Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana

APPENDIX B – COST ENGINEERING

Lower Yellowstone Intake Fish Passage EIS

MAY 2016

Contents

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ATTACHMENTS

1.0 Alternative Construction Cost Estimates

This appendix accounts for the development of five, comparable alternative construction cost estimates. These estimates have all been developed using the Micro-Computer Aided Cost Estimating System (MCACES) software in order to develop detailed unit prices. The estimates have been prepared by various estimators and all estimating assumptions are discussed in detail in subsequent sections of this appendix.

1.1 General

This project is located on the Yellowstone River approximately 17 miles northeast of Glendive, Montana. There is currently an Intake Diversion Dam and Diversion Headworks that provides water for the Lower Yellowstone Irrigation Project's (LYIP) main canal. This canal diverts water on the north side of the river and continues for approximately 71.6 miles delivering water primarily for agricultural use.

The existing diversion dam is presumed to be a complete barrier to the endangered pallid sturgeon, due to the increased turbulence and velocities associated with the rock that forms the dam and the boulder field found immediately downstream of the dam. Monitoring of the pallid sturgeon has indicated that they are unable to move upstream beyond the existing intake dam.

Each of the five proposed action alternatives aim to improve fish passage for the endangered pallid sturgeon and other native fish as well as reduce entrainment of fish into the LYIP main canal. Each of the construction alternatives would contribute to recovery of the pallid sturgeon by increasing access to an additional 165 miles of habitat along the Yellowstone River for migration, spawning and development.

1.2 Purpose

The purpose of this work is to develop total project cost estimates – consistent with the conceptual level designs - for the five construction alternatives.

1.3 Design Alternatives

The project includes five action alternatives and the no action plan. As noted, each of the action alternatives are designed to provide improved fish passage through and/or around the existing Intake Diversion Dam location. The following is a brief description of the alternatives. Subsequent sections of this appendix will

discuss in greater detail the construction elements and assumptions for each alternative.

- **No Action** – This alternative does not assume any new construction would be completed. The existing Intake Diversion Dam would remain in place without any modifications.

- **Rock Ramp** – This alternative would replace the existing rock and timber crib structure of the existing intake diversion dam with a concrete weir and a shallow-sloped, un-grouted boulder and cobble rock ramp.

- **Bypass Channel** - This alternative would construct a new bypass channel on Joe's Island, south of the existing Intake Diversion Dam. This alternative would also include replacing the Intake Diversion Dam with a concrete weir.

- **Modified Side Channel** – This alternative would create a fish bypass channel using the existing 'high flow channel' that runs south of the existing Intake Diversion Dam. The existing channel would be modified to allow for more frequent flows to pass through. The existing Intake Diversion Dam would remain in place.

- **Multiple Pump** - This alternative would remove the existing Intake Diversion Dam and construct five pump stations on the Yellowstone River to deliver water to the Lower Yellowstone Irrigation Project main canal. The pump stations would be designed to provide the same amount of water as is currently being diverted by the dam.

- **Multiple Pumps with Conservation Measures** - This alternative would include several new construction components that would allow for the removal of the existing Intake Diversion Dam along with conservation measures to lessen the water required to be diverted. These construction components include implementation of water conservation measures, shallow ground water pumping, gravity diversions and use of wind energy to offset pumping costs. The conservation measures would consist of installing new check structures, flow measuring devices, modifying existing laterals to pipes, center pivot sprinkler installation, lining the main canal, control over checking and groundwater pumping.

1.4 Alternative Design Levels

Two of the proposed alternatives have been initially designed and estimated by the Omaha District prior to this current study. These alternatives include the Rock Ramp and Bypass Channel. The Rock Ramp alternative has been designed to a conceptual level while the Bypass Channel has previously been designed and

estimated to the 100% design level. Thus the Bypass Channel has much more certainty and has far less chance of future changes, if any.

The remaining three expanded alternatives have been designed only to a conceptual level. These alternatives still have many investigations outstanding that could change many of the assumptions used in both the designs and estimates. Moving into future design phases with any of these alternatives would allow for development of more integrated hydraulic, geotechnical and other technical studies such that many assumptions here within would be modified as necessary.

1.5 Estimates for Comparison Purposes

Given that some of the estimates have been previously completed and/or designed to different levels of detail, each of the five proposed alternative estimates have been newly developed or updated in order for the total project costs to be comparable. These modifications include the updating of price levels based on USACE Civil Works escalation factors, modifying contingencies to reflect associated risks at the estimates' current design levels, and attempting to maintain similar assumptions across all five alternatives. The following sections discuss each of these items in more detail as they relate to each of the five alternatives.

2.0 Initial Alternatives

This section discusses the changes made to the cost estimates of the two initial alternatives such that they would be comparable with three newly proposed alternatives. The two previously estimated alternatives, Rock Ramp and Bypass Channel, were developed by USACE, Omaha District (NWO). For this current study, the primary modifications to these two estimates is to escalate the total costs per the Civil Works Construction Cost Index System (CWCCIS) found in EM 1110-2-1304, and to incorporate an updated abbreviated risk analysis contingency mark-up. The following section is a discussion of these two alternatives and the assumptions made to complete the necessary price level updates for inclusion into a Total Project Cost Summary (TPCS).

2.1 Detailed Alternative Descriptions

2.1.1 Rock Ramp

The Rock Ramp alternative would replace the existing rock and timber crib structure at the Intake Diversion Dam with a concrete weir and a shallow-sloped, un-grouted boulder and cobble rock ramp. The rock ramp would be designed to mimic natural river function and would have reduced velocities and turbulence so that migrating fish could pass over the dam, thereby improving fish passage and contributing to ecosystem restoration.

The replacement concrete weir would approximately 40 feet upstream of the existing weir, and would create sufficient water height to divert 1,374 cfs into the main canal. The cast-in-place reinforced concrete weir would replace the existing timber and rock-filled dam and would provide long-term durability that is lacking in the current structure. The weir crest would vary in elevation, including at least one low-flow channel for fish passage. The historic headworks would be preserved in placed and would serve as a weir abutment on the north bank, while a concrete abutment would be constructed on the south bank. The downstream side of the weir would tie directly into the rock ramp to provide a seamless transition and unimpeded fish passage.

The rock ramp would be constructed downstream of the replacement weir by placing rock and fill material in the river channel to shape the ramp, followed by placement of rock riprap. The new ramp would be constructed over the site of the existing Intake Diversion Dam, preserving most of the historic dam in place. The new ramp would include at least one low flow channel in conjunction with the low flow channel on the weir crest. The rocks in the ramp would be sized to withstand high flows and ice jams and would range from 1 – 4 feet in diameter. The rock would be purchased from commercial quarries in either Wyoming or

Minnesota and likely delivered by train to Glendive before being trucked to the project site.

Staging and rock stockpile areas would be located downstream of the headworks and another construction zone would be located on the Joe's Island side of the dam. Haul roads and a temporary crossing over the main canal would need to be constructed to prevent damage to the existing county bridge.

2.1.2 Bypass Channel

The Bypass Channel alternative would construct a bypass channel on Joe's Island from the inlet of the existing high flow chute to just downstream of the existing dam and rubble field. It would also replace the existing Intake Diversion Dam with a concrete weir. The placement of the bypass channel is thought to allow fish better access to the channel and increase their abilities to migrate upstream of the intake dam.

The bypass channel would be designed to divert approximately 13-15% of total Yellowstone River flows. Significant quantities of excavation would be required to create the channel. The excavated material is assumed to be disposed of all within Joe's Island, and therefore no material would be required to be hauled off-site. Sheet pile cofferdams would be required to complete the channel construction. Two vertical control structures would be constructed within the bypass channel. These structures would consist of riprap and would give the appearance of a seamless channel invert while providing stability during extreme events. The bypass channel would also require stone placement for bank protection and on the channel bed to minimize the risk of erosion. The riprap for the bank protection would be purchased from acceptable quarries and transported to the project site, while the bedding stone is assumed to be screened from the excavation of the bypass channel.

The concrete weir would be constructed approximately 40 feet upstream of the existing dam. The new weir would provide adequate water surface elevations for splitting the river flow into the new bypass channel and also ensuring delivery of irrigation water. The weir would consist of a cantilevered structural wall created by a deep foundation of either driven piles or drilled shafts with a concrete cap. Fill would be placed between the new weir and the existing rock weir, and the new crest would contain at least one low-flow channel for fish passage.

2.2 Basis of Estimates

2.2.1 Rock Ramp

The MCACES construction cost estimate was completed by the NWO during previous alternatives analysis for this project. The MCACES estimate provided by the NWO for use in this current study was completed in April 2011. For inclusion in the economic analysis, the estimate has been escalated to a current pricing date of April 2016. The Civil Works Construction Cost Index System (CWCCIS) escalation factors were used in the escalation of the construction costs. The CWCCIS factors calculate to an approximate 8.25% increase to each feature account. The original MCACES costs along with the escalation factors and current total costs are provided in Table 2.1.

Table 2.1 Rock Ramp Escalation Factors and Cost Updates

Feature Account	Item Description from MCACES	Original Costs (3Q11)	CWCCIS Factor (3Q11)	CWCCIS Factor (3Q16)	Current Costs
06	Coffer Dam	$3,850,361	740.70	801.79	$4,167,924
06	Rock Ramp	$42,351,677	740.70	801.79	$45,844,675
06	Remaining Site Work	$939,069	740.70	801.79	$1,016,520
15	Concrete Crest Structure	$8,268,256	740.70	801.79	$8,950,189
				Total Construction Cost:	$59,979,308
				Total Escalation Percent:	8.25%

2.2.2 Bypass Channel

A MCACES construction cost estimate developed in accordance with final design plans has been developed by NWO. However, this estimate was set up in accordance with the bid schedule, and therefore did not include sorting into CWCCIS feature accounts. Therefore it was decided that the 90% estimate, which still contained costs sorted into feature accounts, would be used for the purposes of completing the analysis for this study.

This 90% MCACES construction cost estimate was prepared in February 2015 by NWO. For inclusion in the current economic analysis, the estimate has been escalated to a current pricing date of April 2016. The CWCCIS escalation factors were used in the escalation of the construction costs. The CWCCIS factors calculate to an approximate 1.93% increase on total construction costs. The original MCACES costs along with the escalation factors and current total costs are provided in Table 2.2.

Table 2.2 Bypass Channel Escalation Factors and Cost Updates

Feature Account	Item Description from MCACES	Original Costs (2Q15)	CWCCIS Factor (2Q15)	CWCCIS Factor (3Q16)	Current Costs
09	Bypass Channel	$17,707,099	845.53	861.75	$18,046,778
15	Intake Weir	$12,065,928	788.66	801.79	$12,266,807
16	Bank Stabilization Rock	$18,714,085	837.55	855.31	$19,110,912
				Total Construction Cost:	$49,424,497
				Total Escalation Percent:	1.93%

2.3 Total Project Cost Summary (TPCS)

The escalated costs have been input into the latest version of the TPCS Excel spreadsheet provided by the USACE, Walla Walla District. The TPCS incorporates the projects constructions costs, project markups, and functional costs. The escalated prices shown in the Table 2.1 and Table 2.2 have been input into the TPCS and have been escalated to both the program year (FY17) and the midpoint of construction per the project schedule. The TPCS spreadsheets are provided in Attachment B.1.

2.4 Project Schedules

The durations used for the construction components are based on discussions and schedules previously developed. These discussions and scheduling information are from the following documents.

- Intake Diversion Dam Modification, Lower Yellowstone Project, Final EA (2010).
- Intake Diversion Dam Modification Project, Cost Appendix, Summary of Fish Passage Design Features (2012).

From the discussion and information within these two reports, simplified project schedules have been developed for use in this study. The tentative project schedules are provided in Attachment B.2 and are based on the following assumptions:

- The Bypass Channel alternative does not include a design phase, as this alternative has already been fully designed. Thus construction could begin much sooner than the other alternatives.
- Assumes design phase of the Rock Ramp alternative would begin in May of 2016.

- Construction would begin in May of 2016 for the Bypass Channel, and May of 2018 for the Rock Ramp alternative.

2.5 Functional Costs

2.5.1 01 Account – Lands and Damages

There are currently no costs assumed for this account, as the NWO did not include real estate costs in their original analysis. However, based on estimated real estate costs developed for other alternatives in this current study, it is not likely that real estate costs would be significant. Therefore, no costs for this account have been added.

2.5.2 02 Account – Relocations

No relocations items were included in the original NWO estimates for either alternative. Therefore no costs are included in either estimate for this feature account.

2.5.3 06 Account – Fish and Wildlife Facilities

In addition to the construction costs, costs for monitoring and adaptive management during construction have been included in the TPCS. These costs are currently estimated at 1.0% of total construction costs.

2.5.4 30 Account – Planning, Engineering and Design (PED)

Costs for this account were estimated as percentages of construction costs for the various feature accounts. This account covers planning, engineering and design including; preparation of plans, specifications, and engineering during construction. The current estimate assumes 9.0% of construction costs for this account for the Rock Ramp alternative. This value is the same percentage used by the NWO in previous analysis on this project.

No PED markup is included for the Bypass Channel alternative. This is due to this alternative already having 100% design plans developed. Thus, no further PED expenditures would be required for this alternative to proceed to construction.

2.5.5 31 Account – Construction Management (CM)

Costs for this account were estimated as percentages of construction costs of the various feature accounts. This costs is assumed to cover construction management

during the construction phase. The current estimate assumes 6.0% of construction costs for this account. This value is the same percentage used by the NWO in previous analysis on this project.

2.6 Project Markups

2.6.1 Escalation

After the MCACES construction costs for both alternatives have been escalated to current prices (3Q16), the costs have been escalated to the program year (1Q17) as well as to the midpoints of construction to estimate the fully funded project cost. The appropriate escalation cost factors for each date and for each feature account have been calculated within the Total Project Cost Summary.

2.6.2 Contingency

An Abbreviated Risk Analysis (ARA) was completed in order to develop the contingency percent used for each alternative. The separate calculated contingencies for construction, PED and CM were used within the TPCS for both alternatives. The ARA documents for these alternatives are found in Attachment B.3.

The overall project contingency for the Rock Ramp is currently 31.0% and the overall project contingency for the Bypass Channel is 8.8%. The Bypass Channel contingency is significantly lower due to the fact that the estimate is based on 90% design plans. Therefore, at this level of design, most risks have been mitigated in the design, and funding streams are already in place.

3.0 Expanded Alternatives

This section discusses the three alternatives that have recently been designed and estimated for use in this study. Each of these three alternatives (Modified Side Channel, Multiple Pump Stations, and Multiple Pumps with Conservation Measures) have been designed to a conceptual level and estimated by Tetra Tech. The following sections discuss each alternative and the assumptions used in the development of MCACES construction cost estimates and TPCS documents such that they are comparable to the Initial Alternatives.

3.1 Detailed Alternative Descriptions

3.1.1 Modified Side Channel

The Modified Side Channel alternative would improve fish passage by creating a fish bypass using the existing "high flow channel." Pallid sturgeon have been documented to pass through the existing high flow channel in previous years. Therefore if the existing channel is constructed to allow for additional and more frequent flows, then it would also provide greater fish passage.

The construction required to allow for additional flow would require the creation of approximately 6,000 feet of new channel. The new channel sections would cutoff several existing bends and create new backwater areas. The entire high flow channel would be lowered significantly and would require bank protection in several areas as well as five grade control structures.

3.1.2 Multiple Pump

The Multiple Pump alternative proposes removing the Intake Diversion Dam, using the existing headworks when there is sufficient flow in the Yellowstone River to gravity divert the required flows, and constructing five pumping stations along the banks of the Yellowstone River to deliver water to the Lower Yellowstone Irrigation Project to be operated when gravity flows are insufficient. The pumping plants would be constructed at various locations along the Lower Yellowstone River between Intake Dam and Savage. The intakes would be screened to minimize fish entrainment and would discharge into existing canals to supply the irrigation districts. Because the irrigation canal system was designed for gravity flow of water primarily from a single water source at Intake, this alternative would require some restructuring of the Lower Yellowstone Irrigation Project canal system to accommodate a water supply from multiple points along the canal.

The pumping stations would be designed for a total diversion capacity of 1,374 cfs when the flow in the Yellowstone River is 3,000 cfs at the upper most point of diversion. Each of the five pumping stations would be designed for a capacity of 275 cfs. Water would be drawn from the river through a feeder canal to a fish screen structure, located at the edge of the channel migration zone. The motors and electrical equipment in both the fish screen structure and the pump station would be located above the 100-year flood elevation. Fish would be screened out and returned to the river through a fish return pipe and irrigation water would pass through the fish screen and flow into the pumping station. Discharge pipes would convey the irrigation water to the main irrigation canal.

3.1.3 Multiple Pumps with Conservation Measures

The Multiple Pumps with Conservation Measures alternative includes four primary components including the implementation of water conservation measures, pumping, gravity diversions through the existing headworks and use of wind energy to offset pumping costs. The removal of the dam would allow passage on the Yellowstone River, and other components would provide a continued water source to the Lower Yellowstone Irrigation District.

The conservation measures are proposed to reduce the amount of water needed by the project by reducing inefficiency losses in the delivery system and on the farms. The proposed level of conservation is assumed to be completed by installing/completing the following:

- Installation of check structures to provide water control along the canal as a means of maintaining water levels high enough to allow match between water needs and water diversions
- Installation of flow measuring devices on the main canal and laterals to measure water flows in areas where there is no monitoring currently.
- Converting existing laterals from open ditches to pipes to reduce losses from evaporation, seepage, bank vegetation consumption and spillage.
- Convert farms from flood irrigation to sprinkler irrigation to provide more efficient water use to certain farms.
- Lining of the main canal with 3-inches of shotcrete over a geomembrane layer to lessen losses in the canal from seepage.
- Control of over checking to avoid higher than necessary water levels. Over checking can exacerbate the seepage losses on unlined canals.
- Installing groundwater pumps to provide water for irrigation when needed.

This alternative would also require the installation of Ranney Wells to provide water to the main canal after removal of the existing Intake Diversion Dam. The Ranney Well pumping stations would be installed at seven sites along the Yellowstone River and would the wells would pump water directly into the canal. The energy needed to operate the numerous Ranney Wells is assumed to be off-set by the construction of a wind turbine at a pre-existing wind farm. Once built, the LYIP is assumed to obtain a banking agreement such that the energy costs to operate the wells would be zero.

3.2 MCACES Construction Cost Estimates

The three new alternatives were estimated using MCACES 2nd Generation (MII) cost estimating software in accordance with guidance contained in ER 1110-2-1302, Civil Works Cost Engineering.

3.3 Basis of Estimate

3.3.1 Basis of Design

The available design documents for these three alternatives can all be found in Attachments A-1, A-2 and A-3 of the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana, Draft Environmental Impact Statement (EIS) (2016). These sections of the EIS contain detailed discussions of the design development and contain all conceptual level design drawings that were used in the estimating process.

3.3.2 Basis of Quantities

The cost estimates are based on project quantity take-offs that have been calculated in accordance with the attachments referenced in the EIS. A quantity summary and detailed quantity take-offs that correspond to the three expanded alternative MCACES cost estimates are found in Attachment B.4.

3.4 Project Schedules

Simplified tentative project schedules have been developed for each of these three construction alternatives. The durations for each of the alternatives have been used in the cost estimates to determine costs for the contractor to maintain field facilities and provide construction supervision. The simplified tentative project schedules are presented in Attachment B.2. These schedules have been developed with the following assumptions:

- Assumes design phase would begin in May of 2016
- Assumes contractor would try and avoid major construction activities that could interrupt the water supply during the irrigation season, which is assumed to be from the middle of April through September.
- Assumes crews would work 10 hours per day and 6 days per week.

3.5 Acquisition Plan

Each cost estimate currently assumes that the projects would be let out in an unrestricted bid process and are expected to have a competitive bidding market. Due to the size of the proposed projects, no small business contracts are assumed. Each estimate has prime and subcontracting assumptions based on an alternative by alternative basis. A brief discussion of the assumptions used in the estimate are below.

- Modified Side Channel – The cost estimate is based on one contract being awarded to a prime contractor to complete the work. The estimate currently assumes that there would be subcontractors required for concrete, landscape and pile driving work. The prime contractor would be responsible for all the preparatory work, and placing all associated site work as well as overseeing the subcontractors' efforts.
- Multiple Pump Stations - The cost estimate is based on two contracts being awarded to a prime contractor. The first contract would be let out for the installation of all five pump stations. The prime contractor for this is currently assumed to be able to handle all the earthwork, but is assumed to require subcontractors for the concrete, pile driving, electrical and pump installation work. The second contract is assumed to be awarded to a prime contractor that would have the capabilities to complete all aspects of the existing dam removal.
- Multiple Pumps with Conservation Measures - The cost estimate is based on six contracts being awarded to a prime contractor to complete. These six contracts, in no particular order) would account for the following: 1) Removal of the existing Intake Diversion Dam, 2) Lining the main canal and converting laterals into pipes, 3) Installing check structures and flow measuring devices, 4) Converting farms to center pivot sprinklers, 5) Erecting a 2 megawatt wind turbine, and 6) Installing the Ranney Wells.

3.6 Project Construction

The following is a brief summary of the key construction elements and the estimated construction methodology for each alternative.

3.6.1 Modified Side Channel

This alternative would require three staging areas and a gravel construction access road installed along the north and east side of the high flow channel. The staging areas and access roads would require the placement of gravel. A single span access bridge would also need to be placed across the high flow channel to allow for access to both sides of the channel. A cofferdam would then be required to facilitate channel excavation at both the upstream and downstream tie-in locations. The cofferdams would consist of sheet piles to reduce seepage with an earthen embankment placed over them. The embankment would have bank protection stone placed on the slopes.

Channel excavation would be completed to construct three bend cutoffs and to lower and widen the existing channel. Approximately one third of the material excavated would be used as fill that would be placed in existing bends in order to cut those sections off. The remaining excavated material would be disposed of at the proposed spoil area located on Joe's Island. The disposal location would require some sediment and erosion control measures. Lastly the newly formed high flow channel would have bank protection installed. This bank protection consist of a bedding layer beneath riprap.

3.6.2 Multiple Pump Stations

This alternative includes the construction of five pump stations along the Yellowstone River. Each of the stations would require the construction of a staging area and access roads that would be cleared, graded, and have gravel placed. The excavation for the pump station would begin first. After the excavation is complete the placement of the reinforced concrete floors, walls and top slab would be completed. Upon completion of the concrete work all pump station items including pumps, motors, piping, and steel structure would be completed.

A feeder canal would also need to be constructed leading to the pump station. The feeder canal would require the installation of sheet piling for dewatering purposes. The canal area would be cleared prior to be being excavated. A steel trash rack would be installed in the feeder canal as well.

To prevent fish from entering the irrigation pumps, a fish screen structure would also be constructed. The fish screen would require clearing and excavation. Then reinforced concrete foundations, floors, footings and walls would be installed.

The fish screen steel supports, screen and deadplates would be installed next. A return pump and pipes would be installed to return fish to the river.

After the pump stations are complete and operational, then the existing Intake Diversion Dam would be removed. The removal of the dam would likely occur in two phases. The initial phase would require steel sheet piles placed just upstream of the dam and downstream of the boulder field. An earthen embankment would be placed, in lieu of sheet piles, over the boulder field to connect the two sheet pile walls. An earthen embankment was assumed because of the uncertain and risk associated with attempting to drive sheet piles through the existing rock dam and boulder field.

After construction of the initial phase cofferdam, a portion of the existing dam and boulder field would be removed. It is assumed that the rock removed would be hauled locally on Joe's Island for stockpiling such that the stone could be reused in the future. After the rock and dam removal is complete, a new sheet pile cofferdam could be driven and the earthen embankment removed. Then the cofferdam would be extended across the remaining portion of the dam and boulder field to allow for the removal of the remaining section of the dam.

3.6.3 Multiple Pumps with Conservation Measures

This alternative has numerous components with some taking multiple years to place due to the scope of the project and/or due to possible narrow work windows that may be required to avoid impacting the irrigation season and the extreme cold weather months. Therefore the following is more a general discussion of each of the components and the assumptions for work required to complete that were used in the estimate, and not necessarily a detailed sequencing of all work.

- Convert Laterals from Ditches to Pipe – This work assumes replacing existing earthen ditches, primarily in the most downstream reaches, to reinforced concrete pipe. Based on the existing dimensions of the laterals, it has been assumed that the pipe sizes required would vary from 18 inches to 72 inches. Some laterals would require far greater pipe sizes, and even double or triple barrel piping. Thus it was assumed after 72 inches the lateral would be lined with shotcrete with same procedures as the lining of the main canal.

  The new pipes would be placed in the existing laterals on top of a base layer. Once the pipes are laid the pipe, and remaining area of the lateral, would be backfilled.

- Line Main Canal – To reduce seepage losses it is proposed that the entire main canal would be lined with shotcrete placed on top of a geomembrane liner. Prior to placing the shotcrete, the channel would need to be filled to approximately half the current volume due to the significant decrease in

flows. The fill material for this is assumed to come from a borrow site within the study region, and therefore would not be purchased. After filling and grading the canal a geomembrane liner would be placed beneath a 3 inch layer of fiber reinforced shotcrete.

- Check Structures – Nine new check structures are anticipated to be constructed within the main canal. These check structures would require earthwork prior to placing the reinforced concrete structures. The check structures would also have hydraulic gates installed for controlling flows. Lastly, riprap erosion protection would be placed.

- Flow Measuring Devices – Numerous flow measuring devices are proposed to be installed at various locations throughout the study region. There are two types of measuring devices proposed, Cipolletti weir and Parshall flumes. These are both concrete structures and can vary in size. Each of the measuring device types would require some earthwork along with reinforced cast-in-place concrete.

- Convert Fields from Flood Irrigation to Sprinklers - Approximately 5,000 acres of flood irrigated farmland is assumed to be converted to sprinkler irrigation. It is assumed that center pivot sprinklers would be installed, and these sprinklers would require pumps for pressurization. The cost estimate also includes costs of installing power lines to the sprinkler systems.

- Renewable Energy Resources – The estimate includes the cost to install a 2 megawatt (MW) wind turbine and a pre-existing windfarm. The construction of the turbine is assumed to offset the cost of the Ranney Well operations.

- Ranney Wells – The Ranney Wells are required to have test drilling and pumping tests. Once finalized, the pumps would be manufactured and the pump station constructed. The Ranney Wells would also require discharge and collector pipelines. Access roads to the pump station would also be built.

3.7 Effective Dates for Labor, Equipment and Material Pricing

The labor, equipment, and material pricing were developed using the MCACES 2012 English Unit Cost Library, 2016 Richland County Labor Library (see Attachment B.5 for Davis-Bacon wages used), and the 2014 Equipment Library (Region IV) for the base cost estimates. The index pricing data has been prepared in April 2016 dollars.

The cost estimate has been updated with current quoted fuel prices of $1.66/gal for off-road diesel, $1.94/gal for on-road diesel and $1.95/gal for gasoline in the Glendive, MT area.

3.8 Estimated Construction Durations

The estimate contains many user created cost items that were developed outside of the MCACES Unit Cost Library. These developed cost items have had crews and production rates created in order to accurately calculate unit costs. See Attachment B.6 for the estimated production rates and duration estimates for these construction items.

3.9 Direct and Contractor Markups

3.9.1 Direct Markups

The cost estimate for each alternative includes a direct markup for crews and equipment working overtime. The markup is calculated in MCACES and is based on the assumption that crews would be working 10 hours per day and 6 days per week. The markup percentage used in the estimate is 16.67 percent.

3.9.2 Contractor Markups

The prime contractor Job Office Overhead (JOOH) markup for each alternative is based on a calculated percentage within MCACES. The JOOH calculation is based off the estimated duration for all construction components. A running percentage has been used in the estimate for the prime contractor Home Office Overhead (HOOH) markup. Profit is included for the prime contractor and is calculated using the profit weighted guideline calculation within MCACES. Bonding has also been included for the prime and sub-contractors.

3.10 Functional Costs

3.10.1 01 Account – Lands and Damages

Real Estate costs have been estimated for these three alternatives. The alternative footprints were overlaid onto parcel data in order to determine the area required to be purchased. Then a value of $10,000 per acre was assumed to be used for purchasing these lands. This value was provided by the Bureau of Reclamation, and was based on reasonable land purchases by the Bureau on other recent projects.

For this project the following acres and costs were included in the TPCS, with an assumed 25% contingency.

Table 3.1 Summary of Assumed Real Estate Costs

Alternative	Acres to be Purchased	Cost per Acre	Total Cost*
Modified Side Channel	22 acres	$10,000	$220,000
Multiple Pump Stations	44.3 acres	$10,000	$443,300
Multiple Pumps with Conservation	280 acres	$10,000	$2,800,000
* Note: Costs do not contain contingency			

3.10.2 02 Account – Relocations

Current analysis for each of the three expanded alternatives shows no relocations within the project extent. Therefore, at this time, no relocation costs are included in any of these three alternatives.

3.10.3 06 Account – Fish and Wildlife Facilities

In addition to the construction costs, costs for adaptive management during construction have been included in the TPCS. These costs are currently estimated at 1.0% of total construction costs.

3.10.4 30 Account – Planning, Engineering and Design (PED)

Costs for this account were estimated as percentages of construction costs for the various feature accounts. This account covers the planning, engineering and design including; preparation of plans, specifications, and engineering during construction. The current estimate assumes 9.0% of construction costs for this account. This value is the same percentage used by the NWO in previous analysis on this project.

3.10.5 31 Account – Construction Management (CM)

Costs for this account were estimated as percentages of construction costs of the various feature accounts. This costs is assumed to cover construction management during the construction phase. The current estimate assumes 6.0% of construction costs for this account. This value is the same percentage used by the NWO in previous analysis on this project.

3.11 Project Markups

3.11.1 Escalation

Each alternative construction cost has been escalated to the program year (1Q17) as well as to the midpoints of construction to calculate the fully funded project cost. The appropriate escalation cost factors for each date and for each feature account have been calculated within the Total Project Cost Summary spreadsheets.

3.11.2 Contingency

An Abbreviated Risk Analysis (ARA) has been completed in order to develop the contingency values for each alternative. The calculated contingencies reflect the uncertainty in designs and other aspects of the alternatives. However, the contingencies are primarily weighted towards the levels of uncertainty in the significant cost drivers of the MCACES estimates. Alternatively stated, the alternatives with less risk of cost increases to these significant cost drivers, in relation to the total cost, are likely to have lower contingencies. The ARA documents are provided in Attachment B.3, and the overall project contingencies for each alternative are as follows:

- Modified Side Channel – 33.7%
- Multiple Pump Stations – 35.4%
- Multiple Pumps with Conservation Measures – 31.6%

3.12 Total Project Cost Summary (TPCS)

A TPCS has been prepared for each alternative using the latest TPCS Excel spreadsheet provided by the USACE, Walla Walla District. The TPCS incorporates the projects construction costs, project markups, and functional costs. The TPCS uses these current price level costs and further escalates to the program year and estimated midpoint of construction for each alternative. The TPCS for each alternative is presented in Attachment B.1.

3.13 MCACES Construction Cost Estimate Summaries

Summary printouts of the MCACES cost estimates can be found in Attachment B.7. The costs shown in these summaries is for construction work only, and does not include PED, CM, escalation or contingencies.

4.0 Operations, Maintenance and Repairs

Cost estimates have been developed for the No Action alternative as well as each of the construction alternatives for the anticipated costs for operations, maintenance and repairs (OM&R) over the life cycle of the project (assumed to be 50-years). These estimates are conceptual level estimates for each of the five construction alternatives and have been calculated for comparison purposes only.

4.1 OM&R Development

In order to estimate the OM&R costs for each alternative, general assumptions had to be made to determine how much costs would be spent each and every year over the lifespan of the project. This was completed in spreadsheet format where a list of assumptions was developed that noted the OM&R item, the assumed annual cost, and the assumed number of occurrences over a 50 year project life. From there a matrix was developed to display the costs for each year and which OM&R item occurs in any given year. These OM&R calculation spreadsheets are provided in Attachment B.8.

Information was gathered from the Lower Yellowstone Irrigation Project (LYIP), the Bureau of Reclamation, and the USACE for use in the OM&R estimates. The current costs have been reviewed by staff from these entities, and updates to the estimates have been developed by BOR, but are still subject to change as the project progresses. Table 4.1 shows the current net present value of OM&R costs over the 50 year project life as well as the average annual costs for OM&R after discounting.

Table 4.1 Summary of Annual OM&R Costs

Alternative	Net Present Value of OM&R	Average Annual OM&R
No Action	$66,420,000	$2,643,000
Rock Ramp	$71,370,000	$2,840,000
Bypass Channel	$70,333,000	$2,799,000
Modified Side Channel	$73,046,000	$2,907,000
Multiple Pump Stations	$126,507,000	$5,034,000
Multiple Pumps with Conservation	$110,212,000	$4,386,000

5.0 References

US Army Corps of Engineers (USACE). 1993. "ER 1110-1-1300: Engineering and Design Cost Engineering Policy and General Requirements." Washington D.C.

US Army Corps of Engineers (USACE). 1999. "ER 1110-2-1150: Engineering and Design for Civil Works Projects." Washington D.C.

US Army Corps of Engineers (USACE). 2008a. "ER 1110-2-1302: Civil Works Cost Engineering." Washington D.C.

US Army Corps of Engineers (USACE). 2008b. "ETL 1110-2-573: Construction Cost Estimating Guide for Civil Works." Washington D.C.

US Army Corps of Engineers (USACE). 2010. "EM 1110-2-1304: Civil Works Construction Cost Index System (CWCCIS)." Washington D.C.

US Army Corps of Engineers (USACE). 2012. "Intake Diversion Dam Modification Project Cost Appendix, Summary of Fish Passage Design Features Concepts and Cost Implications." Omaha, NE.

U.S. Bureau of Reclamation (Reclamation) and U.S. Army Corps of Engineers (USACE). 2010. Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Final Environmental Assessment. Report and Appendixes.

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

Attachment B.1
Total Project Cost Summary (TPCS) Spreadsheets

Rock Ramp TPCS

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Yellowstone River - Rock Ramp Alternative**
PROJECT NO: 0
LOCATION: Yellowstone River, MT and ND

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2015** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
06	FISH & WILDLIFE FACILITIES	$51,029	$16,686	32.7%	$67,715	1.8%	$51,931	$16,981	$68,912	$0	$68,912	5.4%	$54,750	$17,903	$72,653
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$600	$196	32.7%	$796	1.8%	$610	$200	$810	$0	$810	5.4%	$644	$210	$854
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$8,950	$2,927	32.7%	$11,877	1.8%	$9,108	$2,978	$12,087	$0	$12,087	5.4%	$9,603	$3,140	$12,743
	CONSTRUCTION ESTIMATE TOTALS:	$60,579	$19,809		$80,388	1.8%	$61,650	$20,159	$81,809	$0	$81,809	5.4%	$64,997	$21,253	$86,250
01	LANDS AND DAMAGES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN	$5,453	$1,027	18.8%	$6,480	3.6%	$5,650	$1,064	$6,714	$0	$6,714	3.0%	$5,821	$1,096	$6,917
31	CONSTRUCTION MANAGEMENT	$3,635	$747	20.6%	$4,382	3.6%	$3,766	$774	$4,540	$0	$4,540	11.4%	$4,195	$862	$5,058
	PROJECT COST TOTALS:	$69,667	$21,583	31.0%	$91,250		$71,066	$21,997	**$93,063**	$0	**$93,063**	5.5%	$75,013	$23,212	$98,225

_____ **CHIEF, COST ENGINEERING, xxx**

_____ **PROJECT MANAGER, xxx**

_____ **CHIEF, REAL ESTATE, xxx**

_____ **CHIEF, PLANNING,xxx**

_____ **CHIEF, ENGINEERING, xxx**

_____ **CHIEF, OPERATIONS, xxx**

_____ **CHIEF, CONSTRUCTION, xxx**

_____ **CHIEF, CONTRACTING,xxx**

_____ **CHIEF, PM-PB, xxxx**

_____ **CHIEF, DPM, xxx**

ESTIMATED FEDERAL COST: **100%** **$98,225**
ESTIMATED NON-FEDERAL COST: **0%** **$0**

ESTIMATED TOTAL PROJECT COST: **$98,225**

CONTRACT 1

**** CONTRACT COST SUMMARY ****

PROJECT: Yellowstone River - Rock Ramp Alternative
LOCATION: Yellowstone River, MT and ND
This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			13-Apr-11	Program Year (Budget EC):			2017					
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1													
06	FISH & WILDLIFE FACILITIES	$51,029	$16,686	32.7%	$67,715	1.8%	$51,931	$16,981	$68,912	2019Q4	5.4%	$54,750	$17,903	$72,653
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$600	$196	32.7%	$796	1.8%	$610	$200	$810	2019Q4	5.4%	$644	$210	$854
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$8,950	$2,927	32.7%	$11,877	1.8%	$9,108	$2,978	$12,087	2019Q4	5.4%	$9,603	$3,140	$12,743
	CONSTRUCTION ESTIMATE TOTALS:	$60,579	$19,809	32.7%	**$80,388**		$61,650	$20,159	$81,809			$64,997	$21,253	$86,250
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
0.5%	Planning & Environmental Compliance	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
5.0%	Engineering & Design	$3,029	$571	18.8%	$3,600	3.6%	$3,138	$591	$3,729	2017Q3	2.0%	$3,200	$603	$3,803
0.5%	Reviews, ATRs, IEPRs, VE	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
0.5%	Life Cycle Updates (cost, schedule, risks)	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
0.5%	Contracting & Reprographics	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
0.5%	Engineering During Construction	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2019Q4	11.4%	$350	$66	$416
0.5%	Planning During Construction	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2019Q4	11.4%	$350	$66	$416
0.5%	Project Operations	$303	$57	18.8%	$360	3.6%	$314	$59	$373	2017Q3	2.0%	$320	$60	$380
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$3,029	$623	20.6%	$3,652	3.6%	$3,138	$645	$3,783	2019Q4	11.4%	$3,496	$719	$4,214
0.5%	Project Operation:	$303	$62	20.6%	$365	3.6%	$314	$65	$378	2019Q4	11.4%	$350	$72	$422
0.5%	Project Management	$303	$62	20.6%	$365	3.6%	$314	$65	$378	2019Q4	11.4%	$350	$72	$422
	CONTRACT COST TOTALS:	$69,667	$21,583		$91,250		$71,066	$21,997	$93,063			$75,013	$23,212	$98,225

Bypass Channel TPCS

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Yellowstone River - Bypass Channel Alternative**
PROJECT NO: 0
LOCATION: Yellowstone River, MT and ND

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2015** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
06	FISH & WILDLIFE FACILITIES (Adaptive Mgmt.)	$494	$44	8.8%	$538	1.8%	$503	$44	$547	$0	$547	1.4%	$510	$45	$555
09	CHANNELS & CANALS	$18,047	$1,592	8.8%	$19,639	1.8%	$18,366	$1,620	$19,985	$0	$19,985	1.4%	$18,615	$1,642	$20,257
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$12,267	$1,082	8.8%	$13,349	1.8%	$12,484	$1,101	$13,585	$0	$13,585	1.4%	$12,653	$1,116	$13,769
16	BANK STABILIZATION	$19,111	$1,686	8.8%	$20,797	1.8%	$19,449	$1,715	$21,164	$0	$21,164	1.4%	$19,713	$1,739	$21,452
	CONSTRUCTION ESTIMATE TOTALS:	$49,919	$4,403		$54,322	1.8%	$50,801	$4,481	$55,282	$0	$55,282	1.4%	$51,491	$4,542	$56,033
01	LANDS AND DAMAGES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN	$0	$0	0.0%	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
31	CONSTRUCTION MANAGEMENT	$2,996	$264	8.8%	$3,260	3.6%	$3,104	$274	$3,378	$0	$3,378	3.0%	$3,197	$282	$3,479
	PROJECT COST TOTALS:	$52,915	$4,667	8.8%	$57,582		$53,905	$4,755	**$58,660**	$0	**$58,660**	1.5%	$54,688	$4,824	$59,512

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING,xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED FEDERAL COST: **100%** **$59,512**
ESTIMATED NON-FEDERAL COST: **0%** **$0**

ESTIMATED TOTAL PROJECT COST: **$59,512**

****** TOTAL PROJECT COST SUMMARY ******

CONTRACT 1

****** CONTRACT COST SUMMARY ******

PROJECT: Yellowstone River - Bypass Channel Alternative
LOCATION: Yellowstone River, MT and ND
This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			13-Mar-15	Program Year (Budget EC):			2017					
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1													
06	FISH & WILDLIFE FACILITIES (Adaptive Mgmt.)	$494	$44	8.8%	$538	1.8%	$503	$44	$547	2017Q4	1.4%	$510	$45	$555
09	CHANNELS & CANALS	$18,047	$1,592	8.8%	$19,639	1.8%	$18,366	$1,620	$19,985	2017Q4	1.4%	$18,615	$1,642	$20,257
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$12,267	$1,082	8.8%	$13,349	1.8%	$12,484	$1,101	$13,585	2017Q4	1.4%	$12,653	$1,116	$13,769
16	BANK STABILIZATION	$19,111	$1,686	8.8%	$20,797	1.8%	$19,449	$1,715	$21,164	2017Q4	1.4%	$19,713	$1,739	$21,452
	CONSTRUCTION ESTIMATE TOTALS:	$49,919	$4,403	8.8%	**$54,322**		$50,801	$4,481	$55,282			$51,491	$4,542	$56,033
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.0%	Project Management	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning & Environmental Compliance	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering & Design	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Reviews, ATRs, IEPRs, VE	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Life Cycle Updates (cost, schedule, risks)	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Contracting & Reprographics	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering During Construction	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning During Construction	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	8.8%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$2,496	$220	8.8%	$2,716	3.6%	$2,586	$228	$2,814	2017Q4	3.0%	$2,663	$235	$2,898
0.5%	Project Operation:	$250	$22	8.8%	$272	3.6%	$259	$23	$282	2017Q4	3.0%	$267	$24	$290
0.5%	Project Management	$250	$22	8.8%	$272	3.6%	$259	$23	$282	2017Q4	3.0%	$267	$24	$290
	CONTRACT COST TOTALS:	$52,915	$4,667		$57,582		$53,905	$4,755	$58,660			$54,688	$4,824	$59,512

Modified Side Channel TPCS

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Yellowstone River - Modified Side Channel Alternative**
PROJECT NO: 0
LOCATION: Yellowstone River, MT and ND

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2015** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$352	$124	35.2%	$476	1.8%	$358	$126	$484	$0	$484	3.9%	$372	$131	$503
08	ROADS, RAILROADS & BRIDGES	$1,042	$367	35.2%	$1,408	1.8%	$1,060	$373	$1,433	$0	$1,433	3.9%	$1,101	$387	$1,489
09	CHANNELS & CANALS	$16,703	$5,876	35.2%	$22,579	1.8%	$16,998	$5,980	$22,978	$0	$22,978	3.9%	$17,654	$6,210	$23,864
16	BANK STABILIZATION	$17,436	$6,134	35.2%	$23,570	1.8%	$17,744	$6,242	$23,986	$0	$23,986	3.9%	$18,429	$6,483	$24,912
	CONSTRUCTION ESTIMATE TOTALS:	$35,532	$12,500		$48,032	1.8%	$36,160	$12,721	$48,881	$0	$48,881	3.9%	$37,556	$13,212	$50,767
01	LANDS AND DAMAGES	$220	$55	25.0%	$275	1.8%	$224	$56	$280	$0	$280	0.9%	$226	$56	$282
30	PLANNING, ENGINEERING & DESIGN	$3,201	$743	23.2%	$3,944	3.6%	$3,316	$770	$4,086	$0	$4,086	2.7%	$3,405	$790	$4,195
31	CONSTRUCTION MANAGEMENT	$2,133	$532	24.9%	$2,665	3.6%	$2,210	$551	$2,761	$0	$2,761	8.2%	$2,390	$596	$2,986
	PROJECT COST TOTALS:	$41,086	$13,829	33.7%	$54,916		$41,910	$14,097	**$56,008**	$0	**$56,008**	4.0%	$43,577	$14,654	$58,231

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING,xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED FEDERAL COST: **100%** **$58,231**
ESTIMATED NON-FEDERAL COST: **0%** **$0**

ESTIMATED TOTAL PROJECT COST: **$58,231**

****** TOTAL PROJECT COST SUMMARY ******

CONTRACT 1

****** CONTRACT COST SUMMARY ******

PROJECT: Yellowstone River - Modified Side Channel Alternative
LOCATION: Yellowstone River, MT and ND
This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			19-May-16	Program Year (Budget EC):			2017					
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1													
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$352	$124	35.2%	$476	1.8%	$358	$126	$484	2019Q1	3.9%	$372	$131	$503
08	ROADS, RAILROADS & BRIDGES	$1,042	$367	35.2%	$1,408	1.8%	$1,060	$373	$1,433	2019Q1	3.9%	$1,101	$387	$1,489
09	CHANNELS & CANALS	$16,703	$5,876	35.2%	$22,579	1.8%	$16,998	$5,980	$22,978	2019Q1	3.9%	$17,654	$6,210	$23,864
16	BANK STABILIZATION	$17,436	$6,134	35.2%	$23,570	1.8%	$17,744	$6,242	$23,986	2019Q1	3.9%	$18,429	$6,483	$24,912
	CONSTRUCTION ESTIMATE TOTALS:	$35,532	$12,500	35.2%	**$48,032**		$36,160	$12,721	$48,881			$37,556	$13,212	$50,767
01	LANDS AND DAMAGES	$220	$55	25.0%	$275	1.8%	$224	$56	$280	2017Q3	0.9%	$226	$56	$282
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
0.5%	Planning & Environmental Compliance	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
5.0%	Engineering & Design	$1,777	$412	23.2%	$2,189	3.6%	$1,841	$427	$2,268	2017Q3	2.0%	$1,878	$436	$2,313
0.5%	Reviews, ATRs, IEPRs, VE	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
0.5%	Life Cycle Updates (cost, schedule, risks)	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
0.5%	Contracting & Reprographics	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
0.5%	Engineering During Construction	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2019Q1	8.2%	$199	$46	$246
0.5%	Planning During Construction	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2019Q1	8.2%	$199	$46	$246
0.5%	Project Operations	$178	$41	23.2%	$219	3.6%	$184	$43	$227	2017Q3	2.0%	$188	$44	$232
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,777	$443	24.9%	$2,220	3.6%	$1,841	$459	$2,300	2019Q1	8.2%	$1,991	$496	$2,488
0.5%	Project Operation:	$178	$44	24.9%	$222	3.6%	$184	$46	$230	2019Q1	8.2%	$199	$50	$249
0.5%	Project Management	$178	$44	24.9%	$222	3.6%	$184	$46	$230	2019Q1	8.2%	$199	$50	$249
	CONTRACT COST TOTALS:	$41,086	$13,829		$54,916		$41,910	$14,097	$56,008			$43,577	$14,654	$58,231

Multiple Pump TPCS

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Yellowstone River - Multiple Pump Alternative**
PROJECT NO: 0
LOCATION: Yellowstone River, MT and ND

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2015** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
04	DAMS	$6,600	$2,430	36.8%	$9,030	1.8%	$6,716	$2,473	$9,190	$0	$9,190	12.4%	$7,551	$2,781	$10,331
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$843	$310	36.8%	$1,153	1.8%	$858	$316	$1,174	$0	$1,174	7.0%	$918	$338	$1,256
19	BUILDINGS, GROUNDS & UTILITIES	$77,678	$28,606	36.8%	$106,284	1.8%	$79,049	$29,111	$108,161	$0	$108,161	6.5%	$84,164	$30,995	$115,159
	CONSTRUCTION ESTIMATE TOTALS:	$85,120	$31,347		$116,467	1.8%	$86,623	$31,901	$118,524	$0	$118,524	6.9%	$92,633	$34,114	$126,746
01	LANDS AND DAMAGES	$443	$111	25.0%	$554	1.8%	$451	$113	$564	$0	$564	0.9%	$455	$114	$569
30	PLANNING, ENGINEERING & DESIGN	$7,664	$2,033	26.5%	$9,697	3.6%	$7,940	$2,106	$10,047	$0	$10,047	3.4%	$8,210	$2,178	$10,388
31	CONSTRUCTION MANAGEMENT	$5,108	$1,355	26.5%	$6,463	3.6%	$5,292	$1,404	$6,696	$0	$6,696	14.7%	$6,071	$1,610	$7,681
	PROJECT COST TOTALS:	$98,335	$34,846	35.4%	$133,181		$100,307	$35,523	**$135,831**	$0	**$135,831**	7.0%	$107,369	$38,015	$145,384

_____ **CHIEF, COST ENGINEERING, xxx**

_____ **PROJECT MANAGER, xxx**

_____ **CHIEF, REAL ESTATE, xxx**

_____ **CHIEF, PLANNING,xxx**

_____ **CHIEF, ENGINEERING, xxx**

_____ **CHIEF, OPERATIONS, xxx**

_____ **CHIEF, CONSTRUCTION, xxx**

_____ **CHIEF, CONTRACTING,xxx**

_____ **CHIEF, PM-PB, xxxx**

_____ **CHIEF, DPM, xxx**

ESTIMATED FEDERAL COST: **100%** **$145,384**
ESTIMATED NON-FEDERAL COST: **0%** **$0**

ESTIMATED TOTAL PROJECT COST: **$145,384**

****** TOTAL PROJECT COST SUMMARY ******

MULTIPLE PUMP STATIONS

****** CONTRACT COST SUMMARY ******

PROJECT: Yellowstone River - Multiple Pump Alternative
LOCATION: Yellowstone River, MT and ND
This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			19-May-16	Program Year (Budget EC):			2017					
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	MULTIPLE PUMP STATIONS													
04	DAMS	$6,600	$2,430	36.8%	$9,030	1.8%	$6,716	$2,473	$9,190	2023Q1	12.4%	$7,551	$2,781	$10,331
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$843	$310	36.8%	$1,153	1.8%	$858	$316	$1,174	2020Q3	7.0%	$918	$338	$1,256
19	BUILDINGS, GROUNDS & UTILITIES	$77,678	$28,606	36.8%	$106,284	1.8%	$79,049	$29,111	$108,161	2020Q2	6.5%	$84,164	$30,995	$115,159
	CONSTRUCTION ESTIMATE TOTALS:	$85,120	$31,347	36.8%	**$116,467**		$86,623	$31,901	$118,524			$92,633	$34,114	$126,746
01	LANDS AND DAMAGES	$443	$111	25.0%	$554	1.8%	$451	$113	$564	2017Q3	0.9%	$455	$114	$569
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
0.5%	Planning & Environmental Compliance	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
5.0%	Engineering & Design	$4,256	$1,129	26.5%	$5,385	3.6%	$4,410	$1,170	$5,579	2017Q3	2.0%	$4,497	$1,193	$5,690
0.5%	Reviews, ATRs, IEPRs, VE	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
0.5%	Life Cycle Updates (cost, schedule, risks)	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
0.5%	Contracting & Reprographics	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
0.5%	Engineering During Construction	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2020Q3	14.7%	$506	$134	$641
0.5%	Planning During Construction	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2020Q3	14.7%	$506	$134	$641
0.5%	Project Operations	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2017Q3	2.0%	$450	$119	$569
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$4,256	$1,129	26.5%	$5,385	3.6%	$4,410	$1,170	$5,579	2020Q3	14.7%	$5,058	$1,342	$6,400
0.5%	Project Operation:	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2020Q3	14.7%	$506	$134	$641
0.5%	Project Management	$426	$113	26.5%	$539	3.6%	$441	$117	$558	2020Q3	14.7%	$506	$134	$641
	CONTRACT COST TOTALS:	$98,335	$34,846		$133,181		$100,307	$35,523	$135,831			$107,369	$38,015	$145,384

Multiple Pumps with Conservation Measures TPCS

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Yellowstone River - Multiple Pumps with Conservation Measures**
PROJECT NO: 0
LOCATION: Yellowstone River, MT and ND

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 5/19/2016

This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2015** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
04	DAMS	$7,037	$2,278	32.4%	$9,315	1.8%	$7,161	$2,318	$9,479	$0	$9,479	7.0%	$7,662	$2,481	$10,143
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$3,131	$1,014	32.4%	$4,144	1.8%	$3,186	$1,031	$4,217	$0	$4,217	7.0%	$3,409	$1,104	$4,513
09	CHANNELS & CANALS	$195,853	$63,408	32.4%	$259,261	1.8%	$199,312	$64,528	$263,840	$0	$263,840	7.0%	$213,271	$69,048	$282,319
19	BUILDINGS, GROUNDS & UTILITIES	$18,703	$6,055	32.4%	$24,758	1.8%	$19,033	$6,162	$25,195	$0	$25,195	7.0%	$20,366	$6,594	$26,960
20	PERMANENT OPERATING EQUIPMENT	$91,468	$29,613	32.4%	$121,082	1.8%	$93,084	$30,136	$123,220	$0	$123,220	0.0%	$93,084	$30,136	$123,220
	CONSTRUCTION ESTIMATE TOTALS:	$316,191	$102,369		$418,559	1.8%	$321,775	$104,177	$425,952	$0	$425,952	5.0%	$337,793	$109,362	$447,155
01	LANDS AND DAMAGES	$2,800	$700	25.0%	$3,500	1.8%	$2,849	$712	$3,562	$0	$3,562	5.9%	$3,019	$755	$3,773
30	PLANNING, ENGINEERING & DESIGN	$28,458	$7,548	26.5%	$36,006	3.6%	$29,485	$7,820	$37,305	$0	$37,305	5.2%	$31,015	$8,226	$39,241
31	CONSTRUCTION MANAGEMENT	$18,972	$5,032	26.5%	$24,004	3.6%	$19,656	$5,214	$24,870	$0	$24,870	14.7%	$22,549	$5,981	$28,529
	PROJECT COST TOTALS:	$366,421	$115,649	31.6%	$482,069		$373,765	$117,923	**$491,688**	$0	**$491,688**	5.5%	$394,375	$124,324	$518,699

_____ **CHIEF, COST ENGINEERING, xxx**

_____ **PROJECT MANAGER, xxx**

_____ **CHIEF, REAL ESTATE, xxx**

_____ **CHIEF, PLANNING,xxx**

_____ **CHIEF, ENGINEERING, xxx**

_____ **CHIEF, OPERATIONS, xxx**

_____ **CHIEF, CONSTRUCTION, xxx**

_____ **CHIEF, CONTRACTING,xxx**

_____ **CHIEF, PM-PB, xxxx**

_____ **CHIEF, DPM, xxx**

ESTIMATED FEDERAL COST:	**100%**	**$518,699**
ESTIMATED NON-FEDERAL COST:	**0%**	**$0**
ESTIMATED TOTAL PROJECT COST:		**$518,699**

****** TOTAL PROJECT COST SUMMARY ******

CONTRACT 1

****** CONTRACT COST SUMMARY ******

PROJECT: Yellowstone River - Multiple Pumps with Conservation Measures
LOCATION: Yellowstone River, MT and ND
This Estimate reflects the scope and schedule in report; Lower Yellowstone River Intake Diversion Dam Modification Project, Eng. Appx.

DISTRICT: Omaha (NWO)
POC: CHIEF, COST ENGINEERING, xxx

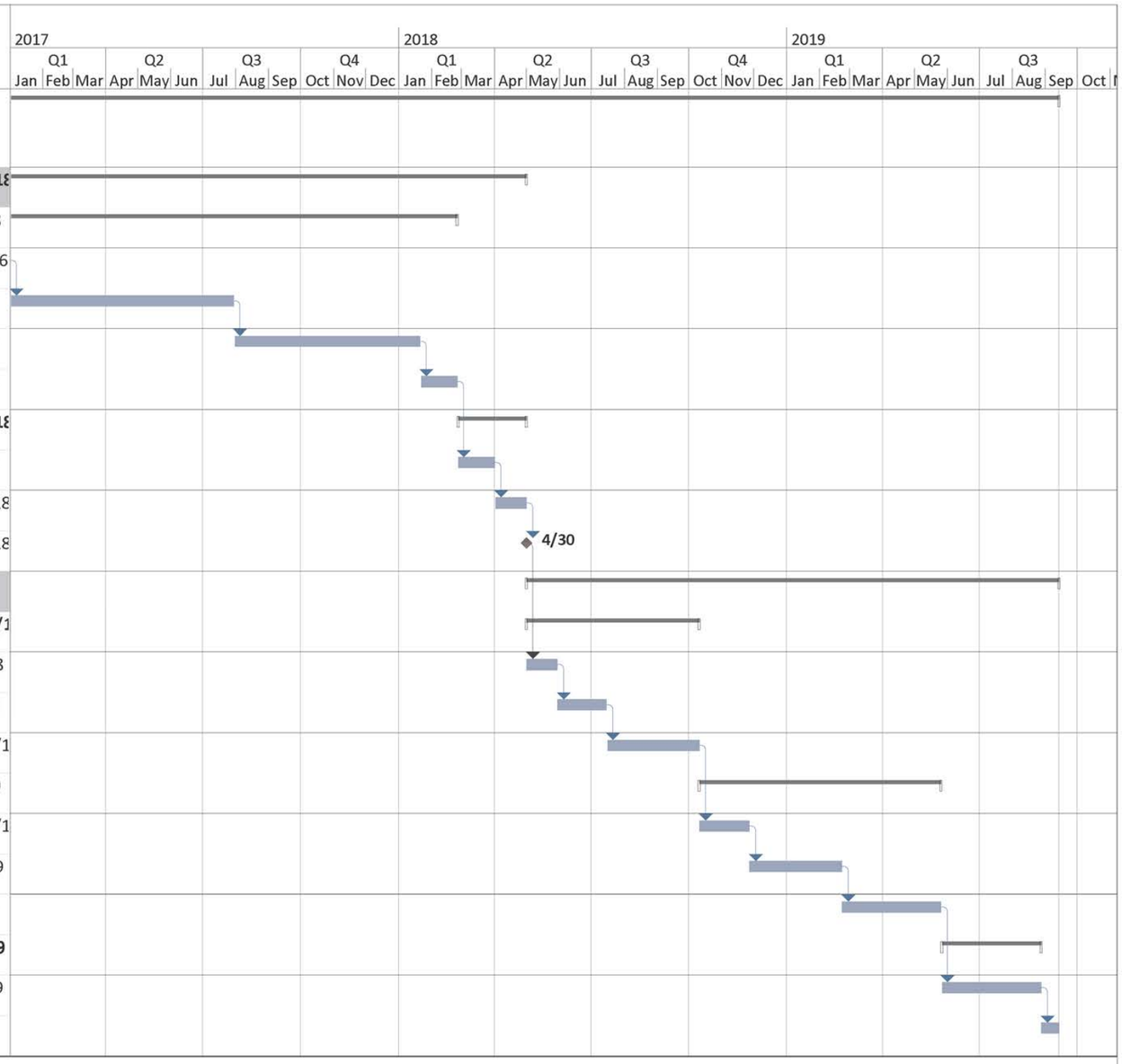
PREPARED: 5/19/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			19-May-16	Program Year (Budget EC):			2017					
		Effective Price Level:			1-Oct-15	Effective Price Level Date:			1 OCT 16					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1													
04	DAMS	$7,037	$2,278	32.4%	$9,315	1.8%	$7,161	$2,318	$9,479	2020Q3	7.0%	$7,662	$2,481	$10,143
06	FISH & WILDLIFE FACILITIES (Monitoring & Adaptive Mgmt.)	$3,131	$1,014	32.4%	$4,144	1.8%	$3,186	$1,031	$4,217	2020Q3	7.0%	$3,409	$1,104	$4,513
09	CHANNELS & CANALS	$195,853	$63,408	32.4%	$259,261	1.8%	$199,312	$64,528	$263,840	2020Q3	7.0%	$213,271	$69,048	$282,319
19	BUILDINGS, GROUNDS & UTILITIES	$18,703	$6,055	32.4%	$24,758	1.8%	$19,033	$6,162	$25,195	2020Q3	7.0%	$20,366	$6,594	$26,960
20	PERMANENT OPERATING EQUIPMENT	$91,468	$29,613	32.4%	$121,082	1.8%	$93,084	$30,136	$123,220	2017Q1	0.0%	$93,084	$30,136	$123,220
	CONSTRUCTION ESTIMATE TOTALS:	$316,191	$102,369	32.4%	**$418,559**		$321,775	$104,177	$425,952			$337,793	$109,362	$447,155
01	LANDS AND DAMAGES	$2,800	$700	25.0%	$3,500	1.8%	$2,849	$712	$3,562	2020Q1	5.9%	$3,019	$755	$3,773
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
0.5%	Planning & Environmental Compliance	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
5.0%	Engineering & Design	$15,810	$4,193	26.5%	$20,003	3.6%	$16,380	$4,345	$20,725	2018Q1	4.0%	$17,035	$4,518	$21,554
0.5%	Reviews, ATRs, IEPRs, VE	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
0.5%	Life Cycle Updates (cost, schedule, risks)	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
0.5%	Contracting & Reprographics	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
0.5%	Engineering During Construction	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2020Q3	14.7%	$1,879	$498	$2,377
0.5%	Planning During Construction	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2020Q3	14.7%	$1,879	$498	$2,377
0.5%	Project Operations	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2018Q1	4.0%	$1,704	$452	$2,155
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$15,810	$4,193	26.5%	$20,003	3.6%	$16,380	$4,345	$20,725	2020Q3	14.7%	$18,791	$4,984	$23,774
0.5%	Project Operation:	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2020Q3	14.7%	$1,879	$498	$2,377
0.5%	Project Management	$1,581	$419	26.5%	$2,000	3.6%	$1,638	$434	$2,072	2020Q3	14.7%	$1,879	$498	$2,377
	CONTRACT COST TOTALS:	$366,421	$115,649		$482,069		$373,765	$117,923	$491,688			$394,375	$124,324	$518,699

Attachment B.2
Tentative Project Schedules

Rock Ramp Project Schedule

ID	Task Name	Duration	Start	Finish
1	**LOWER YELLOWSTONE IRRIGATION PROJECT - ROCK RAMP ALTERNATIVE**	**1055 days**	**Mon 5/2/16**	**Fri 9/13/19**
2	**PRE-CONSTRUCTION AWARD**	**625 days**	**Mon 5/2/16**	**Mon 4/30/18**
3	**Plans & Specifications**	**570 days**	**Mon 5/2/16**	**Sat 2/24/18**
4	30% Design	210 days	Mon 5/2/16	Sat 12/31/16
5	60% Design	180 days	Mon 1/2/17	Sat 7/29/17
6	90% Design	150 days	Mon 7/31/17	Sat 1/20/18
7	BCOE	30 days	Mon 1/22/18	Sat 2/24/18
8	**Procurement & Award**	**55 days**	**Mon 2/26/18**	**Mon 4/30/18**
9	Advertise	30 days	Mon 2/26/18	Sat 3/31/18
10	Award	25 days	Mon 4/2/18	Mon 4/30/18
11	NTP	0 days	Mon 4/30/18	Mon 4/30/18
12	**CONSTRUCTION**	**430 days**	**Tue 5/1/18**	**Fri 9/13/19**
13	**Phase 1 Construction**	**140 days**	**Tue 5/1/18**	**Wed 10/10/1**
14	Mobilization and Site Preparation	25 days	Tue 5/1/18	Tue 5/29/18
15	Place Cofferdam (South Bank to Center of Existing Dam)	40 days	Wed 5/30/18	Sat 7/14/18
16	Place Concrete Weir (South Half)	75 days	Mon 7/16/18	Wed 10/10/1
17	**Phase 2 Construction**	**195 days**	**Thu 10/11/18**	**Sat 5/25/19**
18	Place Cofferdam (Headworks to End of New Weir)	40 days	Thu 10/11/18	Mon 11/26/1
19	Place Concrete Weir (North Half)	75 days	Tue 11/27/18	Thu 2/21/19
20	Place Rock Ramp (North Half)	80 days	Fri 2/22/19	Sat 5/25/19
21	**Phase 3 Construction**	**80 days**	**Mon 5/27/19**	**Tue 8/27/19**
22	Place Rock Ramp (South Half)	80 days	Mon 5/27/19	Tue 8/27/19
23	Demobilization	15 days	Wed 8/28/19	Fri 9/13/19

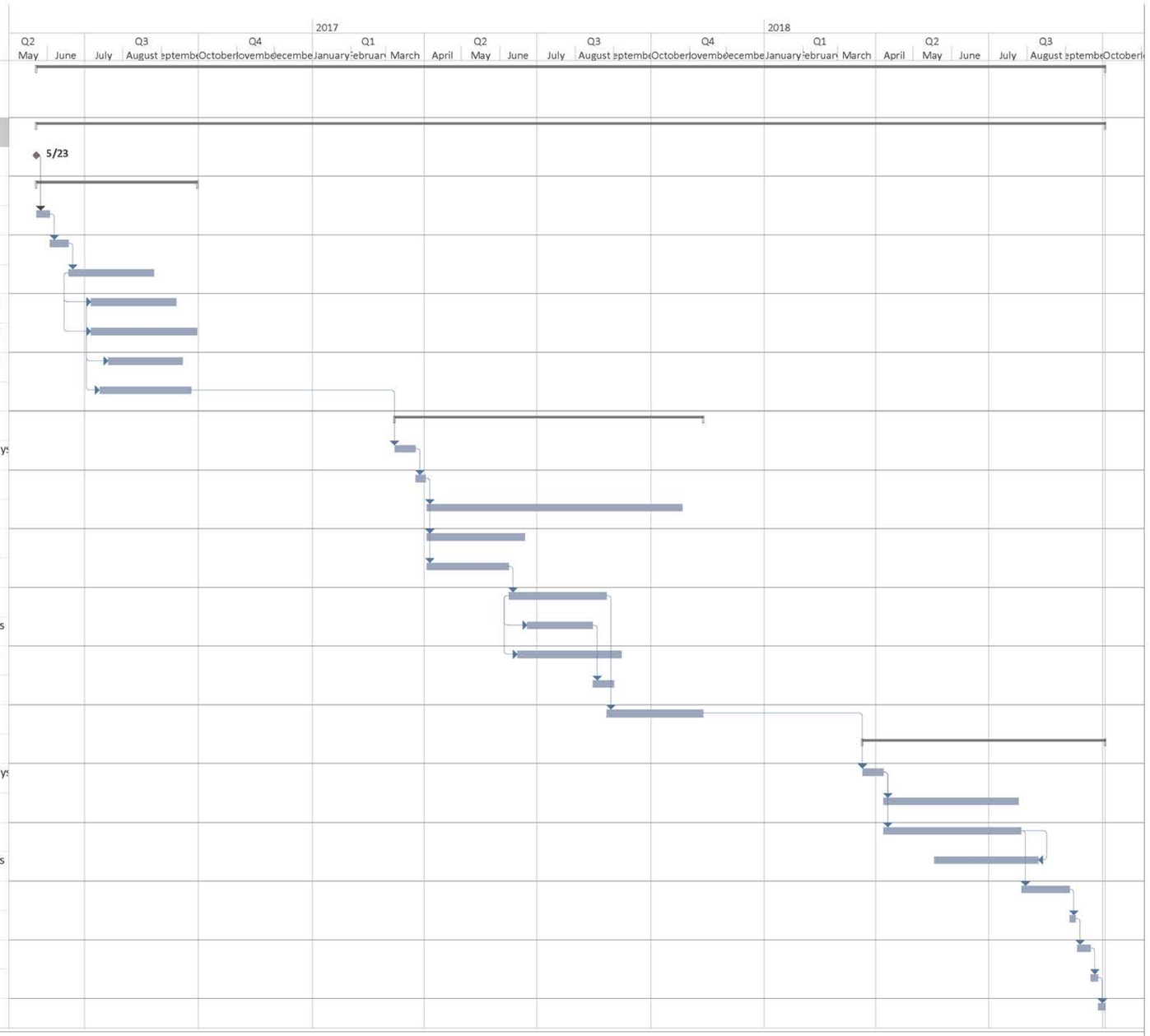


Project: LA River_Project Schedule
Date: Wed 4/20/16

Task	Project Summary	Inactive Milestone	Manual Summary	Progress
Split	External Tasks	Inactive Summary	Start-only	Manual Progress
Milestone	External Milestone	Duration-only	Finish-only	
Summary	Inactive Task	Manual Summary Rollup	Deadline	

Bypass Channel Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**LOWER YELLOWSTONE IRRIGATION PROJECT - BYPASS CHANNEL ALTERNATIVE**	**740 days**	**Mon 5/23/16**	**Tue 10/2/18**	
2	**CONSTRUCTION**	**740 days**	**Mon 5/23/16**	**Tue 10/2/18**	
3	Notice to Proceed	0 days	Mon 5/23/16	Mon 5/23/16	
4	**Weir Construction**	**112 days**	**Mon 5/23/16**	**Thu 9/29/16**	
5	Mobilization	10 days	Mon 5/23/16	Thu 6/2/16	3
6	Haul Roads and Access Ramps	13 days	Fri 6/3/16	Fri 6/17/16	5
7	Sheet Pile	59 days	Sat 6/18/16	Thu 8/25/16	6
8	Excavation	59 days	Wed 7/6/16	Mon 9/12/16	7SS+15 days
9	Place Fill	74 days	Wed 7/6/16	Thu 9/29/16	7SS+15 days
10	Concrete Placement	52 days	Wed 7/20/16	Sat 9/17/16	8SS+12 days
11	Remove/Cut Sheetpile	64 days	Wed 7/13/16	Sat 9/24/16	9SS+6 days
12	**Bypass Channel - Phase 1**	**214 days**	**Wed 3/8/17**	**Sat 11/11/17**	
13	Moblization	15 days	Wed 3/8/17	Fri 3/24/17	11FS+140 days
14	Erosion Control and Site Access	7 days	Sat 3/25/17	Sat 4/1/17	13
15	Clearing and Grubbing	177 days	Mon 4/3/17	Wed 10/25/17	14
16	Outlet Structure	68 days	Mon 4/3/17	Tue 6/20/17	14
17	Inlet Structure	57 days	Mon 4/3/17	Wed 6/7/17	14
18	Excavate Channel from Outlet to DS Outer Bend Protection	68 days	Thu 6/8/17	Fri 8/25/17	17
19	Excavate Channel Between Inlet and Plug	45 days	Fri 6/23/17	Mon 8/14/17	18SS+13 days
20	Screening and Placement of Channel Bottom Armor	72 days	Thu 6/15/17	Wed 9/6/17	18SS+6 days
21	Install Channel Plug	15 days	Tue 8/15/17	Thu 8/31/17	19
22	Place DS Channel Bend Protection	67 days	Sat 8/26/17	Sat 11/11/17	18
23	**Bypass Channel - Phase 2**	**168 days**	**Wed 3/21/18**	**Tue 10/2/18**	
24	Moblization	15 days	Wed 3/21/18	Fri 4/6/18	22FS+110 days
25	Excavate Channel From DS Outer Bend Portection US Outer I	93 days	Sat 4/7/18	Tue 7/24/18	24
26	Excavate Channel Between Plug and US Outer Bend Riprap	95 days	Sat 4/7/18	Thu 7/26/18	24
27	Screening and Placement of Channel Bottom Armor	72 days	Fri 5/18/18	Thu 8/9/18	26FF+12 days
28	Place US Channel Bend Protection	33 days	Fri 7/27/18	Mon 9/3/18	26
29	Final Grade Spoil Area	5 days	Tue 9/4/18	Sat 9/8/18	28
30	Seed Site	10 days	Mon 9/10/18	Thu 9/20/18	29
31	Remove Access Crossings and Culverts	5 days	Fri 9/21/18	Wed 9/26/18	30
32	Demobilization	5 days	Thu 9/27/18	Tue 10/2/18	31

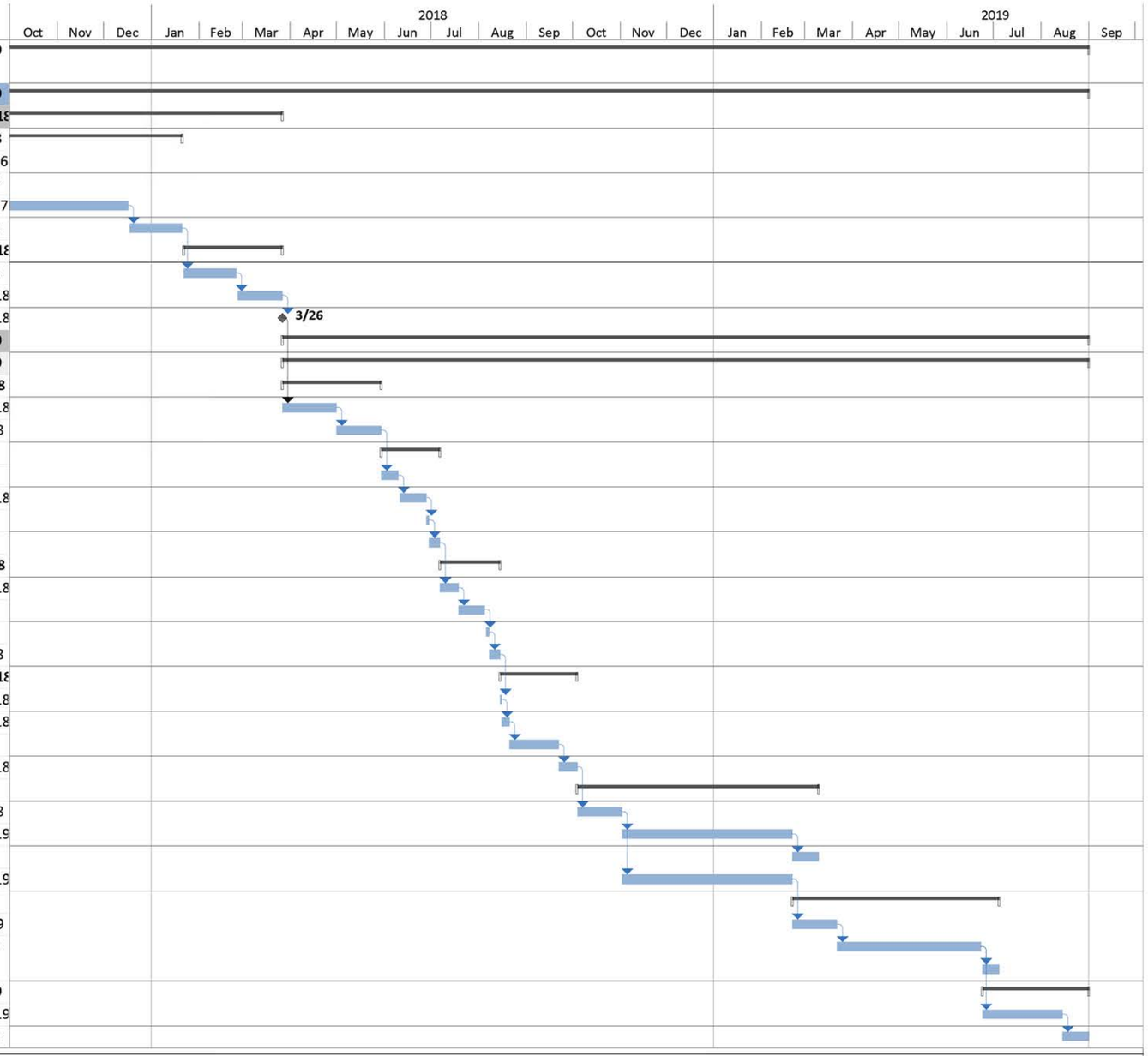


Project: LA River_Project Schedule
Date: Wed 4/20/16

Task — Summary — External Milestone — Inactive Summary — Manual Summary — Deadline
Split — Project Summary — Inactive Task — Duration-only — Start-only — Progress
Milestone — External Tasks — Inactive Milestone — Manual Summary Rollup — Finish-only — Manual Progress

Modified Side Channel Project Schedule

ID	Task Name	Duration	Start	Finish
1	**LOWER YELLOWSTONE IRRIGATION PROJECT - MODIFIED SIDE CHANNEL ALTERNATIVE**	**1044 days**	**Mon 5/2/16**	**Sat 8/31/19**
2	**CONTRACT 1**	**1044 days**	**Mon 5/2/16**	**Sat 8/31/19**
3	**PRE-CONSTRUCTION AWARD**	**595 days**	**Mon 5/2/16**	**Mon 3/26/18**
4	**Plans & Specifications**	**540 days**	**Mon 5/2/16**	**Sat 1/20/18**
5	30% Design	210 days	Mon 5/2/16	Sat 12/31/16
6	60% Design	180 days	Mon 1/2/17	Sat 7/29/17
7	90% Design	120 days	Mon 7/31/17	Sat 12/16/17
8	BCOE	30 days	Mon 12/18/1	Sat 1/20/18
9	**Procurement & Award**	**55 days**	**Mon 1/22/18**	**Mon 3/26/18**
10	Advertise	30 days	Mon 1/22/18	Sat 2/24/18
11	Award	25 days	Mon 2/26/18	Mon 3/26/18
12	NTP	0 days	Mon 3/26/18	Mon 3/26/18
13	**CONSTRUCTION**	**449 days**	**Tue 3/27/18**	**Sat 8/31/19**
14	**High Flow Channel Construction**	**449 days**	**Tue 3/27/18**	**Sat 8/31/19**
15	**Mobilization and Preparatory Work**	**55 days**	**Tue 3/27/18**	**Tue 5/29/18**
16	Mobilization	30 days	Tue 3/27/18	Mon 4/30/18
17	Site Access and Staging	25 days	Tue 5/1/18	Tue 5/29/18
18	**Upstream Cofferdam**	**33 days**	**Wed 5/30/18**	**Fri 7/6/18**
19	Sheet Pile Cutoff	10 days	Wed 5/30/18	Sat 6/9/18
20	Borrow Fill Place and Compact	15 days	Mon 6/11/18	Wed 6/27/18
21	Bedding Placement	2 days	Thu 6/28/18	Fri 6/29/18
22	Riprap Placement	6 days	Sat 6/30/18	Fri 7/6/18
23	**Downstream Cofferdam**	**33 days**	**Sat 7/7/18**	**Tue 8/14/18**
24	Sheet Pile Cutoff	10 days	Sat 7/7/18	Wed 7/18/18
25	Borrow Fill Place and Compact	15 days	Thu 7/19/18	Sat 8/4/18
26	Bedding Placement	2 days	Mon 8/6/18	Tue 8/7/18
27	Riprap Placement	6 days	Wed 8/8/18	Tue 8/14/18
28	**Bridge Installation**	**43 days**	**Wed 8/15/18**	**Wed 10/3/18**
29	Earthwork	1 day	Wed 8/15/18	Wed 8/15/18
30	Abutments and Wingwalls	4 days	Thu 8/16/18	Mon 8/20/18
31	Concrete Cure Time	28 days	Tue 8/21/18	Fri 9/21/18
32	Prefab Bridge Installation	10 days	Sat 9/22/18	Wed 10/3/18
33	**Channel Construction**	**135 days**	**Thu 10/4/18**	**Sat 3/9/19**
34	Clearing and Grubbing	25 days	Thu 10/4/18	Thu 11/1/18
35	Channel Excavation	95 days	Fri 11/2/18	Wed 2/20/19
36	Finish Grading	15 days	Thu 2/21/19	Sat 3/9/19
37	Infill Existing Channel and Spread Material at Waste Site	95 days	Fri 11/2/18	Wed 2/20/19
38	**Bank Stabilization**	**115 days**	**Thu 2/21/19**	**Thu 7/4/19**
39	Bedding Placement	25 days	Thu 2/21/19	Thu 3/21/19
40	Riprap Placement	80 days	Fri 3/22/19	Sat 6/22/19
41	Boulder Placement	10 days	Mon 6/24/19	Thu 7/4/19
42	**Demobilization and Site Restoration**	**60 days**	**Mon 6/24/19**	**Sat 8/31/19**
43	Seeding and Restoration	45 days	Mon 6/24/19	Wed 8/14/19
44	Demobilization	15 days	Thu 8/15/19	Sat 8/31/19

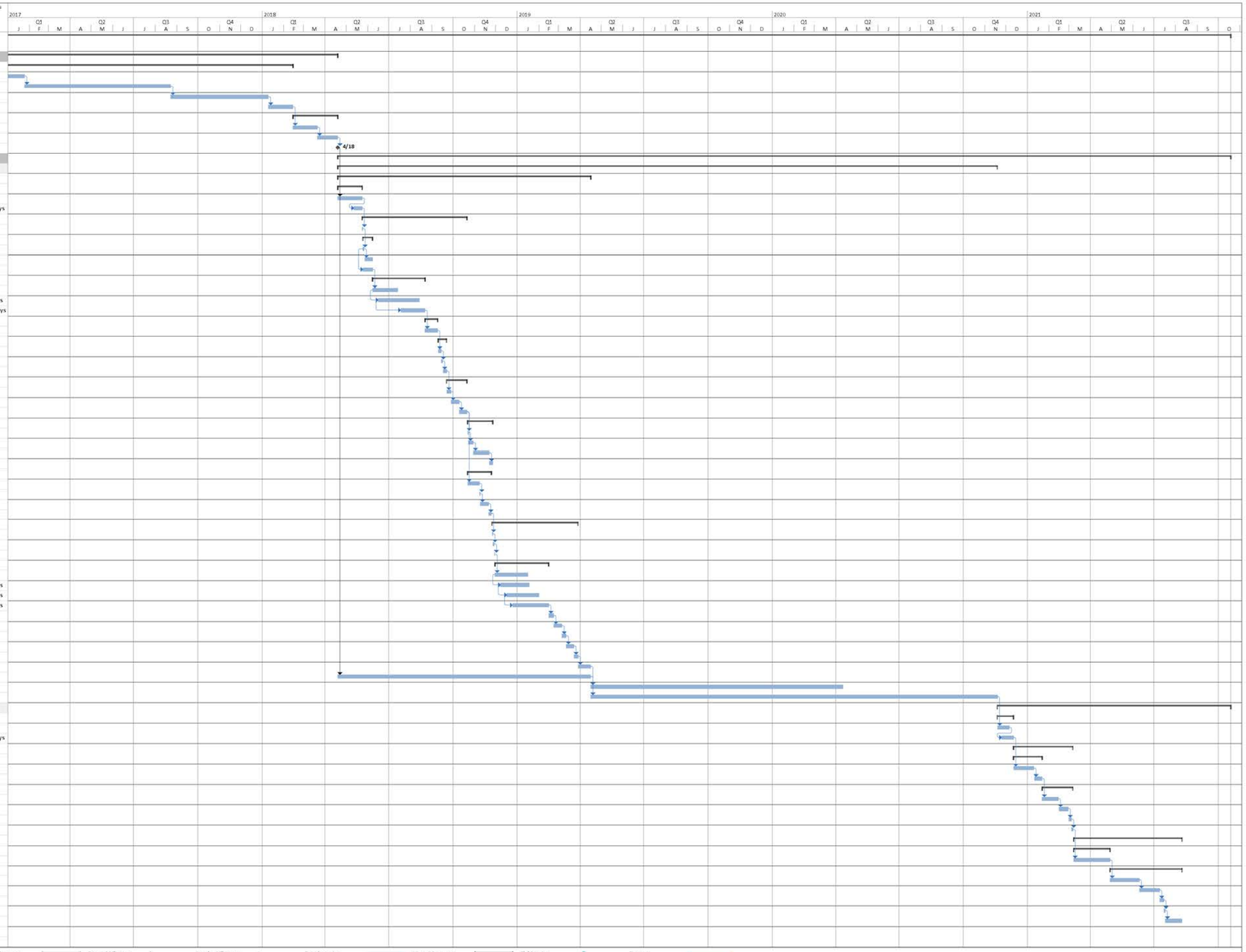


Project: LA River_Project Schedule
Date: Thu 5/19/16

Task — Summary — External Milestone — Inactive Summary — Manual Summary — Deadline
Split — Project Summary — Inactive Task — Duration-only — Start-only — Progress
Milestone — External Tasks — Inactive Milestone — Manual Summary Rollup — Finish-only — Manual Progress

Multiple Pump Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	LOWER YELLOWSTONE IRRIGATION PROJECT - MULTIPLE PUMP ALTERNATIVE	1691 days	Wed 5/25/16	Mon 10/18/21	
2	PRE-CONSTRUCTION AWARD	595 days	Wed 5/25/16	Wed 4/18/18	
3	Plans & Specifications	540 days	Wed 5/25/16	Tue 2/13/18	
4	30% Design	210 days	Wed 5/25/16	Tue 1/24/17	
5	60% Design	180 days	Wed 1/25/17	Tue 8/22/17	4
6	90% Design	120 days	Wed 8/23/17	Tue 1/9/18	5
7	BCOE	30 days	Wed 1/10/18	Tue 2/13/18	6
8	Procurement & Award	55 days	Wed 2/14/18	Wed 4/18/18	
9	Advertise	30 days	Wed 2/14/18	Tue 3/20/18	7
10	Award	25 days	Wed 3/21/18	Wed 4/18/18	9
11	NTP	0 days	Wed 4/18/18	Wed 4/18/18	10
12	CONSTRUCTION	1096 days	Thu 4/19/18	Mon 10/18/2	
13	Multiple Pump Station Construction	810 days	Thu 4/19/18	Wed 11/18/2	
14	Pump Station - Site 1	310 days	Thu 4/19/18	Mon 4/15/19	
15	Mobilization and Preparatory Work	30 days	Thu 4/19/18	Wed 5/23/18	
16	Mobilization	30 days	Thu 4/19/18	Wed 5/23/18	11
17	Site Access and Staging	10 days	Sat 5/12/18	Wed 5/23/18	16FS-10 days
18	Pump Station Work	129 days	Thu 5/24/18	Sat 10/20/18	
19	Clearing and Grubbing	1 day	Thu 5/24/18	Thu 5/24/18	17
20	Earthwork	12 days	Fri 5/25/18	Thu 6/7/18	
21	Excavation - Dry Material	2 days	Fri 5/25/18	Sat 5/26/18	19
22	Excavation - Wet Material	10 days	Mon 5/28/18	Thu 6/7/18	21
23	Haul and Dispose of Excess Material	12 days	Fri 5/25/18	Thu 6/7/18	21SS
24	Reinforced Concrete	64 days	Fri 6/8/18	Tue 8/21/18	
25	Concrete Floor (Include 28-days of Curing)	31 days	Fri 6/8/18	Fri 7/13/18	23
26	Concrete Walls (Include 28-days of Curing)	50 days	Sat 6/16/18	Mon 8/13/18	25SS+7 days
27	Concrete Top Slab (Include 28-days of Curing)	30 days	Wed 7/18/18	Tue 8/21/18	26SS+27 days
28	Irrigation Pumps and Motors	16 days	Wed 8/22/18	Sat 9/8/18	
29	Install Pumps and Motors	16 days	Wed 8/22/18	Sat 9/8/18	27
30	Piping	11 days	Mon 9/10/18	Fri 9/21/18	
31	48" Pipe	4 days	Mon 9/10/18	Thu 9/13/18	29
32	84" Pipe	2 days	Fri 9/14/18	Sat 9/15/18	31
33	Hydraulic Gates	5 days	Mon 9/17/18	Fri 9/21/18	32
34	Remaining Pump Station Work	25 days	Sat 9/22/18	Sat 10/20/18	
35	Concrete Utility Vaults	5 days	Sat 9/22/18	Thu 9/27/18	33
36	Prefabricated Steel Building	10 days	Fri 9/28/18	Tue 10/9/18	35
37	Standby Generators with Buildings	10 days	Wed 10/10/18	Sat 10/20/18	36
38	Discharge Pipelines	31 days	Mon 10/22/18	Mon 11/26/18	
39	Clearing and Grubbing	1 day	Mon 10/22/18	Mon 10/22/18	37
40	Trench Excavation	6 days	Tue 10/23/18	Mon 10/29/18	39
41	84" Pipe	20 days	Tue 10/30/18	Wed 11/21/18	40
42	Trash Rack	4 days	Thu 11/22/18	Mon 11/26/18	41
43	Feeder Canal	30 days	Mon 10/22/18	Sat 11/24/18	
44	Sheet Pile Cofferdam	15 days	Mon 10/22/18	Wed 11/7/18	37
45	Clearing and Grubbing	1 day	Thu 11/8/18	Thu 11/8/18	44
46	Excavation	10 days	Fri 11/9/18	Tue 11/20/18	45
47	Trash Rack	4 days	Wed 11/21/18	Sat 11/24/18	46
48	Fish Screen	106 days	Mon 11/26/18	Thu 3/28/19	
49	Clearing and Grubbing	1 day	Mon 11/26/18	Mon 11/26/18	47
50	Channel Excavation	2 days	Tue 11/27/18	Wed 11/28/18	49
51	Structural Excavation	1 day	Thu 11/29/18	Thu 11/29/18	50
52	Reinforced Concrete	66 days	Fri 11/30/18	Thu 2/14/19	
53	Concrete Foundations (Include 28-days of Curing)	40 days	Fri 11/30/18	Tue 1/15/19	51
54	Concrete Floor (Include 28-days of Curing)	35 days	Sat 12/8/18	Thu 1/17/19	53SS+7 days
55	Concrete Footings (Include 28-days of Curing)	40 days	Mon 12/17/18	Thu 1/31/19	54SS+7 days
56	Concrete Walls (Include 28-days of Curing)	45 days	Tue 12/25/18	Thu 2/14/19	55SS+7 days
57	Structural Steel Supports	6 days	Fri 2/15/19	Thu 2/21/19	56
58	Fish Screen and Deadplates	10 days	Fri 2/22/19	Tue 3/5/19	57
59	Screen Cleaners	5 days	Wed 3/6/19	Mon 3/11/19	58
60	Fish Return Pump	10 days	Tue 3/12/19	Fri 3/22/19	59
61	Fish Return Pipes	5 days	Sat 3/23/19	Thu 3/28/19	60
62	Demobilization	15 days	Fri 3/29/19	Mon 4/15/19	61
63	Pump Station - Site 2	310 days	Thu 4/19/18	Mon 4/15/19	11
64	Pump Station - Site 3	310 days	Tue 4/16/19	Fri 4/10/20	62
65	Pump Station - Sites 4 and 5	500 days	Tue 4/16/19	Wed 11/18/20	63
66	Demolition of Existing Intake Diversion Dam	286 days	Thu 11/19/20	Mon 10/18/2	
67	Mobilization and Preparatory Work	20 days	Thu 11/19/20	Fri 12/11/20	
68	Mobilization	15 days	Thu 11/19/20	Sat 12/5/20	65
69	Site Access and Staging	15 days	Wed 11/25/20	Fri 12/11/20	68FS-10 days
70	Phase 1 Construction	73 days	Sat 12/12/20	Sat 3/6/21	
71	Phase 1 Cofferdam	35 days	Sat 12/12/20	Thu 1/21/21	
72	Sheet Pile Cofferdam	25 days	Sat 12/12/20	Sat 1/9/21	69
73	Earthen Cofferdam	10 days	Mon 1/11/21	Thu 1/21/21	72
74	Phase 1 Dam Removal	38 days	Fri 1/22/21	Sat 3/6/21	
75	Rock Excavation	20 days	Fri 1/22/21	Sat 2/13/21	73
76	Timber Decking Removal	12 days	Mon 2/15/21	Sat 2/27/21	75
77	Timber Cribbing Removal	4 days	Mon 3/1/21	Thu 3/4/21	76
78	Timber Pile Demolition	2 days	Fri 3/5/21	Sat 3/6/21	77
79	Phase 2 Construction	133 days	Mon 3/8/21	Mon 8/9/21	
80	Phase 2 Cofferdam	45 days	Mon 3/8/21	Wed 4/28/21	
81	Sheet Pile Cofferdam	45 days	Mon 3/8/21	Wed 4/28/21	78
82	Phase 2 Dam Removal	88 days	Thu 4/29/21	Mon 8/9/21	
83	Rock Excavation	36 days	Thu 4/29/21	Wed 6/9/21	81
84	Timber Decking Removal	25 days	Thu 6/10/21	Thu 7/8/21	83
85	Timber Cribbing Removal	5 days	Fri 7/9/21	Wed 7/14/21	84
86	Timber Pile Demolition	2 days	Thu 7/15/21	Fri 7/16/21	85
87	Sheet Pile Demolition	20 days	Sat 7/17/21	Mon 8/9/21	86
88	Site Restoration	10 days	Sat 9/25/21	Wed 10/6/21	87
89	Demobilization	10 days	Thu 10/7/21	Mon 10/18/21	88

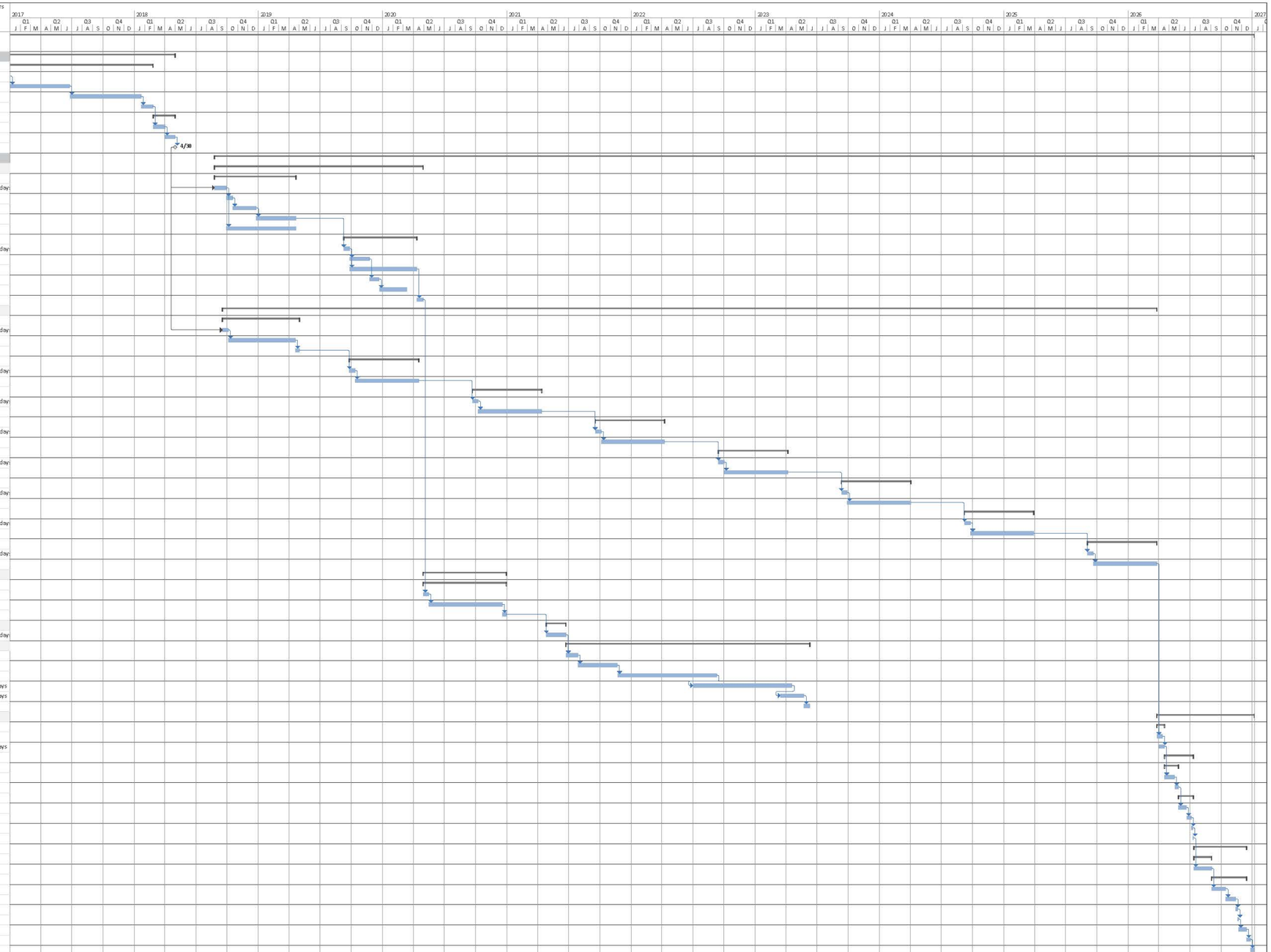


Project: LA River_Project Schedule
Date: Thu 3/19/16

Task | Milestone | Project Summary | External Milestone | Inactive Milestone | Duration-only | Manual Summary | Finish-only | Progress
Split | Summary | External Tasks | Inactive Task | Inactive Summary | Manual Summary Rollup | Start-only | Deadline | Manual Progress

Multiple Pumps with Conservation Measures Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**LOWER YELLOWSTONE IRRIGATION PROJECT - MULTIPLE PUMPS WITH CONSERVATION MEASURES ALTERNATIVE**	**3345 days**	**Mon 5/2/16**	**Wed 1/6/27**	
2	**PRE-CONSTRUCTION AWARD**	**625 days**	**Mon 5/2/16**	**Mon 4/30/18**	
3	**Plans & Specifications**	**570 days**	**Mon 5/2/16**	**Sat 2/24/18**	
4	30% Design	210 days	Mon 5/2/16	Sat 12/31/16	
5	60% Design	150 days	Mon 1/2/17	Sat 6/24/17	4
6	90% Design	180 days	Mon 6/26/17	Sat 1/20/18	5
7	BCOE	30 days	Mon 1/22/18	Sat 2/24/18	6
8	**Procurement & Award**	**55 days**	**Mon 2/26/18**	**Mon 4/30/18**	
9	Advertise	30 days	Mon 2/26/18	Sat 3/31/18	7
10	Award	25 days	Mon 4/2/18	Mon 4/30/18	9
11	NTP	0 days	Mon 4/30/18	Mon 4/30/18	10
12	**CONSTRUCTION**	**2620 days**	**Sat 8/25/18**	**Wed 1/6/27**	
13	**Convert lateral to Pipe**	**525 days**	**Sat 8/25/18**	**Tue 4/28/20**	
14	**Construction - Year 1**	**205 days**	**Sat 8/25/18**	**Sat 4/20/19**	
15	Mobilization and Site preparation	30 days	Sat 8/25/18	Fri 9/28/18	11SS+100 days
16	18" Pipe Laterals	15 days	Sat 9/29/18	Tue 10/16/18	15
17	24" Pipe Laterals	60 days	Wed 10/17/18	Tue 12/25/18	16
18	60" Pipe Laterals	100 days	Wed 12/26/18	Sat 4/20/19	17
19	36" Pipe Laterals	175 days	Sat 9/29/18	Sat 4/20/19	15
20	**Construction - Year 2**	**185 days**	**Mon 9/9/19**	**Fri 4/10/20**	
21	Mobilization and Site Preparation	15 days	Mon 9/9/19	Wed 9/25/19	18FS+120 days
22	36" Pipe Laterals	50 days	Thu 9/26/19	Fri 11/22/19	21
23	48" Pipe Laterals	170 days	Thu 9/26/19	Fri 4/10/20	21
24	72" Pipe Laterals	25 days	Sat 11/23/19	Sat 12/21/19	22
25	Line Remaining Canals with Shotcrete	70 days	Mon 12/23/19	Thu 3/12/20	24
26	Site Restoration and Demobilization	15 days	Sat 4/11/20	Tue 4/28/20	23
27	**Line Main Canal**	**2355 days**	**Mon 9/17/18**	**Wed 3/25/26**	
28	**Construction - Year 1**	**195 days**	**Mon 9/17/18**	**Wed 5/1/19**	
29	Mobilization and Site Preparation	15 days	Mon 9/17/18	Wed 10/3/18	11SS+100 days
30	Place and Compact Fill in Main Canal	170 days	Thu 10/4/18	Fri 4/19/19	29
31	Site Restoration and Demobilization	10 days	Sat 4/20/19	Wed 5/1/19	30
32	**Construction - Year 2**	**175 days**	**Wed 9/25/19**	**Wed 4/15/20**	
33	Mobilization and Site Preparation	15 days	Wed 9/25/19	Fri 10/11/19	31FS+125 days
34	Place Canal Lining	160 days	Sat 10/12/19	Wed 4/15/20	33
35	**Construction - Year 3**	**175 days**	**Mon 9/21/20**	**Mon 4/12/21**	
36	Mobilization and Site Preparation	15 days	Mon 9/21/20	Wed 10/7/20	34FS+135 days
37	Place Canal Lining	160 days	Thu 10/8/20	Mon 4/12/21	36
38	**Construction - Year 4**	**175 days**	**Fri 9/17/21**	**Fri 4/8/22**	
39	Mobilization and Site Preparation	15 days	Fri 9/17/21	Mon 10/4/21	37FS+135 days
40	Place Canal Lining	160 days	Tue 10/5/21	Fri 4/8/22	39
41	**Construction - Year 5**	**175 days**	**Wed 9/14/22**	**Wed 4/5/23**	
42	Mobilization and Site Preparation	15 days	Wed 9/14/22	Fri 9/30/22	40FS+135 days
43	Place Canal Lining	160 days	Sat 10/1/22	Wed 4/5/23	42
44	**Construction - Year 6**	**175 days**	**Mon 9/11/23**	**Mon 4/1/24**	
45	Mobilization and Site Preparation	15 days	Mon 9/11/23	Wed 9/27/23	43FS+135 days
46	Place Canal Lining	160 days	Thu 9/28/23	Mon 4/1/24	45
47	**Construction - Year 7**	**175 days**	**Fri 9/6/24**	**Fri 3/28/25**	
48	Mobilization and Site Preparation	15 days	Fri 9/6/24	Mon 9/23/24	46FS+135 days
49	Place Canal Lining	160 days	Tue 9/24/24	Fri 3/28/25	48
50	**Construction - Year 8**	**175 days**	**Wed 9/3/25**	**Wed 3/25/26**	
51	Mobilization and Site Preparation	15 days	Wed 9/3/25	Fri 9/19/25	49FS+135 days
52	Place Canal Lining	160 days	Sat 9/20/25	Wed 3/25/26	51
53	**Check Structures and Flow Measuring Devices**	**210 days**	**Wed 4/29/20**	**Tue 12/29/20**	
54	**Construction**	**210 days**	**Wed 4/29/20**	**Tue 12/29/20**	
55	Mobilization	15 days	Wed 4/29/20	Fri 5/15/20	26
56	Place and Compact Fill in Main Canal	185 days	Sat 5/16/20	Thu 12/17/20	55
57	Demobilization	10 days	Fri 12/18/20	Tue 12/29/20	56
58	**Construct Wind Turbine**	**50 days**	**Mon 4/26/21**	**Tue 6/22/21**	
59	Build and Test Wind Turbine	50 days	Mon 4/26/21	Tue 6/22/21	57FS+100 days
60	**Construct Ranney Wells**	**615 days**	**Wed 6/23/21**	**Fri 6/9/23**	
61	Mobilization	30 days	Wed 6/23/21	Tue 7/27/21	59
62	Drill and Pump Tests	100 days	Wed 7/28/21	Sat 11/20/21	61
63	Well Installation	250 days	Mon 11/22/21	Thu 9/8/22	62
64	Pump Station Installation	250 days	Fri 7/1/22	Tue 4/18/23	63FS-60 days
65	Discharge Piping	60 days	Wed 3/15/23	Tue 5/23/23	64FS-30 days
66	Demobilization	15 days	Wed 5/24/23	Fri 6/9/23	65
67	**Demolition of Exiting Intake Diversion Dam**	**216 days**	**Thu 3/26/26**	**Wed 1/6/27**	
68	**Mobilization and Prepatatory Work**	**20 days**	**Thu 3/26/26**	**Fri 4/17/26**	
69	Mobilization	15 days	Thu 3/26/26	Sat 4/11/26	52
70	Site Access and Staging	15 days	Wed 4/1/26	Fri 4/17/26	69FS-10 days
71	**Phase 1 Construction**	**73 days**	**Sat 4/18/26**	**Sat 7/11/26**	
72	**Phase 1 Cofferdam**	**35 days**	**Sat 4/18/26**	**Thu 5/28/26**	
73	Sheet Pile Cofferdam	25 days	Sat 4/18/26	Sat 5/16/26	70
74	Earthen Cofferdam	10 days	Mon 5/18/26	Thu 5/28/26	73
75	**Phase 1 Dam Removal**	**38 days**	**Fri 5/29/26**	**Sat 7/11/26**	
76	Rock Excavation	20 days	Fri 5/29/26	Sat 6/20/26	74
77	Timber Decking Removal	12 days	Mon 6/22/26	Sat 7/4/26	76
78	Timber Cribbing Removal	4 days	Mon 7/6/26	Thu 7/9/26	77
79	Timber Pile Demolition	2 days	Fri 7/10/26	Sat 7/11/26	78
80	**Phase 2 Construction**	**133 days**	**Mon 7/13/26**	**Mon 12/14/26**	
81	**Phase 2 Cofferdam**	**45 days**	**Mon 7/13/26**	**Wed 9/2/26**	
82	Sheet Pile Cofferdam	45 days	Mon 7/13/26	Wed 9/2/26	79
83	**Phase 2 Dam Removal**	**88 days**	**Thu 9/3/26**	**Mon 12/14/26**	
84	Rock Excavation	36 days	Thu 9/3/26	Wed 10/14/26	82
85	Timber Decking Removal	25 days	Thu 10/15/26	Thu 11/12/26	84
86	Timber Cribbing Removal	5 days	Fri 11/13/26	Wed 11/18/26	85
87	Timber Pile Demolition	2 days	Thu 11/19/26	Fri 11/20/26	86
88	Sheet Pile Demolition	20 days	Sat 11/21/26	Mon 12/14/26	87
89	Site Restoration	10 days	Tue 12/15/26	Fri 12/25/26	88
90	Demobilization	10 days	Sat 12/26/26	Wed 1/6/27	89



Project: LA River_Project Schedule
Date: Thu 5/19/16

Task | Milestone | Project Summary | External Milestone | Inactive Milestone | Duration-only | Manual Summary | Finish-only | Progress
Split | Summary | External Tasks | Inactive Task | Inactive Summary | Manual Summary Rollup | Start-only | Deadline | Manual Progress

Attachment B.3
Abbreviated Risk Analysis (ARA) Spreadsheets

Rock Ramp ARA

Abbreviated Risk Analysis

Project (less than $40M): **Lower Yellowstone River** — **Alternative: Rock Ramp**

Project Development Stage/Alternative: **Feasibility (Alternatives)**

Risk Category: **Low Risk: Typical Construction, Simple** — **Meeting Date:**

Total Estimated Construction Contract Cost = $ **59,979,308**

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	**Concrete Crest Structure**	$ 8,950,189		26.65%	$ 2,385,078	$ 11,335,267
2	06 FISH AND WILDLIFE FACILITIES	**Coffer Dam**	$ 4,167,924		40.81%	$ 1,701,095	$ 5,869,019
3	06 FISH AND WILDLIFE FACILITIES	**Rock Ramp**	$ 45,844,675		33.24%	$ 15,239,490	$ 61,084,165
4	06 FISH AND WILDLIFE FACILITIES	**Mob/Demob, Haul Roads, Staging, etc.**	$ 1,016,520		28.24%	$ 287,106	$ 1,303,626
5			$ -		0.00%	$ -	$ -
6			$ -		0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 5,453,000		18.84%	$ 1,027,121	$ 6,480,121
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 3,635,000		20.55%	$ 747,162	$ 4,382,162
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 59,979,308	32.6992%	$ 19,612,770	$ 79,592,078
Total Planning, Engineering & Design	$ 5,453,000	18.8359%	$ 1,027,121	$ 6,480,121
Total Construction Management	$ 3,635,000	20.5547%	$ 747,162	$ 4,382,162
Total	$ **69,067,308**	**30.97%**	$ **21,387,053**	$ **90,454,361**

	Base	**50%**	**80%**
Range Estimate ($000's)	$69,067k	$81,899k	$90,454k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.)

Lower Yellowstone River Rock Ramp

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting Date: 0-Jan-00

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				Maximum Project Growth		40%
PS-1	Concrete Crest Structure	Estimate is based on conceptual level design plans with many investigations remaining to complete that could change the design; Further analysis may show that the current design assumptions do not accomplish the projects intent, thus leading to more changes in the design.	Because of low design level, the scope/scale of this could change but is not likely to be significantly different than current assumptions.	Marginal	Likely	2
PS-2	Cofferr Dam	See discussion above.	The current assumptions are likely to change. Further investigations could show need for more dewatering efforts than currently assumed.	Moderate	Likely	3
PS-3	Rock Ramp	See discussion above.	Current assumptions show that the design accomplishes the projects intent. However, some investigations still remain, thus there is still a risk that this could change. Any scope growth could lead to cost impacts though.	Moderate	Likely	3
PS-4	Mob/Demob, Haul Roads, Staging, etc.	See discussion above.	Because of low design level, the scope/scale of this could change but is not likely to be significantly different than current assumptions.	Marginal	Likely	2
PS-5	0			Negligible	Unlikely	0
PS-6	0			Negligible	Unlikely	0
PS-7	0			Negligible	Unlikely	0
PS-8	0			Negligible	Unlikely	0
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0

PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	See discussion above.	Potential need for more investigations to be completed, above and beyond what is already assumed. These investigations could present moderate cost increases.	Negligible	Unlikely	0
PS-14	Construction Management	See discussion above.	Construction management could increase moderately given any scope increases as more management would be required to oversee the additional construction.	Negligible	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Concrete Crest Structure	Due to conceptual level of this project, there is limited contracting plan information; Estimate assumes relatively conservative assumptions regarding number of contracts and sub-contractors; Harsh weather could be a risk, but contractors would likely be experienced in this region; No 8a or small business likely due to scale of the project;	Current estimate assumes one contract to be bid out. Contractor assumes several subs, and schedule includes non-construction period during harsh winter months. So assumptions are relatively conservative, but still have some risk of changing. Impacts would likely be marginal at most if they occured.	Marginal	Likely	2
AS-2	Coffer Dam	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-3	Rock Ramp	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-4	Mob/Demob, Haul Roads, Staging, etc.	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-5	0			Negligible	Unlikely	0
AS-6	0			Negligible	Unlikely	0
AS-7	0			Negligible	Unlikely	0
AS-8	0			Negligible	Unlikely	0
AS-9	0			Negligible	Unlikely	0
AS-10	0			Negligible	Unlikely	0
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-14	Construction Management	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
Construction Elements				**Maximum Project Growth**		**15%**

CE-1	Concrete Crest Structure	Placing concrete within cofferdam and near flowing water.	Not likely to be significant impact but there could be issues in placing the concrete that change the current productivities.	Marginal	Possible	1
CE-2	Coffer Dam	Diversion and control of water	Current dewatering assumptions and sheet pile cofferdams are likely sufficient. There is still a risk that once in place, they are not sufficient. Changes to dewatering efforts could see a large increase in costs.	Significant	Possible	3
CE-3	Rock Ramp	Placing rock within cofferdams and near flowing water	Not likely to be significant impact but there could be issues in placing the rock ramp that change the current productivities.	Marginal	Possible	1
CE-4	Mob/Demob, Haul Roads, Staging, etc.	No significant risks anticipated	These construction elements are common and are unlikely to have any risks that cause cost increases.	Negligible	Unlikely	0
CE-5	0			Negligible	Unlikely	0
CE-6	0			Negligible	Unlikely	0
CE-7	0			Negligible	Unlikely	0
CE-8	0			Negligible	Unlikely	0
CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-14	Construction Management	Diversion and control of water	If increased effort of diverting flows is required then oversight could increase as well.	Marginal	Possible	1
Quantities for Current Scope				**Maximum Project Growth**		**20%**
Q-1	Concrete Crest Structure	None anticipated	No significant risks are anticipated for the quantity of the crest structure.	Negligible	Unlikely	0
Q-2	Coffer Dam	Cofferdam quantities and dewatering assumptions	The cofferdams have detailed quantity take-offs that have been verified, thus these are likely reasonable. There is risk of the contractor requiring more sheet piling and/or longer periods to dewater. This risk is low but could be significant increase.	Significant	Possible	3

Q-3	Rock Ramp	Confidence in rock quantities	Quantities have been calculated with the best info available and have been reviewed. But there is a chance they could change, which could cause a cost increase.	Marginal	Possible	1
Q-4	Mob/Demob, Haul Roads, Staging, etc.	Number of mob/demob periods and assumed mob/demob durations	There is a low risk that the number of mob/demob periods increase. Also a risk that the time to mob equipment and crews to site could be greater than those assumed. These risks are low, but could cause moderate increase if they occur.	Moderate	Possible	2
Q-5	0			Negligible	Unlikely	0
Q-6	0			Negligible	Unlikely	0
Q-7	0			Negligible	Unlikely	0
Q-8	0			Negligible	Unlikely	0
Q-9	0			Negligible	Unlikely	0
Q-10	0			Negligible	Unlikely	0
Q-11	0			Negligible	Unlikely	0
Q-12	Remaining Construction Items			Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Q-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Specialty Fabrication or Equipment				**Maximum Project Growth**		**50%**
FE-1	Concrete Crest Structure	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-2	Coffer Dam	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-3	Rock Ramp	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-4	Mob/Demob, Haul Roads, Staging, etc.	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-5	0			Negligible	Unlikely	0
FE-6	0			Negligible	Unlikely	0

FE-7	0			Negligible	Unlikely	0
FE-8	0			Negligible	Unlikely	0
FE-9	0			Negligible	Unlikely	0
FE-10	0			Negligible	Unlikely	0
FE-11	0			Negligible	Unlikely	0
FE-12	Remaining Construction Items			Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-14	Construction Management	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
CT-1	Concrete Crest Structure	Productivity assumptions	The assumptions regarding the productivity of placing the concrete crest structure could differ once in the field. Conservative assumptions were used, but there is still a risk of these being different than the contractor.	Marginal	Likely	2
CT-2	Coffer Dam	Productivity of placing cofferdams	The cofferdam installation will be completed along the flowing river channel. Therefore there is some risk that current assumptions are wrong. Estimate attempted to make conservative placement assumptions and therefore not likely to see a significant cost increase.	Marginal	Likely	2
CT-3	Rock Ramp	Productivity assumptions; Site accessibility at disposal locations	This alternative involves placing large quantities of rock. Estimated production rates may not be correct, but conservative assumptions have been assumed. Therefore not likley to be a large increase but could occur.	Marginal	Likely	2
CT-4	Mob/Demob, Haul Roads, Staging, etc.	Site accessibility and transport delays	Due to needing to access the site from Joe's Island, there are no existing roadways capable of handling the construction traffic to and from the site. Therefore, access roads are assumed to be installed. But the access speeds and traffic assumptions may be different during construction than currently assumed. This could lead to cost increases if it happens.	Moderate	Possible	2
CT-5	0			Negligible	Unlikely	0
CT-6	0			Negligible	Unlikely	0
CT-7	0			Negligible	Unlikely	0

CT-8	0			Negligible	Unlikely	0
CT-9	0			Negligible	Unlikely	0
CT-10	0			Negligible	Unlikely	0
CT-11	0			Negligible	Unlikely	0
CT-12	Remaining Construction Items			Negligible	Unlikely	0
CT-13	Planning, Engineering, & Design	Percentages assumed for PED	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
CT-14	Construction Management	Percentages assumed for CM	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**20%**
EX-1	Concrete Crest Structure	Severe winter weathere; unanticipated inflations in fuel, and materials; market conditions and bidding climate;	Winter weather is an issue and construction will be likely completed around those times. But impacts to cost/schedule could still occur. The risk of inflation to fuel and other material items is real and could be a significant impact. The bidding climate at time of award, and for possible numerous contracts, could be unfavorable to the cost. Given all these risks, a significant impact would be assumed if they all occured.	Significant	Possible	3
EX-2	Coffer Dam	See discussion above.	See discussion above.	Significant	Possible	3
EX-3	Rock Ramp	See discussion above.	See discussion above.	Significant	Possible	3
EX-4	Mob/Demob, Haul Roads, Staging, etc.	See discussion above.	See discussion above.	Significant	Possible	3
EX-5	0			Negligible	Unlikely	0
EX-6	0			Negligible	Unlikely	0
EX-7	0			Negligible	Unlikely	0
EX-8	0			Negligible	Unlikely	0
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0

EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	See discussion above.	See discussion above.	Significant	Possible	3
EX-14	Construction Management	See discussion above.	See discussion above.	Significant	Possible	3

Lower Yellowstone River Rock Ramp
Feasibility (Alternatives)
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Scope Growth	Acquisition Strategy	Construction Elements	Quantities for Current Scope	Specialty Fabrication or Equipment	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	**Real Estate**								$0
15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	**Concrete Crest Structure**	2	2	1	0	0	2	3	$8,950
06 FISH AND WILDLIFE FACILITIES	Coffer Dam	3	2	3	3	0	2	3	$4,168
06 FISH AND WILDLIFE FACILITIES	Rock Ramp	3	2	1	1	0	2	3	$45,845
06 FISH AND WILDLIFE FACILITIES	Mob/Demob, Haul Roads, Staging, etc.	2	2	0	2	0	2	3	$1,017
0	0	0	0	0	0	0	0	0	$0
0	0	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
All Other	Remaining Construction Items	0	0	0	0	0	0	0	$0
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	0	2	0	0	0	1	3	$5,453
31 CONSTRUCTION MANAGEMENT	Construction Management	0	2	1	0	0	1	3	$3,635
									$69,067
Risk		$ 5,010	$ 2,692	$ 6,051	$ 1,120	$ -	$ 2,347	$ 4,168	**$21,387**
Fixed Dollar Risk Allocation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$0**
	Risk	$ 5,010	$ 2,692	$ 6,051	$ 1,120	$ -	$ 2,347	$ 4,168	**$21,387**
								Total	**$90,454**

Bypass Channel ARA

Abbreviated Risk Analysis

Project (less than $40M): **Lower Yellowstone River** — **Alternative: Bypass Channel**

Project Development Stage/Alternative: **Feasibility (Alternatives)**

Risk Category: **Low Risk: Typical Construction, Simple** — **Meeting Date:**

Total Estimated Construction Contract Cost = $ **49,424,497**

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Bypass Channel**	$ 18,046,778		8.82%	$ 1,591,828	$ 19,638,606
2	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	**Intake Weir**	$ 12,266,807		8.82%	$ 1,082,002	$ 13,348,809
3	16 BANK STABILIZATION	**Bank Stabilization Rock**	$ 19,110,912		8.82%	$ 1,685,690	$ 20,796,602
4			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6			$ -		0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ -		0.00%	$ -	$ -
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 2,996,000		8.82%	$ 264,264	$ 3,260,264
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 49,424,497	8.8206%	$ 4,359,519	$ 53,784,016
Total Planning, Engineering & Design	$ -	0.0000%	$ -	$ -
Total Construction Management	$ 2,996,000	8.8206%	$ 264,264	$ 3,260,264
Total	$ 52,420,497	8.82%	$ 4,623,784	$ 57,044,281
		Base	**50%**	**80%**
Range Estimate ($000's)		$52,420k	$55,194k	$57,044k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Lower Yellowstone River Bypass Channel

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting Date: 0-Jan-00

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				Maximum Project Growth		40%
PS-1	Bypass Channel	None	No risks anticipated as the designs have been fully developed to the 100% level.	Negligible	Unlikely	0
PS-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
PS-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
PS-4	0	None	See discussion above.	Negligible	Unlikely	0
PS-5	0			Negligible	Unlikely	0
PS-6	0			Negligible	Unlikely	0
PS-7	0			Negligible	Unlikely	0
PS-8	0			Negligible	Unlikely	0
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0

PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
PS-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Bypass Channel	None	Contract had already been awarded, and assumptions in estimate were likely over estimated. Therefore no likely cost increase due to acquisition strategy issues.	Negligible	Unlikely	0
AS-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
AS-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
AS-4	0	None	See discussion above.	Negligible	Unlikely	0
AS-5	0			Negligible	Unlikely	0
AS-6	0			Negligible	Unlikely	0
AS-7	0			Negligible	Unlikely	0
AS-8	0			Negligible	Unlikely	0
AS-9	0			Negligible	Unlikely	0
AS-10	0			Negligible	Unlikely	0
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
AS-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
Construction Elements				**Maximum Project Growth**		**15%**
CE-1	Bypass Channel	None	Construction elements are of no risk as the project was previously bid on, and current estimate is likely conservative.	Negligible	Unlikely	0

CE-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
CE-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
CE-4	0	None	See discussion above.	Negligible	Unlikely	0
CE-5	0			Negligible	Unlikely	0
CE-6	0			Negligible	Unlikely	0
CE-7	0			Negligible	Unlikely	0
CE-8	0			Negligible	Unlikely	0
CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
CE-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
Quantities for Current Scope				**Maximum Project Growth**		**20%**
Q-1	Bypass Channel	None	Designs have been built out to the 100% level. Therefore quantities used in the estimate are highly reliable and and are very unlikely to change at this point.	Negligible	Unlikely	0
Q-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
Q-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
Q-4	0	None	See discussion above.	Negligible	Unlikely	0
Q-5	0			Negligible	Unlikely	0

Q-6	0			Negligible	Unlikely	0
Q-7	0			Negligible	Unlikely	0
Q-8	0			Negligible	Unlikely	0
Q-9	0			Negligible	Unlikely	0
Q-10	0			Negligible	Unlikely	0
Q-11	0			Negligible	Unlikely	0
Q-12	Remaining Construction Items			Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
Q-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
Specialty Fabrication or Equipment				**Maximum Project Growth**		**50%**
FE-1	Bypass Channel	None	No specialty fabrication or equipment required for this alternative.	Negligible	Unlikely	0
FE-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
FE-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
FE-4	0	None	See discussion above.	Negligible	Unlikely	0
FE-5	0			Negligible	Unlikely	0
FE-6	0			Negligible	Unlikely	0
FE-7	0			Negligible	Unlikely	0
FE-8	0			Negligible	Unlikely	0
FE-9	0			Negligible	Unlikely	0
FE-10	0			Negligible	Unlikely	0
FE-11	0			Negligible	Unlikely	0

FE-12	Remaining Construction Items			Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
FE-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
CT-1	Bypass Channel	None	Conservative assumptions were made across the board in the cost estimate. This was proven when contractor bids were received. Thus no risk of cost increases from the assumptions made within the MCACES.	Negligible	Unlikely	0
CT-2	Intake Weir	None	See discussion above.	Negligible	Unlikely	0
CT-3	Bank Stabilization Rock	None	See discussion above.	Negligible	Unlikely	0
CT-4	0	None	See discussion above.	Negligible	Unlikely	0
CT-5	0			Negligible	Unlikely	0
CT-6	0			Negligible	Unlikely	0
CT-7	0			Negligible	Unlikely	0
CT-8	0			Negligible	Unlikely	0
CT-9	0			Negligible	Unlikely	0
CT-10	0			Negligible	Unlikely	0
CT-11	0			Negligible	Unlikely	0
CT-12	Remaining Construction Items			Negligible	Unlikely	0
CT-13	Planning, Engineering, & Design	None	See discussion above.	Negligible	Unlikely	0
CT-14	Construction Management	None	See discussion above.	Negligible	Unlikely	0
External Project Risks				**Maximum Project Growth**		**20%**

EX-1	Bypass Channel	Weather, market volatility, unexpected increases in materials/gas	There are some small possibility of these risks occuring. But if this alternative moves forward, it would likely begin construciton quickly and therefore there shouldn't be any major changes to material prices. Contractor is likely very capable of working in the weather conditions at the site. Also, if project needs to be re-bid, likely would not expect price increase.	Marginal	Possible	1
EX-2	Intake Weir	None	See discussion above.	Marginal	Possible	1
EX-3	Bank Stabilization Rock	None	See discussion above.	Marginal	Possible	1
EX-4	0	None	See discussion above.	Marginal	Possible	1
EX-5	0			Negligible	Unlikely	0
EX-6	0			Negligible	Unlikely	0
EX-7	0			Negligible	Unlikely	0
EX-8	0			Negligible	Unlikely	0
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	None	See discussion above.	Marginal	Possible	1
EX-14	Construction Management	None	See discussion above.	Marginal	Possible	1

Lower Yellowstone River Bypass Channel
Feasibility (Alternatives)
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Scope Growth	Acquisition Strategy	Construction Elements	Quantities for Current Scope	Specialty Fabrication or Equipment	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	**Real Estate**								$0
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Bypass Channel**	0	0	0	0	0	0	1	$18,047
15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Intake Weir	0	0	0	0	0	0	1	$12,267
16 BANK STABILIZATION	Bank Stabilization Rock	0	0	0	0	0	0	1	$19,111
0	0	0	0	0	0	0	0	1	$0
0	0	0	0	0	0	0	0	0	$0
0	0	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
All Other	Remaining Construction Items	0	0	0	0	0	0	0	$0
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	0	0	0	0	0	0	1	$0
31 CONSTRUCTION MANAGEMENT	Construction Management	0	0	0	0	0	0	1	$2,996
									$52,420
Risk		$ -	$ -	$ 3,669	$ -	$ -	$ -	$ 954	**$4,624**
Fixed Dollar Risk Allocation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$0**
	Risk	$ -	$ -	$ 3,669	$ -	$ -	$ -	$ 954	**$4,624**
								Total	**$57,044**

Modified Side Channel ARA

Abbreviated Risk Analysis

Project (less than $40M): **Lower Yellowstone River** — **Alternative: Modified Side Channel**

Project Development Stage/Alternative: **Feasibility (Alternatives)**

Risk Category: **Low Risk: Typical Construction, Simple** — **Meeting Date:**

Total Estimated Construction Contract Cost = $ 35,180,547

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 220,000		25.00%	$ 55,000	$ 275,000
1		**Mob, Demob & Site Preparation**	$ 2,254,556		29.96%	$ 675,528	$ 2,930,085
2		**Diversion and Control of Water**	$ 2,178,186		36.97%	$ 805,283	$ 2,983,470
3	08 ROADS, RAILROADS, AND BRIDGES	**Bridge Installation**	$ 975,827		35.74%	$ 348,726	$ 1,324,553
4	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Channel Construction**	$ 12,490,132		36.29%	$ 4,532,849	$ 17,022,981
5	16 BANK STABILIZATION	**Channel Armoring**	$ 17,281,844		34.80%	$ 6,013,658	$ 23,295,503
6			$ -		0.00%	$ -	$ -
7			$ -		0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 3,201,000		23.21%	$ 742,931	$ 3,943,931
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 2,133,000		24.93%	$ 531,717	$ 2,664,717
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ 220,000	25.00%	$ 55,000	$ 275,000.00
Total Construction Estimate	$ 35,180,547	35.2%	$ 12,376,044	$ 47,556,591
Total Planning, Engineering & Design	$ 3,201,000	23.2%	$ 742,931	$ 3,943,931
Total Construction Management	$ 2,133,000	24.9%	$ 531,717	$ 2,664,717
Total	$ **40,734,547**	**33.6%**	$ **13,705,692**	$ **54,440,239**

	Base	**50%**	**80%**
Range Estimate ($000's)	$40,735k	$48,958k	$54,440k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Lower Yellowstone River Modified Side Channel

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting Date: 0-Jan-00

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				**Maximum Project Growth**		**40%**
PS-1	Mob, Demob & Site Preparation	Estimate is based on conceptual level design plans with many investigations remaining to complete that could change the design; Further analysis may show that the current design assumptions do not accomplish the project's intent, thus leading to more changes in the design.	Because of low design level, the scope/scale of this could change but is not likely to be significantly different than current assumptions.	Marginal	Likely	2
PS-2	Diversion and Control of Water	See discussion above.	The current assumptions are likely to change. Further investigations could show need for more dewatering efforts than currently assumed.	Moderate	Likely	3
PS-3	Bridge Installation	See discussion above; ice considerations	Only one bridge is required for crews to travel over the channel. May be slight risk that larger bridge/abutments may be required. Further investigations need to be completed in order to account for ice flows. Current bridge may require changes in future designs	Moderate	Likely	3
PS-4	Channel Construction	See discussion above.	Current assumptions show that the design accomplishes the project's intent. However, some investigations still remain, thus there is still a risk that this could change. Any scope growth could lead to significant cost impacts though.	Significant	Possible	3
PS-5	Channel Armoring	See discussion above.	Current assumptions show that the design accomplishes the project's intent. However, some investigations still remain, thus there is still a risk that this could change. Any scope growth could lead to significant impacts though.	Significant	Possible	3
PS-6	0			Negligible	Unlikely	0
PS-7	0			Negligible	Unlikely	0
PS-8	0			Negligible	Unlikely	0
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0

PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	See discussion above.	Potential need for more investigations to be completed, above and beyond what is already assumed. These investigations could present moderate cost increases.	Moderate	Possible	2
PS-14	Construction Management	See discussion above.	Construction management could increase moderately given any scope increases as more management would be required to oversee the additional construction.	Moderate	Possible	2
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Mob, Demob & Site Preparation	Due to conceptual level of this project, there is limited contracting plan information; Estimate assumes relatively conservative assumptions regarding number of contracts and sub-contractors; Harsh weather could be a risk, but contractors would likely be experienced in this region; No 8a or small business likely due to scale of the project;	Current estimate assumes one contract to be bid out. Contractor assumes several subs, and schedule includes non-construction period during harsh winter months. So assumptions are relatively conservative, but still have some risk of changing. Impacts would likely be marginal at most if they occured.	Marginal	Likely	2
AS-2	Diversion and Control of Water	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-3	Bridge Installation	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-4	Channel Construction	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-5	Channel Armoring	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-6	0			Negligible	Unlikely	0
AS-7	0			Negligible	Unlikely	0
AS-8	0			Negligible	Unlikely	0
AS-9	0			Negligible	Unlikely	0
AS-10	0			Negligible	Unlikely	0
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
AS-14	Construction Management	See concerns listed above.	See discussion listed above.	Marginal	Likely	2
Construction Elements				**Maximum Project Growth**		**15%**
CE-1	Mob, Demob & Site Preparation	Number of mob/demob periods	Current estimate assumes several mob/demob periods that occur before/after the winter closure period. Risk of requiring more mob/demob efforts than currently assumed is there, but not likely to occur.	Moderate	Unlikely	1

CE-2	Diversion and Control of Water	Diversion and control of water	Current assumption for earthen cofferdam with sheetpile cut-offs are likely to be enough. But estimate also made assumptions for well points to be installed. Changes to these dewatering efforts are likely by the contractor, but due to conservative assumptions used, costs is not likely to increase significantly.	Marginal	Likely	2
CE-3	Bridge Installation	No significant risks anticipated	The bridge work should be standard work for the contractor, and therefore very unlikely to see significant cost increases.	Negligible	Unlikely	0
CE-4	Channel Construction	No significant risks anticipated	The construction elements involved for the channel construction are common. Therefore no risks likely to occur or increase costs.	Negligible	Unlikely	0
CE-5	Channel Armoring	No significant risks anticipated	The construction elements involved for the channel construction are common. Therefore no risks likely to occur or increase costs.	Negligible	Unlikely	0
CE-6	0			Negligible	Unlikely	0
CE-7	0			Negligible	Unlikely	0
CE-8	0			Negligible	Unlikely	0
CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-14	Construction Management	Diversion and control of water	If increased effort of diverting flows is required then oversight could increase as well.	Marginal	Possible	1
Quantities for Current Scope				**Maximum Project Growth**		**20%**
Q-1	Mob, Demob & Site Preparation	Number of mob/demob periods and assumed mob/demob durations	There is a low risk that the number of mob/demob periods increase. Also a risk that the time to mob equipment and crews to site could be greater than those assumed. These risks are low, but could cause moderate increase if they occur.	Moderate	Possible	2
Q-2	Diversion and Control of Water	Cofferdam quantities; Well point and other pumping assumptions	The cofferdams have detailed quantity take-offs that have been verified, thus these are not-likely to change. The dewater wells and pumps are based on general assumptions currently, and there is a risk of the contractor requiring more wells and/or longer periods to dewater. This risk is low but could be significant increase.	Significant	Possible	3

Q-3	Bridge Installation	Accounting for ice flow	Bridge quantities for abutments and earthwork are likely to change once further analysis determines the exact height needed to avoid or limit damage from ice. These are not significant cost drivers for the bridge but could have a moderate impact.	Moderate	Likely	3
Q-4	Channel Construction	Confidence level in earthwork quantities	Based on the current design, the quantities were calculated using CAD and therefore are expected to be accurate. The quantities have been backchecked and therefore are not likely to change unless further analysis shows the design must change. Thus the risk of occuring is low, but increases in quantities could have moderate cost impacts.	Moderate	Possible	2
Q-5	Channel Armoring	Confidence level in armoring quantities	The quantities were calculated using the typical bank sections. Further design would likely develop more sections for use in the calculation. However, further sections are likely not going to increase the quantities therefore likelihood and impact of increases would be low.	Marginal	Possible	1
Q-6	0			Negligible	Unlikely	0
Q-7	0			Negligible	Unlikely	0
Q-8	0			Negligible	Unlikely	0
Q-9	0			Negligible	Unlikely	0
Q-10	0			Negligible	Unlikely	0
Q-11	0			Negligible	Unlikely	0
Q-12	Remaining Construction Items			Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Q-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Specialty Fabrication or Equipment				**Maximum Project Growth**		**50%**
FE-1	Mob, Demob & Site Preparation	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-2	Diversion and Control of Water	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-3	Bridge Installation	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-4	Channel Construction	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-5	Channel Armoring	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0

FE-6	0			Negligible	Unlikely	0
FE-7	0			Negligible	Unlikely	0
FE-8	0			Negligible	Unlikely	0
FE-9	0			Negligible	Unlikely	0
FE-10	0			Negligible	Unlikely	0
FE-11	0			Negligible	Unlikely	0
FE-12	Remaining Construction Items			Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
FE-14	Construction Management	None anticipated	No specialty fabrication or equipment required.	Negligible	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
CT-1	Mob, Demob & Site Preparation	Site accessibility and transport delays	Due to needing to access the site from Joe's Island, there are no existing roadways capable of handling the construction traffic to and from the site. Therefore, access roads are assumed to be installed. But the access speeds and traffic assumptions may be different during construction than currently assumed. This could lead to cost increases if it happens.	Moderate	Possible	2
CT-2	Diversion and Control of Water	Productivity of placing cofferdams	The cofferdam installation will be completed along the flowing river channel. Therefore there is some risk that current assumptions are wrong. Estimate attempted to make conservative placement assumptions and therefore not likely to see a significant cost increase.	Marginal	Possible	1
CT-3	Bridge Installation	Unit price for bridge	Due to conceptual level of the design, a bridge quote has not been obtained as no details are available. However, the MII unit price used is relatively conservative based on past bridge estimates. Thus it is possible that the costs would change, but not anticipated to increase significantly as cost is adequate for a basic road bridge.	Moderate	Possible	2
CT-4	Channel Construction	Productivity assumptions; Site accessibility at disposal locations	This alternative is excavating large quantity and disposing of nearby using large haulers. However, the current production rates may not be correct. Also accessing some of the disposal locations may show to be more difficult than assumed. These are not likely to be the case, but could increase earthwork costs significantly.	Significant	Possible	3

CT-5	Channel Armoring	Unit prices for bedding, riprap, and boulders	In order for this estimate to be comparable to previously developed alternatives, the same unit price for the stone material and delivery were assumed. However, given the distances the stone would need to be transported over, there is a likelihood that costs could increase greatly given supply and transport assumptions. This may not be likely to occur but could be significant impact to the rock prices.	Significant	Possible	3
CT-6	0			Negligible	Unlikely	0
CT-7	0			Negligible	Unlikely	0
CT-8	0			Negligible	Unlikely	0
CT-9	0			Negligible	Unlikely	0
CT-10	0			Negligible	Unlikely	0
CT-11	0			Negligible	Unlikely	0
CT-12	Remaining Construction Items			Negligible	Unlikely	0
CT-13	Planning, Engineering, & Design	Percentages assumed for PED	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
CT-14	Construction Management	Percentages assumed for CM	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**20%**
EX-1	Mob, Demob & Site Preparation	Severe winter weathere; unanticipated inflations in fuel, and materials; market conditions and bidding climate;	Winter weather is an issue and construction will be likely completed around those times. But impacts to cost/schedule could still occur. The risk of inflation to fuel and other material items is real and could be a significant impact. The bidding climate at time of award, and for possible numerous contracts, could be unfavorable to the cost. Given all these risks, a significant impact would be assumed if they all occured.	Significant	Possible	3
EX-2	Diversion and Control of Water	See discussion above.	See discussion above.	Significant	Possible	3
EX-3	Bridge Installation	See discussion above.	See discussion above.	Significant	Possible	3
EX-4	Channel Construction	See discussion above.	See discussion above.	Significant	Possible	3
EX-5	Channel Armoring	See discussion above.	See discussion above.	Significant	Possible	3

EX-6	0			Negligible	Unlikely	0
EX-7	0			Negligible	Unlikely	0
EX-8	0			Negligible	Unlikely	0
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	See discussion above.	See discussion above.	Significant	Possible	3
EX-14	Construction Management	See discussion above.	See discussion above.	Significant	Possible	3

Lower Yellowstone River Modified Side Channel
Feasibility (Alternatives)
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Scope Growth	Acquisition Strategy	Construction Elements	Quantities for Current Scope	Specialty Fabrication or Equipment	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	**Real Estate**								$220,000
0	**Mob, Demob & Site Preparation**	2	2	1	2	0	2	3	$2,255
0	Diversion and Control of Water	3	2	2	3	0	1	3	$2,178
08 ROADS, RAILROADS, AND BRIDGES	Bridge Installation	3	2	0	3	0	2	3	$976
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	Channel Construction	3	2	0	2	0	3	3	$12,490
16 BANK STABILIZATION	Channel Armoring	3	2	0	1	0	3	3	$17,282
0	0	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
All Other	Remaining Construction Items	0	0	0	0	0	0	0	$0
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	2	2	0	0	0	1	3	$3,201
31 CONSTRUCTION MANAGEMENT	Construction Management	2	2	1	0	0	1	3	$2,133
									$40,515
Risk		$ 3,343	$ 1,579	$ 2,976	$ 994	$ -	$ 2,314	$ 2,445	**$13,651**
Fixed Dollar Risk Allocation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$0**
	Risk	$ 3,343	$ 1,579	$ 2,976	$ 994	$ -	$ 2,314	$ 2,445	**$13,651**
								Total	**$54,165**

Multiple Pump ARA

Abbreviated Risk Analysis

Project (less than $40M): **Lower Yellowstone River**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Low Risk: Typical Construction, Simple**

Alternative: **Multiple Pump Alternative**
Meeting Date:

Total Estimated Construction Contract Cost = $ **84,277,276**

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 443,000		25.00%	$ 110,750	$ 553,750
1	04 DAMS	**Dam Removal**	$ 6,599,764		45.02%	$ 2,971,122	$ 9,570,886
2	19 BUILDINGS, GROUNDS, AND UTILITIES	**Mob, Demob & Site Prep**	$ 1,821,234		29.48%	$ 536,863	$ 2,358,097
3	19 BUILDINGS, GROUNDS, AND UTILITIES	**Diversion and Control of Water**	$ 2,489,513		39.25%	$ 977,025	$ 3,466,538
4	19 BUILDINGS, GROUNDS, AND UTILITIES	**Pump Stations**	$ 23,599,255		38.10%	$ 8,992,108	$ 32,591,363
5	19 BUILDINGS, GROUNDS, AND UTILITIES	**Discharge Pipelines**	$ 25,527,106		32.46%	$ 8,286,712	$ 33,813,818
6	19 BUILDINGS, GROUNDS, AND UTILITIES	**Feeder Canal**	$ 2,449,067		27.68%	$ 677,917	$ 3,126,984
7	19 BUILDINGS, GROUNDS, AND UTILITIES	**Fish Screen**	$ 18,301,220		38.02%	$ 6,957,999	$ 25,259,219.15
8	19 BUILDINGS, GROUNDS, AND UTILITIES	**Power System Uprating**	$ 3,490,118		46.90%	$ 1,636,975	$ 5,127,092.65
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 7,664,000		26.52%	$ 2,032,783	$ 9,696,783
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 5,108,000		26.52%	$ 1,354,835	$ 6,462,835
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ 443,000	25.0%	$ 110,750	$ 553,750.00
Total Construction Estimate	$ 84,277,276	36.8%	$ 31,036,720	$ 115,313,996
Total Planning, Engineering & Design	$ 7,664,000	26.5%	$ 2,032,783	$ 9,696,783
Total Construction Management	$ 5,108,000	26.5%	$ 1,354,835	$ 6,462,835
Total	$ **97,492,276**	**35.4%**	$ **34,535,089**	$ **132,027,365**

Range Estimate ($000's)	**Base**	**50%**	**80%**
	$97,492k	$118,213k	$132,027k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Lower Yellowstone River Multiple Pump Alternative

Feasibility [Alternatives]
Abbreviated Risk Analysis
Meeting Date: 0-Jan-00

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				Maximum Project Growth		40%
PS-1	Dam Removal	Estimate is based on conceptual level design plans with many investigations remaining to complete that could change the design; Further analysis may show that the current design assumptions do not accomplish the project's intent, thus leading to more changes in the design.	The dam removal requires significantly more analysis to determine the extent of the rock/boulder debris field downstream of the existing dam. There is a chance that current assumptions are off, which although not likely, it would be significant to the costs.	Significant	Possible	3
PS-2	Mob, Demob & Site Prep	See concerns above.	Because of low design level, the scope/scale of this could change but is not likely to be significantly different than current assumptions.	Marginal	Likely	2
PS-3	Diversion and Control of Water	See concerns above.	The current assumptions are likely to change. Further investigations could show need for more dewatering efforts than currently assumed.	Moderate	Likely	3
PS-4	Pump Stations	See concerns above; Ice protection	If further investigations show that more pumps are required, then a major cost increase could occur. However, further analysis could also show that less pumps are required. Thus, the likelihood of a change is very low and the impact could swing either way, and thus is only moderate. Further analysis into ice flows could require changes to the scope of the pump stations. Could be significant impact.	Significant	Unlikely	2
PS-5	Discharge Pipelines	See concerns above.	Discharge pipelines, based on current pump station design, are not likely to increase in scope. The current design calls for large pipe, with already expensive costs, thus any change should not be significant impact.	Marginal	Possible	1
PS-6	Feeder Canal	See concerns above.	No significant risks to scope growing as all items that could be required are included. Some minor losses may arise upon further analysis but these are unlikely and should not increase costs significantly.	Marginal	Possible	1
PS-7	Fish Screen	See concerns above; Ice protection	No significant risk to scope growth as design assumptions are robust for the fish screen. Further analysis could change the design but is not likely to occur and cost impacts likely would only be moderate. Further analysis into possible ice flows could significantly impact the design of the fish screens.	Significant	Unlikely	2

PS-8	Power System Uprating	See concerns above.	Current scale of the power system changes are based on preliminary analysis and discussions with the local power company. Much analysis is likely still needed to ensure there is sufficient utility structures capable of providing power to the pumps. The current assumptions are likely to change and could have significant cost impacts.	Significant	Likely	4
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0
PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	See concerns above.	Potential need for more investigations to be completed, above and beyond what is already assumed. These investigations could present moderate cost increases.	Moderate	Possible	2
PS-14	Construction Management	See concerns above.	Construction management could increase moderately given any scope increases as more management would be required to oversee the additional construction.	Moderate	Possible	2
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Dam Removal	Due to conceptual level of this project, there is limited contracting plan information; Estimate assumes relatively conservative assumptions regarding number of contracts and sub-contractors; Harsh weather could be a risk, but contractors would likely be experienced in this region; No 8a or small business likely due to scale of the project;	Contracting plan changes could significantly impact each of these costs. If the work needs to be broken into multiple contracts then costs would increase. Individual components may be constructed at different times, based on water demands and winter weather conditions, which also could impact costs. Without lack of a detailed contracting plan, there could be changes both increasing and decreasing costs, thus it is likely to change but only marginal impact to costs.	Marginal	Likely	2
AS-2	Mob, Demob & Site Prep	See concerns above.	See discussion above.	Marginal	Likely	2
AS-3	Diversion and Control of Water	See concerns above.	See discussion above.	Marginal	Likely	2
AS-4	Pump Stations	See concerns above.	See discussion above.	Marginal	Likely	2
AS-5	Discharge Pipelines	See concerns above.	See discussion above.	Marginal	Likely	2
AS-6	Feeder Canal	See concerns above.	See discussion above.	Marginal	Likely	2
AS-7	Fish Screen	See concerns above.	See discussion above.	Marginal	Likely	2
AS-8	Power System Uprating	See concerns above.	See discussion above.	Marginal	Likely	2
AS-9	0			Negligible	Unlikely	0

AS-10	0			Negligible	Unlikely	0
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	See concerns above.	See discussion above.	Marginal	Likely	2
AS-14	Construction Management	See concerns above.	See discussion above.	Marginal	Likely	2
Construction Elements				**Maximum Project Growth**		**15%**
CE-1	Dam Removal	Working in wet conditions within the channel, even when dewatered; potential for construction mods/claims; high risk due to river water being diverted nearby and likely working in wet conditions;	The dewatering effort is a significant cost driver. The existing rock downstream of the dam could be a significant hinderance to effectively dewatering the area. Current assumptions are conservative, but there could be significant risks to these assumptions changing.	Significant	Likely	4
CE-2	Mob, Demob & Site Prep	Number of mob/demob periods	There are numerous mob/demob periods across mutliple areas in the study region. These assumptions are assumed to be conservative but are still likely to change.	Marginal	Likely	2
CE-3	Diversion and Control of Water	The assumptions required for dewatering are based on limited information; Future analysis could greatly change the dewatering efforts.	Conservative assumptions have currently been made for dewatering during pump station construction. However, some items may require more dewatering efforts that are currently not assumed. This could impact costs signficantly but is not likely to occur.	Significant	Unlikely	2
CE-4	Pump Stations	Special subcontractors likely needed to install and test pumps and other equipment; Deep excavation for pump stations could increase risks;	The contractors tasked with the installation of the pumps should not be hard to find and would likely be able to complete with little risk; The excavation should not be that difficult but contractor may make different assumptions on how to exactly excavate the area. If shoring or some other methodology is required, costs could increase signficantly.	Significant	Possible	3
CE-5	Discharge Pipelines	See discussions in CE-4	Not likely to be a significant impact.	Marginal	Possible	1
CE-6	Feeder Canal	See discussions in CE-4	Not likely to be a significant impact.	Marginal	Possible	1
CE-7	Fish Screen	See discussions in CE-4	Not likely to be a significant impact.	Marginal	Possible	1
CE-8	Power System Uprating	See discussions in CE-4	Not likely to be a significant impact.	Marginal	Possible	1
CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0

CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Quantities for Current Scope				**Maximum Project Growth**		**20%**
Q-1	Dam Removal	Quantities are based on conceptual level designs and therefore are anticipated to change as project progresses; Many investigations remain to assist in developing accurate quantities.	Due to the low level of design for this alternative quantities are likely to change as the project progresses. The quantity development did take very conservative assumptions and therefore increases to the quantities is not likely to be significant. Thus it is possible that they will change, but due to conservative assumptions, should only be a marginal impact at most to certain elements.	Marginal	Likely	2
Q-2	Mob, Demob & Site Prep	See concerns above.	See discussion above.	Marginal	Likely	2
Q-3	Diversion and Control of Water	See concerns above.	See discussion above.	Marginal	Likely	2
Q-4	Pump Stations	See concerns above.	See discussion above.	Marginal	Likely	2
Q-5	Discharge Pipelines	See concerns above.	See discussion above.	Marginal	Likely	2
Q-6	Feeder Canal	See concerns above.	See discussion above.	Marginal	Likely	2
Q-7	Fish Screen	See concerns above.	See discussion above.	Marginal	Likely	2
Q-8	Power System Uprating	See concerns above.	See discussion above.	Marginal	Likely	2
Q-9	0			Negligible	Unlikely	0
Q-10	0			Negligible	Unlikely	0
Q-11	0			Negligible	Unlikely	0
Q-12	Remaining Construction Items			Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	See concerns above.	See discussion above.	Marginal	Likely	2
Q-14	Construction Management	See concerns above.	See discussion above.	Marginal	Likely	2
Specialty Fabrication or Equipment				**Maximum Project Growth**		**50%**
FE-1	Dam Removal	None anticipated	No significant risks anticipated	Negligible	Unlikely	0

FE-2	Mob, Demob & Site Prep	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-3	Diversion and Control of Water	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-4	Pump Stations	Main irrigation pumps and associated equipment	Discussions have already been held with contractors capable of providing these items. So it can be assumed that there is a reasonable ability to obtain. However, there is still a risk at time of construction the materials needed are not available or have increased in costs. Thus the impact could be moderate.	Moderate	Possible	2
FE-5	Discharge Pipelines	Delivery of large pipes.	The pipes are not huge by any means but delivering 8-ft diameter pipes to this location may be troublesome. It is not likely but could be significant cost increase.	Moderate	Possible	2
FE-6	Feeder Canal	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-7	Fish Screen	Fish return pumps and associated equipment	Discussions have already been held with contractors capable of providing these items. So it can be assumed that there is a reasonable ability to obtain. However, there is still a risk at time of construction the materials needed are not available or have increased in costs. Thus the impact could be moderate.	Moderate	Possible	2
FE-8	Power System Uprating	Electrical towers and equipment to upgrade power system	Cost were provide by the local power company, and are not anticipated to be significantly off. However, at time of construction, and upon further analysis, there may be more specialty items needed. This is not likely but could be a marginal impact.	Marginal	Possible	1
FE-9	0			Negligible	Unlikely	0
FE-10	0			Negligible	Unlikely	0
FE-11	0			Negligible	Unlikely	0
FE-12	Remaining Construction Items			Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
CT-1	Dam Removal	Rock disposal assumptions; cofferdam assumptions	Current estimate assumes disposing of rock removed from the dam nearby, likely on Joe's island. There is risk rock may need to be be trucked to another location, which would increase the haul costs significantly. Placement of cofferdam may be more difficult than assumed and may not be as efficient at diverting flows. Contractor may assume different methods to control flows and seepage.	Significant	Possible	3

CT-2	Mob, Demob & Site Prep	Mob/demob and site prep have been developed based on general assumptions.	The assumptions have been conservatively estimated and therefore are not likely to increase much.	Marginal	Possible	1
CT-3	Diversion and Control of Water	Sheet pile cofferdams and well points sufficient for construction	The estimate assumes sheetpiles with well points also. There is also an assumption of pumping during the pump station work. These assumptions are conservative, but until further analysis is completed there is still a significant impact risk.	Significant	Possible	3
CT-4	Pump Stations	Use of cost quotes on major equipment items; Productivity assumptions;	Significant percentage of cost for this item are in the pump and motor quotes. These were provided by a vendor and then received sub markups in MII. Thus they are likely conservative, but still could increase at time of construction; All productivity assumptions have been estimated with best engineering judgment at this time. These could change though which would obviously impact costs.	Moderate	Possible	2
CT-5	Discharge Pipelines			Moderate	Possible	2
CT-6	Feeder Canal			Moderate	Possible	2
CT-7	Fish Screen	Use of previous project costs for fish screens and deadplates	A previous project estimate was used to estimate the unit costs for the fish screen and dead plates. The value was escalated to current prices, but still may not be accurate at time of construction. This could be significant impact with low likelihood.	Significant	Possible	3
CT-8	Power System Uprating			Moderate	Possible	2
CT-9	0			Negligible	Unlikely	0
CT-10	0			Negligible	Unlikely	0
CT-11	0			Negligible	Unlikely	0
CT-12	Remaining Construction Items			Negligible	Unlikely	0
CT-13	Planning, Engineering, & Design	Percentages assumed for PED	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
CT-14	Construction Management	Percentages assumed for CM	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**20%**

EX-1	Dam Removal	Severe winter weathere; unanticipated inflations in fuel, and materials; market conditions and bidding climate;	Winter weather is an issue and construction will be likely completed around those times. But impacts to cost/schedule could still occur. The risk of inflation to fuel and other material items is real and could be a significant impact. The bidding climate at time of award, and for possible numerous contracts, could be unfavorable to the cost. Given all these risks, a significant impact would be assumed if they all occured.	Significant	Possible	3
EX-2	Mob, Demob & Site Prep	See concerns above.	See discussion above.	Significant	Possible	3
EX-3	Diversion and Control of Water	See concerns above.	See discussion above.	Significant	Possible	3
EX-4	Pump Stations	See concerns above.	See discussion above.	Significant	Possible	3
EX-5	Discharge Pipelines	See concerns above.	See discussion above.	Significant	Possible	3
EX-6	Feeder Canal	See concerns above.	See discussion above.	Significant	Possible	3
EX-7	Fish Screen	See concerns above.	See discussion above.	Significant	Possible	3
EX-8	Power System Uprating	See concerns above.	See discussion above.	Significant	Possible	3
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	See concerns above.	See discussion above.	Significant	Possible	3
EX-14	Construction Management	See concerns above.	See discussion above.	Significant	Possible	3

Lower Yellowstone River Multiple Pump Alternative
Feasibility (Alternatives)
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Scope Growth	Acquisition Strategy	Construction Elements	Quantities for Current Scope	Specialty Fabrication or Equipment	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	**Real Estate**								$443,000
04 DAMS	**Dam Removal**	3	2	4	2	0	3	3	$6,600
19 BUILDINGS, GROUNDS, AND UTILITIES	Mob, Demob & Site Prep	2	2	2	2	0	1	3	$1,821
19 BUILDINGS, GROUNDS, AND UTILITIES	Diversion and Control of Water	3	2	2	2	0	3	3	$2,490
19 BUILDINGS, GROUNDS, AND UTILITIES	Pump Stations	2	2	3	2	2	2	3	$23,599
19 BUILDINGS, GROUNDS, AND UTILITIES	Discharge Pipelines	1	2	1	2	2	2	3	$25,527
19 BUILDINGS, GROUNDS, AND UTILITIES	Feeder Canal	1	2	1	2	0	2	3	$2,449
19 BUILDINGS, GROUNDS, AND UTILITIES	**Fish Screen**	2	2	1	2	2	3	3	$18,301
19 BUILDINGS, GROUNDS, AND UTILITIES	**Power System Uprating**	4	2	1	2	1	2	3	$3,490
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
0	**0**	0	0	0	0	0	0	0	$0
All Other	Remaining Construction Items	0	0	0	0	0	0	0	$0
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	2	2	0	2	0	1	3	$7,664
31 CONSTRUCTION MANAGEMENT	Construction Management	2	2	0	2	0	1	3	$5,108
									$97,049
Risk		$ 4,555	$ 3,783	$ 9,550	$ 3,217	$ 3,301	$ 4,163	$ 5,856	**$34,424**
Fixed Dollar Risk Allocation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$0**
	Risk	$ 4,555	$ 3,783	$ 9,550	$ 3,217	$ 3,301	$ 4,163	$ 5,856	**$34,424**
								Total	**$131,474**

Multiple Pumps with Conservation Measures ARA

Abbreviated Risk Analysis

Project (less than $40M): **Lower Yellowstone River**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Low Risk: Typical Construction, Simple**

Alternative: **Multiple Pumps w/ Conservation Mea**
Meeting Date:

Total Estimated Construction Contract Cost = $ **313,059,999**

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 2,800,000		25.00%	$ 700,000	$ 3,500,000
1		**Mob, Demob & Site Prep**	$ 2,658,292		27.57%	$ 733,006	$ 3,391,298
2		**Diversion and Control of Water**	$ 4,158,633		39.25%	$ 1,632,081	$ 5,790,715
3	04 DAMS	**Existing Dam Removal**	$ 2,533,964		45.02%	$ 1,140,755	$ 3,674,719
4	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Convert Laterals to Pipe**	$ 61,636,775		34.25%	$ 21,110,979	$ 82,747,754
5	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Line Open Canals**	$ 128,664,185		31.04%	$ 39,936,622	$ 168,600,807
6	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Check Structures**	$ 2,547,694		34.74%	$ 884,953	$ 3,432,647
7	09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Flow Measuring Devices**	$ 887,117		27.68%	$ 245,560	$ 1,132,676.44
8	19 BUILDINGS, GROUNDS, AND UTILITIES	**Convert Fields to Sprinklers**	$ 14,920,816		29.24%	$ 4,362,342	$ 19,283,157.44
9	19 BUILDINGS, GROUNDS, AND UTILITIES	**Wind Turbines**	$ 3,584,337		30.74%	$ 1,101,955	$ 4,686,292.79
10	20 PERMANENT OPERATING EQUIPMENT	**Ranney Wells**	$ 91,468,186		33.02%	$ 30,206,753	$ 121,674,938.77
11			$ -		0.00%	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 28,458,000		26.52%	$ 7,548,141	$ 36,006,141
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 18,972,000		26.52%	$ 5,032,094	$ 24,004,094
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals					
Real Estate	$ 2,800,000	25.0%	$ 700,000	$	3,500,000.00
Total Construction Estimate	$ 313,059,999	32.4%	$ 101,355,006	$	414,415,005
Total Planning, Engineering & Design	$ 28,458,000	26.5%	$ 7,548,141	$	36,006,141
Total Construction Management	$ 18,972,000	26.5%	$ 5,032,094	$	24,004,094
Total	$ **363,289,999**	**31.6%**	$ **114,635,241**	$	**477,925,240**
		Base	**50%**		**80%**
Range Estimate ($000's)		$363,290k	$432,071k		$477,925k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Lower Yellowstone River Multiple Pumps w/ Conservation M

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting Date: 0-Jan-00

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				Maximum Project Growth		40%
PS-1	Mob, Demob & Site Prep	Estimate is based on conceptual level design plans with many investigations remaining to complete that could change the design; Further analysis may show that the current design assumptions do not accomplish the project's intent, thus leading to more changes in the design.	Because of low design level, the scope/scale of this could change but is not likely to be significantly different than current assumptions.	Marginal	Likely	2
PS-2	Diversion and Control of Water	See discussion above.	The current assumptions are likely to change. Further investigations could show need for more dewatering efforts than currently assumed.	Moderate	Likely	3
PS-3	Existing Dam Removal	See discussion above.	The dam removal requires significantly more analysis to determine the extent of the rock/boulder debris field downstream of the existing dam. There is a chance that current assumptions are off, which although not likely, it would be significant to the costs.	Significant	Possible	3
PS-4	Convert Laterals to Pipe	See discussion above.	Large quantity of laterals are anticipated to be converted to pipes. But correct conditions, primarily the slopes, may show that this is not feasible. This would then change the design by possibly requiring pumps, lining of canals, etc.	Significant	Possible	3
PS-5	Line Open Canals	See discussion above.	Current assumptions are based on a benefit-cost analysis of various canal lining methods. The method chosen is a more robust lining method, but may be shown to be over designed. Thus the impact for this risk is low, as costs/quantities could actually decrease. Also, the estimate currently assumes lining the entire canal, which may not be needed upon further research.	Negligible	Likely	1
PS-6	Check Structures	See discussion above.	Check structures are based off typical drawings from previous reports, and are basic check structures. Future phases may require more significant structures, and/or higher quantities to accomplish this feature's intent.	Moderate	Likely	3
PS-7	Flow Measuring Devices	See discussion above.	Flow measuring devices are based off typical drawings from previous reports, and are basic check structures. Future phases may require more significant structures, and/or higher quantities to accomplish this feature's intent. Expected only to have a marginal impact though.	Marginal	Possible	1

PS-8	Convert Fields to Sprinklers	See discussion above.	Much more analysis needs to be completed to determine exactly which farms will be converted. Current assumption is a rough 50% of farms that are fed by the laterals to be converted to pipes. This is likley to change, but possibly could decrease too. Therefore the impact is to be considered low.	Marginal	Possible	1
PS-9	Wind Turbines	See discussion above.	Current assumptions are based on estimated energy required for the Ranney wells. Further analysis needs to be completed to finalize this value. Thus there is a risk of this changing, but estimate has already taken conservative steps. Therefore, costs not likely to increase significantly.	Marginal	Possible	1
PS-10	Ranney Wells	See discussion above; Ice protection	Ranney well installation design is based on current assumption of water requirements needed to be pumped into the canal. Further design refinements could change the water needs, and therefore change this design. This is not likely, but could be a moderate impact to costs. Further analysis into ice flows may require changes to the Ranney Well design. Unlikely to occur but could be significant impact to costs.	Significant	Unlikely	2
PS-11	0			Negligible	Unlikely	0
PS-12	Remaining Construction Items			Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	See discussion above.	Potential need for more investigations to be completed, above and beyond what is already assumed. These investigations could present moderate cost increases.	Moderate	Possible	2
PS-14	Construction Management	See discussion above.	Construction management could increase moderately given any scope increases as more management would be required to oversee the additional construction.	Moderate	Possible	2
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Mob, Demob & Site Prep	Due to conceptual level of this project, there is limited contracting plan information; Estimate assumes relatively conservative assumptions regarding number of contracts and sub-contractors; Harsh weather could be a risk, but contractors would likely be experienced in this region; No 8a or small business likely due to scale of the project;	Contracting plan changes could significantly impact each of these costs. If the work needs to be broken into multiple contracts then costs would increase. Individual components may be constructed at different times, based on water demands and winter weather conditions, which also could impact costs. Without lack of a detailed contracting plan, there could be changes both increasing and decreasing costs, thus it is likely to change but only marginal impact to costs.	Marginal	Likely	2
AS-2	Diversion and Control of Water	See discussion above.	See discussion above.	Marginal	Likely	2
AS-3	Existing Dam Removal	See discussion above.	See discussion above.	Marginal	Likely	2
AS-4	Convert Laterals to Pipe	See discussion above.	See discussion above.	Marginal	Likely	2
AS-5	Line Open Canals	See discussion above.	See discussion above.	Marginal	Likely	2
AS-6	Check Structures	See discussion above.	See discussion above.	Marginal	Likely	2

AS-7	Flow Measuring Devices	See discussion above.	See discussion above.	Marginal	Likely	2
AS-8	Convert Fields to Sprinklers	See discussion above.	See discussion above.	Marginal	Likely	2
AS-9	Wind Turbines	See discussion above.	See discussion above.	Marginal	Likely	2
AS-10	Ranney Wells	See discussion above.	See discussion above.	Marginal	Likely	2
AS-11	0			Negligible	Unlikely	0
AS-12	Remaining Construction Items			Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	See discussion above.	See discussion above.	Marginal	Likely	2
AS-14	Construction Management	See discussion above.	See discussion above.	Marginal	Likely	2
Construction Elements				**Maximum Project Growth**		**15%**
CE-1	Mob, Demob & Site Prep	Number of mob/demob periods	There are numerous mob/demob periods across mutliple areas in the study region. These assumptions are assumed to be conservative but are still likely to change.	Marginal	Likely	2
CE-2	Diversion and Control of Water	The assumptions required for dewatering are based on limited information; Future analysis could greatly change dewatering efforts;	Conservative assumptions have currently been made for dewatering of certain measures. However, some items may require dewatering that are currently not assumed to need it. This could impact costs signficantly but is not likely to occur.	Significant	Unlikely	2
CE-3	Existing Dam Removal	Working in wet conditions within the channel, even when dewatered; potential for construction mods/claims; high risk due to river water being diverted nearby;	The dewatering effort is a significant cost driver. The existing rock downstream of the dam could be a significant hinderance to effectively dewatering the area. Current assumptions are conservative, but there could be significant risks to these assumptions changing.	Significant	Likely	4
CE-4	Convert Laterals to Pipe	Scheduling conversion of laterals around irrigation needs.	No significant risks for this item, but the work would need to be coordinated efficiently with the irrigation district to ensure that water is available for farm use. May cause increases to costs and schedule but is not likely to be significant.	Marginal	Likely	2
CE-5	Line Open Canals	Diversion and control of water could be significant risk; Coordinating the construction with irrigation season.	Current assumption is that the intake to the canal would be closed when the canal is lined. Therefore, no significant dewatering costs are assumed. Further analysis may show the need for more dewatering efforts. Coordinating the work with irrigation season may also add some risk.	Significant	Possible	3
CE-6	Check Structures	Scheduling conversion of laterals around irrigation needs.	No significant risks for this item, but the work would need to be coordinated efficiently with the irrigation district to ensure that water is available for farm use. May cause increases to costs and schedule but is not likely to be significant.	Marginal	Possible	1

CE-7	Flow Measuring Devices	Scheduling conversion of laterals around irrigation needs.	No significant risks for this item, but the work would need to be coordinated efficiently with the irrigation district to ensure that water is available for farm use. May cause increases to costs and schedule but is not likely to be significant.	Marginal	Possible	1
CE-8	Convert Fields to Sprinklers	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-9	Wind Turbines	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-10	Ranney Wells	Diversion and control of water; specialty contractor	Contractor would likely be able to adequately control water for well installations, and contractor should be more than capable to install. Still a slight risk that construction required is more complex than currently assumed.	Marginal	Possible	1
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
CE-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Quantities for Current Scope				**Maximum Project Growth**		**20%**
Q-1	Mob, Demob & Site Prep	Quantities are based on conceptual level designs and therefore are anticipated to change as project progresses; Many investigations remain to assist in developing accurate quantities.	Due to the low level of design for this alternative quantities are likely to change as the project progresses. The quantity development did take very conservative assumptions and therefore increases to the quantities is not likely to be significant. Thus it is possible that they will change, but due to conservative assumptions, should only be a marginal impact at most to certain elements.	Marginal	Likely	2
Q-2	Diversion and Control of Water	See discussion above.	See discussion above.	Marginal	Likely	2
Q-3	Existing Dam Removal	See discussion above.	See discussion above.	Marginal	Likely	2
Q-4	Convert Laterals to Pipe	See discussion above.	See discussion above.	Marginal	Likely	2
Q-5	Line Open Canals	See discussion above.	See discussion above.	Marginal	Likely	2
Q-6	Check Structures	See discussion above.	See discussion above.	Marginal	Likely	2
Q-7	Flow Measuring Devices	See discussion above.	See discussion above.	Marginal	Likely	2
Q-8	Convert Fields to Sprinklers	See discussion above.	See discussion above.	Marginal	Likely	2
Q-9	Wind Turbines	See discussion above.	See discussion above.	Marginal	Likely	2

Q-10	Ranney Wells	See discussion above.	See discussion above.	Marginal	Likely	2
Q-11	0			Negligible	Unlikely	0
Q-12	Remaining Construction Items			Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	See discussion above.	See discussion above.	Marginal	Likely	2
Q-14	Construction Management	See discussion above.	See discussion above.	Marginal	Likely	2
Specialty Fabrication or Equipment				**Maximum Project Growth**		**50%**
FE-1	Mob, Demob & Site Prep	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-2	Diversion and Control of Water	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-3	Existing Dam Removal	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-4	Convert Laterals to Pipe	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-5	Line Open Canals	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-6	Check Structures	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-7	Flow Measuring Devices	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-8	Convert Fields to Sprinklers	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
FE-9	Wind Turbines	None anticipated	Wind turbines are a specialty item, but the assumption is that the turbines needed would be constructed at a pre-existing wind farm. The contractor would also be an experienced turbine builder, thus very low risk for the equipment not functioning as designed.	Moderate	Possible	2
FE-10	Ranney Wells	None anticipated	Estimate assumes a contractor with experience installing these wells would be used. The design is at a point for these that the proposed wells would be sufficient in providing the needed amount of water upon construction. However, more analysis remains to ensure that these assumptions are correct.	Moderate	Possible	2
FE-11	0			Negligible	Unlikely	0
FE-12	Remaining Construction Items			Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None anticipated	No significant risks anticipated	Negligible	Unlikely	0

FE-14	Construction Management	None anticipated	No significant risks anticipated	Negligible	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
CT-1	Mob, Demob & Site Prep	Mob/demob and site prep have been developed based on general assumptions.		Negligible	Unlikely	0
CT-2	Diversion and Control of Water	Cofferdam productivity at existing dam;	Placement of both a sheetpile cofferdam and earthen portion may be more difficult than assumed. Also, different crews and placement methods may be used. These risk could increase costs for dewatering significantly.	Significant	Possible	3
CT-3	Existing Dam Removal	Rock disposal assumptions	Current estimate assumes disposing of rock removed from the dam nearby, likely on Joe's island. There is risk rock may need to be be trucked to another location, which would increase the haul costs significantly.	Significant	Possible	3
CT-4	Convert Laterals to Pipe	Crew and productivity assumptions	This work is pretty straight forward, and the current assumptions in the estimate are not likely to see significant changes. Therefore there is a possible risk of the assumptions on crews and productivity changing, but would only be a marginal impact.	Marginal	Possible	1
CT-5	Line Open Canals	Crew and productivity assumptions	The assumptions in the estimate have been based on previous canal lining analysis completed by the BOR. The unit cost for the lining has been compared with previous costs from BOR and are in-line, if not slightly conservative. Therefore risk of increase is small and would likely be moderate at most.	Moderate	Possible	2
CT-6	Check Structures	Crew and productivity assumptions	Typical construction efforts required, and not likely to change significantly.	Marginal	Likely	2
CT-7	Flow Measuring Devices	Crew and productivity assumptions	Typical construction efforts required, and not likely to change significantly.	Marginal	Likely	2
CT-8	Convert Fields to Sprinklers	Cost estimate assumptions; power costs	Use of industry standard installation costs has been compared with recent costs to install sprinkler systems within this region. After the MII markups are applied, unit costs are pretty conservative, therefore there is a small risk of the costs increasing for this item. Costs for updating power grid to power the pumps required for spinkler pressurizaiont is not included. This is a likley cost and could be significant given the amount of spinklers to be placed.	Significant	Possible	3
CT-9	Wind Turbines			Moderate	Possible	2
CT-10	Ranney Wells			Marginal	Possible	1
CT-11	0			Negligible	Unlikely	0
CT-12	Remaining Construction Items			Negligible	Unlikely	0
CT-13	Planning, Engineering, & Design	Percentages assumed for PED	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1

CT-14	Construction Management	Percentages assumed for CM	A typical percentage for this item has been assumed. Percentage may change, but not likely to increase significantly from current.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**20%**
EX-1	Mob, Demob & Site Prep	Severe winter weathere; unanticipated inflations in fuel, and materials; market conditions and bidding climate;	Winter weather is an issue and construction will be likely completed around those times. But impacts to cost/schedule could still occur. The risk of inflation to fuel and other material items is real and could be a significant impact. The bidding climate at time of award, and for possible numerous contracts, could be unfavorable to the cost. Given all these risks, a significant impact would be assumed if they all occured.	Significant	Possible	3
EX-2	Diversion and Control of Water	See discussion above.	See discussion above.	Significant	Possible	3
EX-3	Existing Dam Removal	See discussion above.	See discussion above.	Significant	Possible	3
EX-4	Convert Laterals to Pipe	See discussion above.	See discussion above.	Significant	Possible	3
EX-5	Line Open Canals	See discussion above.	See discussion above.	Significant	Possible	3
EX-6	Check Structures	See discussion above.	See discussion above.	Significant	Possible	3
EX-7	Flow Measuring Devices	See discussion above.	See discussion above.	Significant	Possible	3
EX-8	Convert Fields to Sprinklers	See discussion above.	See discussion above.	Significant	Possible	3
EX-9	Wind Turbines	See discussion above.	See discussion above.	Significant	Possible	3
EX-10	Ranney Wells	See discussion above.	See discussion above.	Significant	Possible	3
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	See discussion above.	See discussion above.	Significant	Possible	3
EX-14	Construction Management	See discussion above.	See discussion above.	Significant	Possible	3

Lower Yellowstone River Multiple Pumps w/ Conservation Measures
Feasibility (Alternatives)
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Scope Growth	Acquisition Strategy	Construction Elements	Quantities for Current Scope	Specialty Fabrication or Equipment	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	**Real Estate**								$2,800,000
0	**Mob, Demob & Site Prep**	2	2	2	2	0	0	3	$2,658
0	Diversion and Control of Water	3	2	2	2	0	3	3	$4,159
04 DAMS	Existing Dam Removal	3	2	4	2	0	3	3	$2,534
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	Convert Laterals to Pipe	3	2	2	2	0	1	3	$61,637
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	Line Open Canals	1	2	3	2	0	2	3	$128,664
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	Check Structures	3	2	1	2	0	2	3	$2,548
09 CHANNELS AND CANALS (Except Navigation Ports and Harbors)	**Flow Measuring Devices**	1	2	1	2	0	2	3	$887
19 BUILDINGS, GROUNDS, AND UTILITIES	**Convert Fields to Sprinklers**	1	2	0	2	0	3	3	$14,921
19 BUILDINGS, GROUNDS, AND UTILITIES	**Wind Turbines**	1	2	0	2	2	2	3	$3,584
20 PERMANENT OPERATING EQUIPMENT	**Ranney Wells**	2	2	1	2	2	1	3	$91,468
0	**0**	0	0	0	0	0	0	0	$0
All Other	Remaining Construction Items	0	0	0	0	0	0	0	$0
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	2	2	0	2	0	1	3	$28,458
31 CONSTRUCTION MANAGEMENT	Construction Management	2	2	0	2	0	1	3	$18,972
									$360,490
Risk		$ 15,770	$ 14,052	$ 35,642	$ 11,948	$ 4,545	$ 10,226	$ 21,753	**$113,935**
Fixed Dollar Risk Allocation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$0**
	Risk	$ 15,770	$ 14,052	$ 35,642	$ 11,948	$ 4,545	$ 10,226	$ 21,753	**$113,935**
								Total	**$474,425**

Attachment B.4
Detailed Quantity Takeoffs

Modified Side Channel Quantities

Item Description	quantity	unit	Comment
Mob/Demob	1	ls	
Coffer dam-upstream			
Earth embankment	21,400	cy	See separate tab
sheet pile	4,800	sf	See separate tab
riprap, d100=27 inch	2,800	cy	See separate tab
bedding 4"minus	600	cy	See separate tab
Coffer dam-downstream			
Earth embankment	21,400	cy	See separate tab, assume same as upstream c
sheet pile	4,800	sf	See separate tab, assume same as upstream c
riprap, d100=27 inch	2,800	cy	See separate tab, assume same as upstream c
bedding 4"minus	600	cy	See separate tab, assume same as upstream c
Dewatering (subgrade for riprap placement and bridge footings)	1	ls	
Clearing and grubbing, including some tree removal	226	ac	See separate tab
Excavation	1,143,900	cy	From CAD
Embankment (compact) overbanks, side channels and floodplain	362,265	cy	From CAD, assume all fill is included in this lin
Haul and dispose (grade); less than 5 miles RT	781,635	cy	From CAD
Finish grading (shaping) channel	100	ac	See separate tab
Channel armoring (1 to 6 inch d50)	50,100	cy	See separate tab
Bank protection at confluence			
Riprap d100 = 27 inch	30,300	cy	See separate tab
Riprap bedding	6,500	cy	See separate tab
Bank protection on bend cutoff (sta 147+00 - 157+00)			
Riprap d100 = 16 inch	8,200	cy	See separate tab
Riprap bedding	4,100	cy	See separate tab
Bank protection on bend cutoff (sta 92+50 - 101+00)			
Riprap d100 = 16 inch	5,500	cy	See separate tab
Riprap bedding	2,800	cy	See separate tab
Grade-control structures (5 structures)			
Cobble/Boulder material	2,000	cy	See separate tab
Riprap d100 = 16 inch	11,000	cy	See separate tab
Riprap bedding	5,500	cy	See separate tab
Construction access road (30' wide with shoulders)	17,000	lf	Measured length, assumed width with should
Staging Areas	34	ac	See separate tab
Bridge Crossing			
Bridge 150 ft clear span truss style bridge	1	ls	
Concrete for Abutments/Wingwalls	74	cy	See separate tab
Micropiles to 10 foot depth	40	ls	Assumed number and depth
Haul road construction and rehabilitation (24' wide, gravel road base)	4000	ft	Measured length
Seed, mulch and netting	128	ac	See separate tab
Erosion control-silt fence	10000	lf	
Dewatering ponds	3	ac-ft	3-1 ac-ft ponds

Quantities for: Upstream Riprap Protection

Comments/Assumptions: Based on RS 20762

Item Description	Length (ft)	Bank Ht (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness (ft)	Quantity	Rounded Quantity	Unit
27" D100 Riprap								
U/S Confluence, YS River	**1000**	**20**	**2.5**	**53.85**	**3.5**	**6981**	**7000**	**CY**
U/S Confluence, HFC LB								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		10.5	4	43.09				
Top and Toes				13.50				
Total	**860**			**113.17**	**3.5**	**12616**	**12600**	**CY**
U/S Confluence, HFC RB								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		4.25	4	17.52				
Top and Toes				13.50				
Total	**940**			**87.60**	**3.5**	**10675**	**10700**	**CY**
					Grand Total	**30271**	**30300**	**CY**
9" Bedding								
Bedding Volume					**0.75**	**6487**	**6500**	**CY**

Quantities for: Side Channel Cutoff Riprap (Sta 147+00 - 157+00)

Comments/Assumptions: Based on RS 16254

Item Description	Length (ft)	Bank Ht (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness (ft)	Quantity	Rounded Quantity	Unit
16" D100 Riprap on Left Bank, Sta 152+50 - 157+00								
Left Bank 16" D100 Riprap								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		0.4	4	1.65				
Top and Toes				11.50				
Total	**650**			**69.73**	**1.5**	**2518**	**2600**	**CY**
16" D100 Riprap on Right Bank, Sta 147+00 - 154+00								
Right Bank 16" D100 Riprap								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		10.4	4	42.78				
Top and Toes				11.50				
Total	**900**			**110.86**	**1.5**	**5543**	**5600**	**CY**
9" Bedding								
Bedding Volume	**1550**			**Varies**	**0.75**	**4030**	**4100**	**CY**

Quantities for: Right Bank Side Channel Cutoff Riprap (Sta 93+50 - 101+00)

Comments/Assumptions: Based on RS 10264

Item Description	Length (ft)	Bank Ht (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness (ft)	Quantity	Rounded Quantity	Unit
16" D100 Riprap on Right Bank								
Right Bank 16" D100 Riprap								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		8.5	4	35.05				
Top and Toes				11.50				
Total	**950**			**103.13**	**1.5**	**5443**	**5500**	**CY**
9" Bedding								
Bedding Volume	**950**			**103.13**	**0.75**	**2721**	**2800**	**CY**

Quantities for: Grade Control Structure

Comments/Assumptions: Based on RS 20273. Crest length is 50', bank protection extends for 240' (from USACE Desi

Item Description	Length (ft)	Bank Ht (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness (ft)	Quantity	Rounded Quantity	Unit
16" D100 Riprap								
Channel Bed	**43**			**40.00**	**0**	**0**	**0**	**CY**
Left Bank								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		4.0	4	16.49				
Top				5.00				
Total	**240**			**78.07**	**1.5**	**1041**	**1000**	**CY**
Right Bank								
Slope 1		4	8	32.25				
Slope 2		4	6	24.33				
Slope 3		4	4	16.49				
Top				11.50				
Total	**240**			**84.57**	**1.5**	**1128**	**1100**	**CY**
					Grand Total	**2169**	**2200**	**CY**
Cobble/Boulder Material (Bed, 64mm - 512mm)								
Bed	**50.0**			**38.50**	**6**	**428**	**400**	**CY**
9" Bedding								
Bedding Volume, Banks	480			162.65	0.75	1084	1100	CY
Bedding Volume, Bed	50.0			38.50	0	0	0	CY
					Grand Total	**1084**	**1100**	**CY**

Grand Totals for 5 Structures

16" D100 Riprap								
					Grand Total		**11000**	**CY**
Cobble/Boulder Material (Bed, 64mm - 512mm)								
					Grand Total		**2000**	**CY**
9" Bedding								
					Grand Total		**5500**	**CY**

Quantities for: Upstream Coffer Dam

Comments/Assumptions: Assume 15' tall, 640 ft long (best estimate is 600 ft long), 4" minus bedding, 400' of sheet pile

Item Description	Length (ft)	Bank Ht/ Height (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness/ Topwidth (ft)	Quantity	Rounded Quantity	Unit
27" D100 Riprap								
Face Riprap	**640**	**15**	**2**	**33.54**	**3.5**	**2783**	**2800**	**CY**
4" minus Bedding								
Bedding for Face Riprap	**640**			**33.54**	**0.75**	**596**	**600**	**CY**
Earth Fill for Embankment								
Compacted Earth Fill	**640.0**	**15**	**2**	**33.54**	**20**	**21333**	**21400**	**CY**
PZ 22 Sheet Pile								
PZ 22 Sheet Pile	**400.0**	**12**				**4800**	**4800**	**SF**

Quantities for: Channel Armor

Comments/Assumptions:

Item Description	Length (ft)	Armored Bank Height (ft)	Side Slope (XH:1V)	Slope Length (ft)	Thickness/ Topwidth (ft)	Quantity	Rounded Quantity	Unit
9" Armor Layer								
Left Bank	20400	3	8	24.19	0.75	13706	13,700	CY
Right Bank	20400	3	8	24.19	0.75	13706	13,700	CY
Bed	20400			40.00	0.75	22667	22,700	CY
						Grand Total	**50,100**	**CY**

Quantities for: Finished Grading (HFC Area)

Comments/Assumptions: Assume upper bank height is 6 feet (estimated average from RAS model)

Item Description	Length (ft)	Bank Ht (ft)	Side Slope (XH:1V)	Slope Length (ft)	Quantity	Rounded Quantity	Unit
16" D100 Riprap							
Channel Bed	**20440**			**40.00**	**18.8**	**19**	**ac**
Left Bank							
Slope 1		4	8	32.25			
Slope 2		4	6	24.33			
Slope 3		6.0	4	24.74			
Top				5.00			
Total	**20440**			**86.32**	**40.5**	**41**	**ac**
Right Bank							
Slope 1		4	8	32.25			
Slope 2		4	6	24.33			
Slope 3		6	4	24.74			
Top				5.00			
Total	**20440**			**86.32**	**40.5**	**41**	**ac**
				Grand Total	**100**	**100**	**ac**

Quantities for: Misc. Areas and Volumes

Comments/Assumptions:

Item Description	Length (ft)	Width (ft)	Area (ac)	Rounded Quantity	Unit	Comment
Staging Areas						
Single Staging Area	540	540	6.7			Assume 540' x 540'
		Number:	5.0			
		Total	**33.5**	**34**	**ac**	
Construction Access Road						
Construction Access Road	17000	30	11.7	12	ac	Assume 30' Wide
Disturbed channel and overbanks (Channel Margins)						
Channel Margins	20400	100	46.8	47		Assume 50' disturbance on both banks
Abandoned Channel Area 1	2200	350	17.7			
Abandoned Channel Area 2	3450	275	21.8			
Abandoned Channel Area 3	1470	220	7.4	47		
New channel reach Area 1	1500	150	5.2			
New channel reach Area 2	2000	150	6.9			
New channel reach Area 3	1400	150	4.8	17		
		Total	**110.6**	**111**	**ac**	
Clearing and Grubbing						
Disturbed channel and overbanks				64	ac	channel margins and new channel
Staging areas				34	ac	See staging area calculations
Disposal site	3550	1420	115.7	116	ac	on bluff
Construction Access Road				12	ac	see construction access rd calculations
		Total		**226**	**ac**	
Seed, mulch and net						
Channel Margins				47	ac	
Staging areas				34	ac	
Abandoned Channel Areas				47	ac	
		Total		**128**	**ac**	
					ac	

Item Description	Length (ft)	Height (ft)	Side Slope (XH:1V)	Width (ft)	Number	Quantity	Rounded Quantity	Unit
Abutment and Wingwall Concrete								
Abutments	24	12		1.00	2	21	21	CY
U/S Wingwalls	12	12		0.75	2	8	8	CY
D/S Wingwalls	12	12		0.75	2	8	8	CY
						Grand Total	**37**	**CY**

Ice Factor	100%
Abutment Quantity:	42
Wingwalls Quantity:	32
Total:	74

Multiple Pump Quantities

Multiple Pump Station Alternative QTO Line Items - 2016-03-23

Item Description	UOM	Site 1	Site 2	Site 3	Site 4	Site 5	Quantity
Mob/Demob	LS	1	1	1	1	1	5
Intake/Feeder Canals:							
Dewatering for channel excavation near river (at 5 sites)	LS	1	1	1	1	1	5
Clearing and grubbing (where on land)	SY	3,400	11,200	12,300	5,700	10,000	42,600
Dredging / In-water excavation (assumed 5% of total excavation)	CY	600	2,100	2,300	1,100	1,900	8,000
Excavation (on land)	CY	12,000	40,000	44,000	20,000	35,000	151,000
Trashrack (60' wide x 6' tall)	EA	1	1	1	1	1	5
Fish Screens:							
Dewatering for excavation (at 5 sites)	LS	1	1	1	1	1	5
Clearing and grubbing	SY	1,720	1,720	1,720	1,720	1,720	8,600
Excavation for fish screen facility	CY	5,831	5,831	5,831	5,831	5,831	29,155
Reinforced concrete	CY	1,498	1,498	1,498	1,498	1,498	7,491
Reinforcement	Tons	140	140	140	140	140	699
Fish screens and deadplates	SF	4,176	4,176	4,176	4,176	4,176	20,880
Steel support structures for fish screens (estimated per 2004 study, for 5 site	Tons	50	50	50	50	50	250
Screen cleaners **(NOTE: price is in 2004 dollars, for 5 sites)**	LS	$ 88,000	$ 88,000	$ 88,000	$ 88,000	$ 88,000	$ 440,000
6" Crushed surfacing (access road surfacing around buildings)	CY	107	107	107	107	107	533
Fish return pumps (total cost for 10 pumps with HPUs, per vendor)	LS	$ 306,000	$ 306,000	$ 306,000	$ 306,000	$ 306,000	$ 1,530,000
18" HDPE Fish return pipe	LF	50	50	50	50	50	250
14" HDPE Fish return pipe	LF	1,000	2,400	2,600	1,400	2,200	9,600
Pump Stations:							
Dewatering for excavation (at 5 sites)	LS	1	1	1	1	1	5
Clearing and grubbing	SY	2,600	2,600	2,600	2,600	2,600	13,000
Excavation for wetwell (5 sites, assumes 1:1 temp. cut slopes)	CY	26,300	26,300	26,300	26,300	26,300	131,500
Reinforced concrete	CY	616	616	616	616	616	3,080
Reinforcement	Tons	100	100	100	100	100	500
Pumps, motors, and controls (per estimates from pump vendors, 5 sites)	LS	$ 1,673,938	$ 1,726,799	$ 1,726,799	$ 1,762,040	$ 1,762,040	$ 8,651,616
48" steel pipe (individual pump discharge lines)	LF	190	190	190	190	190	950
84" steel pipeline (assume 9' depth to IE)	LF	20	20	20	20	20	100
48" check valves	EACH	4	4	4	4	4	20
48" gate valves	EACH	4	4	4	4	4	20
Concrete utility vaults (11' wide x 14' long x 12' deep)	EACH	4	4	4	4	4	20
48" x 84" wyes	EACH	3	3	3	3	3	15
48" bends (45 degrees)	EACH	3	3	3	3	3	15
48" x 84" reducers	EACH	2	2	2	2	2	10
Prefabricated steel building for pump station, heated and insulated, 40' x 25'	EACH	1	1	1	1	1	5
Standby generators:	-						
Site 1: 500 kW, 3 phase, 480V standby generator - (price per vendor)	LS	$ 120,000					$ 120,000
Site 2: 1250 kW (price per vendor)	LS		$ 450,000				$ 450,000
Site 3: 1750 kW (price per vendor)	LS			$ 625,000			$ 625,000
Site 4: 1750 kW (price per vendor)	LS				$ 625,000		$ 625,000
Site 5: 2000 kW (price per vendor)	LS					$ 675,000	$ 675,000
6" Crushed surfacing (access road surfacing around buildings)	CY	40	40	40	40	40	200
Discharge Pipelines:							
Clearing and grubbing	SY	800	3,000	16,800	12,300	5,400	38,300
Excavate trenches (assumes temporary side slopes at 1:1)	CY	1,422	6,000	33,600	24,600	10,800	76,422
72" steel pipeline (assume 8' depth to IE)	LF	300					300
84" steel pipeline (assume 9' depth to IE)	LF		1,000	5,600	4,100	1,800	12,500
Concrete Outlet Structures:							
Excavation	CY	446	365	281		473	1,564
Reinforced concrete (BOR type 1 concrete transitions)	CY	130	109	87		120	447
Reinforcement	Tons	11.6	9.7	7.8		10.7	39.8
Riprap (9" nominal, 18" thick)	CY	800	361	361		361	1,883
Bedding Stone (6" thick)	CY	267	120	120		120	628
Access Roads:							
Clearing and grubbing	SY	3,733	11,200	4,356	9,022	1,556	29,867
Excavation (assumed 2' average cut, 50% of road length)	CY	1,067	3,200	1,244	2,578	444	8,533
Fill (assumed 2' average cut, 50% of road length)	CY	1,067	3,200	1,244	2,578	444	8,533
6" Crushed surfacing (access road surfacing)	CY	444	1,333	519	1,074	185	3,556
Power System Uprating:							
(all cost estimates per MDU)							
Site 1	LS	1					1
Site 2	LS		1				1
Site 3	LS			1			1
Sites 4 and 5 total:	LS					1	1

Feeder Canal QTO

Calc By:	Matt Moore	Date:	2/22/2016
Revised:	JPP	Date:	3/4/2016
Checked By:	FMB	Date:	3/4/2016

Feeder Canal to Pump Site Number	Average existing elevation (Feet NAVD88)	Average depth to Canal Invert (Feet)	Feeder Canal Length (Feet)	Bottom Width (Feet)	Top Width (Feet)	Section Area (SF)	Estimated Cut Volume (CY)	Estimated Wet Excavation (CY)	Estimated Dry Excavation (CY)
1	2000	17	300	32	101	1143	12,701	600	12,000
2	1972	17	1000	32	100	1124	41,630	2100	40,000
3	1964	17	1100	32	100	1130	46,056	2300	44,000
4	1950	17	500	32	101	1147	21,232	1100	20,000
5	1947	17	900	32	100	1113	37,084	1900	35,000
Total Intake Channel Excavation:							**158,703**	**8,000**	**151,000**
								[5% of total Vol.]	[95% of total Vol.]

Feeder Canal Wet Excavation **8,000**

Feeder Canal Dry Excavation **151,000**

Feeder Canal Clearing Area **43,000**

(See original QTO workbook for calculations of the existing elevation and average depth. Only the summary sheet is shown, here)

Fish Screen Quantity Takeoff

By:	JPP	Date:	2/23/2016
Checked By:	FMB	Date:	3/4/2016

Clearing

L	180	Feet
W	86	Feet
Area	1720	SY
Num. of Sites	5	
Total Area	**8600**	**SY**

Access Roads

(Onsite, around the fish screens only)

L	180	Feet
W	16	Feet
Number	2	
Thickness	0.5	Feet
Area	5760	SF
Volume	107	CY
Num. of Sites	5	
Total Volume	**533**	**CY**

Excavation

Assume that the existing ground at the PS location is at the 100 year flood elevation.

Excavate to the bottoms of the walls:

Width	42	Feet
Depth	23	Feet
Length	126	Feet
Section Area	966	SF
Volume	4508	CY

Trapezoidal Section:

Base W	74	Feet
Depth	3.5	Feet
Top W	88	Feet
Length	126	Feet
Section Area	284	SF
Volume	1323	CY

Total Vol. per site	5831	CY
Num. of Sites	5	
Total Excav.	**29155**	**CY**

Fish Return Pipe

Fish return pipe from the bypass sump to the fish pump

Length each	25	Feet
Number	10	
Total	250	Feet

Assume fish return pipe length = intake canal length + 200'

14" dia. HDPE pipe, length varies at each site

	Length, each		Length, total	
Site 1	500	Feet	1000	Feet
Site 2	1200	Feet	2400	Feet
Site 3	1300	Feet	2600	Feet
Site 4	700	Feet	1400	Feet
Site 5	1100	Feet	2200	Feet
Total			9600	LF

Fish Screens and Deadplates

Cost information per Shawn Foster email dated 2016-02-16.

Length	116	Feet
Height	18	Feet
Number	2	
Total Area	4176	SF
Unit Cost	$ 300.00	per SF
Cost per Site	$ 1,252,800.00	
Num. of Sites	5	
Total Cost	$ 6,264,000.00	

Fish Screens Support Structure

Base on weight estimate listed in 2004 study by BOR. Scale linearly based on length and height.

	Reference proj.	Design value	Factor
Length	244	126	52%
Height	20	25	125%
Weight	150000	96824	65%

Estimated weight per site:	48.41	Tons
Number of sites:	5	
Estimated weight total:	**242**	**Tons**

Fish Screen Cleaner

Fish screen cleaners will be approximately the same price and type as cleaners in the 2004 cost estimate by BOR. Smaller screen size won't significantly affect price of screen cleaners. Note that price is still in 2004 dollars.

Cost in 2004 (per pair):	$ 88,000
Number of sites:	5
Total screen cleaner cost in 2004 dollars:	**$ 440,000**

Walls and Concrete QTO

	Length	Height/Width	Thickness	Area	Volume	Reinf. Ratio	Reinforcing
R Wall-footing	214.0	8.0	2.5	1712	4280	6.59	28192
R Wall-stem	214.0	22.0	1.5	4708	7062	6.59	46517
L Wall-footing	214.0	8.0	2.5	1712	4280	6.59	28192
L Wall-stem	214.0	22.0	1.5	4708	7062	6.59	46517
Floor	136.0	38.0	1.0	5168	5168	9.11	47080
R Screen Fdn	126.0	20.0	2.5	2520	6300	6.59	41498
L Screen Fdn	126.0	20.0	2.5	2520	6300	6.59	41498

Reinforced Concrete Volume, per site	1498	CY, per site
Reinforcement Weight, per site	140	Tons, per site
Total Reinforced Concrete Volume	**7491**	**CY**
Total Reinforcement Weight	**699**	**Tons**

Fish Return Pumps

Cost estimates as provided by Magic Valley Heli-Arc & Mfg, Inc. on March 17, 2016.

BP-420 Pump	$ 93,000
HPU	$ 35,000
Ancillary Equipment	$ 25,000
Total Cost per Pump	$ 153,000
Num. of Pumps per Site	2
Number of Sites	5
Total Cost	$ 1,530,000

Pump Station Quantity Takeoff

By: JPP Date: 2/23/2016
Checked By: FMB Date: 3/4/2016
Revision Date: 5/12/2016

All calculations are for a single, typical pump station, except where noted.

Access Roads

(Onsite, around the fish screens only)

L	110	Feet
W	16	Feet
Number	1	
Thickness	0.5	Feet
Area	1760	SF
Volume	33	CY
Num. of Sites	5	
Total Volume	**163**	**CY**

Excavation

Assume that the existing ground at the PS location is at the 100 year flood elevation.
Assume temporary side slopes are cut at 1:1 from the foundation to the EG.

Bottom L	34	Feet
Bottom W	44	Feet
Depth	57	Feet
Side Slopes	1	:1
Bottom Area	1496	SF
Top Area	23384	SF
Volume	26262	CY
Num. of Sites	5	
Total Volume	**131311**	**CY**

Clearing

Use calculation for excavation, above.

Area	2598	SY
Num. of Sites	5	
Total Clearing	**12991**	**SY**

Pumps Revised on

Base cost estimate on quote for Site 5 from Russell Pumps, dated 2016-02-19, including adder for 480V power.
Per Russell Pumps, cost for pumps and motors at sites 1-4 would be 2-5% less than at site 5.

Cost for pumps at Site 5: $ 440,510

	Site 1	Site 2	Site 3	Site 4	Site 5
Num. of Pumps	4	4	4	4	4
Cost Adj.	95%	98%	98%	100%	100%
Cost Each	$ 418,485	$ 431,700	$ 431,700	$ 440,510	$ 440,510
Total Cost	$ 1,673,938	$ 1,726,799	$ 1,726,799	$ 1,762,040	$ 1,762,040

Total Pump and Motor Cost: $ 8,651,616

Pump Station Walls Added on 2

	Length	Height/Width	Thickness	Area	Volume	Reinf. Ratio (l	Reinforcing
D/S Wall-lower	26.0	25.0	2.3	650	1517	11.77	17851
D/S Wall-upper	26.0	32.0	1.5	832	1248	12.57	15687
U/S Wall-lower	26.0	25.0	2.3	650	1517	11.77	17851
U/S Wall-upper	26.0	7.0	1.5	182	273	12.57	3432
R Wall-lower	30.0	25.0	3.0	750	2250	12.12	27270
R Wall-upper	30.0	32.0	1.5	960	1440	17.39	25042
L Wall-lower	30.0	25.0	3.0	750	2250	12.12	27270
L Wall-upper	30.0	32.0	1.5	960	1440	17.39	25042
R Wing	21.0	25.0	1.5	525	788	6.59	5187

L Wing	21.0	25.0	1.5	525	788	6.59	5187
Sump Floor	26.0	30.0	3.0	780	2340	9.11	21317
Top Slab	26.0	30.0	1.0	780	780	7.00	5460

Reinforced Concrete Volume, per site 616 CY, per site
Reinforcement Weight, per site 98 Tons, per site

Total Reinforced Concrete Volume 3080 CY
Total Reinforcement Weight 491 Tons

Discharge Pipelines

Assumes all pipelines are buried with 2' of cover and the temporary sideslopes are at 1:1.

	Length	Dia	Depth	Base Width	Top Width	Sectional Area	Excavated Volume
Site 1	300	6	8	8	24	128	38400
Site 2	1000	7	9	9	27	162	162000
Site 3	5600	7	9	9	27	162	907200
Site 4	4100	7	9	9	27	162	664200
Site 5	1800	7	9	9	27	162	291600

2063400 CF

Total Excavated Volume: 76422 CY
Total Cleared Area: 38300 SY

Ice Protection Berms (Added: 2016-05-12) (Added: 20

All dimensions are approximate, for a typical ice protection berm, top elevation 2' above the 100 year flood

Left Side:

Length	280	Feet
Width	62	Feet
Average Height	4	Feet
Top Area	17360	SF
Bottom Area	20300	SF
Left Side Vol.:	75320	CF
	2790	CY

Right Side:

Length	230	Feet
Width	30	Feet
Average Height	4	Feet
Top Area	6900	SF
Bottom Area	9600	SF
Right Side Vol.:	33000	CF
	1222	CY

Total berm volume per site: 4012 CY
Number of sites: 5
Total ice berm volume: 20059 CY

Pipe Outlet Structure Quantity Takeoff

By: JPP Date: 2/24/2016
Checked By: FMB Date: 3/4/2016

Discharge Pipeline Outlets

Estimate for Type 1 concrete outlet transitions, per USBR's "Design of Small Canals"
Wall thickness of 1.5' estimated by scaling up textbook values.
Floor area measured in AutoCAD. Wall heights based on 10' design depth in irrigation canal + 4' at headwall.

	Length	Height/Width	Thickness	Area	Volume	Reinf. Ratio	Reinforcing
Site 1:							
L Wall	23.5	10.0	1.5	235	353	6.6	2322
Head Wall	7.0	14.0	1.5	98	147	6.6	968
R Wall	101.0	10.0	1.5	1010	1515	6.6	9979
Floor			1.0	1205	1205	6.6	7937
2 Wings (total)	20.0	10.0	1.5	200	300	6.6	1976
Site 2:							
L Wall	23.5	10.0	1.5	235	353	6.6	2322
Head Wall	7.0	14.0	1.5	98	147	6.6	968
R Wall	77.0	10.0	1.5	770	1155	6.6	7608
Floor			1.0	985	985	6.6	6488
2 Wings (total)	20.0	10.0	1.5	200	300	6.6	1976
Site 3:							
L Wall	23.5	10.0	1.5	235	353	6.6	2322
Head Wall	7.0	14.0	1.5	98	147	6.6	968
R Wall	53.5	10.0	1.5	535	803	6.6	5286
Floor			1.0	758	758	6.6	4993
2 Wings (total)	20.0	10.0	1.5	200	300	6.6	1976
Site 4/5:							
L Wall	23.5	10.0	1.5	235	353	6.6	2322
Head Wall	19.0	14.0	1.5	266	399	6.6	2628
R Wall	60.6	10.0	1.5	606	909	6.6	5988
Floor			1.0	1276	1276	6.6	8405
2 Wings (total)	20.0	10.0	1.5	200	300	6.6	1976

Total Reinforced Concrete Volume **447 CY**
Total Reinforcement Weight **40 Tons**

Excavation:

Rough estimate based on average cut depth at each site.

	Area	Depth	Volume
Site 1	1205	10	12050
Site 2	985	10	9850
Site 3	758	10	7580
Site 4/5	1276	10	12760

Total excavation volume all sites: **1564 CY**

Riprap

QTO is as shown on drawings C-001 to C-005.

	Site 1	Site 2	Site 3	Site 4	Site 5	
Length	180	100	100	100	100	feet
Width	80	65	65	65	65	feet
Thickness	1.5	1.5	1.5	1.5	1.5	feet
Area	14400	6500	6500	6500	6500	SF
Volume	800.00	361.11	361.11	361.11	361.11	CY, per site

Total riprap volume, all sites: **2244 CY**

Access Road Quantity Takeoff

By: JPP Date: 2/17/2016
Checked By: FMB Date: 3/4/2016

All calculations assume that 50% of each road is cut by an average of 2' and 50% is filled by an average of 2'.

Access Roads

(Onsite, around the fish screens only)

	Site 1	Site 2	Site 3	Site 4	Site 5	Total	
Road Width	20	20	20	20	20		
Length	1200	3600	1400	2900	500		
Side Slopes	2	2	2	2	2		
Cut/Fill Depth	2	2	2	2	2		
Clear Area	33600	100800	39200	81200	14000	268800	SF
Cut Volume	28800	86400	33600	69600	12000	230400	CF
Fill Volume	28800	86400	33600	69600	12000	230400	CF
Surfacing Area	24000	72000	28000	58000	10000	192000	SF
Surf. Thickness	0.5	0.5	0.5	0.5	0.5		FT
Surf. Volume	12000	36000	14000	29000	5000	96000	CF

Total Clearing Area	**29867**	**SY**
Total Cut Volume	**8533**	**CY**
Total Fill Volume	**8533**	**CY**
Total Surfacing Volume	**3556**	**CY**

Multiple Pumps with Conservation Measures Quantities

Canal Lining Area Calculation **Last updated:** 2/22/2016

(Assumptions:

1. Based the U.S BOR's 2002 canal lining demonstration project report, geomembrane with concrete cover was selected for canal lining method.
2. Canal lining area represents finish surface of canal geometry between top of both canal slopes and does not include any overlaps of fabrics or anchors that are buried.
3. Eleven (11) typical canal cross sections used for the area calculations were based on the U.S BOR's 1992(?) document, and no additional sections were included.

	Cross Sections - U.S.BOR's 1992 document								Surface Area at Each Section [SF/ft]				
Location	RM [mi]	RM [ft]	Bottom [ft]	SS [H:V]	Ht [ft]	V [fps]	S [ft/ft]	Q [cfs]	Sideslope (x2) [SF/ft]	Bottom [SF/ft]	Full X-Section [SF/ft]	Distance [ft]	Surface Area [SF]
U/S End of Canal	0	0											
at Headgate (1)	0.05	264	28.5	1.5:1	40	2.2	0.0001	847	144.0	28.5	172.5	660	113850
at Headgate (2)	0.2	1056	23.5	1.5:1	26	2.15	0.0001	828	93.6	23.5	117.1	28908	3385127
below Lateral HH	11	58080	20.5	1.5:1	12	2.1	0.0001	745	43.2	20.5	63.7	50424	3212009
below Pumping Plant	19.3	101904	21.5	1.5:1	11	2	0.0001	630	39.6	21.5	61.1	36168	2209865
at Sears Bridge	24.7	130416	20.5	1.5:1	18	1.99	0.0001	609	64.8	20.5	85.3	44088	3760706
below Fox Creek Siphon	36	190080	23	1.5:1	10	1.89	0.0001	529	36.0	23.0	59.0	46992	2772528
below Lone Tree Creek Siphon	42.5	224400	23.5	1.5:1	9	1.76	0.0001	419	32.4	23.5	55.9	29040	1623336
below Lateral G	47	248160	15.5	1.5:1	8	2.08	0.0002	318	28.8	15.5	44.3	22440	994092
below Lateral J	51	269280	16.5	1.5:1	7	2.37	0.0003	284	25.2	16.5	41.7	26400	1100880
below Lateral M	57	300960	14.5	1.5:1	6	2	0.0001	164	21.6	14.5	36.1	25080	905388
below Lateral P	60.5	319440	9	1.5:1	5	1.87	0.0001	75.7	18.0	9.0	27.0	60984	1646568
D/S End of Canal	70.3	371184											

Total: 21,724,349 **[SF]**

Total: 371,184 **[LF]**

Total: 70.3 **[MI]**

	Shotcrete Volume			Fill Canal Volume		
Location	Surface Area [sf]	Shotcrete [in]	V [cy]	Length [lf]	XS Area [sf]	V x 50% [cy]
U/S End of Canal						
at Headgate (1)	113,850	3.0	1,054	660	2970	36,300
at Headgate (2)	3,385,127	3.0	31,344	28,908	1320	706,372
below Lateral HH	3,212,009	3.0	29,741	50,424	339	316,551
below Pumping Plant	2,209,865	3.0	20,462	36,168	300	200,766
at Sears Bridge	3,760,706	3.0	34,821	44,088	671	547,426
below Fox Creek Siphon	2,772,528	3.0	25,672	46,992	265	230,609
below Lone Tree Creek Siphon	1,623,336	3.0	15,031	29,040	227	122,210
below Lateral G	994,092	3.0	9,205	22,440	158	65,658
below Lateral J	1,100,880	3.0	10,193	26,400	131	64,167
below Lateral M	905,388	3.0	8,383	25,080	98	45,283
below Lateral P	1,646,568	3.0	15,246	60,984	60	67,760
D/S End of Canal						

Total: 2,403,102 **[CY]**

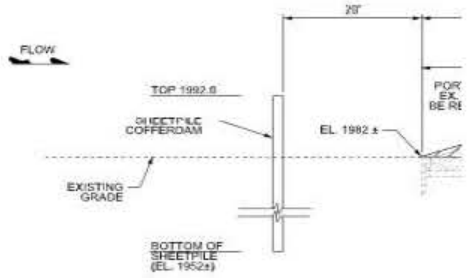
Note: Assumes 50% of existing canal to be filled

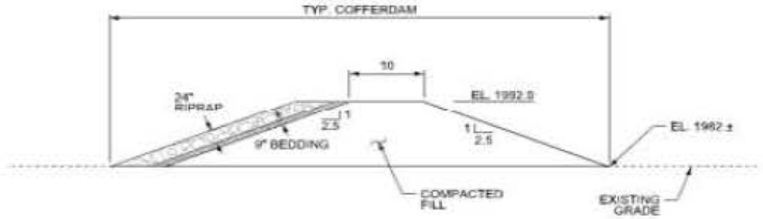
Cofferdam Calculation Last Updated: 3/4/2016

[Assumptions:

1. Dam removal will take place in 2 phases
2. A typical cofferdam will be a sheetpile with the exception of the segment along the flow direction (west to east) in Phase 1
3. A sheetpile will be total of 40 feet in height (10' exposed + 30' embedded)

Location	Length [ft]	Sheetpile Height [ft]	Earthen Dam (X-Section) Comp Fill [SF/ft]	9" Bedding [SF/ft]	24" Riprap [SF/ft]	Sheetpile Area [SF]	Earthen Dam (Volume) Comp Fill	9" Bedding	24" Riprap	
Phase 1 - Removal of North half										
Sheetpile (U/S Face & D/S Face)	895	40				35,800				
Earthen (along the flow direction)	410		380.0	21.20	36.34		155800	8694	25185	[CF]
							5770	322	859	[C.Y.]
Phase 2 - Removal of South half										
Sheetpile	1420	40				56,800				





TYPICAL EARTHEN COFFERDAM

NTS

Existing Intake Dam Removal Calculation **Last updated:** 3/4/2016

(Assumptions:

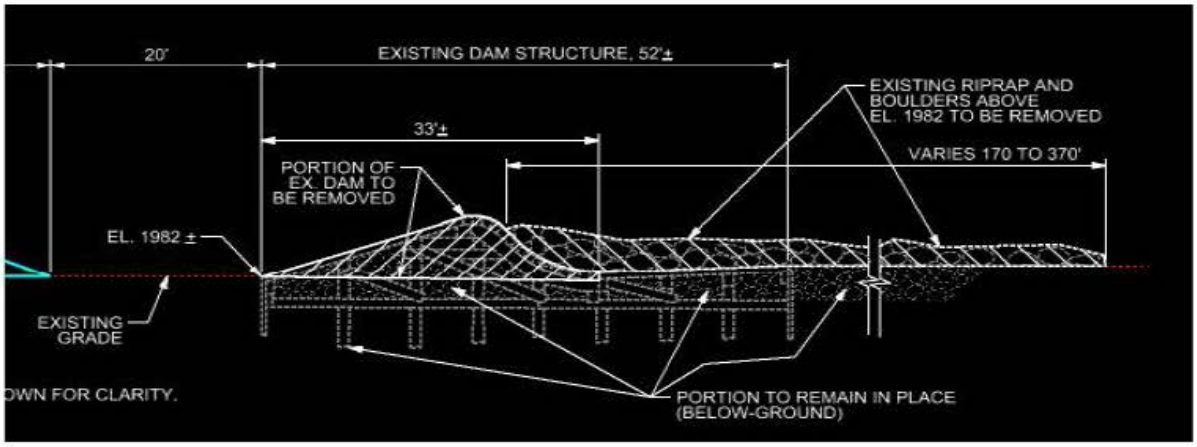
1. A typical intake dam geometry (shown here) is based on the USACE's 1910 as-built plans.
2. Only the portion of the dam that is above adjacent ground elevation (1981.5) was assumed to be removed.
3. The dam crest was assumed to be 1988'.
4. The portion of the dam that is below ground, including timber piles, will be left in place.
5. Quantity of riprap and boulders downstream of the existing dam was based on bathymetric survey.

		X-Section			Volume		
Location	Length [ft]	Removal [SF/ft]	[SF/ft]	[SF/ft]	Removal [CF]	[CY]	
Existing Dam	700	112.0			78400		

Total: **2904** [CY]

			Volume		
Location	Surface Area [SF]	Avg Thickness [ft]	Removal [CF]	[SF/ft]	[SF/ft]
Riprap and Boulders D/S of Ex. Dam	190190	6	1141140.0		

Total: **42264** [CY]



Convert Laterals to Pipe - Lengths

1.5	2	3	4	5	6	No Piping
	Pipe Length (feet)					
-	1,653	14,994	16,181	11,800	-	-
-	1,760	27742	26425	23911	-	14089
-	2973	14688	5766	-	4134	-
-	511	32620	-	300	-	5900
3026	8027	35775	5200	4096	-	9904
-	10548	2150	-	-	2700	-
-	17075	25522	23635	-	-	8400
-	-	14377	5600	11000	-	-
652	-	5275	5600	-	-	-
-	-	-	6684	-	-	-
-	-	3232	-	-	-	-
-	-		8622	-	-	-

3678 42547 176375 103713 51107 6834 38293

Attachment B.5
Labor Rates

General Decision Number: MT160077 01/08/2016 MT77

Superseded General Decision Number: MT20150077

State: Montana

Construction Type: Heavy

Counties: Big Horn, Carter, Daniels, Dawson, Fallon, Garfield, McCone, Phillips, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Treasure and Wibaux Counties in Montana.

HEAVY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016

ELEC0233-021 06/01/2015

PHILLIPS COUNTY

	Rates	Fringes
ELECTRICIAN	$ 29.98	11.60

--ELEC0532-013 06/01/2015

BIG HORN, CARTER, DANIELS, DAWSON, FALLON, GARFIELD, MCCONE, POWDER RIVER, PRAIRIE, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, TREASURE, AND WILBAUX COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 31.39	12.84

ENGI0400-010 05/01/2013

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
(Zone 1)		
(1) A-frame truck Crane,		

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oiler (except crane)	$ 23.47	10.40
(2) Crane Oiler,Bulldozer, Roller (Dirt and Grade Compaction), Backhoe..	$ 23.94	10.40
(3) Mechanic	$ 24.34	10.40
(4) Cranes, 25 tons - 44 tons.....	$ 27.00	11.40
(5) Cranes, 45 tons to and incl. 74 tons.....	$ 28.00	11.40
(6) Cranes, 75 tons to and incl. 149 tons; Cranes, Whirley (All).....	$ 29.00	11.40
(7) Cranes, 150 tons to including 250 tons (add $1.00 for every 100 tons over 250 tons); Crane, Stiff-Leg or Derrick; Helicopter Hoist; Crane, Tower (all)...	$ 30.00	11.40

ZONE DEFINITIONS FOR POWER EQUPMENT OPERATORS:
The zone hourly rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the nearest County Court House of the following listed towns to the center of the job:

BILLINGS, BOZEMAN, BUTTE, GREAT FALLS, HELENA, KALISPELL, MISSOULA

Zone 1: 0 to 30 miles - Base Pay
Zone 2: 30 to 60 miles - Base Pay + $3.50
Zone 3: Over 60 miles - Base Pay + $5.50

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* IRON0732-018 06/01/2015

	Rates	Fringes
IRONWORKER: Reinforcing and Structural	$ 27.00	19.78+a

a: PAID HOLIDAYS: New Years Day, Memorial Day, July 4th, Labor Day, Veteran's DAy, Thanksgiving Day, Day following Thanksgiving, and Christmas Day.

SUMT2011-052 02/08/2011

	Rates	Fringes
CARPENTER (Form Work Only)	$ 24.30	7.80
CARPENTER, Excludes Form Work .	$ 21.13	7.00
LABORER: Common or General ..	$ 17.99	5.90

LABORER: Pipelayer	$ 21.10	5.46
LABORER: Landscape and Irrigation.....	$ 15.14	1.30
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 23.53	8.05
OPERATOR: Excavator ...	$ 23.62	8.05
OPERATOR: Grader/Blade	$ 25.44	8.45
OPERATOR: Loader (Front End)....	$ 24.58	8.05
OPERATOR: Scraper	$ 23.00	6.76
TRUCK DRIVER: Dump Truck	$ 19.99	5.09

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing

this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

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With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2. If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3. If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4. All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

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Attachment B.6
Estimated Construction Durations

Modified Side Channel Construction Durations

TITLE: Yellowstone River - Modified Side Channel
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.: T35234
DATE: 5/10/2016

08 - Roads, Railroads and Bridges

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	10	1	100.0	10.00
Prefabricated Bridge Installation								
Structural Excavation	25.00	100%	10	CY	50	1	2.0	0.20
Concrete Abutments and Wingwalls								
Concrete, Forms	*60.63*	*100%*	*10*	*SFC*	*300*	*1*	*4.9*	*0.49*
Reinforcing Steel	*0.07*	*100%*	*10*	*TON*	*2.8*	*2*	*21.3*	*2.13*
Concrete, Placement	*18.75*	*100%*	*10*	*CY*	*41*	*1*	*2.2*	*0.22*
Bridge Installation	18.13	100%	10	SF	3,600	2	99.3	9.93
Haul Road Construction and Rehab								
Clearing and Grubbing	0.13	100%	10	ACRE	2	1	17.6	1.76
Fine Grading	250.00	100%	10	SY	10,667	2	21.3	2.13
Aggregate Base Course	675.00	100%	10	SY	10,667	1	15.8	1.58
Demobilization	0.10	100%	10	DAY	5	1	50.0	5.00

16 - Bank Stabilization

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	20	1	200.0	20.00
Channel Armoring								
Bedding Stone Placement	30.00	100%	10	CY	24,840	4	207.0	20.70
Riprap Placement	25.00	100%	10	CY	115,610	6	770.7	77.07
Boulder Placement	17.50	100%	10	CY	2,200	2	62.9	6.29
Demobilization	0.10	100%	10	DAY	5	1	50.0	10.00

TITLE: Yellowstone River - Modified Side Channel
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.: T35234
DATE: 5/10/2016

09 - Channels

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	20	1	200.0	20.00
Site Preparation								
Staging Areas								
Clearing and Grubbing	0.13	100%	10	ACRE	33.5	3	89.3	8.93
Fine Grading	250.00	100%	10	SY	162,140	4	162.1	16.21
Aggregate Base Course	675.00	100%	10	SY	81,070	2	60.1	6.01
Temporary Fencing	25.00	100%	10	LF	10,800	4	108.0	10.80
Access/Haul Roads								
Clearing and Grubbing	0.13	100%	10	ACRE	11.7	2	46.8	4.68
Fine Grading	250.00	100%	10	SY	56,667	2	113.3	11.33
Aggregate Base Course	675.00	100%	10	SY	56,667	2	42.0	4.20
Erosion Control								
Silt Fence	43.75	100%	10	LF	10,000	2	114.3	11.43
Jute Mesh	300.00	100%	10	SY	10,000	2	16.7	1.67
Upstream Cofferdam								
Sheetpile Cutoff	60.63	100%	10	SF	4,800	1	79.2	7.92
Earthen Cofferdam								
Borrow Fill Excavate and Load	130.00	100%	10	CY	24,610	2	94.7	9.47
Cycel Haul to/from Borrow Site	60.61	100%	10	CY	24,610	4	101.5	10.15
Place and Compact Embankment	240.00	100%	10	CY	24,610	2	51.3	5.13
Bedding Placement	30.00	100%	10	CY	690	2	11.5	1.15
Riprap Placement	25.00	100%	10	CY	3,080	2	61.6	6.16
Downstream Cofferdam								
Sheetpile Cutoff	60.63	100%	10	SF	4,800	1	79.2	7.92
Earthen Cofferdam								
Borrow Fill Excavate and Load	130.00	100%	10	CY	24,610	2	94.7	9.47
Cycel Haul to/from Borrow Site	60.61	100%	10	CY	24,610	4	101.5	10.15
Place and Compact Embankment	240.00	100%	10	CY	24,610	2	51.3	5.13
Bedding Placement	30.00	100%	10	CY	690	2	11.5	1.15
Riprap Placement	25.00	100%	10	CY	3,080	2	61.6	6.16
Clearing and Grubbing	0.13	100%	10	ACRE	226	8	226.0	22.60
Channel Excavation	210.00	100%	10	CY	1,143,900	6	907.9	90.79
Cycle Haul to/from Overbank Sites	72.70	100%	10	CY	416,605	6	955.1	95.51
Place and Compact Channel Fil	224.00	100%	10	CY	416,605	6	310.0	31.00
Cycle Haul to/from Borrow Site	60.61	100%	10	CY	898,880	10	1483.1	148.31
Spread Material at Disposal Site	140.00	100%	10	CY	898,880	8	802.6	80.26
Finish Grading, Channel	900.00	100%	10	SY	484,000	4	134.4	13.44
Seeding								
Mechanical Seeding	0.19	100%	10	ACRE	128	4	170.7	17.07
Mulching	75.00	100%	10	MSF	5,576	2	37.2	3.72
Netting	312.50	100%	10	SY	619,520	4	495.6	49.56
Demobilization	0.10	100%	10	DAY	5	1	50.0	10.00

Multiple Pump Construction Durations

TITLE: Yellowstone River - Multiple Pump Alternative
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.: T35234
DATE: 5/10/2016

Typical Pump Station Durations

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	30	DAY	30	1	300.0	10.00
Staging Areas								
Clearing and Grubbing	0.13	100%	10	ACRE	0.5	1	3.7	0.37
Fine Grading	250.00	100%	10	SY	2,500	1	10.0	1.00
Aggregate Base Course	675.00	100%	10	SY	2,500	1	3.7	0.37
Temporary Fencing	25.00	100%	10	LF	600	2	12.0	1.20
Access/Haul Roads								
Clearing and Grubbing	0.13	100%	10	ACRE	0.8	1	6.4	0.64
Fine Grading	250.00	100%	10	SY	3,733	1	14.9	1.49
Aggregate Base Course	675.00	100%	10	SY	2,667	1	4.0	0.40
Erosion Control								
Silt Fence	43.75	100%	10	LF	2,500	2	28.6	2.86
Jute Mesh	300.00	100%	10	SY	5,000	2	8.3	0.83
Feeder Canal Dewater								
Sheet Piling	60.63	100%	10	SF	8,000	1	132.0	13.20
Wellpoints	2.00	100%	10	LF	400	2	100.0	10.00
Pump Staitons								
Clearing and Grubbing	0.13	100%	10	ACRE	0.54	1	4.3	0.43
Earthwork								
Channel Excavation	180.00	100%	10	CY	13,150	4	18.3	1.83
Wet Excavation	35.00	100%	10	CY	13,150	4	93.9	9.39
Cycle Haul to/from Borrow Site	53.10	100%	10	CY	12,098	2	113.9	11.39
Spread Material at Disposal Site	140.00	100%	10	CY	12,098	2	43.2	4.32
Fill and Compact from Stockpile	96.00	100%	10	CY	18,147	2	94.5	9.45
Reinforced Concrete								
Concrete Floor								
Concrete Forms	34.38	100%	10	SFC	159	2	2.3	0.23
Reinforcing Steel	0.07	100%	10	TON	10.7	6	24.8	2.48
Concrete Placement	23.13	100%	10	CY	96	1	4.1	0.41
Concrete Walls								
Concrete Forms	50.00	100%	10	SFC	903	2	9.0	0.90
Reinforcing Steel	0.09	100%	10	TON	85	6	150.7	15.07
Concrete Placement	15.00	100%	10	CY	550	1	36.7	3.67
Concrete Top Slab								
Concrete Forms	34.38	100%	10	SFC	53	2	0.8	0.08
Reinforcing Steel	0.07	100%	10	TON	3	6	6.3	0.63
Concrete Placement	23.13	100%	10	CY	32	1	1.4	0.14
Irrigation Pumps and Motors	0.03	100%	10	EA	4	1	160.0	16.00
Piping								
48" Steel Pipe	2.71	100%	10	LF	190	2	35.1	3.51
84" Steel Pipe	1.25	100%	10	LF	20	1	16.0	1.60
Hydraulic Gate	0.06	100%	10	EA	4	2	32.0	3.20
Pipe Wyes and Tees	1.50	100%	10	EA	3	1	2.0	0.20
Pipe Bends/Elbows	1.50	100%	10	EA	3	1	2.0	0.20
Pipe Reducers	1.00	100%	10	EA	2	1	2.0	0.20
Concrete Utility Vaults	0.10	100%	10	EA	4	1	40.0	4.00
Prefab Steel Builcing	0.01	100%	10	EA	1	1	100.0	10.00
Standby Generators	0.01	100%	10	EA	1	1	80.0	8.00
Aggregate Base Course	104.38	100%	10	CY	40	1	0.4	0.04

TITLE: Yellowstone River - Multiple Pump Alternative
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.: T35234
DATE: 5/10/2016

Typical Pump Station (Cont.)

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Discharge Pipelines								
Clearing and Grubbing	0.13	100%	10	ACRE	0.6	1	5.0	0.50
Trench Excavation	50.00	100%	10	CY	6,000	2	60.0	6.00
84" Steel Pipe	1.25	100%	10	LF	1,000	4	200.0	20.00
Concrete Outlet Structures								
Structural Excavation	25.00	100%	10	CY	365	1	14.6	1.46
Structural Concrete	5.00	100%	10	CY	109	1	21.8	2.18
Bedding Stone	30.00	100%	10	CY	138	1	4.6	0.46
Riprap Placement	28.00	100%	10	CY	415	1	14.8	1.48
Feeder Canal								
Clearing and Grubbing	0.13	100%	10	ACRE	0.3	1	2.1	0.21
In Water Excavation	33.00	100%	10	CY	2,100	3	21.2	2.12
Channel Excavation	180.00	100%	10	CY	40,000	3	74.1	7.41
Trash Rack	0.03	100%	10	EA	1	1	40.0	4.00
Fish Screen								
Clearing and Grubbing	0.13	100%	10	ACRE	0.4	1	2.8	0.28
Channel Excavation	180.00	100%	10	CY	5,539	2	15.4	1.54
Structural Excavation	33.00	100%	10	CY	292	1	8.8	0.88
Reinforced Concrete								
Concrete Foundations								
Concrete Forms	43.75	100%	10	SFC	730	2	8.3	0.83
Reinforcing Steel	0.07	100%	10	TON	41.5	6	96.2	9.62
Concrete Placement	50.00	100%	10	CY	514	1	10.3	1.03
Concrete Floor								
Concrete Forms	34.38	100%	10	SFC	348	2	5.1	0.51
Reinforcing Steel	0.07	100%	10	TON	23.5	6	54.5	5.45
Concrete Placement	23.13	100%	10	CY	210	1	9.1	0.91
Concrete Footings								
Concrete Forms	60.63	100%	10	SFC	2,220	2	18.3	1.83
Reinforcing Steel	0.07	100%	10	TON	28	6	71.6	7.16
Concrete Placement	18.75	100%	10	CY	349	1	18.6	1.86
Concrete Walls								
Concrete Forms	50.00	100%	10	SFC	944	2	9.4	0.94
Reinforcing Steel	0.09	100%	10	TON	47	6	82.6	8.26
Concrete Placement	15.00	100%	10	CY	575	1	38.3	3.83
Fish Screens and Deadplates	0.02	100%	10	EA	1	1	60.0	6.00
Structural Steel Supports	0.83	100%	10	TON	50	1	60.0	6.00
Screen Cleaners	0.02	100%	10	EA	1	1	50.0	5.00
Fish Return Pump	0.02	100%	10	EA	1	1	50.0	5.00
14" HDPE Pipe	27.50	100%	10	LF	2,400	2	43.6	4.36
18" HDPE Pipe	17.50	100%	10	LF	50	1	2.9	0.29
Demobilization	0.10	100%	10	DAY	15	1	150.0	15.00

Multiple Pumps with Conservation Measures Construction Durations

TITLE: Yellowstone River - Multiple Pumps with Conservation Measures
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.:
DATE: 3/20/2016

Existing Intake Dam Removal

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	15	1	150.0	15.00
Site Preparation								
Staging Areas								
Clearing and Grubbing	0.13	100%	10	ACRE	2.0	2	8.0	0.80
Fine Grading	250.00	100%	10	SY	9,680	2	19.4	1.94
Aggregate Base Course	675.00	100%	10	SY	4,840	2	3.6	0.36
Temporary Fencing	25.00	100%	10	LF	2,000	2	40.0	4.00
Access/Haul Roads								
Clearing and Grubbing	0.13	100%	10	ACRE	0.7	2	2.8	0.28
Fine Grading	250.00	100%	10	SY	3,388	2	6.8	0.68
Aggregate Base Course	675.00	100%	10	SY	3,388	2	2.5	0.25
Erosion Control								
Silt Fence	43.75	100%	10	LF	3,000	2	34.3	3.43
Jute Mesh	300.00	100%	10	SY	5,000	2	8.3	0.83
Cofferdam - Phase 1								
Sheet Pile Cofferdam	69.13	100%	10	SF	35,800	2	259.0	25.90
Earthen Cofferdam								
Excavate at Borrow Site	130.00	100%	10	CY	6,636	2	25.5	2.55
Cycle Haul from Borrow Site	53.10	100%	10	CY	6,636	4	31.2	3.12
Place and Compact Embankment	240.00	100%	10	CY	6,636	1	27.7	2.77
Bedding Stone								
Place Bedding	30.00	100%	10	CY	556	2	9.3	0.93
Riprap Placement								
Place Riprap	25.00	100%	10	CY	1,416	2	28.3	2.83
Cofferdam - Phase 2								
Sheet Pile Cofferdam	69.13	100%	10	SF	56,800	2	410.8	41.08
Dam Removal								
Rock Removal	10.50	100%	10	CY	45,168	8	537.7	53.77
Rock Load and Haul	157.00	100%	10	CY	45,168	1	287.7	28.77
Timber Decking Removal	27.50	100%	10	SF	38,500	4	350.0	35.00
Timber Cribbing Removal	100.00	100%	10	LF	6,864	1	68.6	6.86
Timber Pile Demolition	75.00	100%	10	VLF	2,024	1	27.0	2.70
Misc. Material Load and Haul	78.00	100%	10	CY	1,200	1	15.4	1.54
Demobilization	0.10	100%	10	DAY	7	1	70.0	7.00

TITLE: Yellowstone River - Multiple Pumps with Conservation Measures
SUBJECT: Estimated Construction Durations
MADE BY: SKV
CHECKED BY:

JOB NO.:
DATE: 3/20/2016

Convert Laterals to Pipe

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	15	1	150.0	15.00
Convert Laterals to Pipe								
Staging Areas								
Clearing and Grubbing	0.13	100%	10	ACRE	33.5	3	89.3	8.93
Fine Grading	250.00	100%	10	SY	162,140	4	162.1	16.21
Aggregate Base Course	675.00	100%	10	SY	81,070	2	60.1	6.01
Temporary Fencing	25.00	100%	10	LF	10,800	4	108.0	10.80
18" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	1,226	1	4.9	0.49
Aggregate Base Course	104.38	100%	10	CY	235	1	2.3	0.23
18" RCP	16.50	100%	10	LF	3,678	2	111.5	11.15
Backfill	132.50	100%	10	CY	1,410	1	10.6	1.06
24" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	18,910	2	37.8	3.78
Aggregate Base Course	104.38	100%	10	CY	2,718	2	13.0	1.30
24" RCP	12.50	100%	10	LF	42,547	8	425.5	42.55
Backfill	132.50	100%	10	CY	13,591	2	51.3	5.13
36" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	97,987	3	130.6	13.06
Aggregate Base Course	104.38	100%	10	CY	15,025	3	48.0	4.80
36" RCP	9.00	100%	10	LF	176,376	12	1633.1	163.31
Backfill	132.50	100%	10	CY	105,172	3	264.6	26.46
48" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	87,770	3	117.0	11.70
Aggregate Base Course	104.38	100%	10	CY	12,016	3	38.4	3.84
48" RCP	8.00	100%	10	LF	112,847	12	1175.5	117.55
Backfill	132.50	100%	10	CY	101,137	3	254.4	25.44
60" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	51,107	3	68.1	6.81
Aggregate Base Course	104.38	100%	10	CY	7,619	3	24.3	2.43
60" RCP	6.00	100%	10	LF	51,107	12	709.8	70.98
Backfill	132.50	100%	10	CY	65,303	3	164.3	16.43
72" Pipe Laterals								
Fine Grading	250.00	100%	10	SY	7,593	2	15.2	1.52
Aggregate Base Course	104.38	100%	10	CY	1,164	2	5.6	0.56
60" RCP	6.00	100%	10	LF	6,834	8	142.4	14.24
Backfill	132.50	100%	10	CY	8,732	2	33.0	3.30
Line Remaining Laterals								
Earthwork	181.25	100%	10	SY	63,822	2	176.1	17.61
Geomembrane	8.13	100%	10	MSF	603	1	74.2	7.42
Shotcrete Placement	337.50	100%	10	SF	574,398	4	425.5	42.55

Line Open Canals

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Mobilization	0.10	100%	10	DAY	30	1	300.0	30.00
Staging Areas								
Clearing and Grubbing	0.13	100%	10	ACRE	14.0	1	112.0	11.20
Fine Grading	250.00	100%	10	SY	67,760	2	135.5	13.55
Aggregate Base Course	675.00	100%	10	SY	33,880	1	50.2	5.02
Temporary Fencing	25.00	100%	10	LF	17,500	4	175.0	17.50
Access Roads								
Clearing and Grubbing	0.13	100%	10	ACRE	9.6	1	76.8	7.68
Fine Grading	250.00	100%	10	SY	46,667	2	93.3	9.33
Aggregate Base Course	675.00	100%	10	SY	23,334	1	34.6	3.46
Fill Canal								
Borrow Fill Excavate and Load	130.00	100%	10	CY	2,763,567	12	1771.5	177.15
Cycle Haul From Borrow Site	157.00	100%	10	CY	2,763,567	12	1466.9	146.69
Place and Compact Fill	224.00	100%	10	CY	2,763,567	12	1028.1	102.81
Line Main Canal								
Shape Embankments	181.25	100%	10	SY	2,413,817	6	2219.6	221.96
Geomembrane	8.13	100%	10	MSF	22,811	6	467.9	46.79
Shotcrete Placement	337.50	100%	10	SF	21,724,353	6	10728.1	1072.81

Durations per Typical Check Structure

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Earthwork								
Structural Excavation	14.50	100%	10	CY	25	1	1.7	0.17
Structural Backfill	56.88	100%	10	CY	29	1	0.5	0.05
Reinforced Concrete								
Concrete Forms	49.38	100%	10	SFC	900	1	18.2	1.82
Reinforcing Steel	0.09	100%	10	TON	3.4	1	36.2	3.62
Concrete Placing	15.00	100%	10	CY	50	1	3.3	0.33
Remaining Check Structure Items								
Hydraulic Gates and Controllers	0.01	100%	10	EA	1	1	80.0	8.00
Riprap Placement	28.00	100%	10	CY	50	1	1.8	0.18

Flow Measuring Devices per 1-ea

Item	Prod. Rate	Prod. Index	Work Hrs/Day	UOM	Quantity	Crews (EA)	Duration (Hrs.)	Duration (Days)
Lateral Turnouts at Main Canal								
Cipolletti Weir								
Excavation	9.00	100%	10	CY	9	1	1.0	0.10
Reinforced Concrete Placement	4.00	100%	10	CY	4.5	1	1.1	0.11
Backfill	9.00	100%	10	CY	9	1	1.0	0.10
Parshall Flume								
Excavation	9.00	100%	10	CY	28	1	3.1	0.31
Reinforced Concrete Placement	8.28	100%	10	CY	27.9	1	3.4	0.34
Backfill	9.00	100%	10	CY	28	1	3.1	0.31
Sublateral Turnouts								
Cipolletti Weir								
Excavation	8.00	100%	10	CY	8	1	1.0	0.10
Reinforced Concrete Placement	4.00	100%	10	CY	8.0	1	2.0	0.20
Backfill	8.00	100%	10	CY	8	1	1.0	0.10
Parshall Flume								
Excavation	10.60	100%	10	CY	40	1	3.7	0.37
Reinforced Concrete Placement	8.28	100%	10	CY	19.8	1	2.4	0.24
Backfill	19.80	100%	10	CY	40	1	2.0	0.20

Attachment B.7
MCACES Construction Cost Estimate Summaries

Rock Ramp MCACES Summary

Estimated by CENWO-ED-C
Designed by Omaha District COE
Prepared by Gary Norenberg
Preparation Date 4/13/2011
Effective Date of Pricing 4/13/2011
Estimated Construction Time Days

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Description	Quantity	UOM	ContractCost	ProjectCost	CostOverride
Project Cost Summary Report			**55,409,363**	**55,409,363**	
Rock Ramp Options	**1.00**	**LS**	**55,409,363**	**55,409,363**	
Coffer Dam Alternatives	**1.00**	**LS**	**3,850,361**	**3,850,361**	
3 Partial Coffer Dam Alternative	**1.00**	**LS**	**3,850,361**	**3,850,361**	
Crest Structure Alternatives	**1.00**	**LS**	**8,268,256**	**8,268,256**	
1 Concrete Crest Structure	**1.00**	**LS**	**8,268,256**	**8,268,256**	
Rock Ramp Alternatives	**1.00**	**LS**	**42,351,677**	**42,351,677**	
1 Original Design Rock Ramp	**1.00**	**LS**	**42,351,677**	**42,351,677**	
Project Costs	**1.00**	**LS**	**939,069**	**939,069**	
All Remaining Work	**1.00**	**LS**	**939,069**	**939,069**	

Bypass Channel MCACES Summary

Added Markups:
Contingencies from CSRA, 80% confidence - 28%
Escalation from TPCS
-Construction - 1.6%
-E&D, S&A - 2.9%

Estimated by CENWO-ED-C
Designed by Omaha & Portland Districts, COED'A
Prepared by Gary Norenberg
Preparation Date 3/13/2015
Effective Date of Pricing 2/17/2015
Estimated Construction Time 720 Days

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Description	Quantity	UOM	ContractCost	ProjectCost	CostOverride
Project Cost Summary Report			**48,487,112**	**48,487,112**	
Selected Plan - 15% Diversion Channel	**1.00**	**LS**	**48,487,112**	**48,487,112**	
1 Construction Costs	**1.00**	**LS**	**48,487,112**	**48,487,112**	
CWWBS 09 01 Bypass Channel	**1.00**	**LS**	**17,707,099**	**17,707,099**	
CWWBS 15 Intake Weir	**1.00**	**LS**	**12,065,928**	**12,065,928**	
CWWBS 16 Bank Stabilization Rock	**1.00**	**LS**	**18,714,085**	**18,714,085**	

Modified Side Channel MCACES Summary

Estimated by Tetra Tech, Inc.
Designed by Tetra Tech, Inc.
Prepared by Tetra Tech, Inc
Preparation Date 5/19/2016
Effective Date of Pricing 5/19/2016
Estimated Construction Time 435 Days

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Description	Quantity	UOM	ContractCost	ProjectCost	CostOverride
Project Cost Summary Report			**35,180,547**	**35,180,547**	
Yellowstone River - Modified Side Channel Alternative	**1.00**	**LS**	**35,180,547**	**35,180,547**	
08 Roads, Railroads and Bridges	**1.00**	**LS**	**1,041,844**	**1,041,844**	
08 01 Bridge	**1.00**	**LS**	**1,041,844**	**1,041,844**	
09 Channels and Canals	**1.00**	**LS**	**16,702,882**	**16,702,882**	
09 01 Channels	**1.00**	**LS**	**16,702,882**	**16,702,882**	
16 Bank Stabilization	**1.00**	**LS**	**17,435,821**	**17,435,821**	
16 01 Channel Armoring	**1.00**	**LS**	**17,435,821**	**17,435,821**	

Multiple Pump MCACES Summary

Estimated by Tetra Tech, Inc.
Designed by Tetra Tech, Inc.
Prepared by Tetra Tech, Inc
Preparation Date 5/19/2016
Effective Date of Pricing 5/19/2016
Estimated Construction Time 800 Days

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Description	Quantity	UOM	ContractCost	ProjectCost	CostOverride
Project Cost Summary Report			**84,277,276**	**84,277,276**	
Yellowstone River - Multiple Pump Alternative	**1.00**	**LS**	**84,277,276**	**84,277,276**	
04 Dams	**1.00**	**LS**	**6,599,764**	**6,599,764**	
04 01 Existing Timber Dam Removal	**1.00**	**LS**	**6,599,764**	**6,599,764**	
			15,535,502.33	*15,535,502.33*	
19 Buildings, Grounds & Utilities	**5.00**	**EA**	**77,677,512**	**77,677,512**	
			10,483,659.19	*10,483,659.19*	
19 01 Pump Station - Site 1	**1.00**	**EA**	**10,483,659**	**10,483,659**	
			12,650,555.78	*12,650,555.78*	
19 02 Pump Station - Site 2	**1.00**	**EA**	**12,650,556**	**12,650,556**	
			22,012,550.11	*22,012,550.11*	
19 03 Pump Station - Site 3	**1.00**	**EA**	**22,012,550**	**22,012,550**	
			17,835,852.83	*17,835,852.83*	
19 04 Pump Station - Site 4	**1.00**	**EA**	**17,835,853**	**17,835,853**	
			14,694,893.73	*14,694,893.73*	
19 05 Pump Station - Site 5	**1.00**	**EA**	**14,694,894**	**14,694,894**	

Multiple Pumps with Conservation Measures MCACES Summary

Estimated by Tetra Tech, Inc.
Designed by Tetra Tech, Inc.
Prepared by Tetra Tech, Inc
Preparation Date 5/19/2016
Effective Date of Pricing 5/19/2016
Estimated Construction Time 2,750 Days

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Description	Quantity	UOM	ContractCost	ProjectCost	CostOverride
Project Cost Summary Report			**313,059,999**	**313,059,999**	
Yellowstone River - Multiple Pumps with Conservation Measures Alternative	**1.00**	**LS**	**313,059,999**	**313,059,999**	
04 Dams	**1.00**	**LS**	**7,036,521**	**7,036,521**	
04 01 Existing Timber Dam Removal	**1.00**	**LS**	**7,036,521**	**7,036,521**	
09 Channels and Canals	**1.00**	**LS**	**195,852,565**	**195,852,565**	
09 02 Convert Laterals From Ditches to Pipe	**1.00**	**LS**	**62,146,232**	**62,146,232**	
09 03 Line Open Canals	**1.00**	**LS**	**130,070,099**	**130,070,099**	
09 04 Check Structures	**1.00**	**LS**	**2,648,406**	**2,648,406**	
09 05 Flow Measuring Devices	**1.00**	**LS**	**987,828**	**987,828**	
19 Buildings, Grounds and Utilities	**1.00**	**LS**	**18,702,727**	**18,702,727**	
19 01 Convert Fields From Flood Irrigation to Sprinklers	**1.00**	**LS**	**15,118,390**	**15,118,390**	
19 02 Renewable Energy Resources	**1.00**	**LS**	**3,584,337**	**3,584,337**	
20 Permanent Operating Equipment	**1.00**	**LS**	**91,468,186**	**91,468,186**	
20 01 Ranney Wells	**1.00**	**LS**	**91,468,186**	**91,468,186**	

Attachment B.8
Operations, Maintenance & Repair Cost Estimates

No Action OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
Main Canal, Laterals, Drains			
1	Main Canal, Laterals, Drains	$ 1,875,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
Headworks			
2	Sediment Removal	$ 10,000.00	Cost estimate from 2015 EA
3	Daily Operations	$ 77,000.00	Cost estimate from 2015 Operation Expenses. James Brower Email to David Trimpe on April 13, 2016. (Problem with Draft EIS O&M Numbers). Costs include: Daily gate adjustments, power costs, backup generator costs and debris/tree removal from screens.
4	Fish Screen Manifolds	$ 2,040,000.00	$170,000 per unit - 12 fish screens - Expected Service life is 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
5	Fish Screen Cylinder Units	$ 1,200,000.00	$50,000 per unit - 2 units per screen - 12 screens - Expected Service Life 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
6	Fish Screen External Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
7	Fish Screen Internal Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
8	Fish Screen Seal System	$ 120,000.00	$10,000 per unit - 1 Unit per screen - 12 Screens - Expected Service Life 10 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
Diversion Dam			
9	Diversion Dam Maintenance	$ 77,000.00	Average cost over the last 3 years (2013, 2014, 2015) and 2012 Rocking Event. James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures)) It is considered resonable and prudent that the LYP would not replace the existing diversion dam. They would just continue to rock. The blue book is a guide developed for financial purposes; it is helpful information that we are taking into consideration along with LYP's real world experience with these features and equipment to identify estimates based on best available information.
Rocking Structure			
10	Trolley Rehab	$ 150,000.00	Replacement at 7 years and not again during the 50 years. The south rocking tower was replaced in the 1990s for approximately $35,000. This number represents replacement of both towers. Also considered is the inflation of costs since the 90's.
11	Cable Replacement	$ 127,000.00	Assumes 1 replacement every 50 years. Shawn Higley Email to David Trimpe April 25, 2016 (SWR Enquiry).
Pumps			
12	Existing Pumps	$ 235,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
Admin. Costs			
13	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
ESA Monitoring Costs			
14	Passage and Entrainment Monitoring	$ 400,000.00	Per David Trimpe BOR. Current Monitoring Costs. It is resonable to assume that Reclamation would be required to monitor for at least the first 8 Years.

Discount Rate (2016):	3.125%
Net Present Value of O&M:	$ 66,419,873
Average Annual O&M:	$2,643,043.01
Cost Per Acre (56,799):	$ 46.53

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	O&M Annual Total	Discount Factor	Discounted O&M
0							End of Construction								$ -	1.0000	$ -
1	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.9697	$ 2,652,121.21
2	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.9403	$ 2,571,753.90
3	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.9118	$ 2,493,821.97
4	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.8842	$ 2,418,251.60
5	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 3,215,000.00	0.8574	$ 2,756,520.14
6	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.8314	$ 2,273,911.52
7	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00	$ 150,000.00	$ 127,000.00	$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 3,012,000.00	0.8062	$ 2,428,327.38
8	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00	$ 400,000.00	$ 2,735,000.00	0.7818	$ 2,138,186.77
9	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.7581	$ 1,770,154.73
10	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,935,000.00	0.7351	$ 2,157,987.86
11	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.7128	$ 1,664,498.12
12	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.6912	$ 1,614,058.78
13	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.6703	$ 1,565,147.91
14	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.6500	$ 1,517,719.18
15	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,815,000.00	0.6303	$ 1,774,267.00
16	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.6112	$ 1,427,129.88
17	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.5927	$ 1,383,883.52
18	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.5747	$ 1,341,947.66
19	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.5573	$ 1,301,282.58
20	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,935,000.00	0.5404	$ 1,586,093.83
21	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.5240	$ 1,223,611.90
22	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.5082	$ 1,186,532.75
23	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4928	$ 1,150,577.21
24	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4778	$ 1,115,711.24
25	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 6,055,000.00	0.4633	$ 2,805,531.24
26	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4493	$ 1,049,116.90
27	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4357	$ 1,017,325.48
28	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4225	$ 986,497.44
29	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.4097	$ 956,603.58
30	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,935,000.00	0.3973	$ 1,165,975.05
31	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3852	$ 899,506.02
32	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3736	$ 872,248.27
33	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3622	$ 845,816.50
34	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3513	$ 820,185.70
35	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,815,000.00	0.3406	$ 958,825.87
36	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3303	$ 771,230.63
37	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3203	$ 747,860.00
38	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3106	$ 725,197.58
39	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.3012	$ 703,221.89
40	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,935,000.00	0.2920	$ 857,135.82
41	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2832	$ 661,248.14
42	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2746	$ 641,210.31
43	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2663	$ 621,779.70
44	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2582	$ 602,937.89
45	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,815,000.00	0.2504	$ 704,855.56
46	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2428	$ 566,949.86
47	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2354	$ 549,769.56
48	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2283	$ 533,109.88
49	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 2,335,000.00	0.2214	$ 516,955.03
50	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 235,000.00	$ 61,000.00		$ 6,175,000.00	0.2147	$ 1,325,680.55
Total Cost:	$ 47,118,893	$ 251,301	$ 1,935,016	$ 1,383,174	$ 813,632	$ 1,133,172	$ 1,133,172	$ 261,542	$ 1,935,016	$ 120,933	$ 102,390	$ 5,905,568	$ 1,532,935	$ 2,799,130			
Annual Cost:	$1,875,000	$10,000	$77,000	$55,041	$32,377	$45,092	$45,092	$10,408	$77,000	$4,812	$4,074	$235,000	$61,000	$111,147		$2,643,043	

Rock Ramp OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
	Main Canal, Laterals, Drains		
1	Main Canal, Laterals, Drains	$ 1,875,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	Headworks		
2	Sediment Removal	$ 10,000.00	Cost estimate fror 2015 EA
3	Daily Operations	$ 77,000.00	Cost estimate from 2015 Operation Expenses. James Brower Email to David Trimpe on April 13, 2016. (Problem with Draft EIS O&M Numbers). Costs include: Daily gate adjustments, power costs, backup generator costs and debris/tree removal from screens.
4	Fish Screen Manifolds	$ 2,040,000.00	$170,000 per unit - 12 fish screens - Expected Service life is 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
5	Fish Screen Cylinder Units	$ 1,200,000.00	$50,000 per unit - 2 units per screen - 12 screens - Expected Service Life 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
6	Fish Screen External Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
7	Fish Screen Internal Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
8	Fish Screen Seal System	$ 120,000.00	$10,000 per unit - 1 Unit per screen - 12 Screens - Expected Service Life 10 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
	Diversion Dam		
9	Diversion Dam Maintenance	$ 10,000.00	Estimate from 2015 EA
	Rock Ramp		
10	Minor Rock Repairs	$ 128,000.00	Estimate from 2015 EA
11	Place Rock (Major Repair)	$ 250,000.00	Every 10 years, assumes 5% riprap placed (TT Estimate)
12	Coffer Dam (Major Repair)	$ 1,000,000.00	Every 10 years, cofer off section of river (TT Estimate)
13	Barge Cost (Major Repair)	$ 100,000.00	Every 10 Years (TT Estimate)
	Pumps		
14	Existing Pumps	$ 235,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	Admin. Costs		
15	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	ESA Monitoring Costs		
16	Passage and Entrainment Monitoring	$ 500,000.00	Per David Trimpe BOR. Anticipated costs for entrainment and passage monitoring. Approximately $200,000 each. Hydrologic criteria monitoring would be another $100,000. It is resonable to assume that Reclamation would be required to monitor for at least the first 8 Years.

Discount Rate (2016)	3.125%
Net Present Value of O&M	$ 71,370,120.87
Average Annual O&M	$2,840,028.00
Cost Per Acre (56,799 acres)	$ 50.00

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	O&M Annual Total	Discount Factor	Discounted O&M
0								End of Construction									$ -	1.000	$ -
1	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.970	$ 2,808,242
2	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.940	$ 2,723,144
3	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.912	$ 2,640,625
4	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.884	$ 2,560,606
5	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000		$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 3,376,000	0.857	$ 2,894,560
6	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.831	$ 2,407,769
7	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.806	$ 2,334,806
8	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000	$ 500,000	$ 2,896,000	0.782	$ 2,264,054
9	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.758	$ 1,816,399
10	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000	$ 120,000	$ 10,000	$ 128,000	$ 250,000	$ 1,000,000	$ 100,000	$ 235,000	$ 61,000		$ 4,346,000	0.735	$ 3,194,847
11	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.713	$ 1,707,982
12	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.691	$ 1,656,225
13	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.670	$ 1,606,036
14	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.650	$ 1,557,368
15	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000		$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,876,000	0.630	$ 1,812,715
16	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.611	$ 1,464,413
17	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.593	$ 1,420,036
18	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.575	$ 1,377,005
19	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.557	$ 1,335,278
20	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000	$ 120,000	$ 10,000	$ 128,000	$ 250,000	$ 1,000,000	$ 100,000	$ 235,000	$ 61,000		$ 4,346,000	0.540	$ 2,348,608
21	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.524	$ 1,255,578
22	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.508	$ 1,217,530
23	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.493	$ 1,180,635
24	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.478	$ 1,144,858
25	$ 1,875,000	$ 10,000	$ 77,000	$ 2,040,000	$ 1,200,000	$ 240,000	$ 240,000		$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 6,116,000	0.463	$ 2,833,795
26	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.449	$ 1,076,524
27	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.436	$ 1,043,902
28	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.422	$ 1,012,269
29	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.410	$ 981,594
30	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000	$ 120,000	$ 10,000	$ 128,000	$ 250,000	$ 1,000,000	$ 100,000	$ 235,000	$ 61,000		$ 4,346,000	0.397	$ 1,726,517
31	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.385	$ 923,005
32	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.374	$ 895,035
33	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.362	$ 867,913
34	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.351	$ 841,612
35	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000		$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,876,000	0.341	$ 979,603
36	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.330	$ 791,378
37	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.320	$ 767,397
38	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.311	$ 744,143
39	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.301	$ 721,593
40	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000	$ 120,000	$ 10,000	$ 128,000	$ 250,000	$ 1,000,000	$ 100,000	$ 235,000	$ 61,000		$ 4,346,000	0.292	$ 1,269,203
41	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.283	$ 678,523
42	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.275	$ 657,961
43	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.266	$ 638,023
44	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.258	$ 618,689
45	$ 1,875,000	$ 10,000	$ 77,000			$ 240,000	$ 240,000		$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,876,000	0.250	$ 720,130
46	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.243	$ 581,761
47	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.235	$ 564,132
48	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.228	$ 547,037
49	$ 1,875,000	$ 10,000	$ 77,000						$ 10,000	$ 128,000				$ 235,000	$ 61,000		$ 2,396,000	0.221	$ 530,460
50	$ 1,875,000	$ 10,000	$ 77,000	$ 2,040,000	$ 1,200,000	$ 240,000	$ 240,000	$ 120,000	$ 10,000	$ 128,000	$ 250,000	$ 1,000,000	$ 100,000	$ 235,000	$ 61,000		$ 7,586,000	0.215	$ 1,628,601
Total Cost:	$ 47,118,893	$ 251,301	$ 1,935,016	$ 1,383,174	$ 813,632	$ 1,133,172	$ 1,133,172	$ 261,542	$ 251,301	$ 3,216,650	$ 544,880	$ 2,179,521	$ 217,952	$ 5,905,568	$ 1,532,935	$ 3,491,412			
Annual Cost:	$1,875,000	$10,000	$77,000	$55,041	$32,377	$45,092	$45,092	$10,408	$10,000	$128,000	$21,682	$86,730	$8,673	$235,000	$61,000	$138,934		$2,840,028	

Bypass Channel OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
	Main Canal, Laterals, Drains		
1	Main Canal, Laterals, Drains	$ 1,875,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	Headworks		
2	Sediment Removal	$ 10,000.00	Cost estimate from 2015 EA
3	Daily Operations	$ 77,000.00	Cost estimate from 2015 Operation Expenses. James Brower Email to David Trimpe on April 13, 2016. (Problem with Draft EIS O&M Numbers). Costs include: Daily gate adjustments, power costs, backup generator costs and debris/tree removal from screens.
4	Fish Screen Manifolds	$ 2,040,000.00	$170,000 per unit - 12 fish screens - Expected Service life is 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
5	Fish Screen Cylinder Units	$ 1,200,000.00	$50,000 per unit - 2 units per screen - 12 screens - Expected Service Life 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
6	Fish Screen External Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
7	Fish Screen Internal Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
8	Fish Screen Seal System	$ 120,000.00	$10,000 per unit - 1 Unit per screen - 12 Screens - Expected Service Life 10 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
	Diversion Dam		
9	Diversion Dam Maintenance	$ 10,000.00	Estimate from 2015 EA
10	Rock Replacement (Major Repair)	$ 100,000.00	Every 5 Years - This cost is assuming a routine amont of scour behind new diversion structure. Already spending 77,000 for rock costs under no action.
11	Barge Cost (Major Repair)	$ 100,000.00	Every 5 Years - This cost is assuming a routine amont of scour behind new diversion structure
	Bypass Channel		
12	Bypass Channel (Minor Repairs)	$ 57,000.00	Cost Estimate from 2015 EA. This includes minor repairs and riprap replacement in bypass channel
13	Coffer Dam (Major Repairs)	$ 500,000.00	Every 10 years (TT Estimate)
14	Riprap Repairs (Major Repairs)	$ 400,000.00	Assumes 2.5% Replacement every 10 Years
15	Channel Repairs	$ 150,000.00	Assumes 1% of excavation every 5 years
16	Bypass Channel Inspection	$ 3,000.00	$1,500 per inspection - twice a year. Lower cost than modified side channel because they bypass channel is much shorter.
	Pumps		
17	Existing Pumps	$ 255,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	Admin. Costs		
18	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
	ESA Monitoring Costs		
19	Passage and Entrainment Monitoring	$ 500,000.00	Per David Trimpe BOR. Anticipated costs for entrainment and passage monitoring. Approximately $200,000 each. Hydrologic criteria monitoring would be another $100,000. It is reasonable to assume that Reclamation would be required to monitor for at least the first 8 Years.

Discount Rate (2016)	3.125%
Net Present Value of O&M	$ 70,333,034.38
Average Annual O&M	$2,798,759.26
Cost Per Acre (56,799 acres)	$ 49.27

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	O&M Annual Total	Discount Factor	Discounted O&M
0	End of Construction																			$ -	1.0000	$ -
1	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.9697	$ 2,742,305.03
2	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.9403	$ 2,659,202.94
3	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.9118	$ 2,578,621.03
4	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.8842	$ 2,500,481.00
5	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00			$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 3,868,000.00	0.8574	$ 3,316,345.46
6	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.8314	$ 2,351,232.82
7	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.8062	$ 2,279,981.34
8	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00	$ 500,000.00	$ 2,828,000.00	0.7818	$ 2,210,892.94
9	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.7581	$ 1,764,848.06
10	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00	$ 500,000.00	$ 400,000.00	$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 4,178,000.00	0.7351	$ 3,071,346.34
11	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.7128	$ 1,659,508.19
12	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.6912	$ 1,609,220.06
13	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.6703	$ 1,560,455.81
14	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.6500	$ 1,513,169.27
15	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00			$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 3,168,000.00	0.6303	$ 1,996,456.55
16	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.6112	$ 1,422,851.55
17	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.5927	$ 1,379,734.84
18	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.5747	$ 1,337,924.69
19	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.5573	$ 1,297,581.52
20	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00	$ 500,000.00	$ 400,000.00	$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 4,178,000.00	0.5404	$ 2,257,819.42
21	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.5240	$ 1,219,943.69
22	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.5082	$ 1,182,975.69
23	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4928	$ 1,147,127.95
24	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4778	$ 1,112,316.49
25	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00		$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00			$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 6,398,000.00	0.4635	$ 2,964,457.28
26	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4493	$ 1,045,971.80
27	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4357	$ 1,014,275.68
28	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4225	$ 983,540.06
29	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.4097	$ 953,735.81
30	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00	$ 500,000.00	$ 400,000.00	$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 4,178,000.00	0.3973	$ 1,659,776.41
31	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3852	$ 896,809.43
32	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3736	$ 869,833.39
33	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3622	$ 843,280.86
34	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3513	$ 817,726.90
35	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00			$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 3,168,000.00	0.3406	$ 1,079,336.17
36	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3303	$ 768,918.59
37	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3203	$ 745,618.02
38	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3106	$ 723,023.54
39	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.3012	$ 701,113.74
40	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00	$ 500,000.00	$ 400,000.00	$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 4,178,000.00	0.2920	$ 1,220,140.87
41	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2832	$ 659,265.81
42	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2746	$ 639,288.06
43	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2663	$ 619,915.69
44	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2582	$ 601,130.37
45	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00			$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 3,168,000.00	0.2504	$ 793,740.27
46	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2428	$ 565,250.23
47	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2354	$ 548,121.43
48	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2283	$ 531,511.69
49	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 10,000.00			$ 57,000.00				$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 2,328,000.00	0.2214	$ 515,405.28
50	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 10,000.00	$ 100,000.00	$ 100,000.00	$ 57,000.00	$ 500,000.00	$ 400,000.00	$ 150,000.00	$ 3,000.00	$ 255,000.00	$ 61,000.00		$ 7,418,000.00	0.2147	$ 1,592,534.14
Total Cost:	$ 47,118,891	$ 251,301	$ 1,935,016	$ 1,383,174	$ 813,632	$ 1,133,172	$ 1,133,172	$ 261,542	$ 251,301	$ 472,155	$ 472,155	$ 1,432,414	$ 1,089,760	$ 871,808	$ 708,233	$ 75,390	$ 5,906,168	$ 1,532,915	$ 3,491,412			
Annual Cost:	$1,875,000	$10,000	$77,000	$55,041	$32,377	$45,092	$45,092	$10,408	$10,000	$18,788	$18,788	$57,000	$43,365	$34,692	$28,183	$3,000	$235,000	$61,000	$138,934			$2,798,759

Modified Side Channel OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
	Main Canal, Laterals, Drains		
1	Main Canal, Laterals, Drains	$ 1,875,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District O M Numbers High Priority Questions/Information (Conservation Measures))
	Headworks		
2	Sediment Removal	$ 10,000.00	Cost estimate from 2015 EA
3	Daily Operations	$ 77,000.00	Cost estimate from 2015 Operation Expenses. James Brower Email to David Trimpe on April 13, 2016. (Problem with Draft EIS O&M Numbers). Costs include: Daily gate adjustments, power costs, backup generator costs and debris/tree removal from screens.
4	Fish Screen Manifolds	$ 2,040,000.00	$170,000 per unit - 12 fish screens - Expected Service life is 25 years. Information Obtained from Sr. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
5	Fish Screen Cylinder Units	$ 1,200,000.00	$50,000 per unit - 2 units per screen - 12 screens - Expected Service Life 25 years. Information Obtained from Sr. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
6	Fish Screen External Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from Sr. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
7	Fish Screen Internal Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from Sr. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
8	Fish Screen Seal System	$ 120,000.00	$10,000 per unit - 1 Unit per screen - 12 Screens - Expected Service Life 10 years. Information Obtained from Sr. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
	Diversion Dam		
9	Diversion Dam Maintenance	$ 77,000.00	Average cost over the last 3 years (2013, 2014, 2015) and 2012 Rocking Event. James Brower Email to David Trimpe on March 17, 2016 (Attached District O M Numbers High Priority Questions/Information (Conservation Measures)) It is considered reasonable and prudent that the LYP would not replace the existing diversion dam. They would just continue to rock. The blue book is a guide developed for financial purposes; it is helpful information that we are taking into consideration along with LYP's real world experience with these features and equipment to identify estimates based on best available information.
	Rocking Structure		
10	Trolley Rehab	$ 150,000.00	Replacement at 7 years and not again in 50. The south rocking tower was replaced in the 1990s for approximately $35,000. This number represents replacement of both towers and cable. Also considered is the inflation of costs since the 90's.
11	Cable Replacement	$ 127,000.00	Assumes 1 replacement every 50 years. Shawn Higley Email to David Trimpe April 25, 2016 (SWR Enquiry)
	Modified Channel		
12	Minor Channel Repairs	$ 100,000.00	This includes minor repairs and riprap replacement in the modified Channel. Slightly higher than the bypass channel because of additional length. Accounts for modifications needed for Baxedder Creek and runoff from county road 303.
13	Coffer Dam (Major Repair)	$ 500,000.00	Every 10 years (TT Estimate)
14	Riprap (Major Repair)	$ 450,000.00	Assumes 2.5% Replacement Levery 10 Years (TT estimate)
15	Channel Excavation (Major Repair)	$ 125,000.00	Assumes 5% of excavation every 5 years (TT estimate).
16	Channel Inspection	$ 5,000.00	$2,500 per inspection - twice a year. Higher cost than the bypass channel because this channel is much longer (TT estimate).
	Bridge Maintenance		
17	Bridge Maintenance	$ 25,000.00	Assumes 2.5% per year (TT estimate)
	Pumps		
18	Existing Pumps	$ 235,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District O M Numbers High Priority Questions/Information (Conservation Measures))
	Admin. Costs		
19	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District O M Numbers High Priority Questions/Information (Conservation Measures))
	ESA Monitoring Costs		
20	Passage and Entrainment Monitoring	$ 500,000.00	Per David Trimpe BOR. Anticipated costs for entrainment and passage monitoring. Approximately $200,000 each. Hydrologic criteria monitoring would be another $100,000. It is reasonable to assume that Reclamation would be required to monitor for at least the first 8 Years.

Discount Rate (2016)	3.125%
Net Present Value of O&M	$ 72,045,804.08
Average Annual O&M	$2,906,708.38
Cost Per Acre (56,799 acres)	$ 51.18

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	O&M Annual Total	Discount Factor	Discounted O&M
0										End of Construction											$ -	1.0000	$ -
1	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.9697	$ 2,875,151.52
2	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.9401	$ 2,788,025.71
3	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.9118	$ 2,703,540.08
4	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.8842	$ 2,621,614.63
5	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 100,000.00			$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 3,570,000.00	0.8574	$ 3,060,994.83
6	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.8314	$ 2,465,136.25
7	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00	$ 150,000.00	$ 127,000.00	$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 3,242,000.00	0.8062	$ 2,613,757.43
8	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00	$ 500,000.00	$ 2,965,000.00	0.7819	$ 2,317,997.72
9	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.7581	$ 1,868,707.25
10	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 100,000.00	$ 500,000.00	$ 450,000.00	$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 4,140,000.00	0.7351	$ 3,043,411.84
11	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.7128	$ 1,757,168.25
12	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.6912	$ 1,703,930.72
13	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.6703	$ 1,652,286.76
14	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.6500	$ 1,602,217.47
15	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 100,000.00			$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 3,070,000.00	0.6303	$ 1,934,991.01
16	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.6112	$ 1,506,584.65
17	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.5927	$ 1,460,930.57
18	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.5747	$ 1,416,659.95
19	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.5573	$ 1,373,730.86
20	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 100,000.00	$ 500,000.00	$ 450,000.00	$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 4,140,000.00	0.5404	$ 2,237,283.96
21	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.5240	$ 1,291,735.90
22	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.5082	$ 1,252,592.39
23	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4928	$ 1,214,635.05
24	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4778	$ 1,177,827.92
25	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 100,000.00			$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 6,310,000.00	0.4633	$ 2,923,683.25
26	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4493	$ 1,107,525.98
27	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4357	$ 1,073,944.59
28	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4225	$ 1,041,410.21
29	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.4097	$ 1,009,962.02
30	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 100,000.00	$ 500,000.00	$ 450,000.00	$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 4,140,000.00	0.3973	$ 1,644,680.31
31	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3852	$ 949,585.59
32	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3736	$ 920,810.27
33	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3622	$ 892,996.92
34	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3513	$ 865,849.14
35	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 100,000.00			$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 3,070,000.00	0.3406	$ 1,045,682.21
36	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3303	$ 814,168.52
37	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3203	$ 789,496.73
38	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3106	$ 765,572.61
39	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.3012	$ 742,373.44
40	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 100,000.00	$ 500,000.00	$ 450,000.00	$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 4,140,000.00	0.2920	$ 1,209,043.27
41	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2832	$ 698,062.81
42	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2746	$ 676,909.39
43	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2663	$ 656,396.98
44	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2582	$ 636,506.17
45	$ 1,875,000.00	$ 10,000.00	$ 77,000.00			$ 240,000.00	$ 240,000.00		$ 77,000.00			$ 100,000.00			$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 3,070,000.00	0.2504	$ 768,705.71
46	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2428	$ 598,514.52
47	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2354	$ 580,377.72
48	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2283	$ 562,790.51
49	$ 1,875,000.00	$ 10,000.00	$ 77,000.00						$ 77,000.00			$ 100,000.00				$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 2,465,000.00	0.2214	$ 545,736.26
50	$ 1,875,000.00	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 77,000.00			$ 100,000.00	$ 500,000.00	$ 450,000.00	$ 125,000.00	$ 5,000.00	$ 25,000.00	$ 235,000.00	$ 61,000.00		$ 7,390,000.00	0.2147	$ 1,584,376.11
Total Cost:	$ 47,118,893	$ 251,301	$ 1,935,016	$ 1,382,174	$ 813,632	$ 1,133,172	$ 1,133,172	$ 261,542	$ 1,935,016	$ 120,933	$ 102,390	$ 2,513,008	$ 1,099,760	$ 980,784	$ 590,194	$ 125,650	$ 628,252	$ 5,905,568	$ 1,532,935	$ 3,491,412			
Annual Cost:	$1,875,000	$10,000	$77,000	$55,041	$32,377	$45,092	$45,092	$10,408	$77,000	$4,812	$4,074	$100,000	$43,765	$39,028	$23,496	$5,000	$25,000	$235,000	$61,000	$138,934		$2,906,708	

Multiple Pump OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
			Main Canal, Laterals, Drains
1	Main Canal Laterals, Drains	$ 1,873,000.00	Average cost over the last 3 years (2012, 2014, 2015). James Brewer Email to David Inman on March 17, 2016 (Attached Docs to O&M Numbers High Priority Questions/Information (Consequence Measures))
2	Sediment Removal	$ -	We do not anticipate significant increased sediment deposition in the main canal and laterals as a result of the alternative. Water would be diverted from the Yuma River early during the low-water flow periods and should have comparatively low sediment loads. During high-flow periods when sediment loads are higher, water would be diverted only from the Laguna Dam, which would not necessitate discharge from the closed Siphon and is not expected to increase sediment flow.
			Headworks
3	Sediment Removal	$ 10,000.00	Cost documented for 2013 IA
4	Daily Operations	$ 77,000.00	Cost documented from 2013 Gila River Indemnity. James Brewer Email to David Inman on March 17, 2016 (Problem with Draft HDO&M Numbers). Costs include: Daily gate adjustments, maintenance, backhoe gate maintenance and debris/noxious removal from screens.
5	Fish Screen - Maintenance	$ 2,040,000.00	$170,000 each x 12 Fish screens - Assumed Screens life is 25 years. Information Obtained from O&M Fish Screen Email to David Inman on March 21, 2016 (Detailed Brief Notes)
6	Fish Screen - Civil Structures	$ 1,200,000.00	$50,000 each x 2 x 12 each screen = 12 screens - Assumed Screens life 25 years. Information Obtained from O&M Fish Screen Email to David Inman on March 21, 2016 (Detailed Brief Notes)
7	Fish Screen - Mechanical Brushes	$ 240,000.00	$10,000 each x 2 x 12 each screen = 12 screens - Assumed Screens life 5 years. Information Obtained from O&M Fish Screen Email to David Inman on March 21, 2016 (Detailed Brief Notes)
8	Fish Screen - Electrical Brushes	$ 240,000.00	$10,000 each x 2 x 12 each screen = 12 screens - Assumed Screens life 5 years. Information Obtained from O&M Fish Screen Email to David Inman on March 21, 2016 (Detailed Brief Notes)
9	Fish Screen - Seal System	$ 120,000.00	$10,000 each x 1 x 12 each screen = 12 screens - Assumed Screens life 10 years. Information Obtained from O&M Fish Screen Email to David Inman on March 21, 2016 (Detailed Brief Notes)
			Pumps
10	Lateral Pumps	$ 30,000.00	Small Lateral Pumps (11 locations) Lateral LA through 11
11	Large Pumps Rehab	$ 2,000,000.00	Rehab of 11 pumps at each screening facility is $180,000. Four screening locations, Four screening sites. Rehab of individual pumps every 4 years. Rounded to $400 K/ year. (Assumes only one pump requires rehab/site)
12	Large Pumps Motors Rehab	$ 100,000.00	Four motors/ $5K per year, per motor (average)
13	Large Pumps Replacement	$ 4,400,000.00	Three at 25 years - Rebuild + Replacement and WAPA Blue Book - life expectancy of structures and assessment with life expectancy of 17 Pumping motors. Estimate motor cost as $220,000 each.
14	Large Pumps Motor Replacement	$ 4,400,000.00	Three at 30 years - Rebuild + Replacement and WAPA Blue Book - life expectancy of structures and assessment with life expectancy of 17 Pumping motors. Estimate motor cost as $220,000 each.
15	Pump House Maintenance	$ 10,000.00	For Year - Yuma Tech Estimate
16	Pump and Motor Removal and Install	$ 200,000.00	Assumes 3 pumps would be pulled and replaced each year at 10,000 each pump. Pulled and replaced each pump every 4 years. (Assumes regularly each pump is pulled)
17	Canal Paved and Fiberglass	$ 3,000.00	Assumes $1000/yr estimate, average across all years.
18	Main Reservoir Maintain and Clean out Pump Inlets	$ 240,000.00	Assumptions at $40,000 each motor. Once a year Clean out during irrigation season - Maintenance assumes on pumps during off season
19	Vehicle	$ 94,132.00	Mileage - 34 miles by 180 miles, by 195 days, by 4 vehicles. (Conservative, based by Mileage by length of irrigation season by # people) (4th Person + night shift)
20	Power Costs	$ 300,000.00	10.1 GWH Power Costs from 11
21	Screened discharge pipes and valves	$ 400,000.00	Estimate a 25 year Water gate and check valves, work at a replacement cost of $10,000 each, total 40 valves @ $10,000 = $400,000 at 25 years and at 50 years.
22	Fencing Repairs	$ 253,000.00	Average cost over the last 3 years (2012, 2014, 2015). James Brewer Email to David Inman on March 17, 2016 (Attached Docs to O&M Numbers High Priority Questions/Information (Consequence Measures))
			Inlet Channel and Fish Screens
23	Fish Screens	$ 20,000.00	Needs to rebuild every life for screen cleaning device (11 total). Assume cost per unit is assessed at $2 K plus. Cleaning screens we need to assume for this case. Also if screens are removed every year needs assembly for screen gate lower (adjusting baffles - flow valves)
24	Fish Screen and Cleaner - Replacement	$ 300,000.00	Assessed life 25 years for screens and cleaners - Assumes the same as location to screen life.
25	Excavating and Sediment Removal from Fish Screens	$ 130,000.00	Annual Cost - sediment removal (use log removal and replacement characteristics.
26	Sediment Removal from Feeder Canal	$ 300,000.00	Annual Cost - 2,000 cy per year at screening gates - $60,000 each screening gate
27	Trash Rack Cleaning - Manual	$ 48,900.00	Assume manually cleaned every 2 weeks with 1 excavator, 2 assistants for 8 hours each time, for max $48,900 each year for 2 half months (6 months per year, using same rates as for dredging).
28	Bank Stabilization	$ 90,000.00	Historically 3 years a total of 9,000 ft was bio-engineered. Yearly (Previous estimate of 3000 ft was increased by 20% to include the bio-engineered banks)
			Admin. Costs
29	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2012, 2014, 2015). James Brewer Email to David Inman on March 17, 2016 (Attached Docs to O&M Numbers High Priority Questions/Information (Consequence Measures))
			ESA Monitoring Costs
30	Passage and Environmental Monitoring	$ 1,000,000.00	Per David Inman 2016. Annualized value for environmental monitoring and invasive species control monitoring, as it exists. After monitoring would be removed as existing headworks. 3 Years consecutive with all alternatives.

Discount Rate (2016)	3.125%
Net Present Value of O&M	$ 129,307,197.27
Average Annual O&M	$3,824,894.00
Cost Per Acre (36,799 acres)	$ 38.82

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	O&M Annual Total	Discount Factor	Discounted O&M
0															End of Construction																	1.0000	$ -
1	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.9697	$ 4,591,341.20
2	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.9401	$ 4,450,493.37
3	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.9113	$ 4,127,261.84
4	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.8836	$ 5,149,144.65
5	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00			$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 5,281,732.00	0.8574	$ 4,527,112.35
6	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.8314	$ 3,528,108.29
7	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.8061	$ 4,790,849.31
8	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.7813	$ 3,315,140.21
9	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.7581	$ 3,216,772.41
10	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00	$ 120,000.00		$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.7353	$ 3,855,183.15
11	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.7128	$ 3,737,148.87
12	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.6910	$ 4,106,573.58
13	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 4,243,732.00	0.6701	$ 3,319,772.41
14	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.6500	$ 3,408,582.25
15	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00			$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 4,231,732.00	0.6302	$ 2,666,949.26
16	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.6112	$ 3,632,987.38
17	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.5927	$ 3,218,992.25
18	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.5749	$ 3,013,720.80
19	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.5576	$ 2,923,486.26
20	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00	$ 120,000.00		$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 5,761,732.00	0.5408	$ 3,115,833.44
21	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.5248	$ 2,752,309.28
22	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.5088	$ 2,668,407.38
23	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.4928	$ 2,584,228.87
24	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.4778	$ 2,840,383.14
25	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00		$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00	$ 400,000.00	$ 253,000.00	$ 20,000.00	$ 9,904,000.00	$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 18,803,732.00	0.4635	$ 8,714,015.38
26	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.4496	$ 2,356,958.50
27	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.4359	$ 2,285,393.50
28	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.4225	$ 2,511,372.21
29	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.4098	$ 2,149,360.32
30	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00	$ 120,000.00		$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 4,991,732.00	0.3973	$ 1,982,753.38
31	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3852	$ 2,019,964.38
32	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.3733	$ 2,218,350.32
33	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3622	$ 1,899,310.81
34	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3512	$ 1,841,722.38
35	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00			$ 30,000.00		$ 100,000.00		$ 4,400,000.00	$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 9,561,732.00	0.3405	$ 3,255,324.38
36	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.3302	$ 1,962,831.38
37	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3202	$ 1,678,909.48
38	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3105	$ 1,627,644.87
39	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.3012	$ 1,578,992.80
40	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00	$ 120,000.00		$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 5,761,732.00	0.2923	$ 1,683,852.49
41	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2833	$ 1,485,758.98
42	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2745	$ 1,439,514.48
43	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2661	$ 1,395,444.35
44	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.2580	$ 1,533,257.26
45	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00		$ 240,000.00	$ 240,000.00			$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 4,231,732.00	0.2504	$ 1,059,523.34
46	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2428	$ 908,407.81
47	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2354	$ 881,327.38
48	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00	$ 2,000,000.00	$ 100,000.00			$ 10,000.00	$ 200,000.00	$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,943,732.00	0.2282	$ 1,357,469.98
49	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00						$ 30,000.00		$ 100,000.00			$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00		$ 253,000.00	$ 20,000.00		$ 130,000.00	$ 300,000.00	$ 40,900.00		$ 61,000.00	$ 1,000,000.00	$ 5,243,732.00	0.2214	$ 928,287.20
50	$ 1,873,000.00	$ -	$ 10,000.00	$ 77,000.00	$ 2,040,000.00	$ 1,200,000.00	$ 240,000.00	$ 240,000.00	$ 120,000.00	$ 30,000.00		$ 100,000.00		$ 4,400,000.00	$ 10,000.00		$ 3,000.00	$ 240,000.00	$ 94,132.00	$ 300,000.00	$ 400,000.00	$ 253,000.00	$ 20,000.00	$ 9,904,000.00	$ 130,000.00	$ 300,000.00	$ 40,900.00	$ 60,000.00	$ 61,000.00	$ 1,000,000.00	$ 33,353,732.00	0.2147	$ 4,133,391.73
Total Costs:	$ 87,131,000.00	$ -	$ 251,100.00	$ 1,925,000.00	$ 1,282,174.00	$ 312,652.22	$ 1,132,172.00	$ 1,132,172.00	$ 261,542.00	$ 1,230,300.00	$ 11,782,870.00	$ 2,511,000.00	$ 1,488,888.00	$ 848,614.00	$ 251,100.00	$ 1,178,327.00	$ 125,550.00	$ 6,011,210.00	$ 1,412,145.00	$ 12,365,000.00	$ 271,211.00	$ 5,305,363.00	$ 302,662.00	$ 4,861,094.00	$ 2,798,341.00	$ 7,539,822.00	$ 1,221,132.00	$ 211,622.00	$ 1,523,015.00	$ 9,852,830.00	
Annual Costs:	$1,873,000.00	$0	$10,000.00	$77,000.00	$53,041.00	$13,027.00	$47,172.00	$47,172.00	$10,900.00	$51,300.00	$490,953.00	$100,000.00	$59,500.00	$37,500.00	$10,000.00	$49,100.00	$5,000.00	$240,000.00	$56,152.00	$500,000.00	$10,782.00	$225,000.00	$20,000.00	$189,275.00	$110,000.00	$300,000.00	$48,500.00	$12,400.00	$61,000.00	$377,097.00		

Multiple Pumps with Conservation Measures OM&R Costs

No.	O&M Item Description	Cost Value	Assumptions/Notes
			Main Canal, Laterals, Drains
1	Main Canal, Laterals, Drains	$ 980,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
2	Sediment Removal	$ -	We do not anticipate a significant increase in sediment accumulation in the main canal and laterals as a result of this alternative. Water supplied from the Ranney Wells is groundwater and should be relatively sediment-free. Water supplied by gravity feed is from the upstream end, the same as it is currently and should not result in an increase.
			Conservation Measures
3	Additional Ditch Riders	$ 583,200.00	12 Ditch Riders at [illegible] per year [illegible] - assumes a SCADA system implemented. Without SCADA # of ditch rides may double.
4	Vehicles	$ 129,600.00	30000 miles per season by .54, per employee
5	Piped Laterals	$ 750,000.00	Replace Approximately 5000 ft every 15 years
6	Lined Lateral	$ 100,000.00	Replace Approximately 1000 ft every 10 years
7	Lined Open Canals	$ 825,000.00	Replace Approximately 2500 ft every 10 years
8	Remove Sediment and Inspect check structures	$ 45,000.00	Assumes $5,000 per check structure every year. 9 Check structures in total
9	Flow Measuring devices inspection and sediment removal	$ 30,000.00	$250 per device per year. 120 devices
10	Operate and Maintain Center Pivots	$ 300,000.00	$60 per acre on 5,000 acres. MOU Cost (This needs to be pulled out. Cannot be spread across the entire district. O&M costs would be born by the individual users. Note: This cost isn't included in the cost calculations on this sheet, to the right.)
11	Wind Turbine Maintenance	$ 50,000.00	Windustry.com - Would Start after 5 years
12	O&M of SCADA System and Flow Measuring Devices	$ 105,000.00	Estimate $150 per site annually for maintenance and replacement
13	Technicians for SCADA System	$ 120,000.00	2 Technicians - 60,000 per year (Work all year round)
14	Transportation	$ 32,400.00	30,000 miles per employee by 2 employees by .54 cents
			Headworks
15	Sediment Removal	$ 10,000.00	Cost estimate from 2015 EA
16	Daily Operations	$ 77,000.00	Cost estimate from 2015 Operation Expenses. James Brower Email to David Trimpe on April 13, 2016. (Problem with Draft 03 O&M Numbers). Costs Include: Daily gate adjustments, power costs, backup generator costs and debris/trash removal from screens.
17	Fish Screen Manifolds	$ 2,040,000.00	$170,000 per unit - 12 fish screens - Expected Service life is 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
18	Fish Screen Cylinder Units	$ 1,200,000.00	$50,000 per unit - 2 units per screen - 12 screens - Expected Service Life 25 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
19	Fish Screen External Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
20	Fish Screen Internal Brushes	$ 240,000.00	$10,000 per unit - 2 units per screen - 12 screens - Expected Service Life 5 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
21	Fish Screen Seal System	$ 120,000.00	$10,000 per unit - 1 Unit per screen - 12 Screens - Expected Service Life 10 years. Information Obtained from ISI. Jim Forseth Email to David Trimpe April 21, 2016 (Schedule of Values)
			Pumps
22	Lateral Pumps	$ 50,200.00	Small Lateral Pumps (77 estimate) Laterals AA - [illegible]
23	Ranney Well Pumps Rehab	$ 2,100,000.00	Pump rehab every 10 years @ $50,000 per pump, or $2,100,000 for 42 pumps
24	Ranney Well Pump Motors Rehab	$ 126,000.00	Estimate average $3,000 per pump per year
25	Ranney Well Pump Replacement	$ 6,300,000.00	Replace pumps every 25 years @ $150,000 per pump
26	Ranney Well Pump Motor Replacement	$ 4,200,000.00	Replace motors every 50 years @ $100,000 per pump
27	Pump and Motor Removal and Install	$ 42,000.00	Rough estimate per Layne Construction: Remove pumps and motors and inspect every 5-10 years @ $5-10k each. Assume average annual cost of $1,000 per well or $42,000 per year total.
28	Inspection and Maintenance of Ranney Well Screens	$ 672,000.00	Rough estimate per Layne Construction: Inspect each well every 7 years at $7000, maintain wells every 15 years at $100-250k. Layne recommends assuming $16,000 per well annually. 42 Ranney Wells @ $16,000 per year per well = $672000 / year
29	Control Panel and Electronics	$ 7,000.00	Assume $1000 per site per year, average across all years.
30	Man Power to Maintain and Operate Pump sites	$ 240,000.00	4 workers at $60,000 per worker. Onsite and Operation during irrigation season - Maintenance activities on pumps during the off season
31	Vehicle	$ 84,152.00	Mileage - 54 cents by 180 miles by 165 days by 4 vehicles. (Government Rate by Mileage by length of irrigation season by 4 people) (4th Person is night shift)
32	Power Costs	$ 240,000.00	4 GWH - Cost Estimate from MOU - First 5 years until wind generation is complete
33	Service discharge pipes and valves	$ 252,000.00	Estimate a 25 year life on gate and check valves, with a replacement cost of $3,000 each. Total: 84 valves @ $3,000 = $252,000 at 25 years and at 50 years.
34	Existing Pumps	$ 130,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
			Admin Costs
35	Administrative/Indirect Costs	$ 61,000.00	Average cost over the last 3 years (2013, 2014, 2015). James Brower Email to David Trimpe on March 17, 2016 (Attached District OM Numbers High Priority Questions/Information (Conservation Measures))
			ESA Monitoring Costs
36	Passage and Entrainment Monitoring	$ 100,000.00	Per David Trimpe BOR. Anticipated costs for entrainment monitoring at the headworks.

Discount Rate (2016)		3.125%
Net Present Value of O&M	$	110,211,703.95
Average Annual O&M		$4,385,300.13
Cost Per Acre (56,799 acres)	$	77.21

Item:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	O&M Annual Total	Discount Factor	Discounted O&M
																		End of Construction																				
Total Cost:	$ 36,627,475	$ -	$ 14,830,861	$ 3,296,858	868,442	217,952	1,796,301	1,130,863	750,902	1,071,203	2,658,658	3,051,608	814,214	241,301	1,838,014	1,580,174	814,632	4,133,170	1,133,171	261,962	1,236,504	4,018,994	3,160,189	2,161,868	1,912,516	1,095,461	16,887,411	179,911	6,051,218	1,612,145	1,095,318	170,864	5,906,568	1,532,335	1,886,560			
Annual Cost:	$980,000	$0	$583,200	$129,600	$38,140	$8,679	$71,502	$45,000	$30,000	$42,626	$105,000	$120,000	$32,400	$10,000	$77,000	$56,041	$32,177	$45,092	$45,091	$10,408	$50,000	$160,133	$126,000	$85,300	$53,821	$42,000	$670,000	$7,000	$240,000	$84,152	$43,582	$6,799	$235,000	$61,000	$65,073			