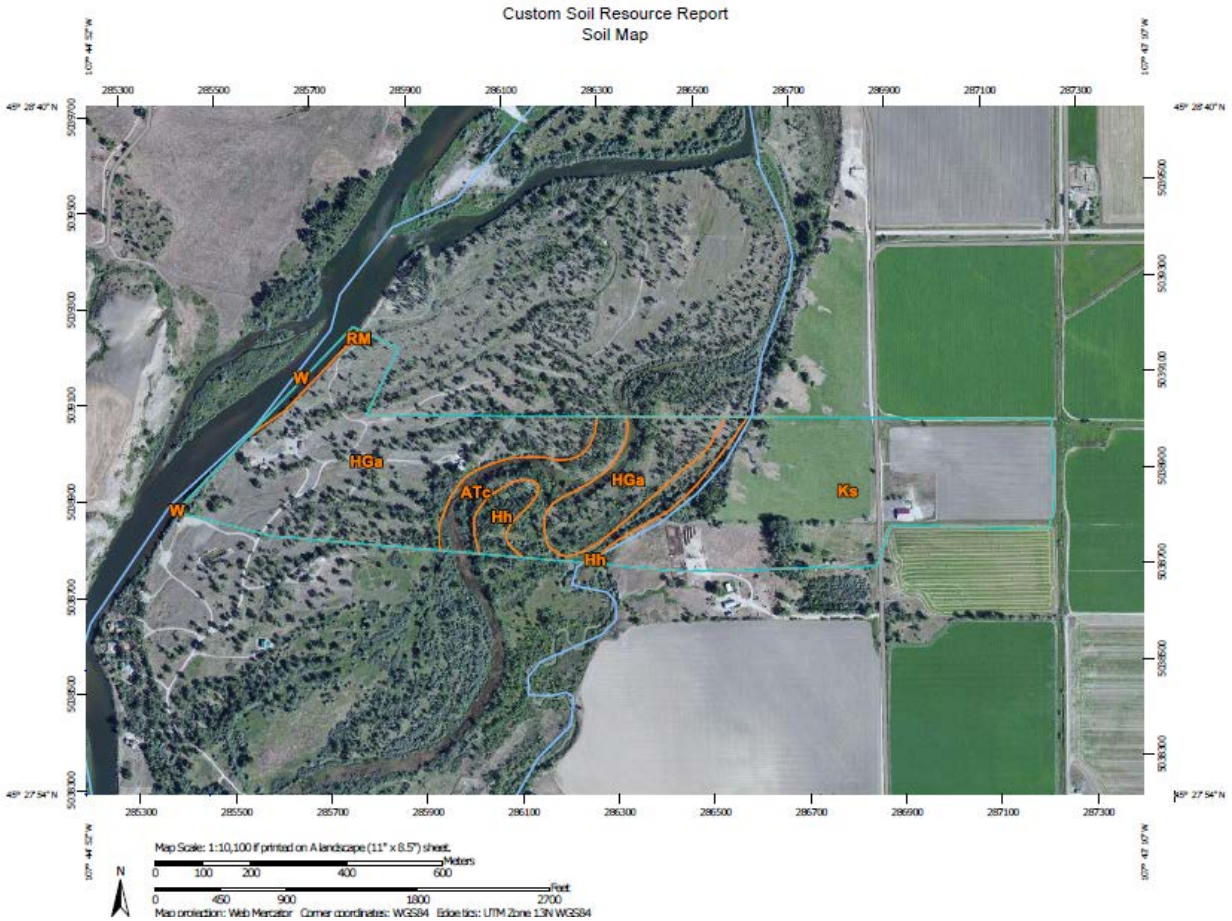

Figure 3-1: Soil Units of the Project Area. ATc – Alluvial land wet, HGa – Haverson and Glenberg soils, Hh - Haverson and Lohmiller wet soils, Ks - Kyle silty clay, RM – River wash, W - Water

The site proposed for the pilot plant and temporary sludge lagoon is classified as Kyle silty clay with slopes of 0-2%. This soil is well drained and rated as “not limited” for lagoons. The wind and water erodibility of the soil is classified as moderate and low, respectively. Kyle silty clay presents a moderate concern for concrete corrosion and a high concern for steel. This soil group is classified as somewhat limiting for shallow excavations based on unstable excavation walls, having too high of a clay content, and being dusty. The pilot plant/lagoon site is within an agricultural field and thus the upper soil horizons have been previously disturbed via cultivation.

3.2.2 Direct, Indirect and Cumulative Effects to Soils from the Pilot Plant Alternative

If the proposed pipeline route was used, approximately 1,800 feet of the pipeline would cross Haverson and Glenberg soils designated "Prime if Irrigated," and if the alternate pipeline route was used, approximately 1,600 feet would cross these soils. Since these soils are not currently farmed or irrigated, and since the pipeline would be temporarily laid on the soil surface, there would be no conversion of the use or purposes of these soils. Therefore, the project would have no impact to farmland soils of importance protected under the FPPA.

Potential effects to soils would include temporary disturbances, one growing season at the most, during construction and excavation and would be limited to within the project area. Potential direct impacts to soils include compaction, disturbance of soil horizons, and chemical contamination. Compaction may occur from the use of heavy equipment during construction and reclamation. The area of possible surface disturbance would total approximately 55 acres for the preferred pipeline route and 57 acres for the alternate pipeline route (Figure 2-1). Disturbance of soil horizons would occur during excavation, which would include the area of the pilot plant building, sludge lagoon, and Mission Loop road crossing, for a total of eight acres. This acreage would not differ between pipeline route options. In the event of a spill associated with equipment refueling, localized chemical contamination of soils could occur.

Soils exposed during construction activity would be indirectly affected due to increased susceptibility to erosion until vegetation is established. Temporary sediment releases would potentially occur during construction anytime water is available to transport excavated or unstable soils. By the next growing season, sediment release and transport would return to pre-construction levels due to re-vegetation efforts following the decommissioning of the pilot plant.

Past and present impacts to soils in the project area are primarily related to farming and ranching, which have cumulatively contributed to compaction and cultivation of soils in the area. This project would result in compaction and surface disturbance to areas that currently experience these impacts from ranching and other uses. Soil excavation would occur in areas of previous disturbance or cultivation. With the implementation of the conservation measures described below to minimize sedimentation, erosion, and contamination, the project would not measurably contribute to additional cumulative effects to soils.

3.2.3 Conservation Measures

Several measures would be in place to minimize impacts to soils. Both temporary and long term impacts would be minimized by limiting the construction area and the extent of excavation. The majority of the length of the supply and discharge pipeline would rest on the top of the ground surface rather than being trenched, preventing sub-surface disturbance and limiting potential for erosion and sedimentation to approximately eight acres of soils.

A site-specific Storm Water Pollution Prevention Plan (SWPPP) would be prepared and implemented for the project, which would outline measures and best management practices (BMPs) to minimize and mitigate construction stormwater runoff, sediment discharge, and erosion and spill prevention, as well as notification and corrective procedures. Temporary and long-term erosion and sediment control structures would be installed and dewatering measures would be implemented as necessary during and after construction and reclamation. Topsoil would be segregated from subsoils during excavations and stored on-site to be used for reclamation and seedbed preparation. Seeding and mulching would occur promptly after construction is complete in order to minimize the time soils are exposed to erosion. The seeding mixture

would be determined through consultation with the BIA Natural Resource Group. Equipment re-fueling would occur in designated areas away from sensitive features. With the use of these measures, impacts or losses to soils as a result of the project would be minor and short term.

Several aspects of the project would also be in place to limit the potential effects of soils on construction materials. Supply and discharge pipelines would be made of PVC material to mitigate the corrosive nature of the Alluvial land, Haverson and Glenberg soils, and Haverson and Lohmiller wet soils. To further mitigate impacts both to and from the Alluvial land soil strata, the pipeline would be suspended across these areas rather than trenching or boring. This would be done for either of the pipeline route options. The pilot plant would be constructed aboveground, thus eliminating impacts on the building structure due to the corrosive nature of the Kyle silty clay.

3.3 Water Resources

The Clean Water Act (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 discharges (Section 402) and for 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 from the National Pollutant Discharge Elimination System (NPDES) program. The U.S. Army Corps of Engineers was consulted regarding Section 404 of the CWA and determined it was not applicable (Cathy Juhas, Regulatory Project Manager, Joint Application Review, pers. comm. 2014).

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 ground water and surface water monitoring plan. Until the EPA adopts such standards, federal water quality regulations are applicable to tribal waters.

For the purposes of this EA, reference to state water quality standards were used, as they are equal to or more stringent than federal standards. 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 as “B-1”, “B-2”, or “B-3” according to beneficial uses each body of water should support, according to Section 303(d) of the CWA (Admin. Rules of Montana 2014, Rules 17.30.623, 17.30.624, and 17.30.625). Variations in water use classifications reflect the potential to support cold-water or warm-water fisheries.

The Tribe has quantified water rights to 500,000 acre-feet per year (AFY) of the natural flow of the Bighorn River, for currently developed uses and new development within the Reservation. In addition to the natural flow, the Tribe is entitled to an allocation of 300,000 AFY of water stored in Bighorn Lake, as measured at the outlet works of Yellowtail Dam. Up to an additional 150,000 AFY of stored water may be used by the Tribe, in the event of a shortage to the Tribe’s natural flow right of 500,000 AFY in the Bighorn River. (Settlement Act, Section 408)

3.3.1 Existing Surface and Ground Water Sources and Water Quality

Water supply for the pilot plant would be via an intake well located at 45°28’23.12”N and 107°44’28.52”W from groundwater under the influence of surface water from the adjacent Bighorn River (Figure 2-1). The

Bighorn River flows north through the reservation from the Montana-Wyoming state line and empties into the Yellowstone River. The Bighorn River is part of the Yellowstone River sub-basin and the Missouri River basin (MTDEQ 2014a). Other surface water resources within the project area include Rottengrass Creek, which is a perennial stream, and an unnamed wetland/intermittent stream. Both pipeline route alternatives cross both of these features in the north half of Section 23 (Figure 2-1).

The Bighorn River above Williams Creek is designated B-1 (supports cold-water fishery) and the Bighorn River mainstem from Williams Coulee to the Yellowstone River is designated B-2 (marginal support of cold-water fishery) (Admin. Rules of Montana, 2014, Rule 17.30.611). The Bighorn River from the north boundary of the Reservation to its mouth (Yellowstone River) is listed by the state as impaired as a result of not meeting water quality standards for lead and mercury (MTDEQ 2014 303(d) list; MTDEQ 2014b). The pilot plant intake/discharge is located north of St. Xavier and south of Williams Coulee. Therefore, the project is in a portion of the Bighorn River designated as B-1 and not listed as impaired.

Groundwater along the bank of the Bighorn River is considered under the influence of surface water. In the fall of 2014, an observation well was installed approximately 100 feet north of the proposed pilot well location. The well is approximately 20 feet in depth and constructed of two-inch PVC/PVC screen. This sample site reflects the anticipated water quality of the raw water proposed for use during the pilot plant study. Sample data that has been collected to date is included in Table 3-2.

Table 3-2: Summary of 2014 Grab Sample Data at Observation Well

	pH	Temp °C	Turbidity (NTU)	ORP (mv)	T. Hardness (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)
Count	7	8	8	7	9	9	9	9
Max	7.83	15	1.33	-37	285	240	0.73	0.77
Average	7.57	11.7	0.61	-42	258	213	0.49	0.75
Min	7.47	9.6	0.27	-54	239	185	0.37	0.72

3.3.2 Direct, Indirect and Cumulative Effects to Water Resources from the Pilot Plant Alternative

Potential effects to water resources as a result of the project include removal and discharge of groundwater during development of the intake well and observations wells and associated aquifer testing; extraction of groundwater for operation of the pilot plant; and discharge of treated water from the pilot plant into the Bighorn River. These effects would all be temporary and minor and would not differ between pipeline route alternatives.

During development of wells, continual dewatering of the boreholes would be necessary. During aquifer testing, water would be pumped at a rate of 500-1000 gallons per minute (GPM) from the intake well until the water ran clear and consistent. The development of the wells would take about one day each and thus would only be a temporary disturbance to the local groundwater aquifer. Once each well is complete, the water table would realign to original levels. Withdrawals of water from the observation wells for sampling would be insignificant.

During operation of the pilot plant, the intake well would extract groundwater at a rate of 60 GPM. This rate is miniscule compared to the Bighorn River flow, of which the well would be influenced, with flows conservatively estimated at 753,086 GPM during the course of the pilot plant study. This estimate was

determined using the minimum monthly flow from May to November 2012 to 2014 (the lowest flow month was October 2012) (USGS 2015). No long-term impacts to the groundwater aquifer are anticipated, due to the relatively minor amount of water which would be withdrawn. The aquifer level is under the influence of surface water flows and would be expected to continuously readjust to near-original levels during the period of withdrawal and to original levels after withdrawal ceases at the end of the study.

The discharge structure for the pilot plant would occur in sufficiently deep water to prevent erosion and sedimentation along the river bank or river bed to protect water quality. During pilot plant operation, clean, treated water would be discharged into the Bighorn at a rate of 26 GPM. The treated water would be of equal or higher quality than the river, therefore, no negative impacts to water quality would occur. The U.S. Army Corps of Engineers was consulted regarding Section 404 of the CWA and determined it was not applicable (Cathy Juhas, Regulatory Project Manager, Joint Application Review, pers. comm. 2014).

No impacts are anticipated to the other surface water features within the project area, since the intake and discharge pipelines would be suspended above Rottengrass Creek and the unnamed wetland/intermittent stream to avoid impacts. There are no federally designated Wild and Scenic Rivers within or downstream of the project area (National Wild and Scenic Rivers System 2015).

Past and present impacts to the water resources of the project area include diversion for irrigation and factors contributing to poor water quality, including natural geology, runoff and irrigation returns, and sedimentation. The Proposed Action is not anticipated to measurably contribute to cumulative effects to water resources because of its temporary nature, the small volume and rate of water required for operation, the avoidance of direct impacts to surface water features, and the implementation of conservation measures as described below to minimize impacts to water quality.

3.3.3 Conservation Measures

Appropriate BMPs, as described here, would be implemented during installation and operation of the intake well and associated aquifer testing facilities to mitigate impacts to water resources. The boreholes for all wells would be done via conventional air-rotary methods with circulation provided by air, unless ground conditions are determined to require injection of water or drilling fluid. If water must be used, this drilling water and the pumped water from aquifer testing would be discharged in a vegetated upland area and allowed to infiltrate into the soil to prevent any impacts to water quality. Following completion of the project, the intake and observation wells would be capped and would no longer impact water resources.

A site-specific SWPPP would be prepared and implemented for the project, which would outline measures and BMPs to minimize and mitigate construction stormwater runoff, sediment discharge, erosion, and spill prevention, as well as notification and corrective procedures. Temporary and long-term erosion and sediment control structures such as silt fence, earth berms, fiber rolls, and straw wattles would be installed and dewatering would be implemented as necessary during and after construction and during reclamation in accordance with the SWPPP. Specific measures would be determined in the preparation of the SWPPP.

Only treated water would be returned to the Bighorn River. Concentrate, backwash, and sediment from flocculation/sedimentation basins would be collected and attenuated in the sludge lagoon rather than discharged to the river. The sludge lagoon would allow for infiltration of the liquid, resulting in groundwater recharge.

3.4 Wetlands

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 do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register 1980).

3.4.1 Existing Wetlands

The intake well and discharge would be located west of an unnamed wetland area and the pilot plant would be located to the east of this area, which extends to the north and south beyond the project area (refer to Figure 2-1). National Wetland Inventory maps developed by the United States Fish and Wildlife Service (USFWS) identify this wetland as a Freshwater Emergent Wetland (USFWS 2014).

3.4.2 Direct, Indirect, and Cumulative Effects to Wetlands from the Pilot Plant Alternative

The unnamed wetland area would be crossed under either pipeline route alternative. To avoid disturbance to vegetation, soils, or hydrology of the wetland, the intake and discharge pipelines would be suspended across the wetland with a cable suspension system and support posts on either side installed outside of the wetland boundary. There is no evidence that the wetland is hydrologically connected to the groundwater of the intake well. Therefore, the project would result in no impacts to wetlands.

The project would have no impacts to wetland acreages with implementation of avoidance and mitigation measures; therefore, the project would not measurably contribute to cumulative effects on wetlands.

3.4.3 Conservation Measures

Open trench and pipe boring construction methods were considered for crossing the wetland area, but the impact to the wetland was determined to be too great. Since the pipelines for this project would be on the ground surface rather than underground, environmental impacts to the wetland would be mitigated by suspending the pipelines across the features rather than using the other methods.

3.5 Vegetation and Land Use

The Tribe does not have any laws that specifically apply to vegetation or plants. However the Crow Tribal Culture Department has a policy that certain plants important for cultural practices be protected from destruction, contamination, and eradication. The policy includes medicinal plants and roots, ceremonial foods, trees (particularly those identified as potential final resting places), and willows along waterways; however, no species lists are provided in the policy (Reed 2002). Many native plants are culturally important to the Tribe and are used for food, medicinal, and religious or spiritual purposes.

3.5.1 Existing Vegetation and Land Use

The project is within the Northwestern Great Plains ecoregion (Montana Central Grasslands), generally characterized as unglaciated semiarid rolling plains and typically used for rangeland (Woods et al. 2002). Agricultural production is restricted to areas near irrigation water sources. The site of the pilot plant/sludge lagoon is intermittently agricultural land supporting cultivated crops. The intake and discharge pipelines cross undeveloped land near the Bighorn River that is used for cattle grazing. The vegetation is a canopy of

scattered cottonwood trees with an understory of shrubs and grasses (S. Simmers, Botanist, Wenck, pers. obs., Nov. 2014).

No plants are listed as threatened or endangered under the Endangered Species Act (ESA) within the project area. 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).

Table 3-3 lists noxious weeds that could occur in Big Horn County (MTDA 2013, BONAP 2014). No lists specific to the Reservation were available. Of these, the noxious weeds observed in the project area during a preliminary survey of the pipeline routes include Canada thistle and cheatgrass. Though not listed as noxious, several other non-native, invasive species are present in the project area, including Russian olive (*Elaeagnus commutata*), Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), Canada bluegrass (*Poa compressa*), crested wheatgrass (*Agropyron cristatum*), and reed canarygrass (*Phalaris arundinacea*) (S. Simmers, Botanist, Wenck, pers. obs., Nov. 2014). No acreage estimates or exact locations are available for these species in or surrounding the project area.

Table 3-3: Noxious Weed Species Listed in Big Horn County, Montana

Priority	Description of Priority Status	Listed Plant Species*
2A	Common in isolated areas of Montana	Perennial pepperweed (*Lepidium latifolium*)
2B	Abundant in Montana and widespread in many counties	**Canada thistle (*Cirsium arvense*)**
		Field bindweed (*Convolvulus arvensis*)
		Leafy spurge (*Euphorbia esula*)
		Whitetop (*Cardaria draba*)
		Russian knapweed (*Rhaponticum repens*)
		Spotted knapweed (*Centaurea stoebe*)
		Diffuse knapweed (*Centaurea diffusa*)
		Dalmation toadflax (*Linaria dalmatica*)
		St. Johnswort (*Hypericum perforatum*)
		Sulfur cinquefoil *(Potentilla recta*)
		Common tansy (*Tanacetum vulgare*)
		Houndstongue (*Cynoglossum officinale*)
		Yellow toadflax (*Linaria vulgaris*)
		Saltcedar (*Tamarix spp*.)
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*)**

*Species in bold are known within project area. Source: BONAP 2014, MTDA 2013

3.5.2 Direct, Indirect and Cumulative Effects to Vegetation and Land Use from the Pilot Plant Alternative

During operation of the pilot plant, the agricultural production of the land would be temporarily reduced by 8 acres due to the placement of the pilot plant and sludge lagoon site. This would be a short term impact

during the pilot plant study timeframe. In the recent growing seasons, the agricultural area that would be impacted has not been seeded. The date of last agricultural use is unknown. However, the potential for agricultural production would resume in the 2016 growing season. The land use of the undeveloped land would not be impacted as part of this project.

Construction activities associated with pipeline installation and removal would include placement of the pipe on the ground surface and potentially driving a skid steer to bring pipe materials to necessary locations for installation. These activities would lead to vegetation surface disturbance due to compaction and leveling, but not direct removal. The maximum area of possible surface disturbance would total 55 acres for the preferred pipeline route and 57 acres for the alternate pipeline route (Figure 2-1).

Soil stripping and vegetation removal activities are expected to be limited to the pilot plant/sludge lagoon site and the Mission Loop road crossing, an area encompassing a maximum of eight acres. These areas consist of either cultivated agricultural land or previously disturbed vegetation in road ditches. Removal of limited number of trees may be required to lay the pipeline of either route. If removal is necessary, the BIA, Tribal Forestry Department, and Crow Tribal Historic Preservation Office (THPO) would be consulted for guidance on required pre-construction surveys and restrictions.

The project would not impact potential areas of culturally significant wetland or grassland plants since the pipelines would be suspended above the wetland areas and the pipeline would be laid on the surface through native understory grassland communities. No ESA-listed plants would be affected since none occur in the project area.

Construction equipment could spread seeds or root fragments of noxious weeds or invasive plants in the project area. Soil-disturbing activities would potentially disturb and expose buried seed banks of noxious weeds. Bare soils provide an environment where noxious weeds typically establish and thrive, whether seeds of the species were already present or are newly dispersed into the area.

Past and present cumulative impacts to vegetation in the project area are primarily related to farming and ranching, having contributed to conversion of native plant communities and introduction of noxious or invasive plants. This project would result in surface disturbance to areas that currently experience disturbance from livestock grazing. Vegetation removal has been limited to previously disturbed areas. With the implementation of conservation measures described below to restore temporary impacts to land use and to avoid or minimize the spread of noxious/invasive species, the project would not measurably contribute to cumulative effects to vegetation and land uses.

3.5.3 Conservation Measures

Following completion of the pilot project, the disturbed land used for the pilot site would be returned to its original state, thus avoiding long term impacts to land use. Solids in the sludge lagoon would be analyzed to determine the appropriate disposal method, either incorporation into the soil or removed to an approved landfill. The lagoon would be filled and seeded with a cover crop to prevent erosion unless near-term agricultural use is planned. Other site disturbance, such as gravel staging and parking areas, would be reclaimed by removing any fill, subgrade or gravel surfacing material placed during construction. For further details see the *Decommissioning and Reclamation Plan* in Appendix C.

Prior to construction, a survey would be completed detailing location and areas of noxious weeds, as allowed by surface conditions. The BIA would be notified of any noxious weeds found. If noxious weeds are

found on site, disturbance to those areas would be avoided and the populations would be treated according to BIA guidelines.

During construction, contractors would follow the Reclamation's *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species* (DiVittorio et al. 2012). In addition, revegetation following construction and reclamation activities would mitigate the introduction or spread of noxious weeds by minimizing the time disturbed soils are exposed. When construction is complete, seeding and mulching would be done in non-cultivated areas where soil has been disturbed. Seedbed preparation would include removal or treatment of noxious weeds or infested topsoil. Seeding mixtures would be determined through consultation with the BIA Natural Resource Group and would include native species.

3.6 Fish and Wildlife

Section 2 of 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 with other project purposes and will be coordinated with other features of water resources development projects.

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 and/or adversely modify their habitat. 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 which requires that animals used in religious rights and ceremonies or used as ceremonial food be protected from injury and extinction (Reed 2002). In 2002, the Crow Tribal Legislature designated Yellowstone cutthroat trout a "species of special concern" on the Crow Reservation under Joint Action Resolution number JAR0231 (Crow Tribal Legislature 2002). Other than this species, lists of Crow Tribal Fish and Game Commission designated species were not available.

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711), Executive Order (E.O.) 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. E.O. 13186 requires all federal agencies support the conservation intent of migratory bird conventions and integrate bird conservation principles into their activities.

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.

3.6.1 Existing Fisheries and Wildlife

The Bighorn River area supports aquatic communities comprised of native species and popular, introduced sport fisheries. Due to the construction of Yellowtail Dam and the release of cold, clear, nutrient rich water, the Bighorn River supports a world class tailwater fishery for rainbow and brown trout from Fort Smith to Hardin. Some headwaters of the Bighorn River support native Yellowstone cutthroat trout, however the

tailwaters of the project area do not provide habitat for this species. Management of the Bighorn River fishery is accomplished through adjustment of outflow and retention of water at the Yellowtail Dam.

Many animal species important to the Tribe are common in Bighorn County and potentially exist in or near the undeveloped riparian woodland of the project area along the Bighorn River, including deer, badger, coyote, eagles, hawks, and other birds.

Migratory birds and bald and golden eagles migrate or reside in southeastern Montana, potentially 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 (MFWP 2014a). 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 (MFWP 2014b). Due to the habitat preference of bald and golden eagles, it is unlikely they would nest within the project boundary. No bald or golden eagle nests were present along the proposed pipeline routes during a preliminary survey of the project area (D. Ackerman, Wildlife Biologist, Wenck, pers. obs., Nov. 2014).

There is the potential for one federally-listed endangered species and two candidate species to be present within Bighorn County (Table 3-4) (USFWS 2014). The project area consists of agricultural land and riparian woodland and would thus not provide necessary habitat for any of these three species.

Table 3-4: Threatened, Endangered and Candidate Species in Bighorn County

Species	Scientific Name	Status	Range in Montana
Black-footed ferret	*Mustela nigripes*	Endangered	Prairie dog complexes; Eastern Montana
Greater sage grouse	*Centrocercus urophasianus*	Candidate	Eastern, central and southwestern Montana in sagebrush, sagebrush-grasslands, and associated agricultural lands.
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland habitats with little or no shrub cover east of the Continental Divide.

Source: USFWS 2014

3.6.2 Direct, Indirect and Cumulative Effects to Fisheries and Wildlife from the Pilot Plant Alternative

Operation of the pilot plant would remove a small net volume of water from the groundwater aquifer and associated Bighorn River; the majority of the intake water removed would be replaced by discharge of clean, treated water into the river. This minor amount of water would not measurably reduce instream flow and thus would have no effect on the existing fisheries in the Bighorn River.

During construction and reclamation activities, there is potential for sediment-laden runoff from excavated areas of the site to eventually reach drainages within or adjacent to the project area, which could temporarily impact water quality and affect fisheries and aquatic life. For several reasons, this likelihood is very low. No excavation areas are within or immediately adjacent to drainages. Excavation would occur in a relatively small area of eight total acres and erosion control would be in place to minimize sediment migration off-site. The discharge and discharge structure would have no impact to fisheries in the Bighorn River due to the nature of the discharge water (treated water of higher quality than Bighorn River water) and due to the design of the discharge structure above the water surface with insignificant flow (Mike Ruggles, Montana Fish, Wildlife, and Parks Fisheries Specialist, pers. comm. 2014).

Though wildlife species of concern, including migratory birds, eagles, and culturally significant wildlife, have the potential to occur in the project area, no population-level effects are expected to result from project actions. No direct mortality and minimal, if any, removal or disturbance to potential wildlife habitat in the project area would occur from project construction. No large numbers of wildlife are expected to be affected; and no significant adverse impacts are anticipated for any one species or species group. Indirect impacts could be result from displacement from habitat due to construction activity, noise, visual interference, or human presence. Displacement would be temporary, limited to the duration of the pilot project with an expected maximum of five months.

The nearest federally designated wilderness area is the Cloud Peak Wilderness, over 60 miles southeast of the project within the Bighorn National Forest (Wilderness.net 2015). No project actions would affect the wilderness area at such a distance.

The project would not measurably reduce instream flow of the river and would have temporary and localized impacts to wildlife and terrestrial habitat with no direct, long-term, or population-level effects. With the implementation of conservation and reclamation measures described below to further minimize temporary indirect effects to water quality and habitat, the project would not measurably contribute to cumulative effects on wildlife from other actions.

3.6.3 Conservation Measures

Water discharged to the Bighorn River would meet the requirements set forth in the NPDES permit from the EPA. As such, the discharged water would meet necessary requirements to not be detrimental to existing fisheries. Implementation of construction BMPs such as silt fences or other measures identified within the project SWPPP would ensure sedimentation impacts are minimized and localized to the immediate project work area.

A pre-construction survey would be completed to ensure no nests or habitat necessary for any of the protected or culturally significant animals would be affected by the project. After construction, disturbed areas would be reclaimed; vegetation would re-establish and provide habitat within one to three growing seasons.

3.7 Historic Properties and Culturally Sensitive Areas

Cultural resources encompass sites, objects, or practices of archaeological, historical, cultural and religious significance that are protected under various laws and regulations. The proposed project area is located entirely on the Crow Reservation and, as such, the project should proceed with particular sensitivity to Crow culture and heritage.

Section 106 of the National Historic Preservation Act (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 2013). The THPO also issues permits for excavation and construction projects within the boundary of the Crow Reservation (Crow THPO 2013). The Native American Graves Protection

and Repatriation Act (NAGPRA) of 1990 allows tribes to protect American Indian graves and to repatriate human remains; it applies to all developments regardless of the funding source.

3.7.1 Existing Cultural Resources

Three Class III Cultural Resource Inventories have been completed for the project to identify any cultural, historical, or sacred sites within proposed areas of disturbance (SWCA 2014; SWCA 2015a and 2015b). The inventories identified eleven irrigation features associated with the Bighorn Unit of the Crow Irrigation Project (CIP), three isolated finds, and one previously recorded archaeological site within the project area.

3.7.2 Direct, Indirect and Cumulative Effects to Cultural Resources from the Pilot Plant Alternative

The eleven features associated with the CIP include a culvert and associated ditch, an inlet/drain, seven irrigation ditches, and two road crossings on the upper terrace east of Rottengrass Creek. The culvert and inlet drain features are near the pilot plant site. One of the irrigation ditches would be crossed by both the preferred and alternate pipeline routes. Another irrigation ditch is to the north of the preferred pipeline route; whereas the remaining five ditches are crossed or run near the alternate pipeline route. The road crossings are also near the alternate pipeline route. These features would not be impacted by the project (SWCA 2014; SWCA 2015a and 2015b).

The three isolated finds were considered insignificant and ineligible for the NRHP and would not be impacted by the project (SWCA 2015b).

The previously recorded site is a collection of historic outbuildings located about 0.1 mile southwest of the pilot plant site. Because the site was associated with the construction of the original CIP, it has likely contributed to the eligibility of the CIP for the NRHP. The alternate pipeline route would cross the northern edge of the site boundary. However, because the pipeline route would avoid outbuildings and features on the site and would be above ground with no construction disturbance, the site would not be impacted by the project. (SWCA 2015b, and George Shannon, Reclamation Regional Archeologist, pers. comm. 2014).

With the stipulation described below (Section 3.7.3) being met, the construction would not impact any known significant cultural resources, and a finding of *No Historic Properties Adversely Affected was* recommended for the project. The three Class III reports for the project (SWCA 2014, 2015a, 2015b) were submitted to THPO for concurrence and to obtain further guidance for mitigation and necessary permits. THPO concurred with Reclamation's determinations in early 2015.

The project would have no direct or indirect effects to cultural resources and therefore would not contribute to cumulative effects.

3.7.3 Conservation Measures

If cultural resources or burial sites are discovered during construction activities, work would be stopped immediately, the site secured, and the THPO 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. Project workers would be prohibited from collecting artifacts or disturbing cultural resources in any area, under any circumstances.

3.8 Paleontological Resources

The 2010 Paleontological Resources Preservation Act does not apply on Reservation lands; however, paleontological resources on the reservation are treated as a Trust asset because of their potential commercial value.

3.8.1 Existing Paleontological Resources

The project area is in alluvial sediments that are not fossiliferous, categorized as having "low fossil potential" (BLM 2011).

3.8.2 Direct, Indirect and Cumulative Effects to Paleontological Resources from the Pilot Plant Alternative

Since the project involves soil-disturbing activities, there is potential for encountering paleontological materials during construction or reclamation. However, the likelihood of disturbing fossils is low because of the low fossil potential of alluvial soil materials and because of the limited area of soil excavation, a maximum of eight acres. No direct, indirect, or cumulative impacts are expected and no conservation measures are necessary.

3.9 Environmental Justice

E.O. 12898 (1994) 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. Environmental Justice also relates to existing hazards that may affect the health of individuals or communities, especially those with low incomes.

3.9.1 Existing Hazards to Minority and Low Income Populations

The reservation population is both a minority and low income population, consisting of an American Indian population at an economic disadvantage compared to surrounding communities. In comparison to surrounding counties and census populations, the Reservation has a higher percentage of individuals living below the poverty level, a lower median household income, and a higher unemployment rate (US Census Bureau 2009-2013).

Existing hazards within or near the reservation include hazardous waste generators regulated by Resources Conservation and Recovery Act and potentially contaminated Brownfield sites. Brownfield sites are properties which may be contaminated with a hazardous substance or pollutant. The EPA has a program to assess, clean up, and rehabilitate these sites (USEPA 2012). The city of Hardin, approximately 20 miles from the project area, has twelve hazardous waste generators, two Brownfield sites, and the City of Hardin Class II landfill (i.e. non-hazardous waste) (USEPA 2014a and 2014b). One Brownfield site is located in Lodge Grass, about 20 miles from the project area (USEPA 2014a). The nearest Superfund site is in the city of Billings, over 40 miles northwest from the project area (USEPA 2014a). Superfund sites are abandoned hazardous waste sites with cleanup funded under an EPA program (USEPA 2013).

3.9.2 Direct, Indirect and Cumulative Effects to Minority and Low Income Populations from the Pilot Plant Alternative

No adverse or disproportionately negative impacts are anticipated to the minority and low income population of the reservation. Existing hazardous sites or facilities on or near the Reservation are not in proximity to the project area and would not be affected by the pilot plant study, nor would any of those sites have an effect on the proposed project. The project would generate sludge waste consisting of concentrate, backwash, and sediment from flocculation/sedimentation basins. This waste would be attenuated in the sludge pond and disposed of properly, either through incorporation into the soil or at an approved landfill. Therefore, no negative health or environmental effects to minority or low income populations are anticipated and the project would not contribute to cumulative effects to the communities.

3.10 Indian Trust Assets

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, culturally important resources (fish and wildlife, vegetation, etc.), hunting and fishing rights, water rights, and in-stream flows. ITAs may be located on or off-reservation lands. This policy reaffirms the legal trust relationship and the government-to-government relationship between the Secretary of the Interior and Indian tribes. This project is being initiated and completed by the Tribe with the broad purpose of benefitting the Tribe and tribal members.

3.10.1 Direct, Indirect and Cumulative Effects to Trust Assets from the Pilot Plant Alternative

No adverse or disproportionately negative impacts are anticipated to Trust resources. While the pilot plant alone would not have a large positive impact on the Tribe and their assets, it would aid in the construction of a drinking water treatment plant and associated distribution system with a large positive and cumulative impact. Using a pilot plant study prior to construction of a full scale treatment facility contributes to more informed decision making and planning, which often results in cost savings and reduced impacts to resources. Short-term employment for construction workers, of Indian preference, would be generated due to construction of the pilot plant. Monitoring and testing associated with the pilot plant would also generate short term employment. Therefore, overall positive effects to property and resources of the Tribe are anticipated under the Pilot Plant Alternative.

4.0 Compliance with Environmental Statutes

The proposed project would comply with the following federal and tribal statutes and orders, as well as state statutes pertaining to the Bighorn River. The relevance of these laws to the project is explained under individual resource discussions and analysis. All required permits and necessary authorizations would be obtained prior to construction.

Federal

- American Indian Religious Freedom Act (P.L. 95-341)
- Archaeological Resources Protection Act of 1979 (P.L. 96-95)
- Archaeological and Historic Preservation Act of 1974 (P.L. 93-291)

- Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines (Federal Register, Vol. 48, No.190, 1983, pp. 44716 to 44740)
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250)
- Clean Air Act (42 U.S.C. §§ 7401-7671q) and Amendments of 1970
- Clean Water Act (33 U.S.C. 1251 et seq.)
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (P.L. 96-510)
- Endangered Species Act of 1973 (P.L. 93-205), 16 U.S.C. Sections 1531-1544
- Executive Order 11593, 1971 (Protection and Enhancement of the Cultural Environment) (16 USC 470)
- Executive Order 11988 (Floodplain Management, 1977)
- Executive Order 11990 (Protection of Wetlands, 1977)
- Executive Order 12898 (Environmental Justice, 1994)
- Executive Order 13112 (Invasive Species Control, 1999)
- Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds, 2001)
- Farmland Protection Policy Act of 1981
- Federal Water Protection Recreation Act of 1965 (P.L. 89-72)
- Fish and Wildlife Coordination Act of 1958 (P.L. 85-624, as amended, and 40 CFR 1502.25)
- Indian Trust Policy (July 2, 1993)
- Migratory Bird Treaty Act (16 U.S.C. 703-711),
- National Historic Preservation Act of 1966, as amended through 1992 (P.L. 89-665 and P.L. 96-515)
- National Invasive Species Act of 1996
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001 et seq.) and 43 CFR Part 10 – Native American Graves Protection and Repatriation Act Regulations
- Paleontological Resources Preservation Act of 2010
- Rivers and Harbors Act of 1890, Section 10 Permit
- 36 CFR 60.4 – National Register Criteria
- 36 CFR 79 – Curation of Federally Owned and Administered Archeological Collections
- National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee (Refuge Administration Act)

Tribal

- Crow Law and Order Code (CLOC) 12-5-108 Protection of Species Designated by Crow Tribal Fish and Game Commission
- CLOC 12-7-110 and 111 Protection of Migratory Birds
- CLOC 12-7-110 Protection of Bald and Golden Eagles
- Crow Tribal Legislature Joint Action Resolution JAR0231 Designation of Yellowstone Cutthroat Trout "Species of Special Concern"
- Crow Tribal Culture Department Policy protecting culturally important plants
- Crow Tribal Culture Department policy protecting ceremonially important animals

State
These state laws would potentially apply to resources within the banks of the Bighorn River pursuant to the ruling from Montana v. United States, 450 U.S. 544 (1981).

- Montana Water Quality Act (Title 75, Ch. 5)
- Montana Stream Protection Act (SPA 124 Permit)
- Montana Natural Streambed and Land Preservation Act (310 Permit)
- Short-term Water Quality Standard for Turbidity (318 Authorization)
- Montana Floodplain and Floodway Management Act
- Montana Land-Use License or Easement on Navigable Waters

5.0 Consultation and Coordination

The following persons and agencies were consulted as part of permitting, developing this EA, or aspects of conservation or reclamation measures for the proposed pilot plant.

- BIA Crow Agency Office, Crow Agency, MT
- Bureau of Reclamation Regional Office, Billings, MT
- Crow Tribe Tribal Historic Preservation Office, Emerson Bull Chief, Crow Agency, MT
- Crow Tribe Water Resource Department, Crow Agency, MT
- EPA, Denver, CO
- Montana Fish, Wildlife, and Parks, Mike Ruggles, Fisheries Specialist, Billings, MT
- NRCS Crow Agency Field Office, Crow Agency, MT
- NRCS Hardin Field Office, Hardin, MT
- US Army Corps of Engineers, Cathy Juhas, Billings Regulatory Office, Billings, MT

6.0 List of Preparers

The following individuals contributed to preparation of this EA (Table 6-1).

Table 6-1: List of Preparers

Affiliation	Name	Title	Project Role	Years of Experience
Reclamation	Christina Gomer	Environmental Specialist	Coordination of ESA informal consultation, Content review	7.5
	George Shannon	Regional Archeologist	Cultural review	41
BIA	Robin Stewart	Regional Environmental Specialist	Environmental review	unavailable
	John Hill	Natural Resource Officer	Environmental review	unavailable
CTWRD	Titus Takes Gun	Director	Coordination	7
Crow THPO	Emerson Bull Chief	Crow Tribal Historic Preservation Officer	Historical Review	unavailable

Affiliation	Name	Title	Project Role	Years of Experience
Bartlett & West	Colin Nygaard, P.E.	Project Manager	Project Management and Coordination	9
	Jodie Binger, P.E.	Project Engineer	Primary Author	4
	Chris Maus	Project Engineer	Scoping Coordination	2
	Xuejiao Rich	GIS Specialist	Map Production	2
Wenck Associates, Inc.	Sara Simmers	Natural Resource Specialist, Botanist	QA/QC, Contributing author, Preliminary Vegetation Survey	8
	Daniel Ackerman	Wildlife Biologist	Preliminary Wildlife/Nest Survey	15

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