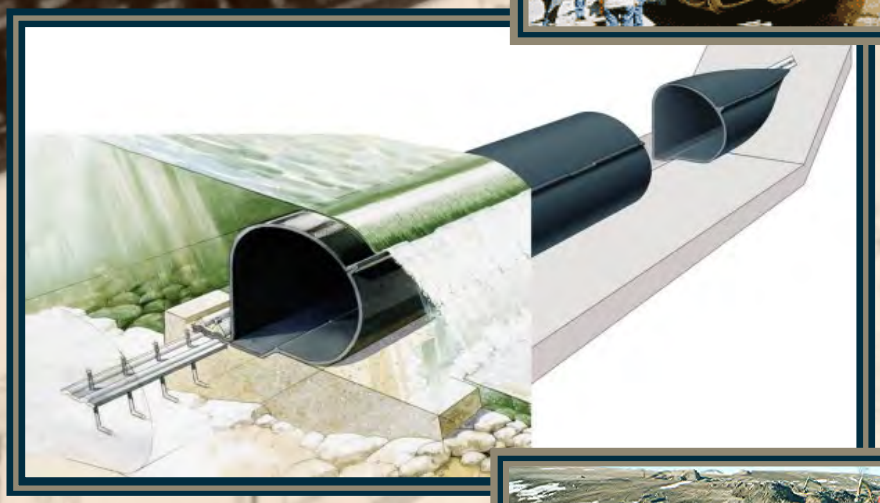
ST. MARY DIVERSION FACILITIES
FEASIBILITY AND PRELIMINARY ENGINEERING REPORT
FOR FACILITY REHABILITATION

August 2006 Final



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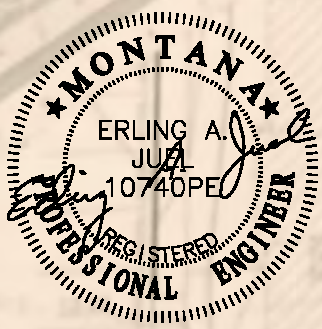

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Conservation & Resource
Development Division

I. TABLE OF CONTENTS

APPENDICES

II. LIST OF FIGURES

III. LIST OF TABLES

IV. LIST OF ABBREVIATIONS

AC	-	acre
ACHP	−	Advisory Council on Historic Preservation
ACOE	−	Army Corps of Engineers
Ac-Ft	−	acre-feet (43,560 cubic feet)
AENV	-	Alberta Environment
AIRFA	−	American Indian Religious Freedom Act
ARPA	−	Archaeological Resources Protection Act
APE	−	area of potential effect
BA	−	biological assessment
BGS	-	below ground surface
BIA	−	Bureau of Indian Affairs
CFR	−	Code of Federal Regulations
CFS	−	cubic feet per second
CIP	−	cast-in-place
CMP	−	corrugated metal pipe
DNRC	−	Department of Natural Resources
DR	−	discipline reports
EA	−	environmental assessment
EIS	−	environmental impact statement
EPA	−	Environmental Protection Agency
FONSI	−	finding of no significant impact
F&WCA	−	Fish and Wildlife Coordination Act
GIS	−	geographical information system
GPS	−	global positioning system
HAER	−	Historic American Engineering Record
HDPE	−	high-density polyethylene
H:V	−	horizontal to vertical

IJC	−	International Joint Commission
MDT	-	Montana Department of Transportation
MEPA	−	Montana Environmental Policy Act
MFWP	−	Montana Fish, Wildlife & Parks
MOU	−	memorandum of understanding
MR&I	−	municipal, rural and industrial
NAGPRA	−	Native American Graves Protection and Repatriation Act
NEPA	−	National Environmental Policy Act
NHPA	−	National Historic Preservation Act
NPS	−	National Park Service
NRCS	−	Natural Resource Conservation Service
NRIS	−	Natural Resource Information Service
NRPH	−	National Register of Historic Places
O&M	−	operations and maintenance
PA	−	Preferred Alternative (for context of this report, PA refers to the overall capacity that the St. Mary River Diversion Facilities will ultimately be rehabilitated)
PER	−	preliminary engineering report
PVC	−	polyvinyl chloride
RCP	−	reinforced concrete pipe
RFP	−	request for proposals
ROW	−	right-of-way
SCADA	−	supervisory control and data acquisition
SCS	−	Soil Conservation Service
SHPO	−	State Historic Preservation Office
St.	−	Saint
TD&H	−	Thomas, Dean & Hoskins, Inc.
T&E	−	threatened & endangered

TERO	–	Tribal Employment Rights Ordinance
THPO	–	Tribal Historic Preservation Office
USBR	-	United States Bureau of Reclamation
USFWS	–	United States Fish and Wildlife Service
USGS	–	United States Geological Survey
VE	-	Value Engineering

V. ACKNOWLEDGEMENTS

This report represents the combined efforts of many individuals and organizations through their input, cooperation and dedication to the overall goal of finding a workable solution towards the rehabilitation of the St. Mary Diversion Facilities. These parties include, but are not limited to, the State of Montana DNRC – Conservation and Resource Development Division, the Blackfeet Nation, the U.S. Bureau of Reclamation – Montana Area Office, and the members and supporters of the St. Mary Rehabilitation Working Group.

This report also represents the combined efforts of our design team including TCB – Denver, CO and UMA – Lethbridge, AB. Although Thomas, Dean & Hoskins is ultimately responsible for the content of this report, it could not have been possible without everyone's technical expertise, experience and enthusiasm for this project.

This Final Report supersedes the Draft version dated January 25, 2006. Review comments provided by the cooperating parties were incorporated into the Final Report where applicable.

Much of the background information contained in this report was obtained from many other sources. We have made attempts to credit the sources and ensure accuracy; however, some omissions may exist. For this, we apologize.

TCB | AECOM

UMA | AECOM

1.0 EXECUTIVE SUMMARY

The Milk River is the economic mainstay of North Central Montana from Havre to Glasgow. The majority of the Milk River flow utilized by irrigators, municipalities, and for recreational and wildlife benefits is diverted from the St. Mary River near Glacier National Park into the North Fork of the Milk River via a 90-year old, 29-mile long facility. Separate components include Sherburne Reservoir, a diversion dam on the St. Mary River, canal headgates, several inverted siphons, check and wasteway structures, five hydraulic drops, and approximately 26 miles of earthen, one-bank canal. The diversion facilities are owned and operated by the U.S. Bureau of Reclamation (USBR), and many portions are in danger of failure. Sudden failure would result in severe environmental damage to the Blackfeet Indian Reservation and the St. Mary River or the North Fork of the Milk River as well as an economic catastrophe for the economies of North Central Montana.

The USBR's "*North Central Montana Regional Feasibility Report*" (USBR, 2004) screened numerous alternatives to reduce water shortages in the Milk River Basin and concluded that the rehabilitation of the St. Mary Diversion Facilities was the most viable option and the only one that would produce positive economic benefits. That report assessed various rehabilitated canal capacities but did not provide a preferred alternative or recommended capacity.

The following report presents and summarizes two additional diversion and conveyance alternatives that have been proposed since the USBR's 2004 Feasibility Report. Appraisal-level cost estimates were developed for each new alternative along with a comparison of advantages and disadvantages. Of these alternatives, neither the Duck Lake Tunnel nor the All Canadian Route, provide the same level of cost-benefits as the alternative that constitutes rehabilitation of the existing St. Mary Facilities. Both of these alternatives were considerably more expensive; $325,000,000 and $175,000,000 for the Duck Lake Tunnel and All Canadian Route respectively. Based on the comparison of advantages and disadvantages (see Table 1.1), as well as estimated construction costs, rehabilitation of the existing St. Mary Diversion Facilities remains the most favorable alternative to divert and convey water from the St. Mary River to the North Fork of the Milk River for use in North Central Montana.

Table 1.1 Comparison of Remaining Alternatives

Items	Duck Lake Tunnel	All Canadian Route	St. Mary Rehabilitation
Estimated Years to Construct	4 Yrs	7 Yrs	10 Yrs
Estimated Total Construction Cost ($)	$324,500,000	$175,000,000	$130,000,000
Annual Construction Cost ($)	$ 81,125,000	$ 25,000,000	$ 13,000,000
Estimated Percentage of U.S. Apportionment Delivered to Fresno	80%	90 - 100%	80%
Requires Demolition/Restoration of Existing St. Mary Canal	Yes	Yes	Partial
Requires New Diversion Dam & Fish Deterrents	Yes	No	Yes
Construction Employment for Blackfeet Nation	Slight	None	Yes
Provides Water to N. Fork for Blackfeet Irrigation Use	Yes	No	Possible
Potential U.S. Hydro Power	Slight	Yes	Yes
Impacts to Existing Wetlands & Riparian Areas	Negative	Negative	Positive
Impacts to Current Landowners Adjacent to Existing St. Mary Canal	Negative	Negative	Positive
Environmental Impacts to the North Fork of the Milk River	Negative	None	None

The existing diversion and conveyance facilities were originally designed for a capacity of 850 cfs. Due to deterioration and degradation of the aging infrastructure, the existing "safe" capacity varies from approximately 650 to 725 cfs depending on location. Downstream of the St. Mary River siphon, the "safe" capacity is on the order of 650 cfs due primarily to the sloughing and continued failure of the earthen canal prisms. Accounting for canal seepage losses upstream of the St. Mary River siphon, this equates to a "safe" diversion rate of approximately 725 cfs. In the last 10 years, the highest discharge measured at the St. Mary River siphon was 678 cfs and the largest diversion rate as measured at the headgates was 729 cfs.

Also, inherent to the aged facilities, is the inability to manage storm water (inflows) and lack of facility automation, which results in a cautious operational approach and lost opportunities to maximize diversion of the U.S. apportionment. Also, several midseason shutdowns due to

localized failures and maintenance issues have been required to avoid progressive, catastrophic failure and to make the subsequent repairs. With continued aging and deterioration, these types of shutdowns and lost diversion will become more frequent. Annual water shortages in the Milk River Basin have been well documented (DNRC, 1990 and USBR, 2004). The USBR and the Montana DNRC agree that rehabilitation of the St. Mary Facilities back to its original capacity or greater would significantly reduce these shortages.

The diversion facilities lie entirely within the boundaries of the Blackfeet Nation, and as such, the Blackfeet are an important stakeholder. For the last 90 years, environmental issues and concerns, both Tribal and Federal, have arisen regarding the operation of the facilities. For example, the diversion dam precludes passage of Bull Trout (a threatened species) during operation, and Bull Trout, as well as other fish species, are permanently lost into the conveyance canal each season. Also, the canal prism and elevated siphons impact elk migration. Improvements are warranted to mitigate these environmental shortcomings, as well as many others. A comprehensive list of known or potential environmental concerns is provided in Section 4.2 of this report. The list is not meant to be final and future environmental compliance documents will address these concerns as well as others identified by all stakeholders, especially the Blackfeet Nation.

With respect to the overall rehabilitation of the St. Mary Facilities, numerous alternatives exist which warrant consideration and evaluation. The following report provides preliminary engineering and construction cost estimates for various alternatives relating to the overall rehabilitation of the existing St. Mary Facilities. Recommended alternatives were selected based on construction costs, improved O&M efficiency, ease of construction and mitigation of currently-identified environmental and Blackfeet Nation issues. In summary, the recommended alternatives include the following:

- Diversion Dam and Headgates – Adjustable pneumatic crest with enhanced natural stream flow during the off-season. Rock-surfaced, naturalized channel will be utilized to allow fish passage during diversion. Sluice-style headgates with fish deterrent and

debris deflection enhancements are proposed. Fish screens with either mechanical or air burst cleaning will be located downstream of the canal headgates.

- Kennedy Creek Siphon – For canal capacities up to 850 cfs, we recommend rehabilitating the deteriorated concrete of the existing structure. For canal flows above 850 cfs, we recommend replacing the structure with a new siphon consisting of dual RCP's and transition structures.

- Canal Prisms – We recommend realignment of the existing canal to improve hydraulic efficiency, reduce lengths, avoid existing instabilities, and reduce overall costs. It is further recommended to adopt a two-bank canal with armoring to facilitate inspection and maintenance. The ROW should be fenced. Additional enhancements include controlled inlets to create ponded wetlands, livestock turnouts, additional maintenance turnouts, and canal lining in select areas to reduce potential instabilities.

- St. Mary River and Hall Coulee Siphons – We recommend re-evaluating costs for these structures during the design phase since the replacement costs are predominantly material related and have experienced significant volatility in the last two years. Also, the landslide studies for the St. Mary River Siphon have yet to be finalized. It is envisioned that a single, buried barrel will be utilized except for possibly the south side of the St. Mary River crossing where deep-seated movements are suspected. This may warrant an elevated siphon. The river crossing would be below grade.

- Hydraulic Drops – Costs for replacement structures consisting of either pipe drops, or chutes with Type III stilling basin are comparable. Impacts to O&M activities favor the open chutes. To reconfigure the drops for "hydro-ready" considerations, add approximately $6,000,000 excluding costs for land acquisition, the plant, hydro-machinery, and transmission. Hydropower remains economically feasible pending a final study.

- Automation, Instrumentation and Remote-Control - The rehabilitated facilities should be automated with respect to storm water inflows and operating wasteways. The diversion components could also be automated. Instrumentation (SCADA) would allow real-time monitoring of the flow and diversion conditions. Remote-control capabilities would allow operation of remote structures and devices from either Camp Nine or the Area Office in Billings.

Depending on the rehabilitated canal capacity, current estimates to rehabilitate the Diversion Facilities range from $130,000,000 to $140,000,000 at 2005 construction prices. The current overall project costs are summarized on Tables 1.2 through 1.4 for a reshaped canal capacity of 850 cfs and realigned canal capacities of 850 cfs and 1000 cfs, respectively. The reshaping alternative follows the original alignment while realigning the canal allows for significant enhancements.

The pending rehabilitation of the St. Mary Diversion and Conveyance Facilities represents a tremendous opportunity to incorporate numerous enhancements and improvements that would influence operation for the next 100 years. These modernizations will mitigate environmental concerns, improve hydraulic efficiencies, maximize diversions of U.S. apportionment water, improve public safety, and reduce maintenance costs. Rehabilitating the facilities while maintaining the existing alignment is basically rehabilitating 100-year old technology and construction for another 100-plus years. As such, the opportunity for prudent improvements will not come around for another 100 years.

Realignment of the canal can reduce the overall conveyance length by 9,450 feet or 7 percent based on the proposed alignment. The actual cost-effective alignment can be established once the topographical surveying has been completed. Canal shortening means improved hydraulic efficiency, less overall ROW, less seepage losses, and less maintenance. The true advantage of canal shifting or realignment is during the construction phase that must be completed during the off-season, i.e. winter. Canal shifting outside of the current canal footprint reduces the volume of muck excavation (unusable soil) that cannot be readily used and must be disposed of (wasted). This requires that additional borrow must be generated off-site at specified borrow sties. This

increases costs. Shifting the canal centerline sufficiently results in a place to dispose of waste excavation (the abandoned, reclaimed canal) and the new excavation generates drier and useable material for new embankments.

Rehabilitation costs will continue to increase, simply from inflation, by approximately $3,000,000 per year. Constant and fruitful progress must be made toward this goal to avoid system failure and avert environmental and economic catastrophes. Should sudden failure of one of the major hydraulic structures occur, it would be prudent to have completed designs of the replacement structure in hand ready to implement to avoid additional delays. To enter the design phase, it is imperative to initiate the environmental compliance studies, complete the topographical surveys and geotechnical studies, and establish an understanding of ROW issues.

Table 1.2 OVERALL ESTIMATED PROJECT COSTS – 850 cfs - Reshape

Line Items	Diversion Dam and Headgates	Kennedy Creek Siphon	St. Mary River Siphon[2]	Hall Coulee Siphon[3]	Hydraulic Drops No. 1 – No. 5[4]	Rehab. Canal Prism	TOTALS
Approx. Construction Costs[1]	$8,463,354	$535,802	$13,348,252	$6,011,096	$4,040,244	$32,436,271	$64,835,019
Unlisted Items (10%)	$846,335	$53,580	$1,334,825	$601,110	$404,024	$3,243,627	$6,483,501
Contract Costs	$9,309,689	$589,382	$14,683,077	$6,612,206	$4,444,268	$35,679,898	$71,318,520
Contingencies (25%)	$2,327,422	$147,346	$3,670,769	$1,653,052	$1,111,067	$8,919,975	$17,829,631
Field Costs	$11,637,111	$736,728	$18,353,846	$8,265,258	$5,555,335	$44,599,873	$89,148,151
Non-Contract Costs (37%)	$4,305,731	$272,589	$6,790,923	$3,058,145	$2,055,474	$16,501,953	$32,984,815
Construction Costs	$15,942,842	$1,009,317	$25,144,769	$11,323,403	$7,610,809	$61,101,826	$122,132,966
Tribal Fees (5%)	$797,142	$50,466	$1,257,238	$566,170	$380,540	$3,055,091	$6,106,647
Total Costs per Structure	$16,739,984	$1,059,783	$26,402,007	$11,889,573	$7,991,349	$64,156,917	$128,239,613
						Rounded	$130,000,000

[1] Includes 8% Mobilization **[2] Single Steel Barrel**
[3] Single Cast-In-Place Concrete **[4] Includes Canals Between Drops**

TABLE 1.3 OVERALL ESTIMATED PROJECT COSTS – 850 cfs - Realignment

Line Items	Diversion Dam and Headgates	Kennedy Creek Siphon	St. Mary River Siphon[2]	Hall Coulee Siphon[3]	Hydraulic Drops No. 1 – No. 5[4]	Realign. Canal Prism	TOTALS
Approx. Construction Costs[1]	$8,463,354	$535,802	$13,348,252	$6,011,096	$4,040,244	$32,714,512	$65,113,260
Unlisted Items (10%)	$846,335	$53,580	$1,334,825	$601,110	$404,024	$3,271,451	$6,511,325
Contract Costs	$9,309,689	$589,382	$14,683,077	$6,612,206	$4,444,268	$35,985,963	$71,624,585
Contingencies (25%)	$2,327,422	$147,346	$3,670,769	$1,653,052	$1,111,067	$8,996,491	$17,906,147
Field Costs	$11,637,111	$736,728	$18,353,846	$8,265,258	$5,555,335	$44,982,454	$89,530,732
Non-Contract Costs (37%)	$4,305,731	$272,589	$6,790,923	$3,058,145	$2,055,474	$16,643,508	$33,126,370
Construction Costs	$15,942,842	$1,009,317	$25,144,769	$11,323,403	$7,610,809	$61,625,962	$122,657,102
Tribal Fees (5%)	$797,142	$50,466	$1,257,238	$566,170	$380,540	$3,081,298	$6,132,854
Total Costs per Structure	$16,739,984	$1,059,783	$26,402,007	$11,889,573	$7,991,349	$64,707,260	$128,789,956
						Rounded	$130,000,000

[1] Includes 8% Mobilization **[2] Single Steel Barrel**
[3] Single Cast-In-Place Concrete **[4] Includes Canals Between Drops**

TABLE 1.4 OVERALL ESTIMATED PROJECT COSTS – 1000 cfs - Realignment

Line Items	Diversion Dam and Headgates	Kennedy Creek Siphon	St. Mary River Siphon[2]	Hall Coulee Siphon[3]	Hydraulic Drops No. 1 – No. 5[4]	Rehab. Canal Prism	TOTALS
Approx. Construction Costs[1]	$8,847,253	$1,259,486	$14,307,359	$6,533,458	$4,381,690	$35,147,756	$70,477,002
Unlisted Items (10%)	$884,725	$125,949	$1,430,736	$653,346	$438,169	$3,514,776	$7,047,701
Contract Costs	$9,731,978	$1,385,435	$15,738,095	$7,186,804	$4,819,859	$38,662,532	$77,524,703
Contingencies (25%)	$2,432,995	$346,359	$3,934,524	$1,796,701	$1,204,965	$9,665,633	$19,381,177
Field Costs	$12,164,973	$1,731,794	$19,672,619	$8,983,505	$6,024,824	$48,328,165	$96,905,880
Non-Contract Costs (37%)	$4,501,040	$640,764	$7,278,869	$3,323,897	$2,229,185	$17,881,421	$35,855,176
Construction Costs	$16,666,013	$2,372,558	$26,951,488	$12,307,402	$8,254,009	$66,209,586	$132,761,056
Tribal Fees (5%)	$833,301	$118,628	$1,347,574	$615,370	$412,700	$3,310,479	$6,638,052
Total Costs per Structure	$17,499,314	$2,491,186	$28,299,062	$12,922,772	$8,666,709	$69,520,065	$139,399,108
						Rounded	$140,000,000

[1] Includes 8% Mobilization
[2] Single Steel Barrel
[3] Single Cast-In-Place Concrete
[4] Includes Canals Between Drops

2.0 PURPOSE OF STUDY

2.1 PROJECT BACKGROUND

The St. Mary Diversion Facilities are located entirely within the boundaries of the Blackfeet Nation in Glacier County, Montana. The Project is situated east of Glacier National Park and south of the Canadian Border. Figure 2.1 shows the location of the Diversion Facilities and the location of several hydraulic components comprising the Project.

The Diversion Facilities consist of, in part, the following key components:

- Sherburne Reservoir/Dam - Sherburne Reservoir collects and stores winter flows and spring and summer runoff from the mountains draining into the upper portion of Swiftcurrent Creek. The dam is used to regulate releases from the reservoir to supplement the U.S. share of diverted water throughout the irrigation season.

- Swiftcurrent Creek Dike - This is a manmade earthen dike below Sherburne Dam, which controls and directs creek flows and reservoir releases into Lower St. Mary Lake. Prior to construction of the Diversion Facilities, Swiftcurrent Creek flowed across an actively-forming alluvial fan and the creek channel was prone to periodic migrations during severe flood events.

- St. Mary Diversion Dam - Located on the St. Mary River approximately 0.75 miles downstream (north) of Lower St. Mary Lake, the diversion dam diverts water into the St. Mary Canal. The diversion season typically begins in mid to late March and ends in late September to early October. Earlier shutdowns are initiated when large-scale maintenance or critical repairs are required.

St. Mary Diversion Facilities

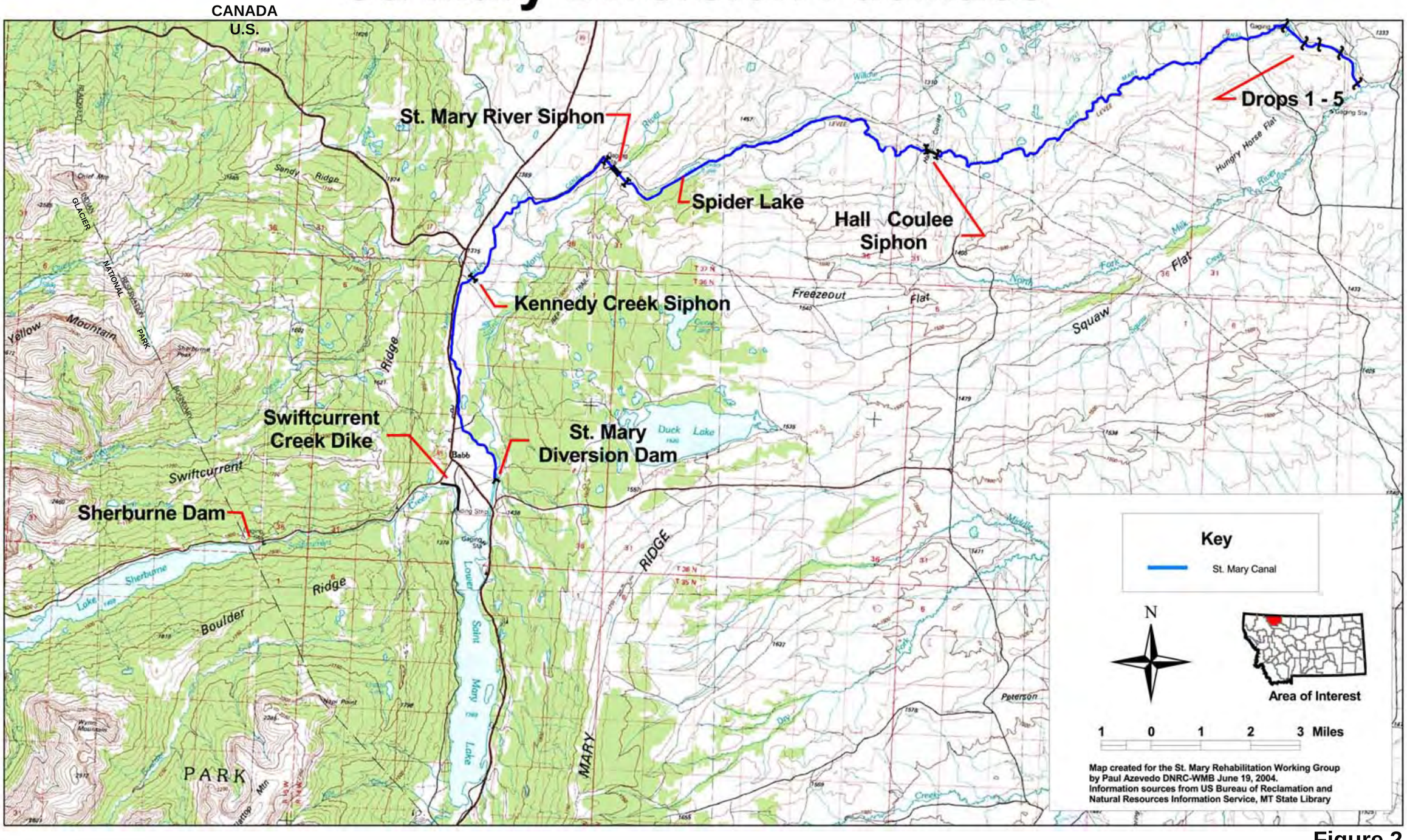

Figure 2.1

- Canal Prism – The canal, approximately 29 miles long including siphons and drops, is a one-bank, unlined, contour canal of earthen construction. Originally, the prism consisted of a 26-foot bottom trapezoidal section with 2:1 (H:V) fill slopes and 1½:1 cut slopes. The invert slope is approximately 0.0001 ft/ft or 0.53 ft per mile.

- Kennedy Creek Siphon - Kennedy Creek, similar to Swiftcurrent Creek, flows atop an active alluvial fan. The St. Mary Canal passes under Kennedy Creek through a reinforced concrete, inverted siphon. Manmade dikes upstream of the siphon crossing control Kennedy Creek's propensity for channel migration.

- St. Mary River Siphon - The diverted water crosses the St. Mary River from one side of the valley to the other through two 90-inch diameter, mild steel, inverted pipe siphons. The siphons, approximately 3,205 feet in length, cross the river atop a bridge that also serves as a Glacier County road bridge. The siphon diameter reduces to 84 inches atop the bridge.

- Hall Coulee Siphon - Another pair of inverted siphons, 1,405 feet long, conveys the diverted water across a topographical low region, Hall Coulee. Although smaller, 78 inches in diameter, the siphons are of similar construction as the St. Mary River Siphons.

- Hydraulic Drops 1 to 5 - Five separate concrete chutes and plunge pools convey the diverted water into the North Fork of the Milk River. These structures are necessary to dissipate the hydraulic energy associated with an overall elevation drop of 218 feet from the St. Mary - Milk River divide down to the North Fork of the Milk River below.

- Milk River - The natural channel of the North Fork and main Milk River downstream of the hydraulic drops is used to convey diverted water to Fresno Reservoir and eventually to the direct and indirect beneficiaries of the Milk River Irrigation Project. The Milk River enters Canada and flows approximately 216 miles before re-entering the U.S. 50 miles northwest of Havre. Figure 2.2 shows the relationship of the St. Mary Diversion Facilities to the downstream portion of the Milk River Basin where the diverted water is utilized.

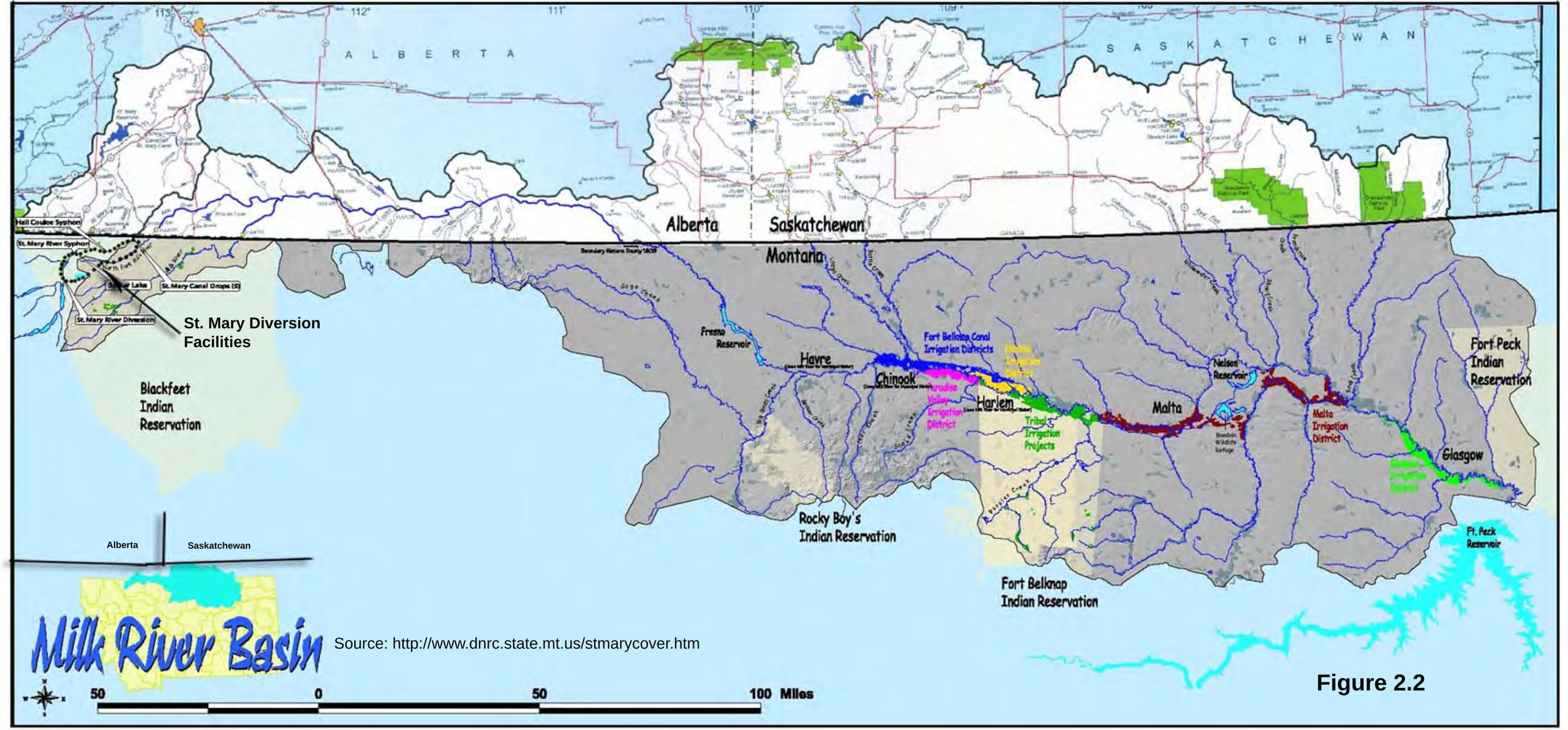
ALBERTA
SASKATCHEWAN
Alberta
Saskatchewan
Montana
Hell Coulee Syphon
St. Mary River Syphon
North Fork Milk River
Sherar Lake
St. Mary Canal Drops (5)
St. Mary River Diversion
St. Mary Diversion Facilities
Blackfeet Indian Reservation
Fresno Reservoir
Havre
Chinook
Fort Belknap Canal Irrigation Districts
Harlem
Malta
Nelson Reservoir
Bowdoin Wildlife Refuge
Malta Irrigation District
Fort Peck Indian Reservation
Glasgow
Ft. Peck Reservoir
Rocky Boy's Indian Reservation
Fort Belknap Indian Reservation
Milk River Basin
Source: http://www.dnrc.state.mt.us/stmarycover.htm
50 0 50 100 Miles

Figure 2.2

2.2 PRIMARY OBJECTIVE

Water diverted from the St. Mary River to the Milk River via the St. Mary Diversion Facilities is essential to the economy of Montana's Hi-line Region from Havre to Glasgow, as well as the remainder of the State. However, the St. Mary Diversion Facilities, of which many of the hydraulic components are 90 years old, are in dire need of immediate rehabilitation to avert failure and avoid economic and environmental catastrophes. The "North Central Montana Regional Feasibility Report" prepared by the United States Bureau of Reclamation (USBR) screened numerous alternatives to reduce water storages in the Milk River Basin and concluded that the rehabilitation of the St. Mary Diversion Facilities was the most viable option and the only one that would produce net positive economic benefits (USBR, 2004). That report evaluated four different canal capacities between 500 and 1000 cfs. Alternatives for rehabilitating or replacing the various major hydraulic structures were reviewed and construction cost estimates were developed. The USBR considers the cost estimates to be feasibility-level.

The primary objectives of this study are 1.) to develop appraisal-level cost estimates and feasibility comparisons for the two remaining "global" diversion alternatives which include the Duck Lake Tunnel and the All Canadian Route alternatives and 2.) prepare a Preliminary Engineering Report for rehabilitation of the existing St. Mary Diversion Facilities. The latter objective expands work performed by the USBR by providing additional alternatives and enhancements to improve operational efficiency and reduce long-term maintenance costs. The overall goal of this report is to assess the new global alternatives with respect to the currently preferred alternative of existing facility rehabilitation. The additional engineering studies and cost estimating performed for the St. Mary Rehabilitation alternative better define the overall project costs and advances the project.

2.3 SCOPE OF WORK

The State of Montana Department of Natural Resources (DNRC), acting as facilitator on behalf of the St. Mary Rehabilitation Working Group, issued a Request for Proposals (RFP) in 2004 to summarize existing conditions, studies completed to date, and estimated Project costs. In

addition, a “roadmap” or plan towards the primary objective of overall rehabilitation of the St. Mary Diversion Facilities was prepared along with additional studies and scopes of work to advance the Project. The first phase of this work was completed in February 2005 (TD&H, 2005). That report recommended in part, a study to perform reconnaissance level feasibility studies of two additional alternatives that have been proposed after the “North Central Montana Regional Feasibility Report”. This report provides an appraisal-level cost comparison of those two new alternatives with respect to the currently most cost-effective alternative; the rehabilitation of the existing facilities. In addition, a Preliminary Engineering Report of the St. Mary rehabilitation alternative was prepared as part of this current study.

3.0 DIVERSION AND CONVEYANCE ALTERNATIVES

3.1 DUCK LAKE TUNNEL ALTERNATIVE

The Duck Lake Tunnel Alternative consists of conveying diverted St. Mary River water comprising the U.S.'s apportionment of natural flow into the North Fork of the Milk River via a large diameter tunnel. The shortest possible, and most likely, alignment is shown on Figure 3.1. The tunnel would extend under Duck Lake and would discharge to the North Fork upstream of Hydraulic Drop No. 5 of the existing St. Mary Facilities.

A tunnel of this magnitude would require use of a Tunnel Boring Machine (TBM). TBMs utilize a full-face, rotating cutterhead to excavate rock tunnels at relatively high advance rates through many types of rocks. The exact type and ability of the TBM would be influenced by the type and makeup of the material being excavated, such as strong or weak rock and the presence of fault and groundwater zones. Rock penetration rates are generally a function of tunnel geometry, rock mass characteristics, ground behavior and machine parameters.

The overall costs and the suitability of a TBM-installed, conveyance structure are highly dependent on the nature of subsurface soil/rock and groundwater conditions to be traversed by the tunnel. The geology and geotechnical properties will influence the costs of excavation and the final tunnel liner. An extensive subsurface exploration is critical to determining the true feasibility of a TBM project of this size and scope. Preliminary geologic information indicates that the proposed TBM alignment would traverse predominantly Cretaceous-aged sedimentary rock consisting of shale, siltstone, sandstone and occasional limestone beds. These rocks are relatively soft compared to other types of bedrock. Although easier and less expensive to excavate, these soils often pose strength and stability issues with respect to the finished liner inserted behind the TBM.

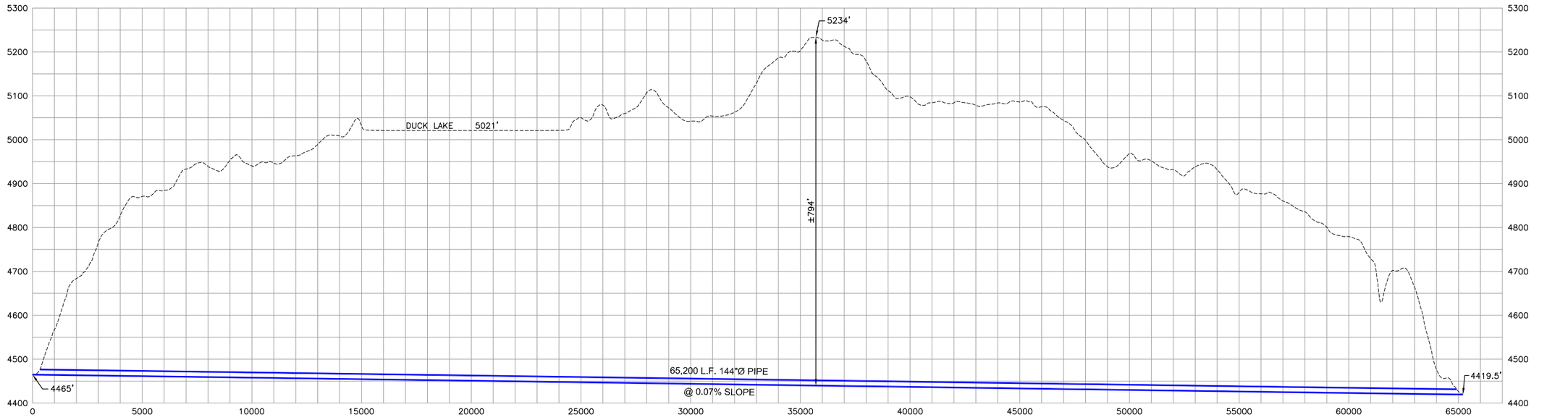

FIGURE 3.1

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10740PE
REGISTERED PROFESSIONAL ENGINEER
MONTANA

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DESCR DATE BY
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THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS–BOZEMAN–KALISPELL–HELENA
MONTANA
WASHINGTON
IDAHO
SPOKANE
LEWISTON
TD&H

DRAWN BY:	MWC
DESIGNED BY:	EAJ
QUALITY CHECK:	
DATE:	01.17.06
JOB NO.	04-167
FIELDBOOK	

DNRC - CARDD
ST. MARY CANAL REHABILITAION

DUCK LAKE TUNNEL ALTERNATIVE
PROPOSED ALIGNMENTAND PROFILE

CAD NO. 04167fig3.1 .DWG
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For the subsurface conditions anticipated, excavation rates would be on the order of 100 feet per day and the total bore would take approximately 660 days. Excavation would commence at the outlet invert in the North Fork drainage and advance upslope toward the inlet adjacent to the St. Mary River. This direction of excavation would facilitate removal of groundwater and the TBM cuttings. It is assumed that disposal sites in the vicinity of the outlet could be located for the tunnel cuttings.

For the soft sedimentary rock, it is assumed that a segmental, precast conduit liner with rubber gaskets would be required. The exterior annulus of the conduit would be grouted into place. For a boring project of this magnitude, it is likely that concrete batch and conduit fabrication plants would be set-up on-site at the North Fork portal.

Initial estimates indicate that an approximate 12-foot diameter, concrete-lined tunnel, with a slope of 0.00073 (0.073%) and a total length of roughly 65,200 feet would be required for an 850 cfs capacity. The actual tunnel bore would be at least 14 feet in diameter. The final alignment of the tunnel would depend on the elevation differences between the tunnel inlet and outlet to provide the required slope for the desired capacity. The required selection of a lining material will influence the hydraulic performance of the tunnel and will need to be examined. The capacity of the river downstream of the tunnel would also have to be studied and could impact the location of the tunnel outlet.

The design-life for a properly designed and constructed tunnel would exceed 100 years. Typical O&M costs are minimal and related to the diversion dam, headgates, fish screens and portals. The TBM liner would be relatively maintenance free in absence of large scale, geologic ground movements.

The potential for hydropower is not directly available for the Duck Lake Tunnel Alternative; however, the first 9 miles of the existing St. Mary Canal could be rehabilitated and reconfigured to include a hydropower plant at the existing St. Mary Siphon. At 200 to 250 cfs capacity over 214 days, revenue on the order of approximately $0.5 to $0.7 million per year is possible assuming 6.0 cents per kilowatt-hour wholesale revenue prices. The availability of additional

water for hydropower diversion above that diverted to the North Fork via the tunnel would have to be assessed.

The Duck Lake Tunnel Alternative would require a new diversion dam and both inlet and outlet portal structures. Diversion from the St. Mary River to the Duck Lake Tunnel inlet would require incorporation of fish screens. Also a simple fish barrier, such as a fixed weir may be required at the outlet end to preclude inter-basin transfer of fish species at low discharges. Excavation of the tunnel would generate approximately 300 Ac-ft (484,000 cubic yards) of rock excavation assuming a net earthwork swell factor of 1.3 (30 percent).

This alternative would most likely require an Environmental Impact Statement to address disposal of the tunnel excavation material, the new diversion dam, headgates, fish screens, and potential impacts to the North Fork upstream of Drop No. 5. The existing canal and related structures would most likely be abandoned, obliterated and the surrounding terrain regraded and reclaimed. The need for wetland mitigation along the abandoned canal route would need to be addressed in the environmental compliance documents.

The appraisal-level cost estimate to construct the tunnel is approximately $300 million. Additional costs associated with this alternative are summarized in the Table below.

Table 3.1 Cost Summary for the Duck Lake Tunnel Alternative.

Item	Estimated
Duck Lake Tunnel	$300,000,000
Demolition/Restoration of St. Mary Canal	$ 6,000,000
Wetland Mitigation	$????
New Diversion Dam with Fish Screens	$ 17,500,000
Annual O&M Costs	$ 200,000

3.2 ALL CANADIAN ROUTE ALTERNATIVE

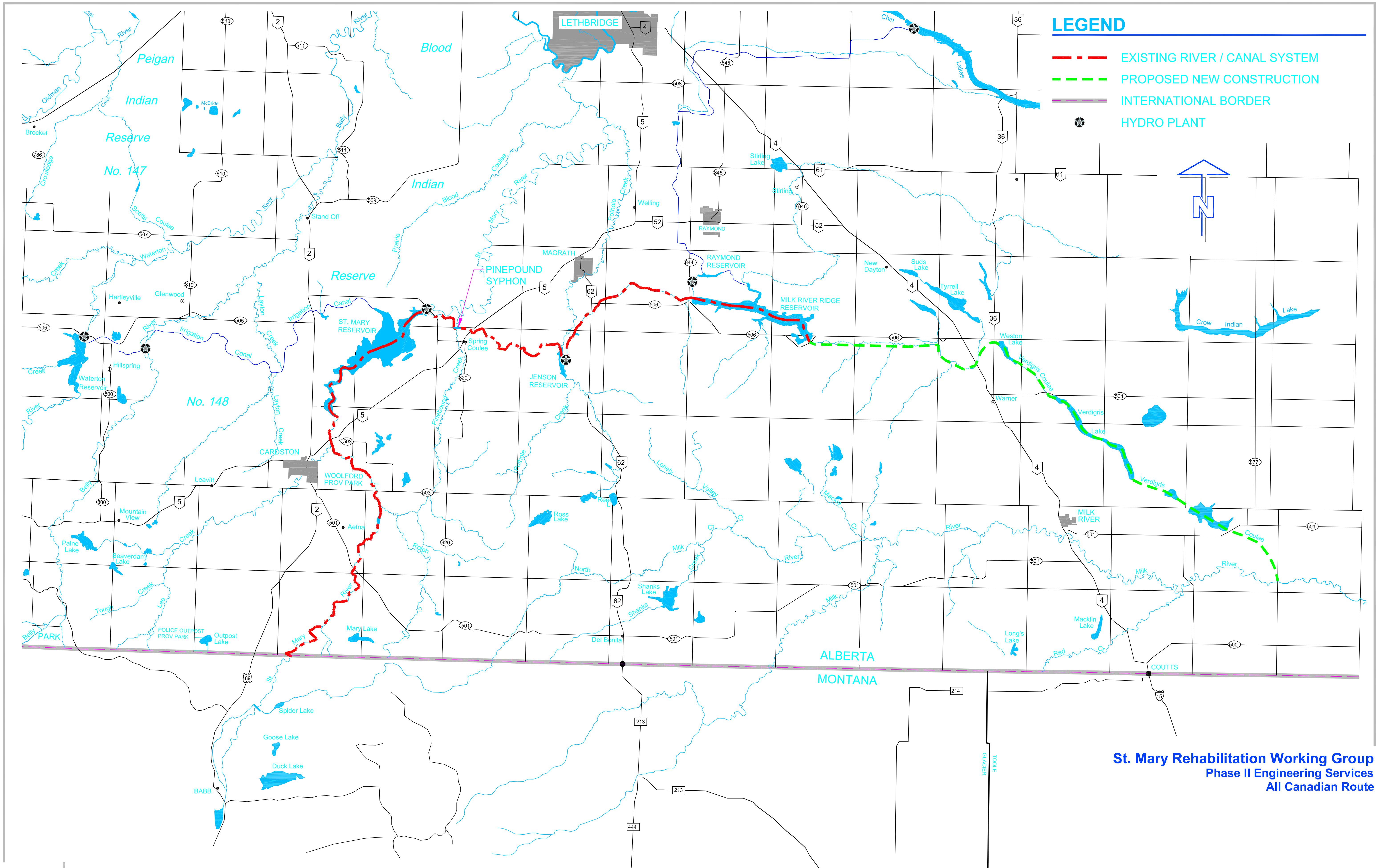
In theory, there currently exists an alternative route to convey water from the St. Mary River Basin into the Milk River Basin. Located entirely in Canada, this potential alternative is the result of Canada's commitment to long-term development and inter-basin management of their water resources. This alternative route has been labeled the All Canadian Route and is shown on Figure 3.2. As shown, this route utilizes a series of existing storage reservoirs interconnected by a system of canals of varying capacities.

The existing components of the All Canadian Route, upstream to downstream, are as follows:

1. St. Mary River from US-Canada Border to St. Mary Reservoir. This is the natural river channel that is dammed near Spring Coulee northeast of Cardston, AB to form the St. Mary Reservoir.

2. St. Mary Reservoir. The reservoir is owned and operated by the Province of Alberta. Its primary purpose is to store water (300,000 Ac-ft) for use by four irrigation districts in southern Alberta. There is a low level outlet, a spillway and an irrigation outlet. A small hydro plant has been incorporated with the low-level outlet discharging to the river. The spillway has been recently replaced. The irrigation outlet structure has a capacity greater than the downstream canal.

3. St. Mary-Jensen Canal. This is the irrigation canal from the St. Mary Reservoir to Jensen Reservoir. It has a capacity of 3200 cfs. The Pinepound Siphon is a major conveyance structure in this stretch of canal and was recently constructed and is in excellent condition. There are numerous minor structures such as road bridges and farm crossings, turnouts and in-line control structures. The canal itself is a one-bank canal in good condition and has adequate freeboard. If necessary, it would not be difficult to increase the canal capacity by 10% but the capacity of the Pinepound Siphon would be a limiting factor.



St. Mary Rehabilitation Working Group
Phase II Engineering Services
All Canadian Route

UMA | AECOM

FIGURE - 3.2

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4. Jensen Reservoir. This is a minor reservoir in the system with little storage. There is a gated spillway but it has never been used since it was built. The major outlet structure to the canal is the Taylor Coulee Chute which is new and in excellent condition. There is also a small hydro plant at this location that would benefit from an increase flow rate.

5. Jensen-Milk River Ridge Canal. This canal has a capacity of 3000 cfs in this section. It is a one-bank canal with adequate freeboard and is in good condition. There are numerous minor structures such as road bridges and farm crossings, turnouts and in-line structures.

6. Milk River Ridge Reservoir. In the early 1990's, a diversion canal and penstock to a hydro plant were constructed immediately upstream of the reservoir. The hydro plant can divert up to 2000 cfs and is owned by the irrigation districts. Water demands up to 2000 cfs effectively bypass Ridge Reservoir and are delivered to the district's system downstream of the reservoir. There are 2 outlets from the reservoir. The north outlet feeds the major irrigation systems. The east outlet has a capacity of 1685 cfs but downstream releases generally never exceed 100 cfs. This outlet could be used to deliver water to a new canal system that would terminate at the Milk River.

It is feasible to transfer water via the existing Canadian infrastructure by changes in current operations without major upgrades. The historical diversions for the US – St. Mary Canal are shown on Figure 3.3 and indicate a relatively steady diversion rate of about 650 cfs (design capacity is 850 cfs) from early April to the end of August.

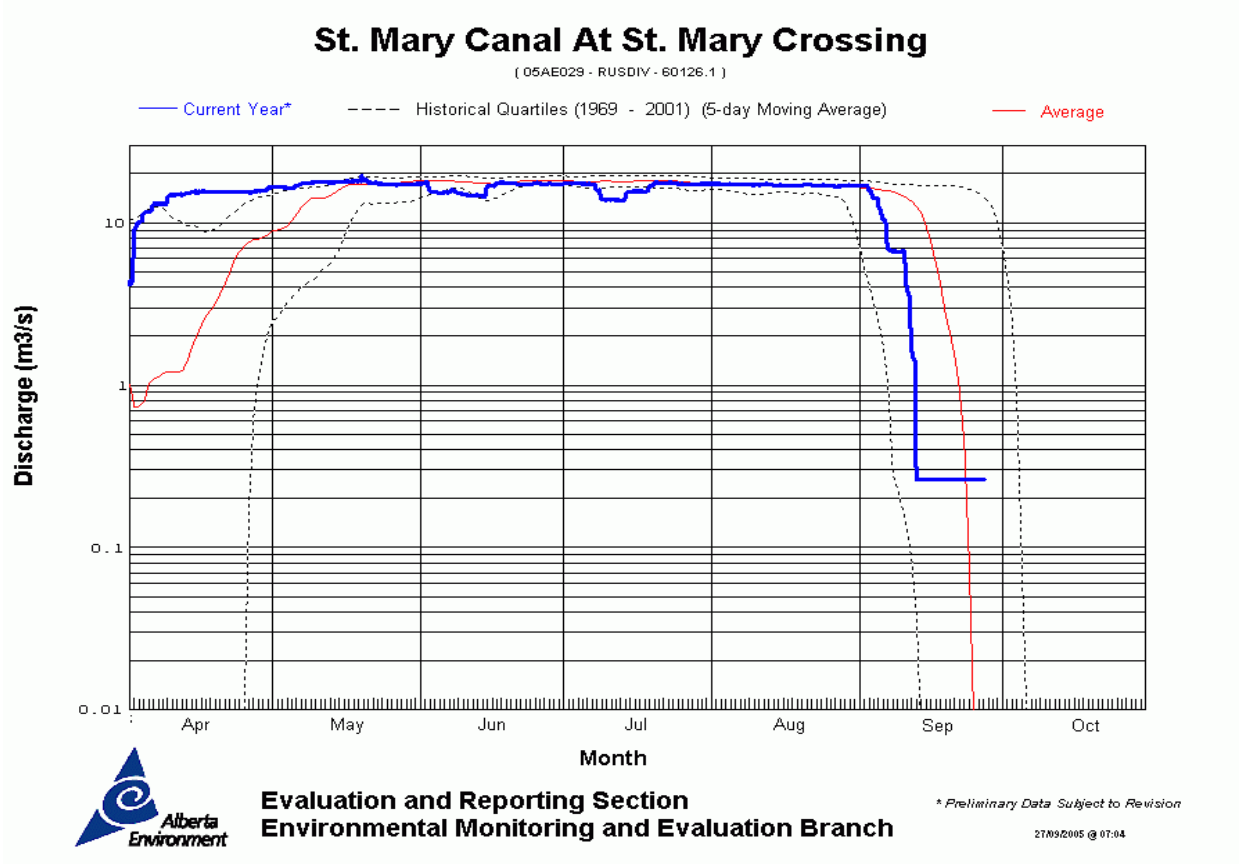


Figure 3.3 Historical Flows of the U.S. St. Mary Canal at the St. Mary River Siphon.

The historical water levels of the St. Mary Reservoir are shown on Figure 3.4

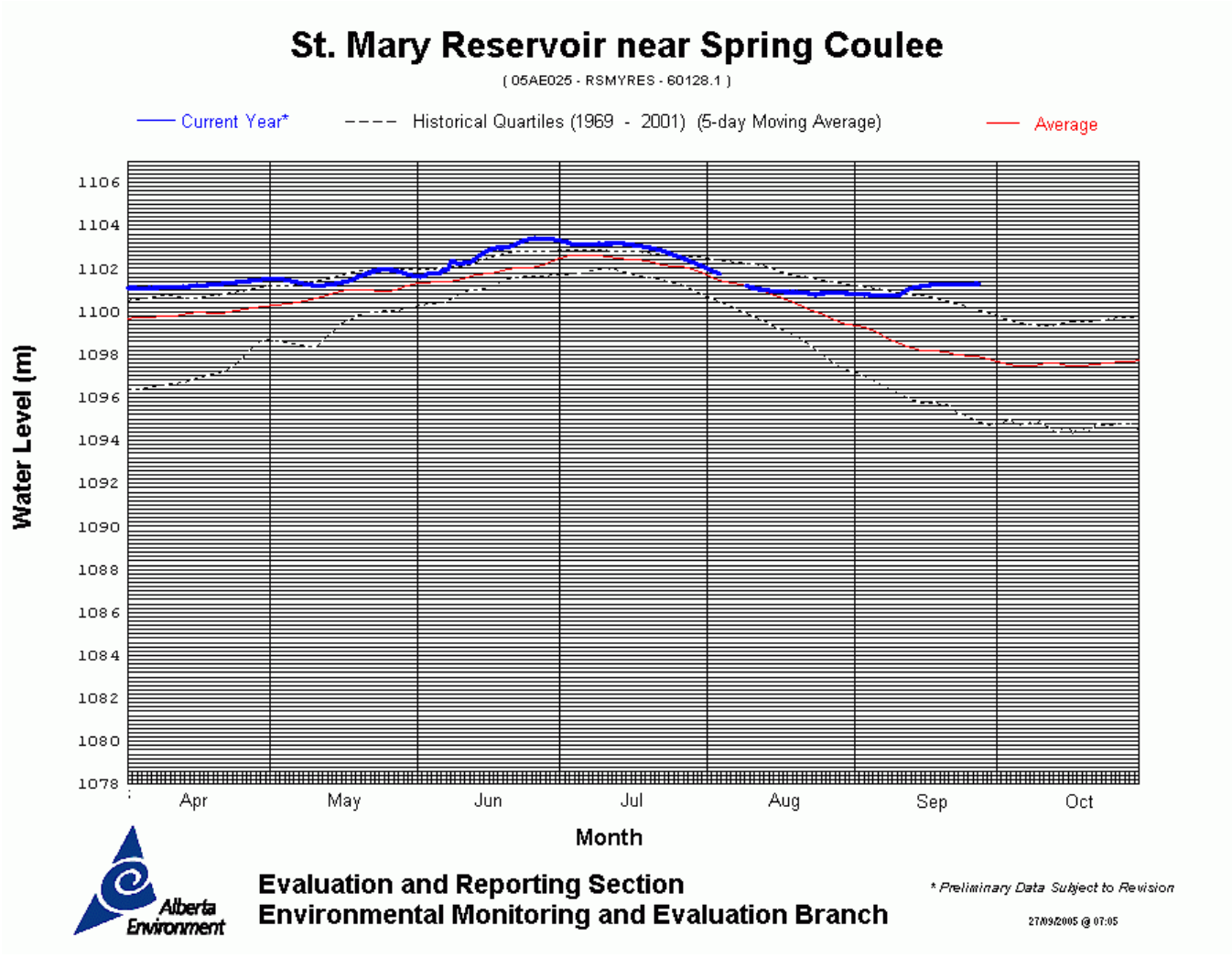


Figure 3.4 Historical Reservoir Levels at St. Mary Reservoir, Canada.

Major storms that could result in flooding generally occur in May and June. The reservoir's operational plan is therefore designed to reach full supply level (FSL) at the end of June so that there is some capacity to mitigate these events.

The historical diversions from St. Mary Reservoir are shown below in Figure 3.5 for the gauge at Spring Coulee. During the peak period, from mid-June to the end of July, the canal flow averages 2120 cfs with an upper quartile of 2500 cfs that is less than the canal capacity of 3000 cfs.

Transferring US water at 850 cfs through this canal cannot be guaranteed during peak demand periods or in dry years. However, the annual volume of US entitled water for the April – October period could be delivered to Fresno reservoir by operating the canal at 3000 cfs for a longer period than is currently done. A US diversion at 850 cfs is a monthly volume of 51,000 ac-ft. The available canal capacity above the upper quartile flows would yield a monthly average of 60,000 ac-ft. This scenario requires that the operational practices of Sherburne Reservoir, the Canadian system and Fresno Reservoir be changed.

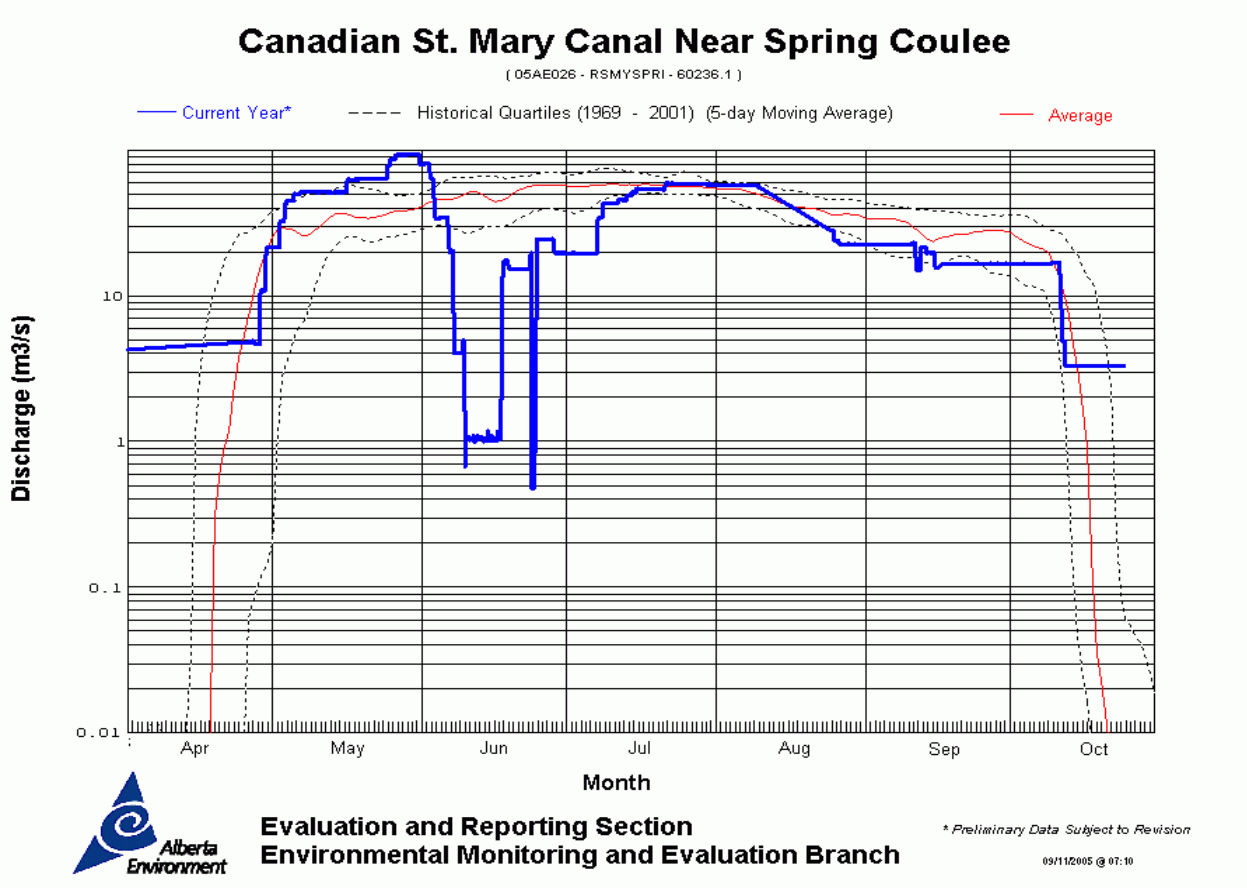


Figure 3.5 Historical Canal Flows in the Canadian St. Mary Canal

Downstream of Milk River Ridge Reservoir, a new canal system would have to be constructed to convey the U.S. apportionment to the Milk River. Ridge Reservoir's east outlet was built to deliver water for an irrigation development along Verdigris Coulee that is now defunct due to water quality and soil salinity issues. A review of the reports on that project indicates that the flows were too small (70 cfs) to flush the salts and improve the water quality in Verdigris Lake.

It was felt that larger flows would improve the quality of the water bodies in Verdigris Coulee. Verdigris Slough, located downstream of Verdigris Lake, would be bypassed.

The portion of the All Canadian Route that would require improvements and capacity upgrades is described as follows:

1. Middle Coulee (16 miles). This is the coulee downstream of the Ridge Reservoir east outlet. The valley has a wide bottom and a steep grade in the direction of flow toward the east. A new canal will require frequent drop structures to accommodate significant grade changes (see Figure 3.6). The canal will have to cross under a railway and primary highway reaching the junction to Tyrell Lake. Due to the relatively even slope and the low flows, building hydro power plants along this stretch is probably not feasible or economical.

2. Verdigris Coulee (27 miles.) The Verdigris Coulee section of the route extends from the Tyrell Lake Junction to the Milk River. It is envisioned that water could be conveyed through a combination of constructed works and the existing natural water bodies in the coulee.

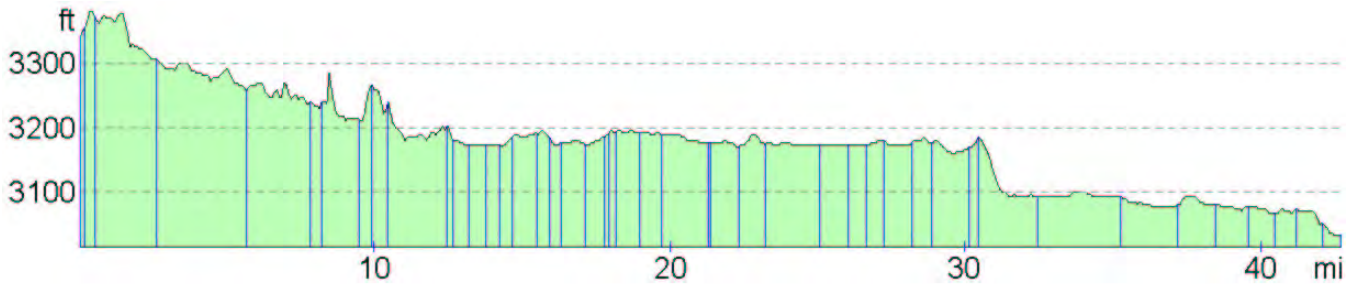


Figure 3.6 Surface Profile from Milk River Ridge Reservoir to the Milk River

In conclusion, it is technically feasible to deliver St. Mary River water to the Milk River and Fresno Reservoir via an "All Canadian Route". The capital cost to construct new works is estimated at $155,000,000 as outlined on the Preliminary Cost Estimate included in Appendix A.

There are however a number of issues and unknowns that would need to be addressed. These include, in part:

- The administration of the international water sharing agreement by the International Joint Commission.

- Possible adverse consequences along the upstream portion of the Milk River due to moving the delivery point downstream of the Town of Milk River. Although this section of the river would be returned to its natural state, there will likely be objections from water users and those with environmental and fishery concerns.

  The majority of the licensed water users are upstream of the Town of Milk River. Alberta's water licenses are based on the natural flow and do not guarantee water availability. However, the higher summer flows now in effect are beneficial to the on-stream irrigators and the Towns of Milk River and Coutts. Changing this section of the river back to its natural state will make it more difficult for them to locate and operate pump sites as the channel will likely move and flow levels will be lower. In addition, the flexibility to make adjustments in water withdrawals will be lost.

  Fisheries and in-stream habitat would be adversely affected which could raise the issue of minimum in-stream flows and result in objections from environmental groups. It would be very difficult to mitigate the lower flows.

- Land acquisition and ownership. Most of the land along the Ridge Reservoir to Milk River portion of the route is privately owned and it is assumed that it would be available for purchase. Utilization of Weston and Verdigris Lakes would likely have to be approved by Alberta Environment, as they would be impacted by increased flows.

- An agreement with the Province of Alberta for use of their existing infrastructure. This would likely entail financial compensation recognizing the value of the infrastructure and also on-going operation and maintenance costs.

- US interests would own the newly constructed works downstream of Milk River Ridge Reservoir. An organization will be required to operate and maintain the works. This could possibly be contracted out to some third party.

- On-going operational decisions and management would have to be coordinated between all affected parties. This would include national representation, Alberta Environment, the Canadian Irrigation Districts of the St. Mary Project, several water cooperatives that source water from Milk River Ridge Reservoir, affected municipalities and the IJC.

- The operating and management rules for the affected reservoirs may have to be adjusted to ensure timely releases and storage of the water. This would include Sherburne, St. Mary, Jensen, Milk River Ridge and Fresno Reservoirs.

A summary of costs associated with the All Canadian Route is provided below. Given the cursory nature of this assessment and the unknowns regarding the mitigation of wetlands, it would be prudent to estimate total project costs on the order of $200,000,000.

Table 3.2 Cost Summary for the All Canadian Route Alternative.

Item	Estimated
Canadian Infrastructure Improvements	$ 155,000,000
Demolition/Restoration of St. Mary Canal	$ 6,000,000
Wetland Mitigation	$???
Land Acquisition	$ 1,560,000
Financial Compensation to Alberta	$???
Annual O&M Costs	$ 750,000

3.3 ST. MARY CANAL REHABILITATION

Rehabilitation of the existing St. Mary Diversion Facilities was identified by the USBR in their *"North Central Montana Regional Feasibility Report"* (USBR, 2004) as the most viable option and the only alternative that would produce positive economic benefits. Four rehabilitated capacities between 500 and 1000 cfs were investigated, however, USBR did not recommend a

preferred capacity. Their evaluations focused on rehabilitating the existing canal prism along its present alignment in order to minimize ROW requirements. No considerations were given for improvements and enhancements to the existing alignment or operational regime. Minor realignments were proposed by the USBR only to facilitate construction of replacement in-line hydraulic structures. Chapter 4 of this report evaluates several additional alternatives regarding overall rehabilitation of the existing facilities including, but not limited to, the following:

- Canal realignments to improve prism hydraulics to reduce internal erosion and deposition,
- Canal realignments to reduce overall length thereby reducing construction cost, maintenance costs and final right-of-way requirements,
- Canal realignments to generate sufficient useable borrow for earthwork thereby reducing construction costs,
- Use of gravel armoring to reduce internal erosion, pond weed and maintenance costs,
- Considerations for a two-bank canal to improve maintenance efficiency,
- Considerations for "hydro-ready" hydraulic drops to provide revenue incentive,
- Additional alternatives for the diversion dam and headgate structure to reduce maintenance costs, and
- Incorporation of SCADA devices to provide automation, remote-control operation and remote monitoring.

3.4 COMPARISON OF ALTERNTIVES

A relative comparison of the advantages, disadvantages and related costs for the Duck Lake Tunnel, All Canadian Route, and St. Mary Facility Rehabilitation are listed in the Table below. Based on projected costs of $130,000,000, rehabilitation of the existing St. Mary Diversion Facilities remains the most favorable diversion and conveyance alternative to deliver water to North Central Montana.

Table 3.3 Comparison of Remaining Alternatives

Items	Duck Lake Tunnel	All Canadian Route	St. Mary Rehabilitation
Estimated Years to Construct	4 Yrs	7 Yrs	10 Yrs
Estimated Total Construction Cost ($)	$330,000,000	$200,000,000	$130,000,000
Annual Construction Cost ($)	$ 82,500,000	$ 28,600,000	$ 13,000,000
Estimated Percentage of U.S. Apportionment Delivered to Fresno	80%	90 - 100%	80%
Requires Demolition/Restoration of Existing St. Mary Canal	Yes	Yes	Partial
Requires New Diversion Dam & Fish Deterrents	Yes	No	Yes
Construction Employment for Blackfeet Nation	Slight	None	Yes
Provides Water to N. Fork for Blackfeet Irrigation Use	Yes	No	Possible
Potential U.S. Hydro Power	Slight	Yes	Yes
Impacts to Existing Wetlands & Riparian Areas	Negative	Negative	Positive
Impacts to Current Landowners Adjacent to Existing St. Mary Canal	Negative	Negative	Positive
Environmental Impacts to the North Fork of the Milk River	Negative	None	None

4.0 REHABILITATION OF ST. MARY FACILITIES

4.1 BLACKFEET NATION ISSUES & CONCERNS

The Blackfeet Nation is an important stakeholder because the entire diversion and conveyance system to the North Fork of the Milk River lies within the boundaries of the Blackfeet Nation. As such, they have had issues with the Diversion Facilities over the last 90 years and concerns regarding the proposed project rehabilitation. An initial meeting was held on November 30, 2004 in Browning with Tribal environmental and natural resource staff to discuss the project and begin the process of documenting the Tribes' concerns. Based on preliminary discussions with Tribal representatives, concerns of the Blackfeet cover four broad areas: 1) the Blackfeet Nation, its people, its cultures and Tribal ordinances; 2) land and water quality; 3) impacts to wildlife and 4) environmental. Full documentation of the Tribe's concerns is beyond the scope of this report and will be addressed through the NEPA process.

Blackfeet Nation

The Blackfeet Nation's status as a stakeholder must be considered on three different levels. The Tribe's status as a government requires government-to-government consultation and full consideration of and compliance with tribal jurisdiction and regulatory requirements, as well as tribal policies and cultural and religious factors. The Tribe's status as an affected landowner requires full consideration of all impacts to tribal lands and natural resources, including water resources and fish, wildlife and plant resources. Separate consultation with and input of individual tribal members and communities, particularly those most directly impacted by the project, is also critical.

Key tribal agencies that should provide input on design alternatives and should be involved in the review process include the Fish and Game Department, Environmental Programs Department, Water Resources Department, Land Department, Planning Department, and Tribal Historic Preservation Office. The Tribal Employment Rights Office (TERO) will also have a significant role relating to construction activities.

The Blackfeet Nation should provide input on design alternatives and should be involved with the review process. This can be accomplished with public meetings, public announcements and coordination with Tribal staff. This involvement must also include that from land users and local landowners adjacent to the project.

It is likely that additional right-of-way (ROW) and/or easements will be required for relocation and construction of replacement structures such as the diversion dam and canal headgates, Kennedy Creek, St. Mary River and Hall Coulee siphons, the St. Mary River Bridge, and the hydraulic drops. Also, improvements to the canal prism involving realignment and widening will require additional land acquisition.

The USBR is continuing to develop a GIS-based map compiling their understanding of documented land ownerships, easements and ROW. The Bureau of Indian Affairs (BIA) is also researching land ownership along the canal. Section 4.3.2 of this report presents the USBR's current understanding of existing facility ROWs and projects anticipated needs for both temporary construction easements and final ROWs. It is important that the final map show the present locations of the canal, maintenance roads, and related structures as well as a list of current landowners. At this stage of the process, only general statements can be made as to a likely location of a given replacement structure or canal realignment. Actual land acquisition requirements, both permanent and temporary for construction purposes, can only be fully determined and finalized during the design phases. Land acquisitions and negotiations will involve both tribal and non-tribal landowners, the Blackfeet Tribe, the USBR and the Bureau of Indian Affairs (BIA).

Sensitivity to cultural resources, living history, archaeology, and ethnographic/traditional cultural properties must be understood and properly mitigated prior to project rehabilitation. This will involve a close working relationship with the Blackfeet Tribal Historic Preservation Office (THPO).

All Tribal ordinances including, but not limited to, environmental permitting, environmental compliance, TERO, and other Tribal fees must be adopted and incorporated into the overall project rehabilitation.

Impacts to Land and Water Quality

These issues include, in part, the following:

- Changes to riparian corridor and wetlands that result from canal leakage.
- Provision for future livestock watering.
- Creation of additional wetlands.
- Aesthetics of the finished project.
- Temporary construction impacts to land and water quality.
- Water quality in North Fork of Milk River.
- Impacts of canal system on Babb water system and nearby wells.
- Environmental impacts, erosion and sedimentation from, and including, Lake Sherbourne to the diversion dam.

Impacts on Wildlife

Concerns expressed regarding potential impacts to wildlife include, in part, the following:

- Destruction of existing and the creation of new habitat for waterfowl and other game birds.
- Lack of wildlife crossings (elk migration) with respect to the rehabilitated canal prism and livestock fencing.
- Elevated siphon affects elk migration.
- Bull Trout issues with respect to the diversion dam and canal headgates.
- Implications of increasing hunter and other human access to wildlife.
- Construction impacts on grizzly bears, bald eagles, wolves, lynx, bull trout, and elk calving areas.

These concerns can be systematically addressed and incorporated into the project as the studies and designs progress by working closely with Tribal staff and local landowners.

4.2 BLACKFFET ENVIRONMENTAL ISSUES

Existing environmental information is limited for the project area. The Bureau of Reclamation (USBR) provided a general summary of environmental impacts and effects, published in their Regional Feasibility Report that included the St. Mary Facility Rehabilitation. A limited-scope Environmental Assessment was produced in 1990 on canal maintenance involving vegetation removal. The State of Montana has some GIS coverage for the project area, including wetland mapping from the National Wetland Survey.

Environmental issues related to irrigation facility rehabilitation are primarily centered on the cultural resources, fish and wildlife resources, and water resources of the project area. The USBR has been conducting research on Bull Trout related to the St. Mary Facilities; reports are available. A preliminary environmental process was defined in the "Data Review, Preliminary Cost Estimate and Proposed Rehabilitation Plan" prepared by Thomas, Dean and Hoskins (TD&H, 2005) which outlined potential roles of the Blackfeet Tribe and other Stakeholders, including Federal Agencies. The permitting will follow Blackfeet Tribe permitting procedures. The Blackfeet Tribe will be involved in the entire environmental process. The Bureau of Reclamation (USBR) will be the lead agency for the National Environmental Policy Act (NEPA) process.

Blackfeet Fish and Game Department is the primary agency managing fish and wildlife resources on the Reservation. The United States Fish and Wildlife Service (USFWS) will be a key agency in the implementation of the Fish and Wildlife Coordination Act (F&WCA) and the Endangered Species Act. An expected outcome of following the F&WCA will be the avoidance, minimization, and mitigation of impacts to biological resources. The Tribal Historic Preservation Office and/or the State Historic Preservation Office will be involved with cultural resource clearances.

Currently the USBR and US Fish and Wildlife Service are collaborating through informal consultation on Bull Trout research for the St Mary Rehabilitation. Key issues include:

- No winter flows in Swiftcurrent Creek immediately downstream of Sherburne Reservoir;

- Modifications to the dam to allow winter releases are being studied;
- Fish passage through the St. Mary Diversion Dam;
- Fish entrainment in the St. Mary Canal;

Initial interviews with the Blackfeet Tribe and the USBR have identified the following list of plants and animals, topics and issues that may require a combination of new data collection, data analysis, and/or additional environmental studies to achieve the goals of the NEPA compliance of the project. These lists are preliminary and subject to change as a result of the NEPA process and input from the Blackfeet Nation. This list of environmental issues will likely be changed during Environmental Scoping. Many of these issues were also identified as Blackfeet Nation concerns in Section 4.1.

The following environmental issues have been identified as potentially requiring analysis in the environmental document:

- concern about Swiftcurrent Creek and changes in water level, flows, and being de-watered. Also a sediment problem.
- concern about sediment problems in Sherburne Reservoir and Lower St. Mary Lake.
- instream flows in St. Mary River below diversion dam.
- wildlife crossings of the canal, including elk migration.
- canal lining, if any, and how different linings (e.g. concrete, PVC, HDPE) affect wildlife crossings.
- effects of widening or deepening the canal.
- effects of canal fencing.
- effects on grizzly bears, wolves, lynx, bull trout, bald eagle and slender moonwort (plant).
- timing of construction and potential effects on wildlife.
- implications of increasing hunter and other human access to wildlife.
- effects on elk populations with nearby calving areas.
- changes to riparian corridor and wetlands resulting from canal leakage control.
- potential to disrupt sub-irrigation of farmland with canal improvements. Potential to disrupt cattle watering. Potential to eliminate creek flows fed by canal leakage. About 70

to 80 cfs of flow is lost from the canal between the St. Mary diversion dam and the St. Mary siphon.

- concern exists about native plants along the canal and project impacts.
- Pondweed is a maintenance problem downstream of the St. Mary siphon – especially at Spider Lake.
- local runoff at drain inlets is a sediment problem.
- spring water that enters the canal.
- Cultural Resources - Impacts to Tribal spiritual places. For example, a spiritual place is located near the St. Mary Diversion structure. The Tribe knows other important areas.
- concern about water source impacts (quantity and quality) to the Babb School, assuming canal leakage is recharge for local groundwater.
- water quality concerns (primarily sedimentation) in the North Fork of the Milk River resulting from drop structure hydraulics.
- interest in habitat mitigation related to wetlands and wildlife, including waterfowl and other game birds.
- upstream concerns:
- bio-transfer (inter-basin transfer) of unwanted fish species (e.g. troutperch).

4.3 DESIGN PARAMETERS AND CONSIDERATIONS

4.3.1 Operations and Maintenance

A two-person, full-time crew based at Camp Nine near the St. Mary River siphon crossing is responsible for the daily O&M activities during the diversion season and repairs during the off-season. During operation, the diversion and conveyance structures are visually inspected at least three times a week. Of particular concern is the condition of the numerous areas of on-going bank instabilities located both on the down slope fill sections and in the backslope cut sections. When instabilities are observed or known landslides are active, daily inspections are reportedly performed.

The USBR Reservoirs and Rivers Operation staff located in Billings, MT dictate the beginning and ending of the diversion season as well as releases from Sherburne Reservoir based on

updated operational plans. This information and operation instructions are conveyed to the on-site O&M staff to be implemented. Maximizing daily diversions to the St. Mary Canal is the responsibility of the on-site crew. This represents a balancing act of encumbered natural flows, releases from Sherburne Reservoir and potential storm water inflows. The present canal system has no operating checks, only one operating wasteway and limited canal freeboard at several locations. There are five grassy swales along the existing alignment that allow spill at higher than normal flows. When the local USBR staff anticipates significant precipitation events, the diversion discharge at the canal headgates is reduced to create canal freeboard thereby accommodating the potential storm water inflows. When this threat passes, normal diversion resumes. If the anticipated storm event fails to fully materialize, this cautious, although warranted, operational approach represents lost opportunities to maximize diversion.

During sustained precipitation events, the maintenance road atop the downstream bank becomes relatively impassable due to an inadequate gravel section and the plastic nature of the native soils. This limits inspection during critical times. The "rule-of-thumb" employed by the on-site maintenance crew is "if its raining…we're staying."

The on-site crew is responsible for the start-up and shutdown activities. The local staff also performs the off-season repairs such as replacing siphon joints, repairing concrete surfaces at the various structures and earthwork rehabilitation to the canal prism. Conversations with USBR staff were held to discuss maintenance issues regarding the existing facilities and potential improvements for the rehabilitated project. Some of the key maintenance issues are as follows:

- Early start-ups prior to April 1st pose tremendous difficulties with snow and ice removal from canal and hydraulic structures.
- Woody brush on downstream bank hampers maintenance activities.
- Pondweed along full length reduces canal capacity.
- Lack of fencing and wildlife crossings.
- All-weather maintenance road needed.
- Narrow maintenance road with sharp bends precludes travel with tractor-trailer semis when moving maintenance equipment. Insufficient areas to park or pass.

- Floating trash at diversion dam and headgates is an all season maintenance issue.
- Lack of operating checks and only one working wasteway.
- Poor sealing headgates results in year-round flows between dam and Kennedy Creek wasteway.
- Bank instabilities are a yearly maintenance item, wet years are worse.
- Insufficient number of canal crossings for maintenance and opposite bank access is very limited.
- Additional, strategically positioned turnouts are recommended for dewatering at the end of the season.

4.3.2 Right-of-Way Requirements.

A full understanding of the existing right-of-ways (ROW) for the St. Mary Diversion Facilities has yet to be developed. In 2005, the USBR prepared an initial GIS-based map showing their facilities and their understanding of Facility ROW based on their files and historical data. Concurrence with the Blackfeet Nation, Bureau of Indian Affairs (BIA) and local owners has not been obtained. In fact, disagreement between USBR and BIA already exists on certain portions of the Facility ROW and/or land ownership. It is imperative that an understanding and agreement be obtained prior to design and construction in order to identify spatial limits or constraints impacting potential improvements, replacement structures and shifts in canal alignment. An alternative is to assume new construction and to negotiate and acquire all temporary and final easements from the impacted landowners once the final alignment has been determined. This alternative would most likely relinquish existing ROW where practical.

The following six drawings (Figure 4.1) indicate the USBR's understanding of the current ROW for the existing canal and related facilities. These drawings are based on GIS-based maps prepared and provided by the USBR to TD&H in 2005. The USBR is continuing to update this information. During the Draft review of this document, the USBR noted the following:

- The lands shown in Section 27 and the majority of the lands in Section 22 (on Sheet 1) are no longer owned by USBR. This land was relinquished to the Blackfeet Tribe in 1945.

- Not all the ROW for the original canal and the 1949 canal relocation to Spider Lake flume are shown (Sheet 3).
- ROW for Hall Coulee wasteway not completely shown (Sheet 4).
- ROW between Drop 3 and Drop 4 not shown (Sheet 6).

In general, the canal ROW from the diversion dam to Kennedy Creek is typically 200 feet wide and 150 feet wide from Kennedy Creek to the St. Mary River Siphon. From near Spider Lake to the Hydraulic Drops, the ROW widens to typically 300 feet. Larger tracts of ROW exist for the major structures, such as the dam/headworks, siphons, checks and wasteways, and the hydraulic drops.

For the most part, the existing facilities appear to be within the existing ROW except a segment between the St. Mary Siphon and Spider Lake where the canal was relocated. An earthen canal section, built between May 1949 and June 1951, replaced the original Spider Lake flume. This occurred due to failure of an elevated flume and replacement with a canal prism. The USBR reports that the necessary ROW was obtained in 1949. This ROW; however, is not shown on the USBR GIS-based map showing existing USBR ROW (Figure 4.1).

Additional right-of-ways (ROW) will be required, to implement the proposed canal alignment improvements, and due to canal enlargement, and enhanced design standards of flatter canal bank slopes, increased freeboard, wider bank widths, two-bank construction and upslope buttresses and drainage. Final ROW limits should extend at least 10 feet beyond the outside toe of the proposed fill embankments and 10 feet beyond the limits of the backslope cuts. Temporary construction easements at least 50 feet wide beyond the permanent ROW will be required along the proposed final ROWs to facilitate construction, allowing for haul roads and access, material stockpiling and other related activities. Also, designated borrow and disposal areas, yet to be determined, will require temporary construction easements if sufficient material or space cannot be accommodated within the proposed ROW.

For the existing canal alignment and using the approximate existing ROW widths provided by USBR (shown on Figure 4.1), the existing ROW for the current canal prism and alignment is on the order of 800 acres. For the proposed alternative alignment shown on Figure 4.1 and using a

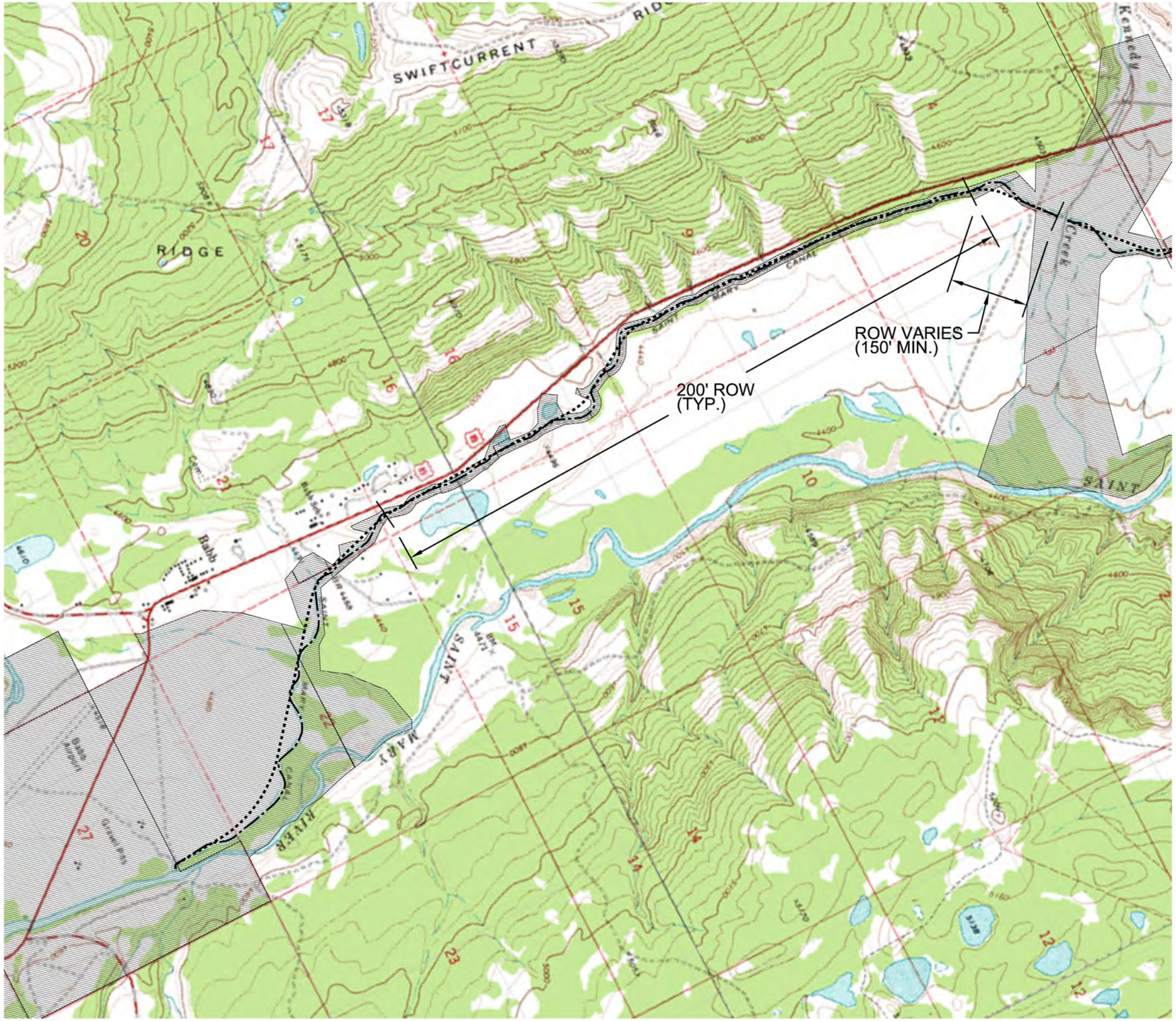
consistent 300-ft ROW width, the new canal prism would require approximately 866 acres. This assumes 125,746 feet of canal extending from the diversion dam to the inlet to Drop No. 1. Very few canal realignment opportunities are possible between Drop No. 1 and the North Fork of the Milk River. The 866 acres excludes any new ROW that may be required for the diversion dam/headworks, checks and wasteways, the siphons and the areas encompassing the hydraulic drops. The additional ROW anticipated for replacement of these major structures is shown in the Table below. The actual ROW requirements maybe less, depending on the proximity of the replacement structure to the existing structure and the existing ROW. The hydro-ready alternative between Drops 4 & 5 would require additional ROW on the order of approximately 70 acres for the approach canal and penstocks and 10 acres for the plant and related equipment.

Table 4.1 Anticipated Land Acquisition Requirements for Replacement Structures

Replacement Structures	Potential Required ROW
Diversion Dam / Headworks	10 Ac
Kennedy Creek Siphon	3 Ac
St. Mary Siphon	24 Ac
Hall Coulee Siphon	12 Ac
Checks and Wasteways	3 Ac
Hydraulic Drops	8 Ac
Total	60 Ac
Hydro-Ready Alternative, Add…….>	80 Ac

The USBR's feasibility studies (USBR, 2004) assumed rehabilitation of the existing canal along its current alignment within the existing ROW. In their cost estimate, a value of $300 per acre was used for the cost of land acquisition. They estimated a need for an additional 180 acres of ROW for rehabilitation back to the original 850 cfs canal capacity and 360 acres for a 1000 cfs canal along the same alignment. The additional ROW was anticipated for temporary easements, borrow areas, and temporary and permanent ROW for repair of bank instabilities and slope failures. The required ROW width may be decreased where favorable topography allows and may increase where larger cut and fill sections are required.

As stated above, the ROW requirement for the proposed alternate canal alignment (Figure 4.1) is approximately 866 acres and 60 acres for the replacement structures. The hydro-ready alternative requires approximately another 80 acres. This assumes new construction with all land acquisition without any regard to existing ROW. Assuming a price of between $500 and $1,000 per acre, this equates to $463,000 to $926,000. The proposed hydro-ready alternative (Section 4.7.4) would add another 80 acres or $40,000 to $80,000. The actual cost of land acquisition required for the realignment improvements could be lower than the assumption of new construction and all new ROW. This is because of the existing ROW and the actual net acreage required. Where the same landowner exists on both sides of the shifted canal, the net ROW exchange may be zero thereby facilitating the process. Also, the proposed canal improvements such as fencing, livestock watering, improved roads and etc. will directly benefit the adjacent landowners. ROW acquisition leverage may be offset by these potential added benefits to the landowners. The land acquisition process could be hampered when different landowners exist on opposite sides of the canal and the proposed canal shift negatively impacts one of the landowners. Based on existing land use, land acquisition may be more complicated upstream of the St. Mary River siphon than downstream.



REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 1 (DIVERSION DAM TO KENNEDY CREEK SIPHON INLET)	25009 L.F.	23680 L.F.

0 1000' 2000' 3000'
SCALE

LEGEND

- USBR RIGHT–OF–WAY
- APPROX. CANAL CENTERLINE
- ALTERNATIVE ALIGNMENT

NOTE:
1. RIGHT–OF–WAY SOURCE INFORMATION PROVIDED BY USBR.

2. CANAL CENTERLINE SURVEY BY TD&H, 2005

3. BACKGROUND TOPOGRAPHICAL IMAGE IS FOR REFERENCE ONLY DUE TO THE LENGTH OF THE PROJECT AND SUBSEQUENT IMAGE DISTORTION.

FIGURE 4.1

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ST. MARY DIVERSION FACILITIES

PRELIMINARY ENGINEERING STUDY
USBR RIGHT-OF-WAY / CANAL REACH NO. 1

CAD NO. 04-167-ROW .DWG
SHEET 1 OF 6

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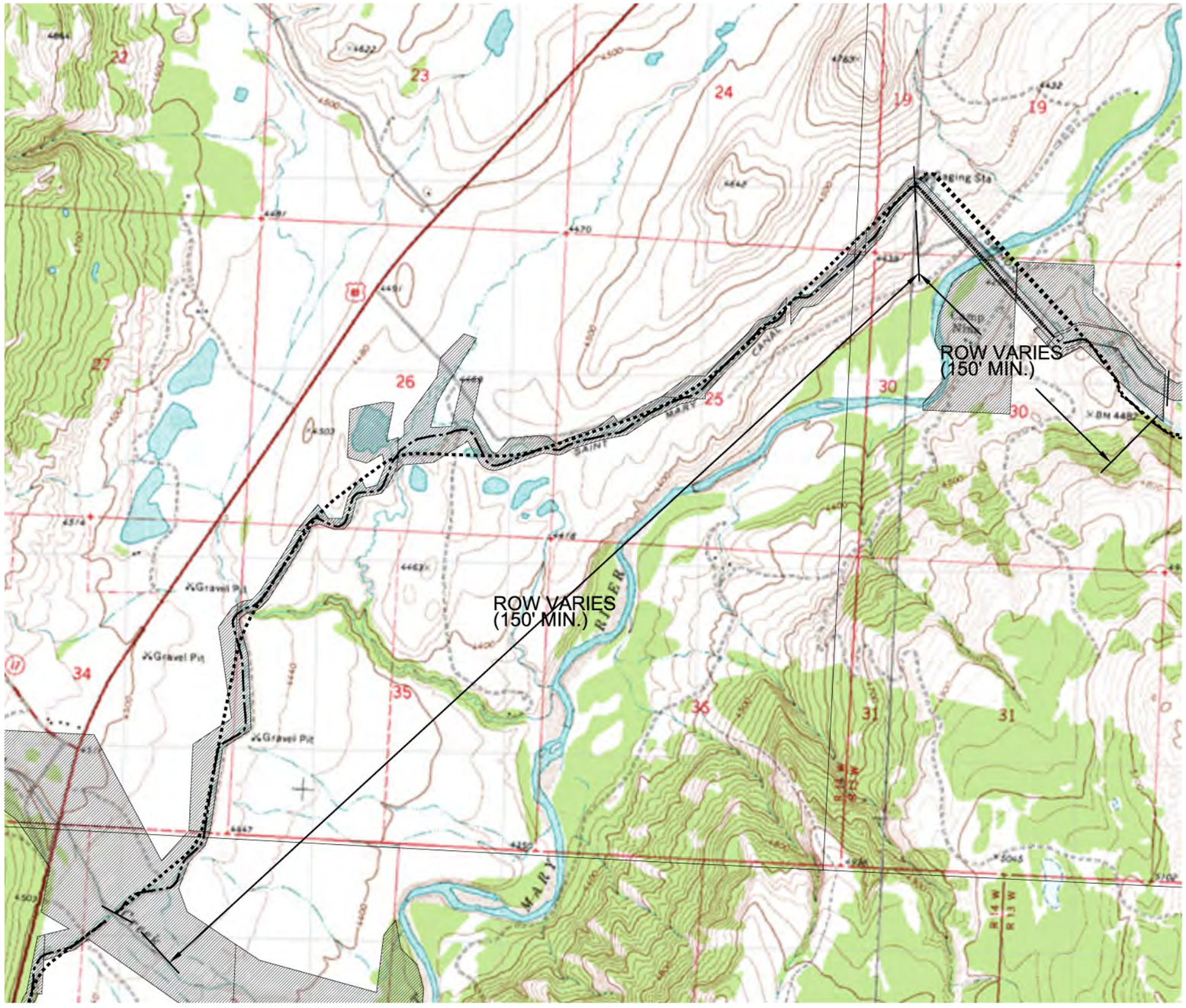

REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 2 (KENNEDY CREEK SIPHON OUTLET TO ST. MARY SIPHON INLET)	22141 L.F.	20706 L.F.

0 1000' 2000' 3000'
SCALE

LEGEND

- USBR RIGHT-OF-WAY
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FIGURE 4.1

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PRELIMINARY ENGINEERING STUDY
USBR RIGHT-OF-WAY / CANAL REACH NO. 2

CAD NO. 04-167-ROW .DWG
SHEET 2 OF 6

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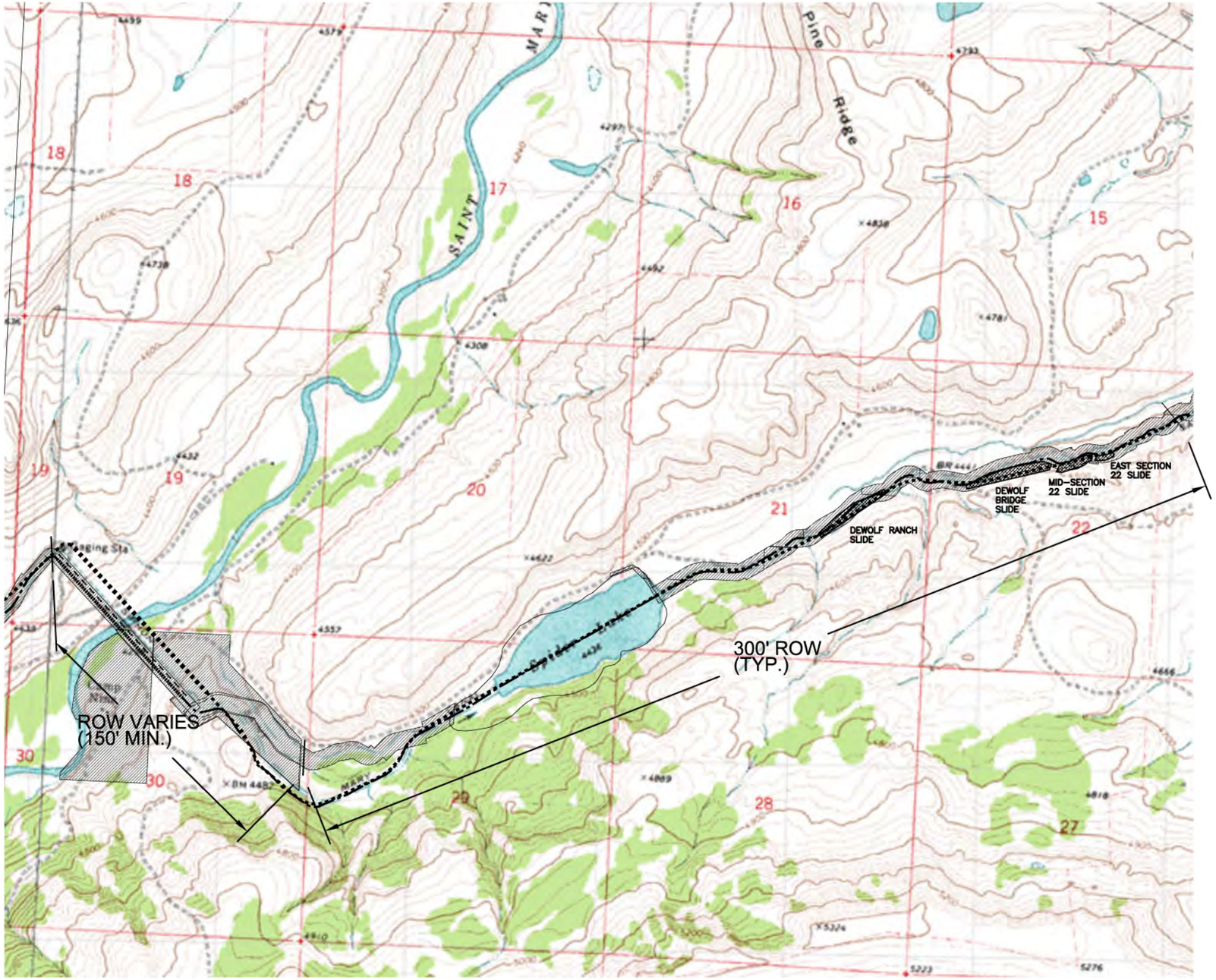

REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 3 ST. MARY SIPHON OUTLET TO STA. 715+00	20303 L.F.	19547 L.F.

0 1000' 2000' 3000'
SCALE

LEGEND

- USBR RIGHT-OF-WAY
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- ALTERNATIVE ALIGNMENT

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FIGURE 4.1

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PRELIMINARY ENGINEERING STUDY
USBR RIGHT-OF-WAY / CANAL REACH NO. 3

CAD NO. 04-167-ROW .DWG
SHEET 3 OF 6

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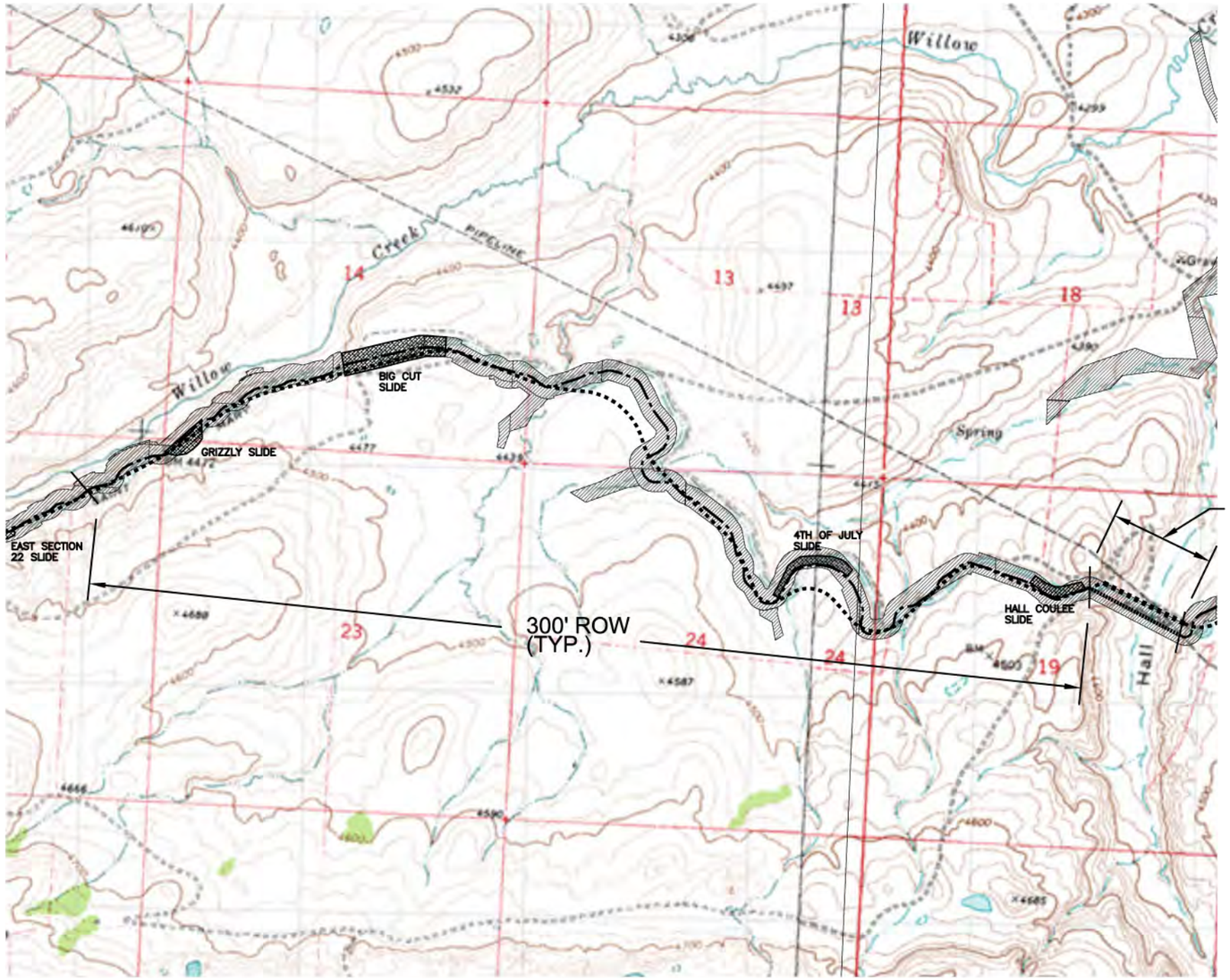

REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 4 (STA. 715+00 TO HALL COULEE SIPHON INLET)	19851 L.F.	17851 L.F.

0 1000' 2000' 3000'
SCALE

LEGEND

- USBR RIGHT-OF-WAY
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FIGURE4.1

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PRELIMINARY ENGINEERING STUDY
USBR RIGHT-OF-WAY / CANAL REACH NO.4

CAD NO. 04-167-ROW .DWG
SHEET 4 OF 6

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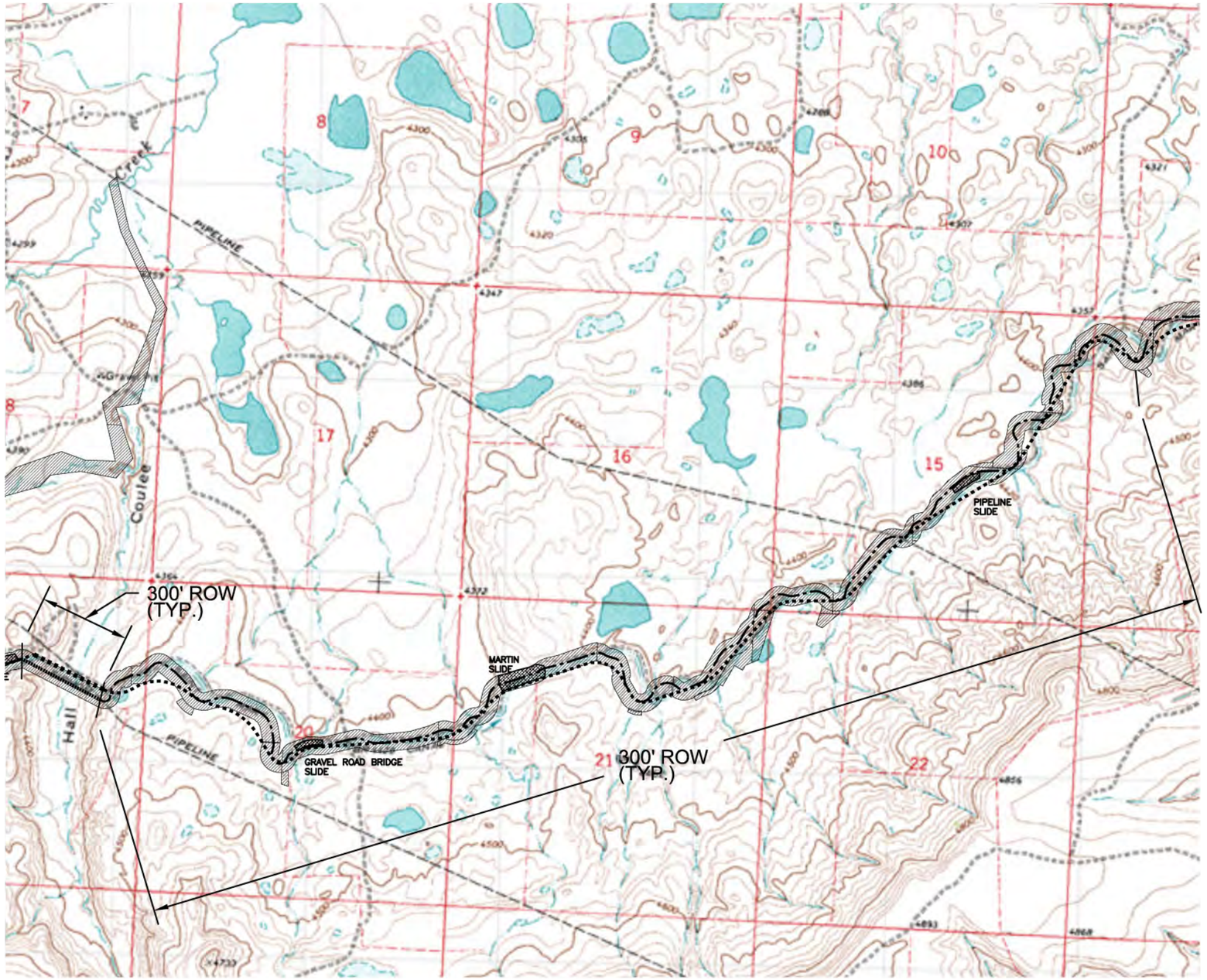

REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 5 HALL COULEE SIPHON OUTLET TO STA. 1173+50)	24290 L.F.	21666 L.F.

0 1000' 2000' 3000'
SCALE

LEGEND

- USBR RIGHT–OF–WAY
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FIGURE 4.1

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PRELIMINARY ENGINEERING STUDY
USBR RIGHT-OF-WAY / CANAL REACH NO. 5

CAD NO. 04-167-ROW .DWG
SHEET 5 OF 6

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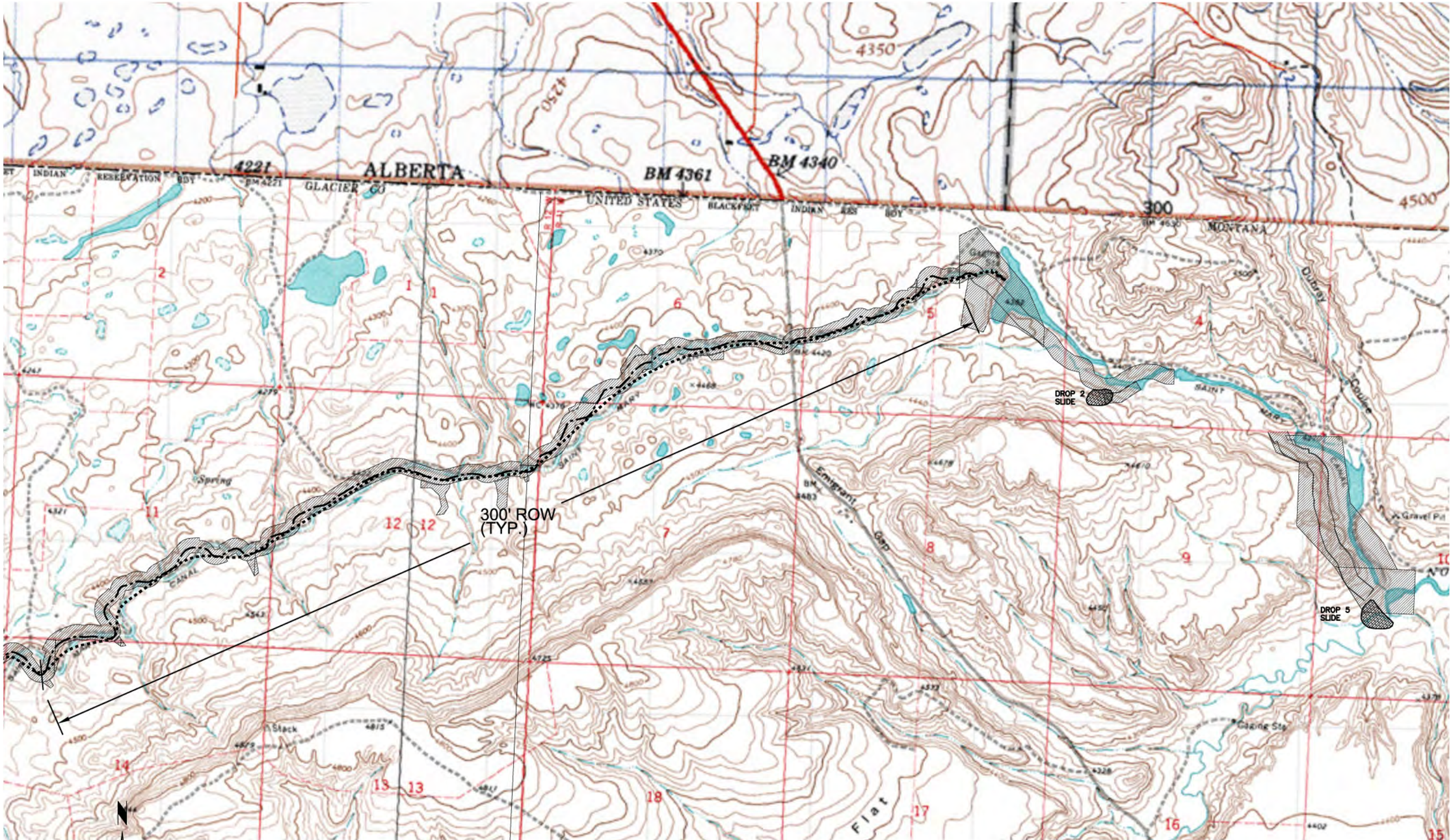

REACH	EXISTING LENGTH	PROPOSED LENGTH
REACH NO. 6 (STA. 1173+50 TO TOP OF DROP NO. 1)	23576 L.F.	22266 L.F.

LEGEND

- USBR RIGHT-OF-WAY
- APPROX. CANAL CENTERLINE
- ALTERNATIVE ALIGNMENT

NOTE:
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FIGURE 4.1

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USBR RIGHT-OF-WAY / CANAL REACH NO. 6

CAD NO. 04-167-ROW .DWG
SHEET 6 OF 6

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4.3.3 Construction Staging

Disruption of water deliveries during the irrigation season due to construction must be avoided and is the primary concern regarding rehabilitation of the existing facilities. Large replacement structures for the diversion dam, Kennedy Creek, St. Mary River and Hall Coulee siphons, and the hydraulic drops will require more construction time than that permitted during the off season. Therefore replacement of these structures must be located adjacent but off the current alignment. This will require additional ROW and/or land acquisition but also permit summertime construction without disruption of service. Once the existing major structure is replaced, it can be demolished, the land restored and the existing ROW relinquished to the adjacent landowner.

The modifications to the canal prism and many of the in-line hydraulic structures must be completed during the off-season during the winter. Therefore it is critical that the length of canal reach proposed for reconstruction and the related appurtenance structures be carefully selected in order to guarantee successful completion prior to springtime water-up of the canal system. Table 4.2 below provides a proposed staging sequence and breakdown of canal segments to be constructed. It is recommended that overall rehabilitation should proceed in an upstream to downstream direction.

Table 4.2 Proposed Segments for Reconstruction of the Canal Prism

Canal Reach	Existing Length	Proposed Alignment
No. 1 Diversion Dam to Kennedy Creek Siphon Inlet	25,009	23,680
No. 2 Kennedy Creek Siphon Outlet to St. Mary Siphon Inlet	22,141	20,706
No. 3 St. Mary Siphon Outlet to Station 715+00	20,303	19,547
No. 4 Station 715+00 to Hall Coulee Siphon Inlet	19,851	17,851
No. 5 Hall Coulee Siphon Outlet to Station 1173+50	24,290	21,666
No. 6 Station 1173+50 to Drop No. 1	23,576	22,266
Total	135,170	125,716

4.3.4 Canal Prisms

Rehabilitation of the 90-plus year St. Mary Canal represents a tremendous opportunity to enhance and improve the diversion and conveyance structures. Construction equipment and technique was limited during original construction relative to today. Several of the original

design criteria should be amended and enhanced to promote the long-term performance of the rehabilitated Facilities. These include, in part, the following:

- Prism Geometry – the original cut and fill slopes were excessive considering the nature of the soils comprising these slopes. Flatter fill and cut slopes are recommended where applicable. This will reduce instabilities, bank sloughing and maintenance and help maintain design capacity into the next 100 years.

- Tortuosity – Inherent to a one-bank, contour canal and limited excavation equipment, the existing canal exhibits a high degree of sinuosity. This creates erosion and deposition internal to the canal; usually within close proximity to each other as the flowing water is trying to straighten its channel. This promotes bank sloughing and overall channel deterioration resulting in diminished capacity. Canal realignment and minimum radius criteria are proposed to improve canal hydraulics.

- Maintenance Access – The lack of a two-bank canal, all-weather access road, second maintenance road, road turnouts, additional crossings etc. severely hampers maintenance activities. Improvements for maintenance access are proposed.

- Livestock Control – Lack of livestock control leads to deterioration of the canal prism. ROW fencing with cattle guards is proposed to protect the rehabilitated facilities.

- Armoring – Lining the canal with rock armoring is proposed to further protect the earthen prism from deterioration.

- Instrumentation, Automation and Remote-Control Capabilities – The rehabilitated facilities should include instrumentation to allow remote observations, automation to maximize diversion and conveyance efficiencies, and remote-control capabilities to reduce operational costs.

As mentioned earlier, the efforts to rehabilitate the St. Mary Facilities are at a significant crossroads that will not present itself for another 100 years. This opportunity to improve and correct existing deficiencies is paramount to the long-term performance of the rehabilitated structures. These improvements are proposed to reduce maintenance and operating costs and improve hydraulic efficiencies while providing benefits to local landowners.

The preliminary design criteria for rehabilitation of the St. Mary canal are as follows:

Design Capacity. For cost estimating purposes, design capacities of 700, 850 and 1000 cfs were used. Seepage losses are estimated to be 10% of the canal discharge. This seepage value was established in the *Hydrologic and Hydraulic Design Considerations For Overall Canal Rehabilitation* report prepared by TD&H in 2006. The seepage rate was determined by both empirical relationships and by reviewing canal losses at varying discharges between gaging stations (TD&H, 2006b). Higher diversion rates and canal capacities should be considered during final design to account for seepage losses, livestock turnouts, hydropower enhancements, etc.

Canal Slope. The existing canal slopes vary from 0.000077 to 0.000176 ft/ft. We do not anticipate the need for grade controlling checks or additional drop structures within the canal prism. Shortening of the canal as a result of alignment shifts will provide additional hydraulic head and design flexibility.

Velocity. Target design values to be checked during final design are from 1.5 to 2.5 fps.

Manning's Roughness Coefficient. The Manning's roughness factor ("n") to be used for the establishment of the basic prism geometry is 0.025. The USBR (1967) recommends use of 0.025 for earthen canals and 0.020 to 0.0225 for canals greater than 100 cfs. An "n" value of 0.0275 should be used to confirm the channel geometry for minimum freeboard and the hydraulic efficiency of check structures.

Side Slopes. The inside canal slopes should be a minimum 2½H:1V, except in lined areas. Inside canal slopes in lined sections will be 3H:1V. A prism liner should be used in embankment fill crossings (e.g. Powell Creek underdrain) and within 500 feet of the transition structures for the St. Mary River and Hall Coulee siphons. The outside slopes should be a minimum of 3H:1V except in high fill areas, where the minimum slopes will be established on the basis of future geotechnical design information and recommendations.

Freeboard. Minimum freeboard shall be 0.375 times the design water depth (in feet) plus 8 inches. Final freeboard must consider storm water inflows; flood routing and transient flow conditions and must be determined during final design.

Width of Bank Tops. The downstream bank (O&M road) top will be 16 feet wide and provided with sufficient gravel surfacing. The O&M road will be an all-weather road. Sufficient number and spacing of vehicle pullouts for parking and unloading of maintenance equipment will be provided. For the two-bank canal, the proposed width of the upstream bank (emergency road) top is 12 feet with minimal gravel surfacing.

Bend Curvatures. A minimum radius of curvature of five times the design water surface width at the normal full supply level (FSL) will be used at all bends. Whenever these criteria cannot be met, additional protection of the outside bank will be considered.

Gravel Armor. Any area of the canal recommended to be lined with a plastic membrane lining for seepage control, a 12-inch gravel armor cover will be provided for the entire cross-section. All unlined areas of the canal will be provided with 8 inches of gravel armor erosion protection on the canal inside slopes. Gravel armor will extend up to the design freeboard level.

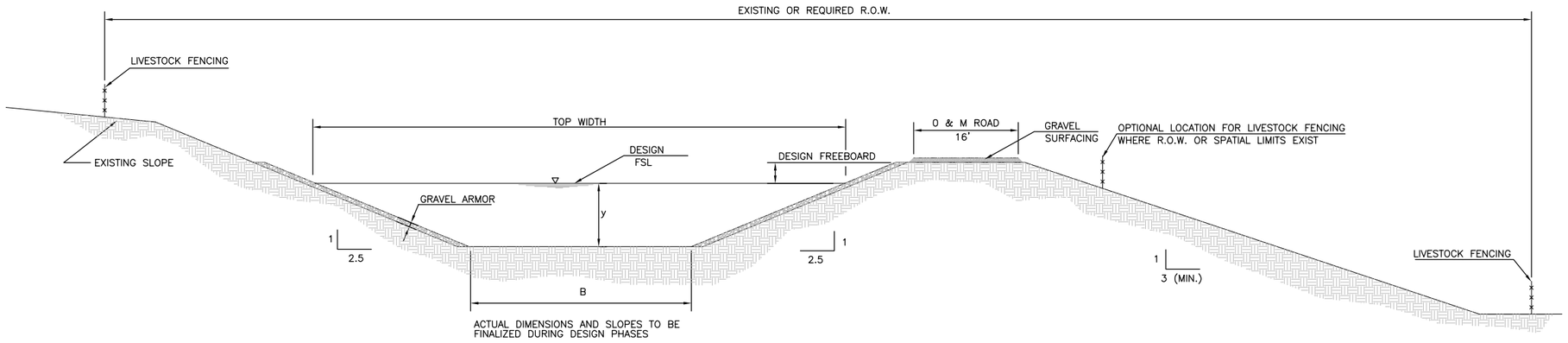
Depth to Width Ratio. A design range for the depth to width ratio is 3 to 5. Higher ratios may be required during final design where spatial constraints occur.

Grass Seeding and Landscaping. The outside slopes of embankments and the areas within the canal right-of-way will be spread with topsoil (depending on availability), graded and seeded to

reestablish native grasses. All haul roads and any disturbed areas within construction easements will be stripped before the start of haulage operations, scarified and spread with topsoil after use and reclaimed by grading and cultivating and/or seeding to grass. Control of noxious weeds will be enforced.

Fencing. The entire canal should be fenced with four-strand, wildlife friendly, barbed-wire fence along the new right-of-way boundaries. Cattle guard crossings would be provided at all road crossings. Access control gates will be provided where required. Temporary fencing will be provided during construction, if necessary.

Typical canal prisms are shown on Figure 4.2.

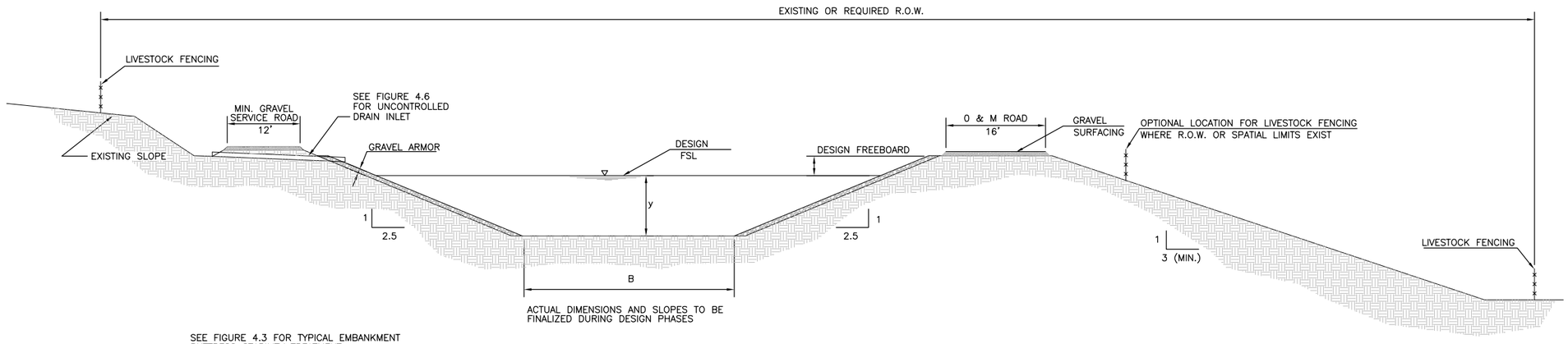


SEE FIGURE 4.3 FOR TYPICAL EMBANKMENT
BUTTRESS STABILITY TREATMENT

ONE - BANK CANAL WITH ARMORING

TYPICAL (N.T.S.)

PRELIMINARY DESIGN CRITERIA	
DESIGN DISCHARGE	650 TO 1000 cfs
FLOW VELOCITY	1.5 TO 2.5 fps
GRADIENT	0.0001 TO 0.0002 ft/ft
MANNING'S ROUGHNESS	0.020 TO 0.025
INSIDE SIDE SLOPES	2.5:1 (MAX.)
OUTSIDE SIDE SLOPES	3:1 (MAX.)
ARMOR THICKNESS	6" TO 8"
B TO Y RATIO	3 TO 5
FREEBOARD	0.375y + 0.67
MIN. CURVATURE	5x TOP WIDTH



SEE FIGURE 4.3 FOR TYPICAL EMBANKMENT
BUTTRESS STABILITY TREATMENT

TWO - BANK CANAL WITH ARMORING

TYPICAL (N.T.S.)

FIGURE 4.2

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PRELIMINARY ENGINEERING REPORT
TYPICAL CANAL SECTIONS

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4.3.5 Bank Instabilities

The existing St. Mary Canal is plagued with both embankment fill and backslope stability issues downstream from Spider Lake. The USBR has identified at least 15 areas of instability that currently impact or have the potential to impact the facilities. Failures of the backslope tend to close off the canal prism and reduce capacity. Instability of embankment fill sections tends to increase seepage and increase the potential for catastrophic bank failure. The known instabilities and their locations are listed in Table 4.3 and are shown on Figure 4.1

Table 4.3 Summary of Slope Instabilities Identified by USBR

Slide Name (USBR)	Approximate Station	Location
DeWolfe Ranch Slide	650+00	Backslope
DeWolfe Bridge Slide	675+00	Backslope
Mid Section 22 Slide	690+00	Backslope
East Section 22 Slide	710+00	Backslope
Grizzly Slide	735+00	Backslope
Big (Deep) Cut Slide	765+00 to 780+00	Cut Slopes, Both Sides
4th of July Slide	870+00	Embankment Fill
Hall Coulee Slide Complex	910+00 to 935+00	Backslope
Gravel Road Bridge Slide	980+00	Embankment Fill
Martin Slide	1025+00 to 1035+00	Cut Slopes, Both Sides
Pipeline Slide	1125+00	Backslope
Drop No. 2 Slide	1500+00	Reservoir Slope
Drop No. 5 Slide	1529+00	Backslope

The USBR maintains a Landslide Register for all landslide and embankment instabilities impacting USBR projects. For the St. Mary Diversion Facilities, only one slide was listed in the Register prior to 1995. This slide, known as the St. Mary Canal Slide, was a long area extending from approximately Sta. 650+00 to 800+00. No specific slides were delineated. In 1995, this area was replaced with discrete individual slides identified by a local landmark and approximate canal stationing.

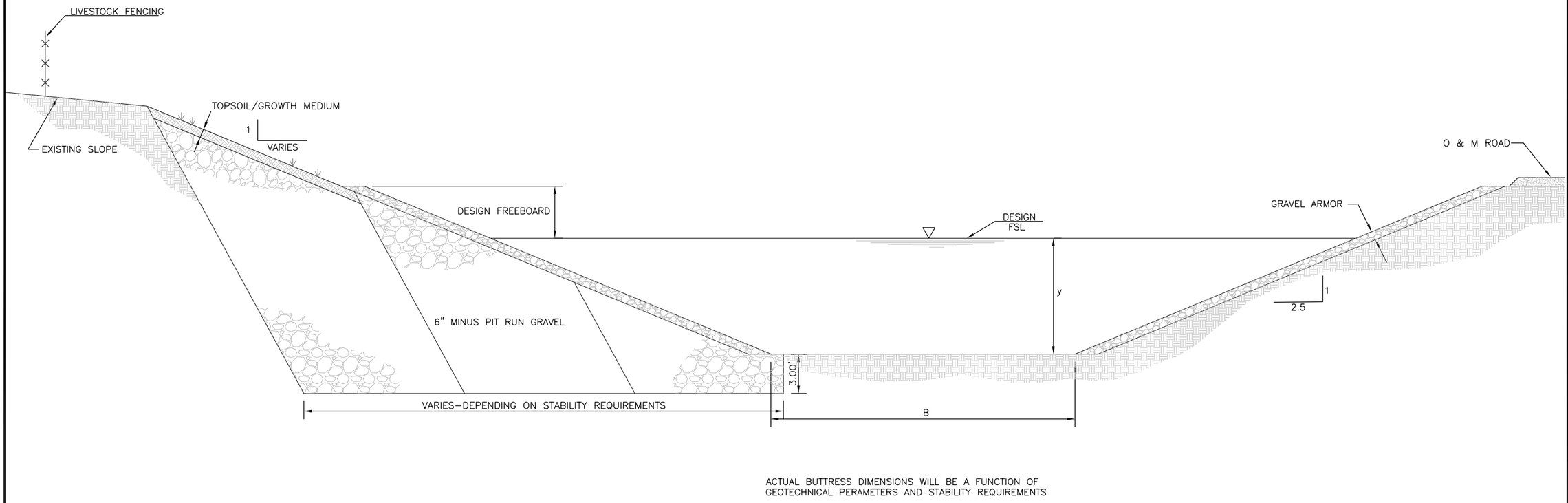
In 1995, heavy precipitation triggered many of the former slides. In 1996, two new slides were added to the Register along with the St. Mary River Siphon instabilities. An additional slide was included in the Register in 1997. In 2002, three more slides were added. USBR geologists conduct annual inspections to observe the known slides. In the last three to four years, little significant landslide activity has been observed although periodic maintenance is required to maintain canal capacity in these areas. To our knowledge, subsurface soils information does not exist for the identified landslides downstream of the St. Mary River Siphon. The impact of the existing instabilities on a rehabilitated canal section is the greatest monetary unknown influencing realignment issues, treatment options and construction uncertainties.

The down slope embankment failures are most likely related to inadequate surface preparation, insufficient material compaction and excessive fill slope angles. These inherent deficiencies are compounded by seepage from the canal. Backslope failures are most likely related to the soil comprising the cut section and shear strength softening that occurs due to saturation. During wet years, increased soil moistures and groundwater flows increase instabilities and movement. Removing the sloughed material increases instability as does rapid drawdown conditions experienced within the canal prism during dewatering.

Based on our limited field observations, most of the instabilities can be mitigated during canal rehabilitation. Flatter fill and cut slopes will increase stability. Lined canal sections in large fills should be considered to enhance long-term stability of these embankments. For more complex instabilities, a gravel gravity toe buttress is typically employed. A typical toe buttress detail is shown on Figure 4.3. Actual details of instability mitigation can only be developed during final design.

USBR considered construction of an 84-foot high, earthen dam just east of Spider Lake as a means of avoiding the landslides along the existing canal by using a pass-through reservoir. As such, the reservoir could not provide any potential storage with respect to the St. Mary facilities. Potential, non-project benefits include recreation and fisheries at the reservoir. This concept was originally conceived in 1912 during the construction of the canal.

An appraisal level design and cost estimate for this proposal was developed by USBR. The appraisal-level proposal did not assess the magnitude of year-round seepage or evaporative losses. The estimated cost for Spider Lake Dam was $9,600,000 in 2001, with a projected annual Operation, Maintenance and Inspection (OM&I) cost of $5,000. The proposed Spider Lake Dam did not appear cost effective as a slope stability mitigation measure and was not included in the final feasibility cost estimate prepared by USBR for the *North Central Regional Feasibility Study* (USBR, 2004).



ACTUAL BUTTRESS DIMENSIONS WILL BE A FUNCTION OF
GEOTECHNICAL PERAMETERS AND STABILITY REQUIREMENTS

EMBANKMENT BUTTRESS STABILITY TREATMENT

TYPICAL (N.T.S.)

FIGURE 4.3

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PRELIMINARY ENGINEERING REPORT
TYPICAL BUTTRESS STABILITY TREATMENT

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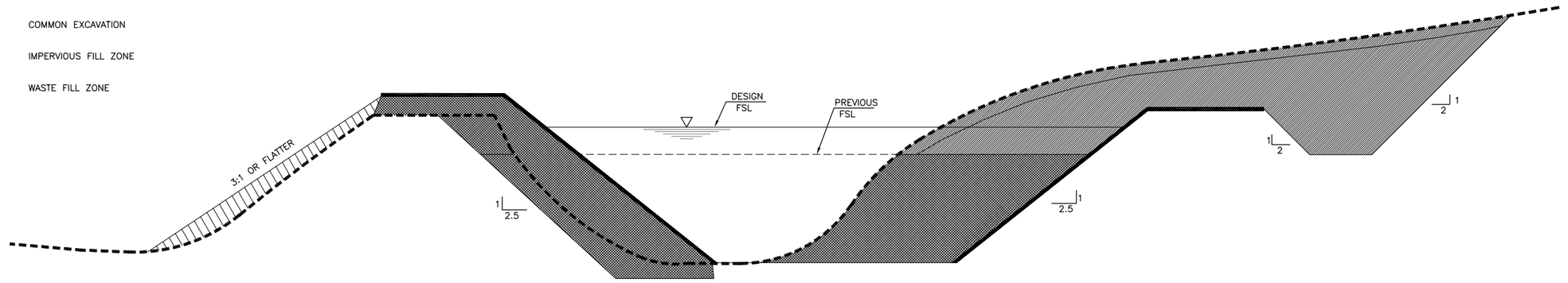
4.3.6 Earthwork Considerations

Rehabilitating an existing canal without disruption of water deliveries during the irrigation seasons poses limitations and difficulties. First, the earthwork must be performed in the wintertime when freezing temperatures and snowfall hinder excavation and compaction. Secondly, the soils adjacent to the canal have elevated moisture contents that make them unsuitable for reuse as embankment fill. As a result, this wet soil is typically placed and wasted outside of the new embankment fill zone. This material could also be used to fill the existing canal where significant realignment results in the former canal alignment being abandoned. Figure 4.4 shows the typical earthwork zones for various canal prisms. As can be seen, for slight centerline shifts with canal widening, considerable unsuitable wet excavation will be generated. A shortage of useable common excavation for embankment construction also results.

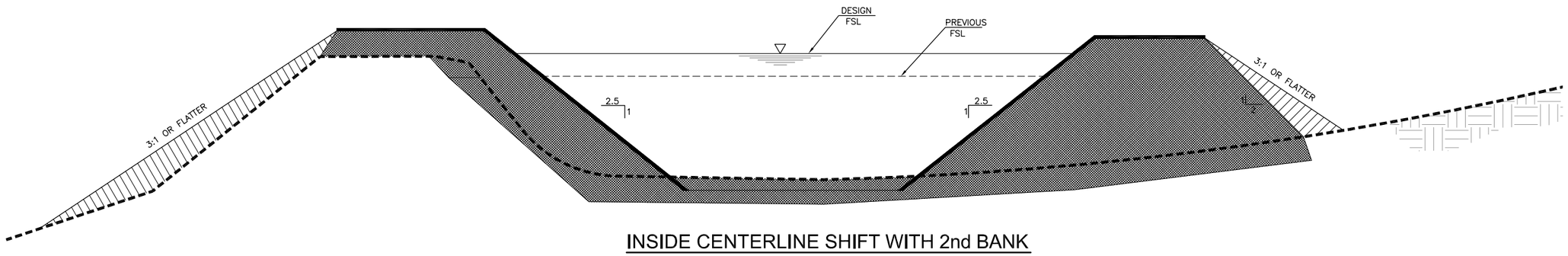
Significant canal shifting and/or realignment, where possible, will result in additional topsoil for reclamation and useable common excavation for the new prism. Figure 4.5 shows a typical example where proposed canal realignment can be made that both shortens the overall canal length and facilitates the earthwork phase. Also, the abandoned canal provides a place to waste unusable excavation. The original canal was constructed mainly by using horse-drawn fresnos. This limitation resulted in a one-bank, contour canal that minimized the required excavation. With today's equipment, considerable realignments can be made to improve canal efficiency, shorten the canal lengths while facilitating the earthwork phase and lowering construction costs.

LEGEND

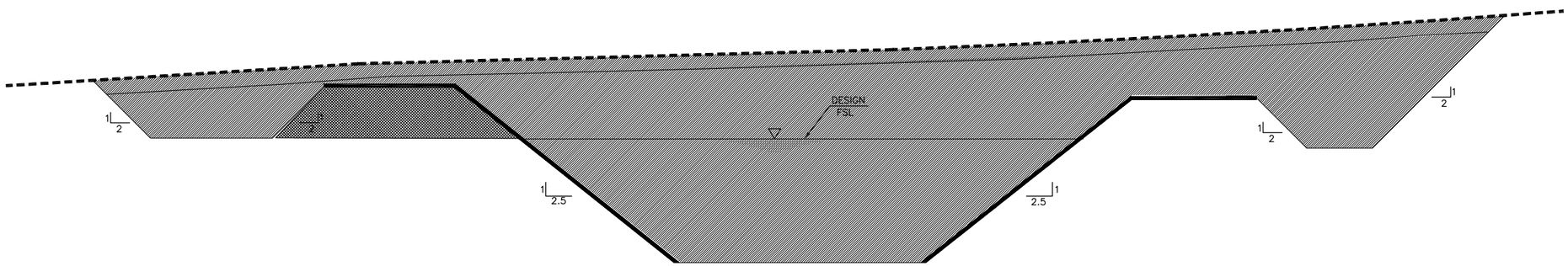
- ROAD SURFACE
- EXISTING SURFACE
- GRAVEL ARMOR
- TOPSOIL STRIPPING
- WET EXCAVATION
- COMMON EXCAVATION
- IMPERVIOUS FILL ZONE
- WASTE FILL ZONE



INSIDE CENTERLINE SHIFT



INSIDE CENTERLINE SHIFT WITH 2nd BANK



NEW ALIGNMENT IN VIRGIN GROUND

FIGURE 4.4

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PRELIMINARY ENGINEERING REPORT
TYPICAL EARTHWORK ZONES FOR CANAL REHABILITATION

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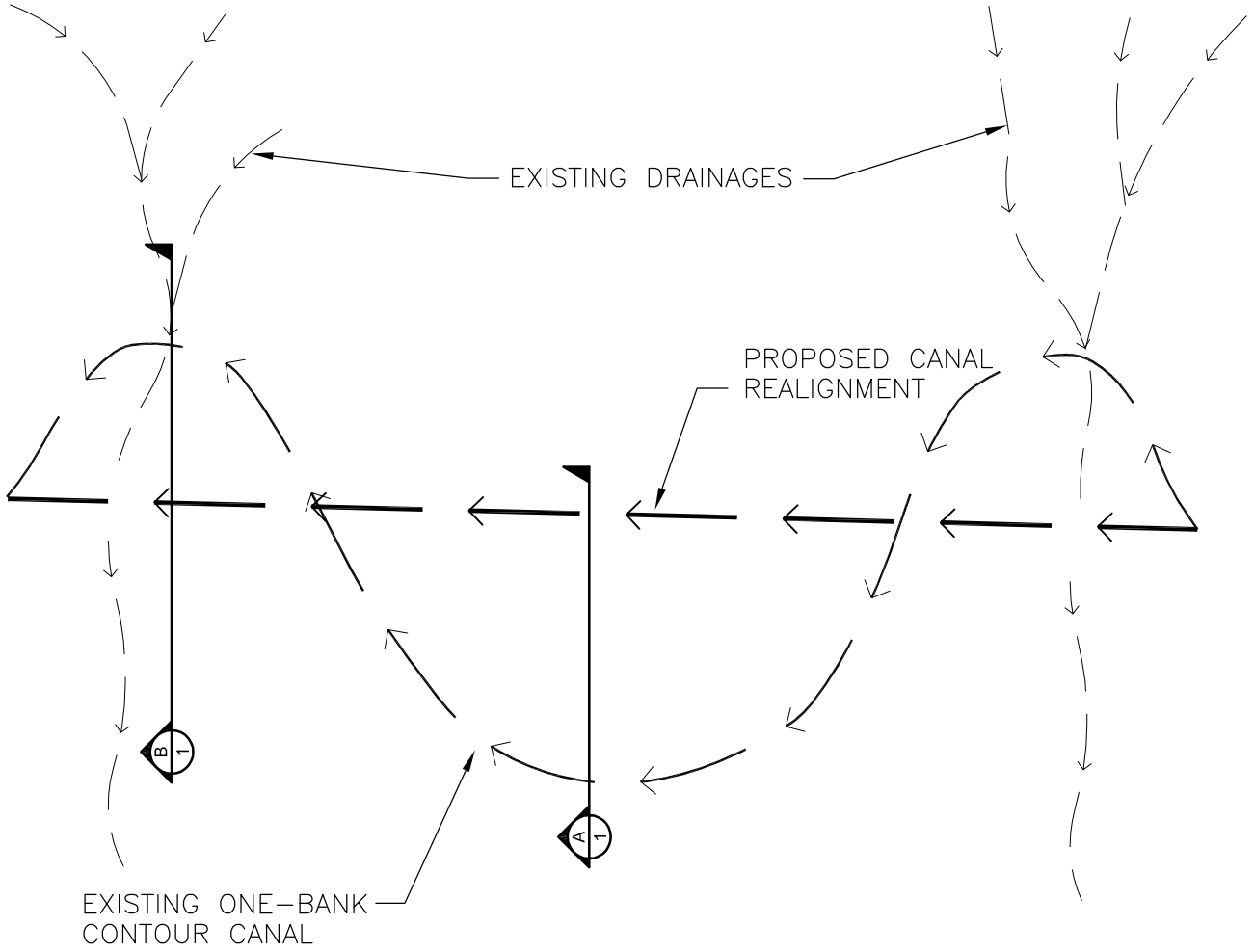
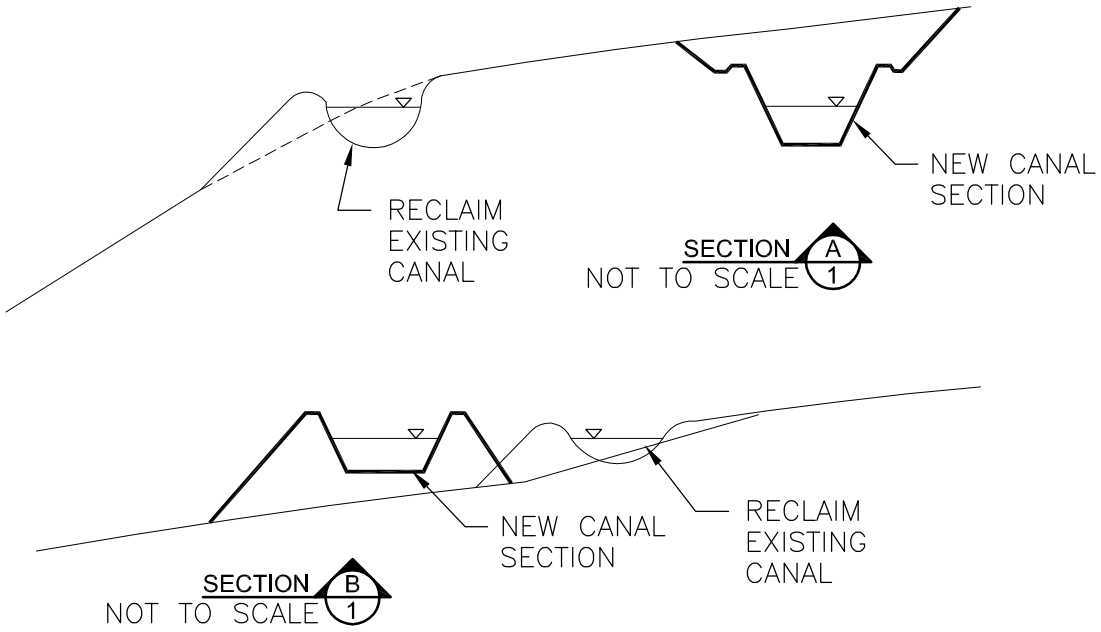


TYPICAL CANAL REALIGNMENT - PLAN VIEW



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TYPICAL REALIGNMENT FOR CANAL REHABILITATION

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FIGURE 4.5

4.3.7 Drain Inlets

For a two-bank canal, drain inlets are required to allow storm runoff to enter the canal as inflows. Depending on the site topography, the design inverts for these structures may be above or below the canal FSL, and will therefore require a specific type of structure; either uncontrolled or controlled. The type and design requirements of a particular drainage structure are dependent on its location (above or below FSL), function, and discharge capacity. Drain inlets are normally sized to accommodate flows from the 25-year summer peak event. The inverts of all above FSL drainage inlets shall be kept a minimum of 8-inches above the design canal FSL.

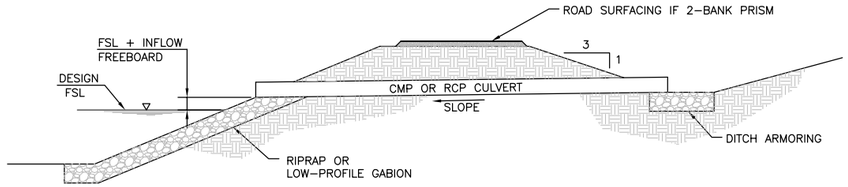
The low lying, upslope pond inundation areas, where practical, will be maintained as is, in order to preserve existing habitat. Portions of these pond areas may be considered for placement of waste material from canal rehabilitation excavations. Installation of gated drainage inlets (inlet below canal FSL) will be limited to where local situations require this type of structure. Appropriate protective works will be provided at the drainage inlets to prevent erosion damage to canal bottom banks.

Figure 4.6 shows typical examples of both uncontrolled and controlled drain inlets. As mentioned above, controlled drain inlets can be used to create pond inundation areas to enhance wildlife habitat. They are typically located in existing drainage swales. The current canal floods or ponds numerous upland low areas but these areas drain when the canal is dewatered. The controlled inlets allow the ponded area to remain into the winter thus are more favorable to wildlife as suitable replacement habitat.

4.3.8 Underdrains/Cross Drains

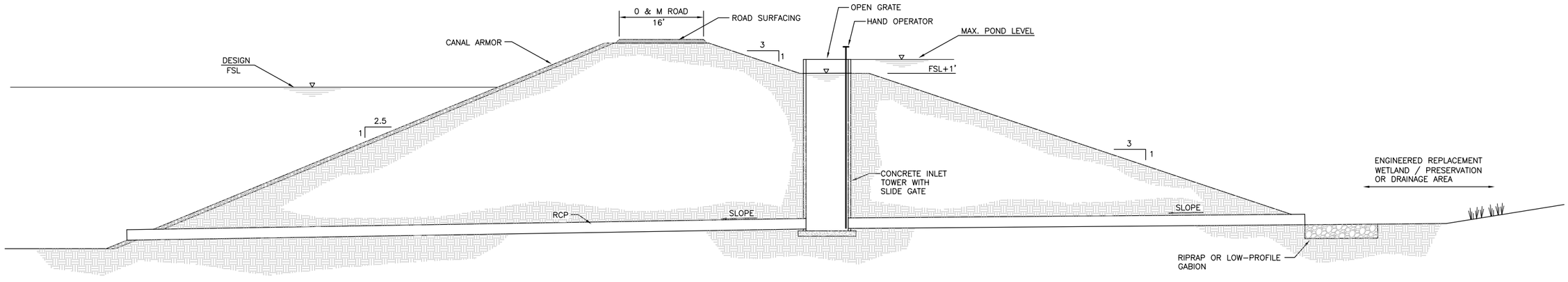
An underdrain or cross drain structure is used to convey runoff water under the canal. Cast-in-place concrete (inlet and outlet/terminal structures) and a precast concrete conduit are normally required due to corrosivity issues and desired design life.

The underdrain structure is usually sized to handle peak flows during the 25-year annual flood. However, its performance during the 100-year annual flood is normally also assessed to verify that the integrity of the canal embankment and structure are not compromised, and that excessive



UNCONTROLLED DRAIN INLET

TYPICAL (N.T.S.)



CONTROLLED DRAIN INLET WITH OVERFLOW

TYPICAL (N.T.S.)

FIGURE 4.6

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PRELIMINARY ENGINEERING REPORT
TYPICAL DRAIN INLET SECTIONS

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backwater effects are not occurring. A minimum inside pipe diameter of 42-inches is preferred to permit periodic inspection.

In addition, measures to prevent seepage and piping should be provided since failure of the embankment would result in loss of the canal and flood damage. Where the pipe crosses below the canal bed, a minimum cover of 2-feet of impervious backfill is preferred, and the use of a membrane liner and gravel armor within the canal should be considered to reduce seepage and scour. Furthermore, the pipe joints should be wrapped with geotextile fabric as an added measure against piping. The USBR recommends the use of soil-cement as bedding. Actual details will be developed during the design phase.

There are currently seven underdrains along the St. Mary Canal. Their locations and specific details are listed in Table 4.4 below. The table also provides the 25-yr, 24-hr peak discharge and proposed replacement structure at each existing underdrain location. Due to the corrosive soils encomposing the majority of the project (TD&H, 2006a) and the desired design life, reinforced precast concrete (RCP) pipe will be used for all underdrains. Final sizes and lengths will be determined in the design phase in conjunction with the storm water inflow routing analyses.

Table 4.4 Existing and Proposed St. Mary Canal Underdrains.

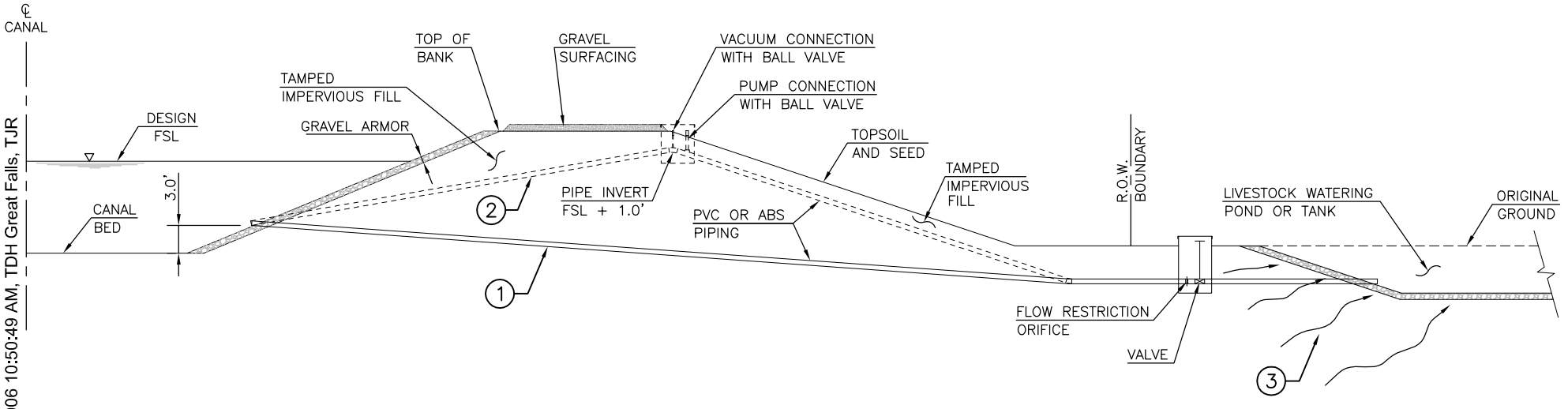
Station/Locations	Existing Underlain Structure	25yr – 24hr Peak Discharge (cfs)[(1)]	Proposed Replacement
Powell Creek	Two 66" Φ RCP Pipes	400	In-Kind
794+46	180 LF - 4.5' x 5.5' Conc. Box	800	Two 72" Φ RCP
978+61	143 LF – 30" Φ RCP Pipe	385	48" Φ RCP
1051+71	140 LF – 30" Φ RCP Pipe	230	48" Φ RCP
1093+94	168 LF – 30" Φ RCP Pipe	200	48" Φ RCP
1132+35	143 LF – 30" Φ RCP Pipe	160	42" Φ RCP
1195+65	157 LF – 30" Φ RCP Pipe	105	42" Φ RCP

(1) From TDH, 2006b

4.3.9 Turnouts

Turnout structures are used to deliver canal water from the main canal to a water user via a lateral canal, pipeline, or pump well. Currently there are no existing or proposed irrigation turnouts. For the St. Mary Canal, existing turnouts are used to provide drainage during canal dewatering and maintenance. There are currently eight drain turnouts on the canal (USBR, 2003). The USBR maintenance crew has expressed a desire for more drain turnouts to facilitate their maintenance activities. Such devices typically consist of RCP conduit with an upstream cast iron slide gate and both inlet and outlet erosion control structures. The drain turnout is located at the bottom of the canal bed. We have assumed 18 drain turnouts will be installed, three per each of the six proposed canal rehabilitated reaches.

Turnouts can also be used to supply canal water for livestock watering. These turnouts are typically smaller in diameter and located above the canal bed. Direct discharge or siphon style livestock turnouts are typically used. Another option available is to provide livestock watering dugouts adjacent to the canal that is supplied by seepage losses from the adjacent canal. Examples of livestock watering alternatives are shown on Figure 4.7



TURNOUT ALTERNATIVES

1. GRAVITY OPTION
2. VACUUM SIPHON OPTION
3. SEEPAGE COLLECTION OPTION

NOTE:

1. AT THE INLET END, CONSIDER NEED FOR A VORTEX BREAKER

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LIVESTOCK WATERING ALTERNATIVES

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FIGURE 4.7

4.3.10 Cost Estimating

The USBR completed an appraisal level study in 2001 to rehabilitate the Diversion Facilities. That cost was $90,000,000. Additional studies began that same year to further refine costs and to establish costs for rehabilitated capacities ranging from 500 cfs to 1,000 cfs. This work was completed in 2003 and cost estimates ranged from $72,000,000 to $98,000,000 (USBR, 2003). The USBR considers these estimates to be feasibility level. In 2005, TD&H reviewed the USBR's work at the request of Montana DNRC. TD&H (TD&H, 2005) made adjustments to the USBR's 2003 costs that included the following:

- Additional costs for instrumentation, remote control capabilities, and facility automation.
- Indexing of costs to a 2007 reference time
- Included costs to cover Tribal and TERO fees; 5% of total construction costs.

The adjusted project costs determined by TD&H were $120,000,000 and $125,000,000 for canal capacities of 850 and 1,000 cfs, respectively.

More detailed designs and realistic cost estimates are possible as each study and design phase progresses towards final design. Although several unknowns have been addressed, many data gaps, which have influence on the cost estimates, still exist. These include, in part, the following:

- The desired diversion rate and the desired canal discharge to the North Fork of the Milk River.
- ROW issues, land acquisition availability, and related costs.
- Sufficient topographical data beyond the existing canal prism.
- Final geotechnical recommendations for the replacement siphons at both the St. Mary River and Hall Coulee crossings, and
- Geotechnical information with respect to the numerous instabilities along the canal prism.

The cost estimates in this report reflect feasibility-level estimates based on the information available. They represent an improvement over the previous appraisal-level and feasibility-level cost estimates.

To provide consistency with cost estimating practices employed by the USBR, we have been requested to follow their approach by using 8% for mobilization, 10% for unlisted items, 25% for contingencies, and 37% for non-contract costs. We have added 5% for Blackfeet Tribal fees for work being performed within the Blackfeet Reservation.

The USBR's Cost Estimating Handbook (USBR, 1989) defines unlisted items, contingencies, and non-contract items as follows:

- Unlisted Items – Percentage allowance for additional items of work, which will appear in the final design, required for a fully finished feature (i.e. design contingency).
- Contingencies – Percentage allowance to cover minor differences between actual and estimated quantities, unforeseeable difficulties at the site, possible minor changes in the plans, and other uncertainties (i.e. construction contingency).
- Non-contract Costs – Non-contract activities are usually based on a percentage of the construction cost. Non-contract costs include: planning, investigations, designs and specifications, contract administration, water rights, environmental permits, and rights-of-ways.

The prices in this Feasibility and PER Report reflect 2005 prices. Extrapolation for future costs can be made by cost indexing with an appropriate inflationary factor. In the last year, the construction environment has experienced price increases significantly greater than economic inflation alone can account. Specifically, diesel fuel, steel, concrete, plastics and rubber products all have experienced considerable price increases.

Also, comparisons between repair costs and the costs to replace a given structure should be made cautiously. Actual repair costs can often exceed estimated replacement costs due to unforeseen conditions not fully realized until exposed during construction. Additional contingencies must be planned ahead to account for these potential unknowns. When replacement and repair costs are comparable, it is typically prudent to plan and budget for replacement.

4.4 DIVERSION DAM AND CANAL HEADGATES

4.4.1 Background

Description

The existing diversion dam is a simple sharp-crested, overflow dam with a structural height of approximately 6.5 feet. The total width of the dam is approximately 254 feet. The easterly portion of the dam has an effective crest length of 190 feet. The westerly portion of the dam includes a 6-bay sluiceway with a total width of 56 feet. Four bays contain removable timber stop logs. Two bays of the sluiceway have cable operated timber gates. Portions of a steel truss bridge with timber decking remain which originally provided passage for vehicles and may have been used for access to remove debris from the dam crest. Portions of this bridge have been demolished. The remaining portion has rotted timber decking and is unsafe.

The existing canal headworks facility has eight 5.0 ft. x 5.5 ft. steel slide gates set in a concrete wall approximately 20.7 feet high and 105 feet long. An electric fish barrier has been installed at the gate entrances to prevent fish from entering the canal system. A floating boom has been installed in front of the gate system to deflect floating debris from the canal gates. Some of the gates are bent and inoperable. The facility is in extremely poor condition and is recommended for replacement. Detailed descriptions of the facility can be found in previous reports.

Operating Concerns

The existing facility is difficult to operate and maintain. Floating trees, stumps, and other debris hang up on the dam crest and piers, block the sluiceways, and frequently prevent closure of gates. There is no access or way for operating personnel to reach and remove most of the debris without entering the river channel. Debris removal is a major safety issue and maintenance cost at the structure. A floating boom has been added relatively recently to divert debris past the gates. It is not totally effective because the majority of the water is being taken into the headworks. The primary purpose of the boom was to help control floating debris impacting the on-going studies researching fish entrainment into the canal. The diverted debris collects on the former bridge piers and dam crest.

Four of the dam sluiceway bays have timber stop logs that can only be added or removed by entering the stream. This can only be done during periods of low stream flow when the dam is not in operation. These stop logs cannot be removed during flood situations to help reduce upstream water elevations. The two remaining bays have timber gates that are lowered on a cable from an operator located on a platform above the sluiceways. These two gates can generally be pulled open but cannot be closed if flows are high or when debris blocks the bottom.

Ice can be a problem in the spring when the canal system is started up. Canal gates are partially submerged at all times and tend to freeze shut. The timber gate and stop log guides can collect ice that prevents closure. The ice must be chipped away if the canal is to be opened early in the year.

The effectiveness of the electric fish barrier is not known at this time. The USBR's evaluation is on-going. These types of barriers have not demonstrated an acceptable degree of effectiveness at other facilities.

4.4.2 USBR Alternative

General.

A Value Engineering (VE) study was conducted by USBR in March 2002 for the diversion dam, the headworks, and the fish passage/entrainment issues. The VE Team evaluated various alternatives and options such as moving the diversion dam location and an option for an inflatable dam downstream of the Lower St. Mary Lake outlet. Ultimately, two concept configurations were selected to be evaluated in further detail. Both concepts are similar to the original dam with some significant improvements. Radial gates are utilized in place of the existing timber gates. The stop log sluiceways have been eliminated. A fish passage has been added. A concrete ogee weir crest is utilized in place of the existing sharp edged weir crest. The dam is about 30 feet shorter.

The USBR's Concept 1 considered rehabilitation of the existing dam with the new canal headworks located downstream. Concept 2 considered construction of a new dam and canal

headworks downstream of the existing dam. The existing dam and headworks facility would be removed after completion of the new dam. Design flows of 500, 670, 850 and 1,000 cfs were considered. Concept 2 was recommended by USBR.

Key issues considered in the design are:

- Maintaining canal operation during the construction process.
- Prevention of fish passage into the canal system.
- Provision for fish passage up and down the river while the dam is in operation.

Diversion Dam.

The concept dam included:

- A 30-foot, V-shaped crest for a fish passage on the easterly side of the river.
- A 30-foot wide grouted rock channel would extend from the dam crest to the downstream riverbed on a 3.5% grade to provide a fish passage.
- One hundred seventy feet of fixed concrete weir with an ogee crest from the fish passage channel to the sluiceways.
- Two sluiceways with 10 ft wide x 16 feet high radial gates.
- Total dam width is approximately 220 feet.
- Dam height is approximately 6.5 feet.

The proposed dam crest elevation was 4472.5. This is close to the existing dam crest elevation.

Canal Headworks.

A four-bay sluiceway was recommended for a canal diversion of 850 cfs or greater. A three-bay sluiceway was recommended for a 650 cfs diversion. Each bay would have 10 ft wide x 18 ft high radial gates to control flow. A manually cleaned trash rack is proposed in front of the gates to remove debris. The concrete gate head wall is approximately 45 feet long.

Fish Screens.

A vertically oriented flat plate fish screen was recommended for the canal. The screens are approximately 10 feet high and are fabricated with stainless steel profile wire (wedge wire). The

proposed screen opening is 0.07 inches. This is compatible with NOAA fisheries standards for Bull Trout fry. The total proposed length of the fish screen assembly varied between 280 feet and 330 feet depending on the selected design flow. A traveling brush system was proposed to clean debris from the screen. The screen was oriented angling down the canal in order to accommodate the screen length and provide an adequate sweeping velocity parallel to the face of the screen. Flow guides are required to distribute the flow evenly along the screens. A by-pass flow of 40 to 50 cfs was recommended to flush debris and fish back to the river as needed.

Cost.

The estimated cost of the facility varies depending on the proposed diversion flow. Costs for the dam do not vary with capacity but the costs of the diversion headgates and fish screens do vary with flow. Total estimated project costs for the USBR's Concept No. 2 (recommended alternative) are compared to the 2002 USBR prices adjusted by TD&H (TD&H, 2005) in the Table below:

Table 4.5
Comparison of Construction Costs For the USBR's
Recommended Radial Gate Alternative (Concept No. 2)

Diversion Capacity	Radial Gate Alt. Current Probable Construction Costs	Radial Gate Alt. Adjusted 2002 USBR Estimates(1)
700cfs	$16,500,000	$15,058,600
850 cfs	$17,500,000	$15,947,400
1,000 cfs	$18,500,000	$16,781,200

(1) From TD&H, 2005

These costs include project construction, engineering, administrative costs, and Tribal TERO fees. Cost estimating sheets for each diversion flow are provided in the Appendix. Costs are based on 2005 dollars and reflect current construction prices.

Operational Concerns.

Debris has been a consistent problem at the existing facility. The proposed dam will rely on manual labor and heavy equipment to remove trees, stumps, and other debris that block or partially block the sluiceways or dam crest. The method of access to remove the debris was not

described in the USBR's concept description. The proposed sluiceway bay widths are narrow enough that trees and other large debris will likely be caught and at least partially block the entrances. Current problems with debris removal would most likely continue. The inherent method of flushing debris with underflow radial gates results in a considerable loss of impounded water. An access bridge and/or special equipment will be needed for debris removal although they were not discussed in the USBR's concept proposal.

The trash rack proposed for the front of the canal gates will probably require significant maintenance effort to remove debris. Although a trash rack should prevent fouling of the gates by debris, ice will likely continue to be a problem during start up since the river level will still be above the bottom of the gates.

Canal flood protection is also an item of concern. The canal needs to be protected against water overflowing the radial gates into the canal. Proper selection of gate height is an important design issue. The radial gates will require regular maintenance of the rubber seals on the gate sides and bottoms in order to remain effective.

4.4.3 Adjustable Crest Alternative

General.

The fixed weir dam with radial gate sluiceways proposed by the USBR is similar in concept to the existing dam. The facility consists of a long fixed weir with radial gates that can be opened to drain the dam and restore normal river levels when diversion is not needed. A stable and adequate river elevation is important to the operation of the canal. A long overflow weir is used to maintain a reasonably stable upstream river elevation over the anticipated range of river flows. The river water surface elevation impacts the effective canal hydraulic gradient and the amount of flow into the canal. A stable river elevation helps maintain stable and adequate flow in the canal. Canal headgates can be utilized to regulate canal flow under varying river elevations, but this requires substantially more operating time and effort.

The proposed dam is a definite improvement over the existing facility, but it does not appear to adequately address operating problems with ice, trees, stumps, and other debris. An adjustable crest alternative is evaluated herein to more effectively address these operating issues and determine if there are potential cost savings with this type of facility. This proposed alternative facility will be located downstream of the existing dam similar to the USBR's Concept 2.

A variety of adjustable crest gates are available. These include inflatable rubber gates, Obermeyer gates, and bottom hinged steel gates such as Bascule and Pelican gates. Obermeyer gates are a combination of inflatable rubber gates and hinged steel gates. In general, bottom hinged gates are intended for dam crests and not suitable for mounting in a channel bottom where sand, gravel, and ice can interfere with the hinge assembly and gate operation. Depending on the gate type, trees and other debris may also hang up on the operating mechanisms or damage the gates. Most of these gates will not lay flat on the channel bottom. The inflatable rubber gate or dam is the only option truly suitable for mounting in the channel bottom. Obermeyer gates could be utilized but are more likely to have more problems with ice, sand, gravel, and debris as well as more side leakage and seal maintenance.

Inflatable Rubber Dams.

Inflatable dams combine the functions of a weir and a sluiceway into a single component. As such, they offer some unique advantages for river diversion facilities. They include:

- The dam crest can be automatically adjusted up or down as necessary to maintain a constant upstream water elevation despite changes in river flow.
- A shorter dam can be utilized to pass a wider range of flows.
- The dam combines the function of a crest weir and a sluiceway in one device.
- The dam can be deflated in winter and the original river channel basically restored through the dam. There is less overall impact on the natural stream.
- The rubber dam is flexible and tolerates substantial debris build up without transferring the additional forces to the dam.
- The dam can be lowered if necessary to dump trees, stumps and other debris and then inflated to quickly restore the upstream water level. The opening is wide so that trees cannot hang up. While deflated during the off-season, the flow is over the top so that

stumps and large rocks that may be moving along the river bottom are simply passed over the top. Gravel and rocks won't interfere with inflation of the dam. These types of objects frequently prevent other types of gates from opening or closing.

- Ice will not build up on the dam and prevent its operation. The black color quickly absorbs solar heat to melt ice away. Ice does not adhere strongly to the rubber and is easily shed when the dam is inflated and deflated.
- Rubber dams are very resistant to damage by floating debris such as trees passing over the top.

Rubber crest dams have proven to be very resilient to damage by trees and similar debris. They can be lowered to an essentially flat position that matches the stream channel. Special attachment systems (double clamping line) are required for river applications where the downstream water level can rise above the dam. Typical items of concern for this type of dam include the expected usable life, operating cost, and potential for damage by vandals. These are discussed in more detail below.

Description of Dam Layout

A potential layout for an inflatable rubber dam is shown on Figure 4.8 at the end of this section. The east side of the dam will have a fixed weir entrance to a rock-surfaced fish passage similar to the USBR proposal. A simple concrete stem wall will form a sharp crest for this section (see Figure 4.9). The total length of this crest will be about 54 feet in order to accommodate the fish passage plus a 3:1 slope on the side of the rock-surfaced fish passage channel.

The key component of this alternative is an inflatable rubber dam that will constitute the middle segment of the dam. The inflatable dam permits the crest level to be automatically varied to accommodate changes in flow while maintaining a constant river level above the dam. An automated level sensing system will increase or decrease the dam inflation to maintain constant upstream level. This will make it easier to maintain a constant head at the canal head gates and constant flow through the fish passage during periods of high river flow. Excessively high flows in the fish passage could interfere with fish movements.

Sloped ends rather than vertical ends are recommended for inflatable dams at newly constructed sites in order to facilitate installation. An 80-foot wide bottom segment with 2:1 side slopes on the ends has been selected for this initial analysis (see Figure 4.10). A 20-foot wide segment of the bottom is depressed one additional foot to enhance a deeper low flow channel for fish passage when the dam is deflated. The deeper segment of the dam is located close to the fish passage in order to attract fish toward the bottom of the fish passage channel. The top of the rubber dam is 112 feet in length. The dam does not have to be nearly as long as a fixed crest dam to accommodate the same range of river flows.

The original river channel has been significantly widened at the current dam site to accommodate the length of the existing dam. An initial bottom width of 80 feet was selected for an inflatable dam in order to generally match the natural river channel width both upstream and downstream of the dam. A dam of this width should have less impact on the natural river system.

Hydraulically the dam opening can probably be shortened. A more detailed hydraulic analysis can be made during final design to determine optimum dimensions.

The westerly 10 feet of the dam structure is related to the head gate system and is not involved with river flow. The proposed total width of the dam structure is 186 feet. This is approximately 70 feet shorter than the existing dam and 40 feet shorter than the USBR's Concept 2 dam proposal. The bottom of the dam would be set at about elevation 4464. The crest would ordinarily be set at 4472.5 but an additional adjustment capability to 4473.5 is recommended for operational flexibility. A removable timber flashboard system is recommended at the entrance to the fish passage. Timbers can be added to stop flow over the passage in case the passage needs to be removed from service for maintenance or other reasons during the diversion season.

Canal Head Gate Structure

Debris control and prevention of fish passage into the canal are the two major operating concerns with the canal head works. Debris frequently interferes with the operation of the existing slide gate system. Rather than utilize a manually cleaned trash rack system as described in the USBR's Concept 2 proposal, a less maintenance intensive system is proposed. A guide wall and

debris deflector wall would be constructed in front of the head gate structure. The concrete guide wall would be constructed either parallel or at a very shallow angle to the natural river flow (see Figure 4.11). The top of the wall would create a submerged weir approximately 100 feet in length and be at an approximate elevation of 4469.5. A steel deflector rail system utilizing highway guardrails or similar rails would be attached to the wall so that water flowing to the canal would flow beneath or through the rails and over the top of the concrete wall. The top of the rails would extend slightly above the design high water elevation of 4473.5. The head gate floor elevation would be at an elevation of approximately 4462.5, which matches the canal bottom.

Orienting the debris deflector wall parallel to the river flow will encourage debris to be swept downstream rather than enter the canal. Horizontal deflector rails will be less likely to catch debris than a typical trash rack. Debris that tends to be drawn to the deflector rails by the canal current can be swept down the river by briefly lowering the inflatable dam. The steel deflector system will also skim off floating leaves and debris and direct it toward the dam rather than into the canal. This should help reduce the debris load on the fish screen located in the canal. The concrete deflector wall will deflect sand and gravel carried by the river toward the inflatable rubber dam section and away from the canal headgate. This should minimize sediment deposition problems in the headgate area. The deflector wall will also encourage deeper swimming fish such as Bull Trout toward the middle of the river rather than encourage them to congregate near the canal gates as the current system does.

The deflector wall also acts as a retaining wall. The riverbed is at approximately 4465 while the canal bottom is at 4462.5. The deflector wall separates the canal system from the riverbed. The deflector wall also prevents water from entering the head gate area when river flows are dropped below the top of the deflector wall. A sluice gate in the dam headwall at the downstream end of the area between the head gate wall and the deflector wall will permit the area to be drained. This will eliminate existing problems with ice freezing the gates shut and preventing gate operation during spring start up.

The slide gates will be placed about one foot above the channel bottom so that sediment and any leaking water will not accumulate against the gates. Gates approximately 6.0 ft x 6.0 feet with electric actuators are proposed. The electric actuators permit easier operation of the gates and also allow the gates to be remotely controlled if desired. An automated control system for the inlet gates can be beneficial in preventing downstream flooding of the canal during large storms. Slide gates provide a tight seal against the wall and overtopping of the gates is not a concern as long as the headwall is constructed to the proper elevation. If gate maintenance is required, the river level can be dropped below the primary weir and the water drained from between the gates and the weir. Stop log guides could be constructed on both sides of each gate in order to do maintenance without disruption of service.

The number of gates depends on the amount of flow to be diverted to the canal. If the velocity through the gates is limited to approximately 5 fps, six gates will be needed for a diversion flow of 1,100 cfs. This will provide 1,050 cfs to the canal and 50 cfs for the fish screen by-pass. Five are required for 925 cfs and four are required for 725 cfs. Total head loss across the deflection wall and headgates is initially estimated at 1.6 feet at 1,100 cfs. A river elevation of 4473.3 is needed to drive the canal system based on current assumptions on canal design. Ultimately, a total hydraulic analysis of the canal system is needed to determine the design canal operating depth and river level needed to support the flow.

Fish Screen

Design Parameters. The fish screen design proposed by USBR is based on the assumption that Bull Trout fry must be protected at the canal inlet. Key NOAA fisheries design parameters for fry are:

- Screen opening size for profile bar or wedge wire screens is 0.069 inches.
- Maximum approach velocity normal to the screen is 0.4 fps.
- Maximum exposure time along the screen face is 60 seconds.

Screens are to be designed with a sweeping velocity along the face and a system to return the fish to the river.

The design parameters are based on very small fry being present at the canal intake. Studies on the river suggest that the Bull Trout spawn in the small steams that feed into the Lower St. Mary Lake or into the river. If this is true, fry are not likely to be found in the St. Mary River and the screen design parameters may be overly conservative. This is an important issue, since the fish screen is extremely expensive and the cost is roughly proportionate to the required length of the screen. Further biological review of the size of fish to be protected and the appropriate approach velocity is recommended. Substantial cost savings are possible if the approach velocity and opening size can be increased.

Types of Screens. A variety of static and mechanical screens are available. Static screens include vertical screens, sloped screens, and overflow screens. Fixed screens typically require some form of external screen cleaning device, however, cleaning of overflow screens is designed by the flow of water over the screen. Mechanical self-cleaning screen options include drum screens and belt screens.

USBR has recommended a fixed vertical plate screen with a traveling rotating brush to clean the screen. The screen is located in the canal as shown in Figure 4.8. The screen is oriented at a slight angle to the axis of the canal so that a sweeping velocity is created along the face of the screen to flush debris downstream to a collection point at the end. Fish swimming along the face of the screen are ultimately captured by the flushing system at the end of the screen system and returned to the river downstream of the dam through a pipe. A flushing flow of 40 to 50 cfs was proposed.

The allowable approach velocity and the depth of flow in the canal determine the total length of the fish screen. Fish exposure along the face of the screen is limited to 60 seconds. USBR has proposed the screens be set about one foot above the canal bottom so that the fish may swim in a protected bottom area without being exposed to the flow velocity through the screen. This is a practical approach and a method of avoiding intermediate return points to the river along the face of the screen.

Alternative types of screens were considered. The Washington Department of Fish and Wildlife has their own screen fabrication facility. Personnel from this facility indicated a general preference for drum screens where site conditions and flows are favorable. Drum screens are typically low maintenance and self-cleaning. Large drum screen installations, however, become more costly and maintenance of the rubber seals becomes a more significant maintenance problem. Ice can also adversely effect their operation. Drum screens would be more costly to construct and operate for this installation. They may also have operational restrictions due to ice in the early spring, and as such, are not given further consideration.

Belt screens are particularly applicable for installation with varying upstream water levels. The Washington Department of Fish and Wildlife personnel indicated that belt screens require a lot of maintenance due to the many hinge points. Ice can also adversely effect operation. These installations are typically more costly to construct and operate. They may also have operational restrictions due to ice in the early spring. As such, they are not given further consideration for this application.

An overflow type static screen does not appear adaptable for this installation because of site constraints and the approach velocity to the screen would be difficult to control.

USBR has recommended vertical static screens with an automated brush cleaner that travels along the face of the screen and sweeps it clean. Brush cleaners require significant maintenance and may not be usable during early season operation because they are prone to freezing air temperatures and ice conditions.

An alternative to the vertical fixed screen is a sloped fixed screen that is cleaned by an air burst system. An air burst system has no moving parts except for the compressor that supplies air. This type of system should require less maintenance than a brush system and is less affected by ice and freezing temperatures early in the season. Further investigation into this type of system can be made during final design. A sloped screen face will require greater screen length and as such will likely have additional initial cost. Reduced maintenance and simpler operation, however, may offset the additional cost.

Fish contact time along the face of the screen is limited to 60 seconds. In order to meet this requirement, a one-foot space was proposed beneath the screens to form a channel where the fish may swim unaffected by the flow through the screen. Fish and debris are swept downstream along the face of the screen by the canal current where they are ultimately captured by a structure at the end of the screen and returned to the river through a pipe. The by-pass or flushing flow was estimated at 40 to 50 cfs by USBR.

The vertical screen proposed by USBR is a reasonable selection and suitable for cost estimating at this time. Further evaluation of a sloped screen with an airburst cleaning system is recommended as part of final design. Further biological evaluation of the size of fish to be screened is strongly recommended. The design opening size of 0.07 inches and the approach velocity of 0.4 fps controls the total length and cost of the screen. There is significant potential cost savings if the screen can be shortened and the fish adequately protected.

Operational Concerns.

The adjustable rubber dam and headgate deflector wall offer some significant operating and maintenance advantages with regard to debris removal and elimination of gate operating problems with ice, rocks, stumps, and other debris. While the advantages out weigh the disadvantages there are some potential operational concerns (albeit minor) with rubber dams that require consideration.

One concern is vandalism. What happens if some one shoots a hole in the dam or cuts it? The rubber is very thick. Tests indicate that shotgun blasts from 10 feet away do not penetrate it. A rifle bullet can penetrate the dam, but the rubber tends to close the hole and the leakage rate is typically small and easily overcome by the blower required to operate the facility. Air pressure inside the tube will be less than 4 psi that helps minimize the rate of loss. The hole when located can be repaired while the dam is in service. Knife cuts pose some risk although it takes substantial effort to cut the material. If knife vandalism is considered to be a high risk, a rubber dam with ceramic chips is available for this application. This material is very difficult to cut. Other rubber dam projects in Montana at Dodson, Toston, Rainbow Dam, and Eagle Bend have

not reported major vandalism problems. A hole was shot in the Toston dam, and was not noticed for a while because the leakage rate was small. The hole was easily repaired.

A second concern is life expectancy. The industry has made significant improvements in the life expectancy of these types of dams. Ultraviolet inhibitors are included in the rubber material to reduce deterioration due to the sun. Vulcanized seams and joints are greatly improved. The material is not significantly affected by freeze thaw cycles. While the original dams 40 years ago had fairly short life cycles, there are improved dams that have been in operation for 30 years. The industry projects the dams should have a 40 to 50 year life cycle.

A third concern is operating requirements and costs. A high volume, low-pressure blower is required to inflate the dam and a substantial amount of air is required. Once inflated, only a small amount of air is needed to maintain inflation. Leakage is typically very minimal. Very little power is needed to maintain inflation. An automated system will monitor river level above the dam and automatically adjust the dam inflation to maintain a constant water level. This control system is electronic and will require minimal maintenance effort to insure proper operation although special skills may be required to troubleshoot the system when it does need repair. All automated controls can be overridden by manual operation.

A fourth concern is operation during power outages. The dams typically require very little air to keep them inflated. Power outages are not a problem with maintaining inflation. If the dam must be deflated during an emergency to prevent flooding during a power outage, the systems can be equipped with standby battery power systems adequate to power instrumentation and monitors and, if necessary, automatically operate vent valves to deflate the bag. However, reinflation will require resumption of electrical power. During a sustained power outage, the cleaning mechanism on the fish screens will not operate and debris build-up is possible. If restriction to flow occurs (debris), the pressure head differential across the screens could cause damage. Sensors connected to the rubber dam controls, could be programmed to deflate the dam to avoid this undesirable scenario.

Adjustable Crest Alternative Estimated Costs.

The estimated cost of the facility varies depending on the proposed diversion flow. Construction costs for the dam do not vary with capacity but the costs of the diversion headgates and fish screens do vary with flow. Total estimated project costs for the adjustable crest alternative are shown in the Table below. This Table also lists the estimated cost for the USBR's recommended alternative (Concept No. 2) and the original USBR cost estimates adjusted by TD&H (TD&H, 2005).

Table 4.6 Cost Estimates to Replace the Diversion Dam and Canal Headgates

Diversion Capacity	Radial Gate Alt. Current Cost	Inflatable Crest Alternative	Radial Gate Alt. Adjust 2002 USBR Estimates[(1)]
700 cfs	$16,500,000	$16,500,000	$15,058,600
850 cfs	$17,500,000	$17,000,000	$15,947,400
1000 cfs	$18,500,000	$17,500,000	$16,781,200

(1) From TD&H, 2005

These costs include project construction, engineering, administrative costs, and Tribal TERO fees. Individual cost estimates are included in the Appendix. Costs are based on 2005 dollars and reflect current construction prices.

4.4.4 Recommendations

Based on the results of our studies, it is our recommendation that the adjustable crest diversion dam and enhanced headgate structure be further considered and refined as the preferred alternative. This selection is based on the performance characteristics and superior maintenance advantages this alternative exhibits over the other alternatives considered by both the USBR and TD&H.

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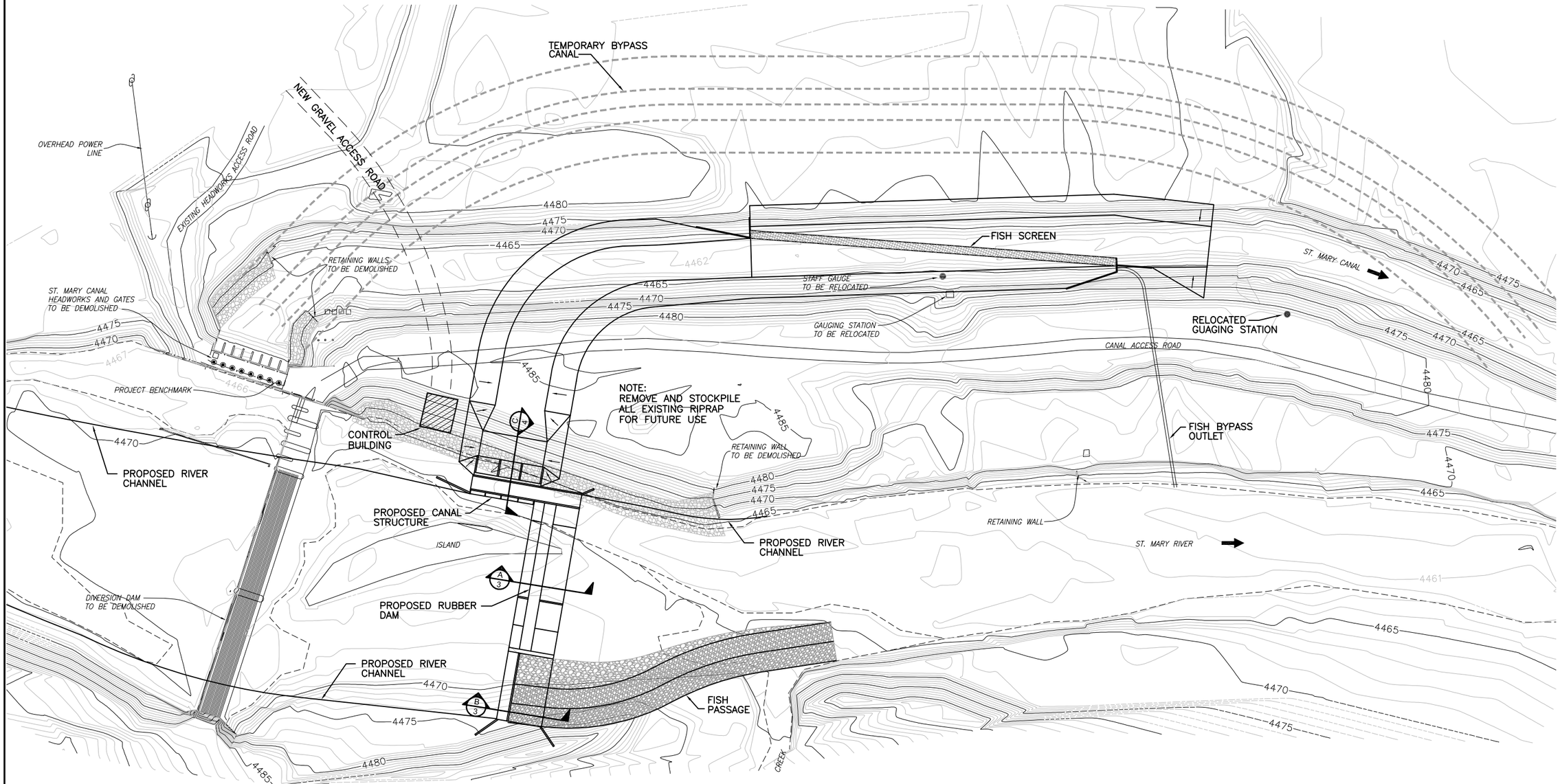

0 40' 80' 120'
SCALE

FIGURE 4.8

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ENGINEERING CONSULTANTS
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TD&H

REVISIONS
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DRAWN BY:	TWC
DESIGNED BY:	GAH
QUALITY CHECK:	
DATE:	01.20.06
JOB NO.	04-167
FIELDBOOK	

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ST. MARY DIVERSION FACILITIES

PRELIMINARY ENGINEERING REPORT
DIVERSION DAM STRUCTURE SITE LAYOUT

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SHEET 1 OF 4

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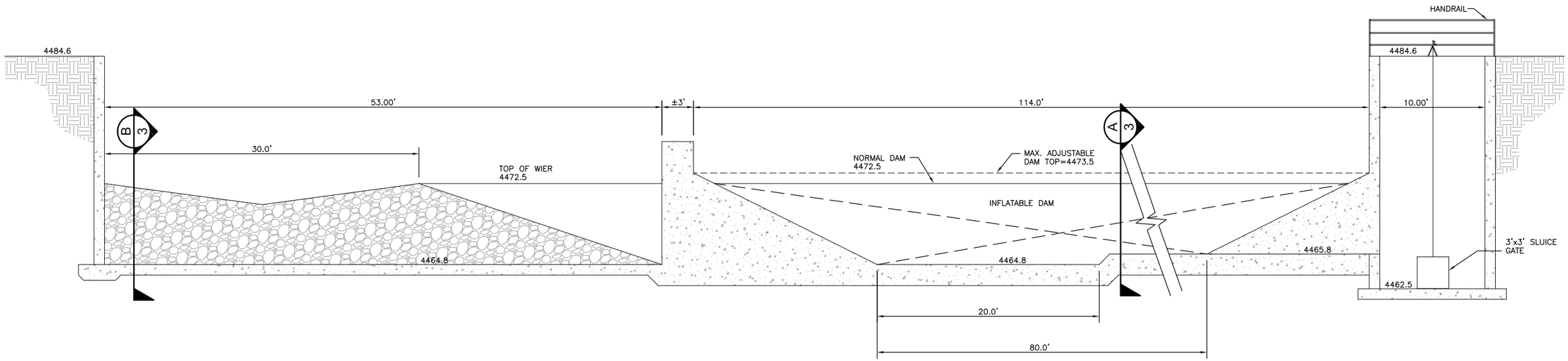

DIVERSION DAM - NORTH ELEVATION

0 5' 10' 15'
SCALE

FIGURE 4.9

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PRELIMINARY ENGINEERING REPORT
DIVERSION DAM STRUCTURE NORTH ELEVATION

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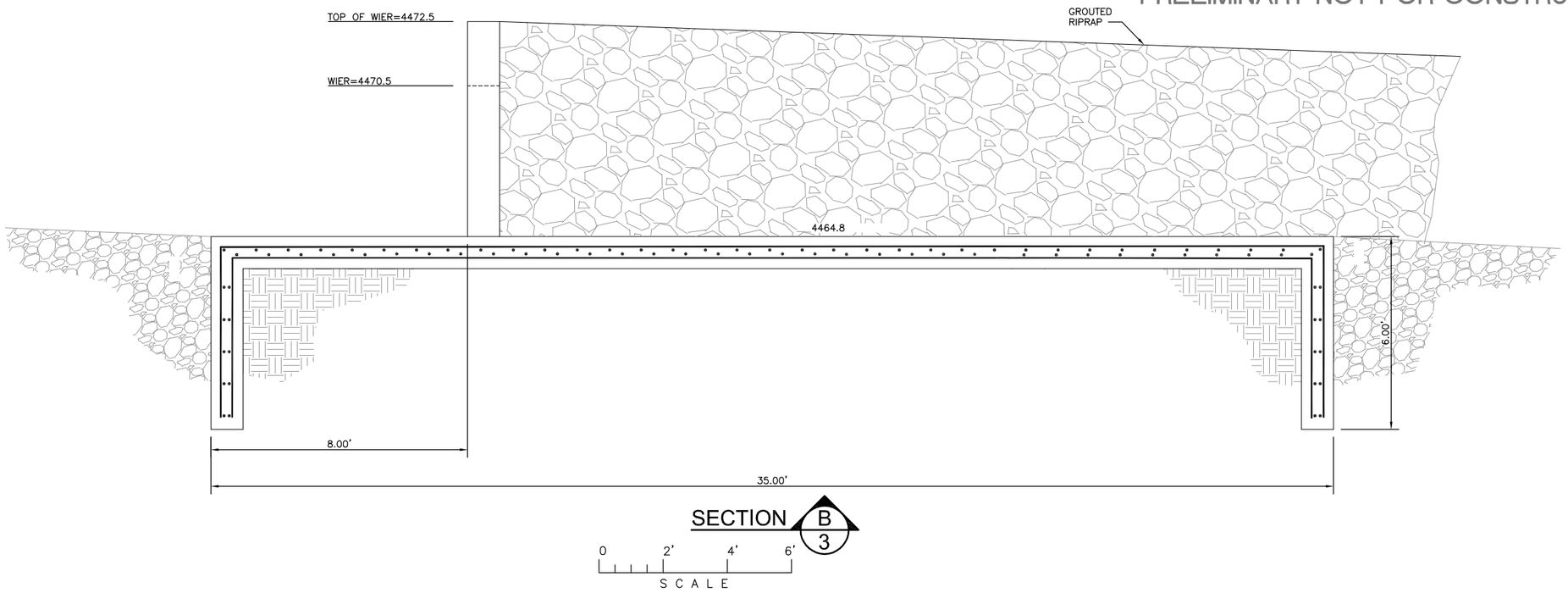
SHEET 2 OF 4

PRELIMINARY NOT FOR CONSTRUCTION



SECTION B 3

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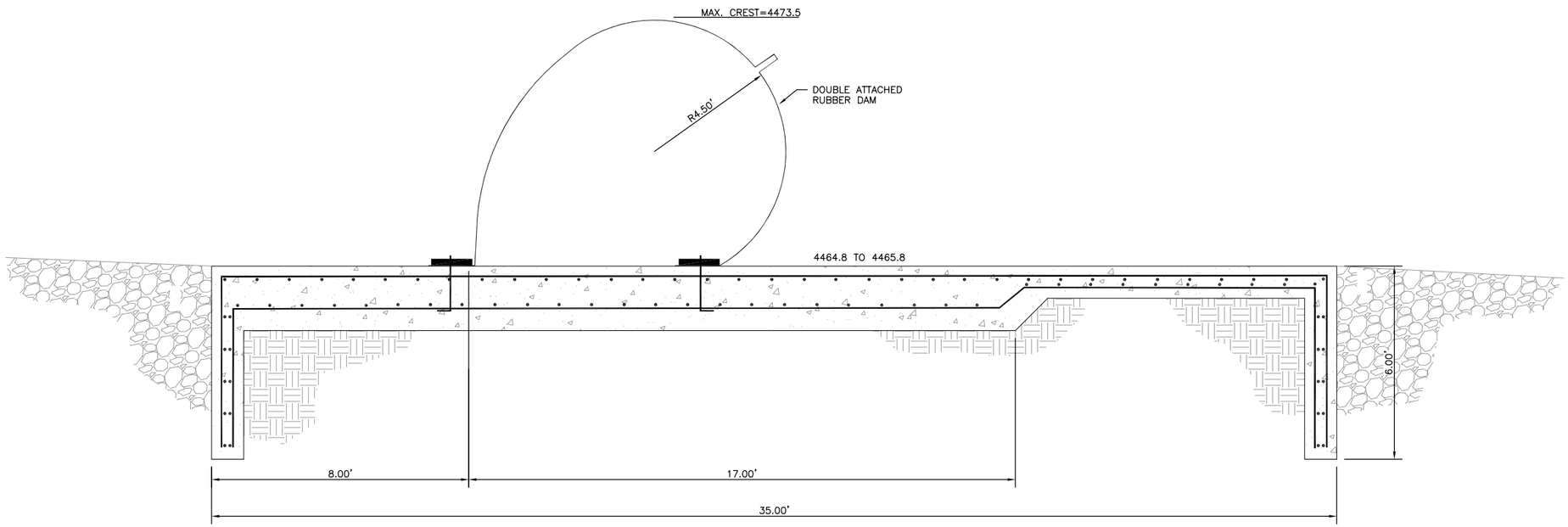

SECTION A 3

0 2' 4' 6'

SCALE

FIGURE 4.10

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PRELIMINARY ENGINEERING REPORT
DIVERSION DAM STRUCTUE SECTIONS

CAD NO. DIVERSION .DWG

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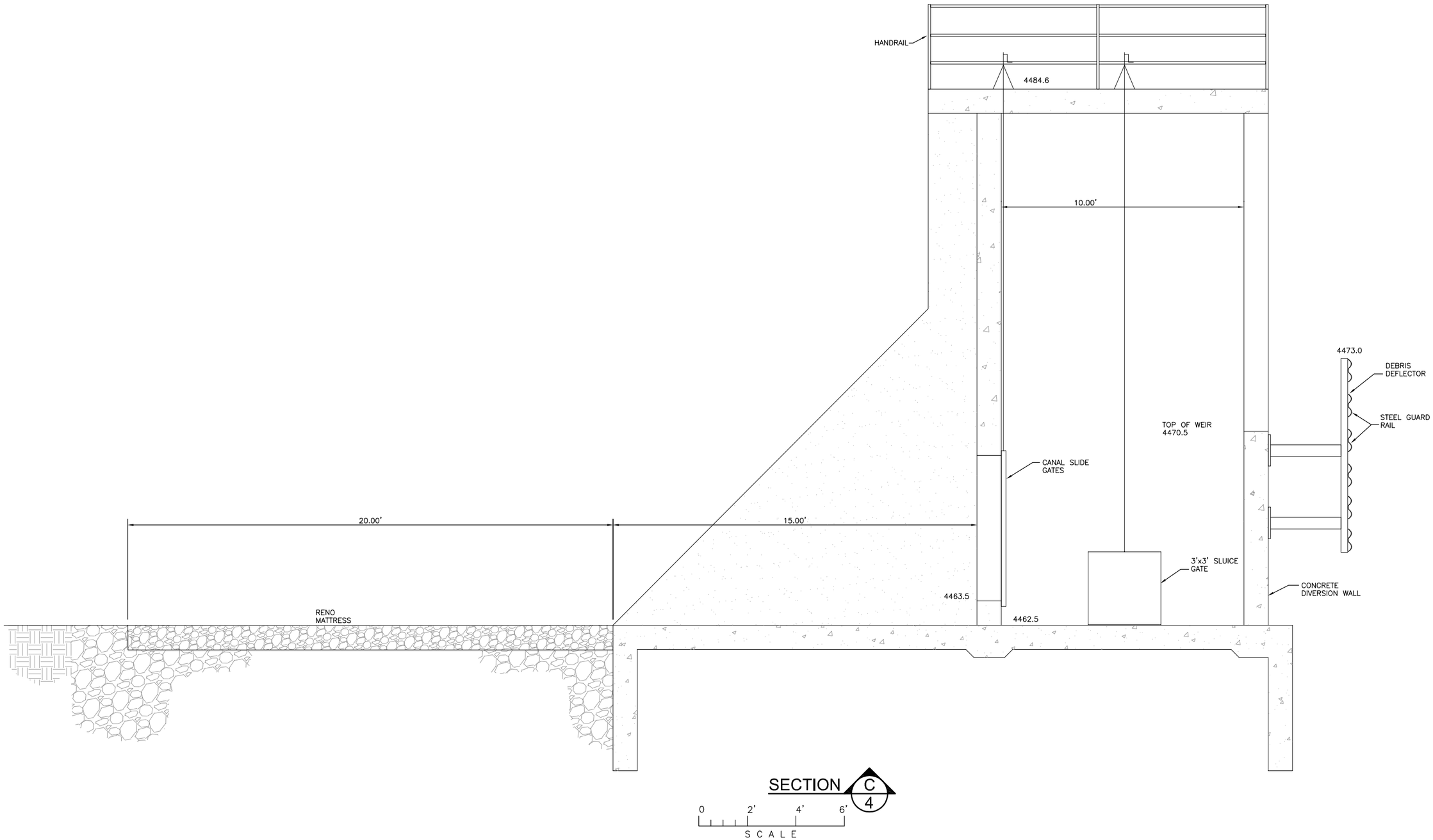

SECTION C/4

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SCALE

FIGURE 4.11

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PRELIMINARY ENGINEERING REPORT
DIVERSION DAM STRUCTURE SECTION

CAD NO. DIVERSION .DWG

SHEET 4 OF 4

4.5 KENNEDY CREEK SIPHON

4.5.1 Existing Structure

Kennedy Creek Siphon is the first of three inverted siphons along the St. Mary Canal. The siphon was designed to convey 850 cfs of canal water a total length of 200 feet under Kennedy Creek to the north side of the creek. The siphon is a cast-in-place, horseshoe shaped pipe that has an approximate area of 78.6 SF. and a design head of 3.02 feet. The siphon has concrete inlet and outlet structures designed to control the water in and out of the siphon. The existing siphon crosses Kennedy Creek atop an active alluvial fan. Numerous armored dikes were built upstream of the siphon crossing to control the propensity for migration during flood flows.

The existing siphon has areas of exposed reinforcement, delaminated concrete, spalls, and cracks. Downstream of the siphon outlet structure, turbulent discharge has eroded the bottom of the canal. The top of the siphon is exposed in Kennedy Creek and has caused a washout on the downstream side of the siphon. If the washout worsens, fish such as the Bull Trout, an threatened species under the Endangered Species Act, that inhabit Kennedy Creek, will have a difficulty passing over the siphon or will not be able to cross the siphon at all.

4.5.2 Siphon Alternatives

Three options were considered and are shown on Figures 4.12 through 4.14. The first option is to repair and/or replace sections of the existing structures. Along with the repairs, an additional siphon pipe could be added for increased canal flow. The second option is to completely remove the existing siphon and replace it with a new low profile box culvert located upstream of the existing siphon. Both inlet and outlet structures will also have to be replaced. The third alternative is similar to the second in that two parallel pipes are used instead of the box culvert. Along with the replacement alternative, the overall length and the depth should increase to enhance passage of Kennedy Creek.

Two additional design considerations were used. First, there is a known loss of around 70 cfs at lower flows in the canal up to the St. Mary Siphon with an increase of loss as flows increase. To maximize the needed flow at St. Mary Siphon an increase of 100 cfs was used in the capacity

design for Kennedy Creek Siphon. Secondly, it is possible to enhance the elevation difference between the inlet and outlet as a result of overall Project improvements due to canal shortening. Siphons are designed on head loss from inlet to outlet. Using the existing elevations there is an allowed head of 2.92 ft. Pipe sizes will decrease as the allowed head increases.

Alternative #1

Use of the existing structure up to 850 cfs allows repairing and/or replacing portions of the siphon as an alternative. Repairs would have to be constructed during the off-season during cold temperatures. Correctly performed crack and concrete repairs can be effective (see Figure 4.14). However, the problem is that the old concrete is subject to deterioration and break down more rapidly. In Kennedy Creek, the downstream area of the siphon will also have to be mitigated to prevent further washouts and allow fish to pass over the siphon.

To increase the flow to 1000 cfs, and still use the existing siphon, an additional 6-foot diameter pipe will be required. The pipe will connect to the existing inlet and outlet structures on the upstream side of the existing siphon. The pipe will angle upstream on the slope then turn and run parallel with the existing siphon (Figure 4.12). Through the creek crossing, it will have a deeper bury.

Alternative #2

The second alternative is to completely replace the siphon with a new double box culvert located directly upstream of the existing siphon (see Figure 4.13). The new double box siphon will be longer than the existing siphon as discussed above. The additional length will allow for a larger buffer between Kennedy Creek and the inlet and outlet structures. The upside in using double box culverts as a siphon is that they have a lower profile than the original pipe. With the lower profile, less excavation is needed due to a shallower bury than that of pipe. The downside in a double box culvert is that the joints are not as watertight relative to the replacement pipe alternative discussed below. Grout and crack/joint sealant will have to be applied to each internal joint after installation. Leaking is bound to accrue and periodic inspections and repairs of the joints would be required.

Alternative #3

The third alternative is similar to that of the second with the only difference being that parallel pipe will be used instead of the double box siphon. The upside in using parallel pipes, unlike the double box siphon, is that the pipes have sealing joints and require no maintenance. The downside for parallel pipes is they will have to be buried deeper than a box type conduit to allow more clearance for Kennedy Creek.

4.5.3 Estimated Costs

The estimated cost of the facility varies depending on the proposed diversion flow. Costs for the inlet and outlet structure do not vary greatly but the cost of the siphon conduit does vary with flow. Pipe sizes will decrease as the allowed head difference increases. If the canal is rehabilitated to allow a larger head difference across the siphon, pipe sizes will decrease and so will the cost. These variations can be checked and adjusted during final design. Total estimated project costs for the three flow alternatives are as follows

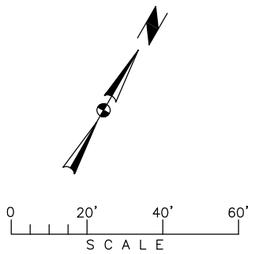
Table 4.7 Cost Estimates to Rehabilitate and Replace Kennedy Creek Siphon

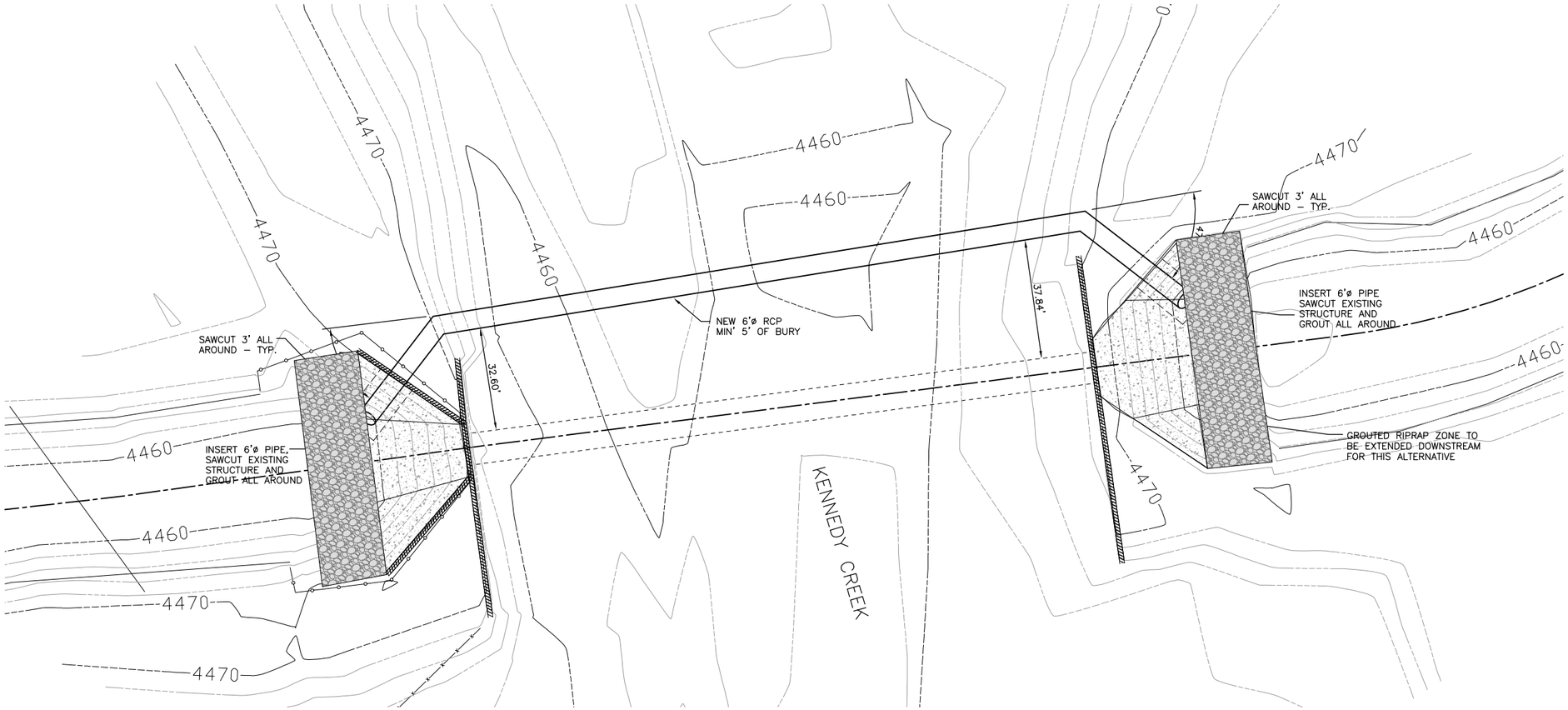
Canal Capacity	Repair Existing With Modification	Replacement With Box Culvert	Replacement With Dual Pipes
700 cfs	$1,100,000	$2,300,000	$2,300,000
850 cfs	$1,100,000	$2,400,000	$2,400,000
1000 cfs	$1,900,000	$2,500,000	$2,500,000

4.5.4 Recommendations

The estimated costs for each alternative are comparable for each design capacity. For canal capacities up to 850 cfs, we recommend that siphon rehabilitation be given further consideration during final design. For canal flows exceeding 850 cfs, we recommend replacement of the siphon with dual RCP conduit and extending the distance between the inlet and outlet to enhance passage of Kennedy Creek.

PRELIMINARY NOT FOR CONSTRUCTION





ADDITIONAL NEW 6'Ø RCP W/EXISTING SIPHON

FIGURE 4.12

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WASHINGTON
IDAHO
SPOKANE
LEWISTON

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REVISIONS

BY	DATE	DESCR
BY	DATE	DESCR
BY	DATE	DESCR

DRAWN BY:	TWC
DESIGNED BY:	EAJ
QUALITY CHECK:	
DATE:	1/06
JOB NO.	04-167
FIELDBOOK	

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PRELIMINARY ENGINEERING REPORT
KENNEDY CREEK SIPHON CROSSING - MODIFIED ALTERNATE LAYOUT

CAD NO. SIPHONPROFILE.DWG

SHEET 1 OF 3

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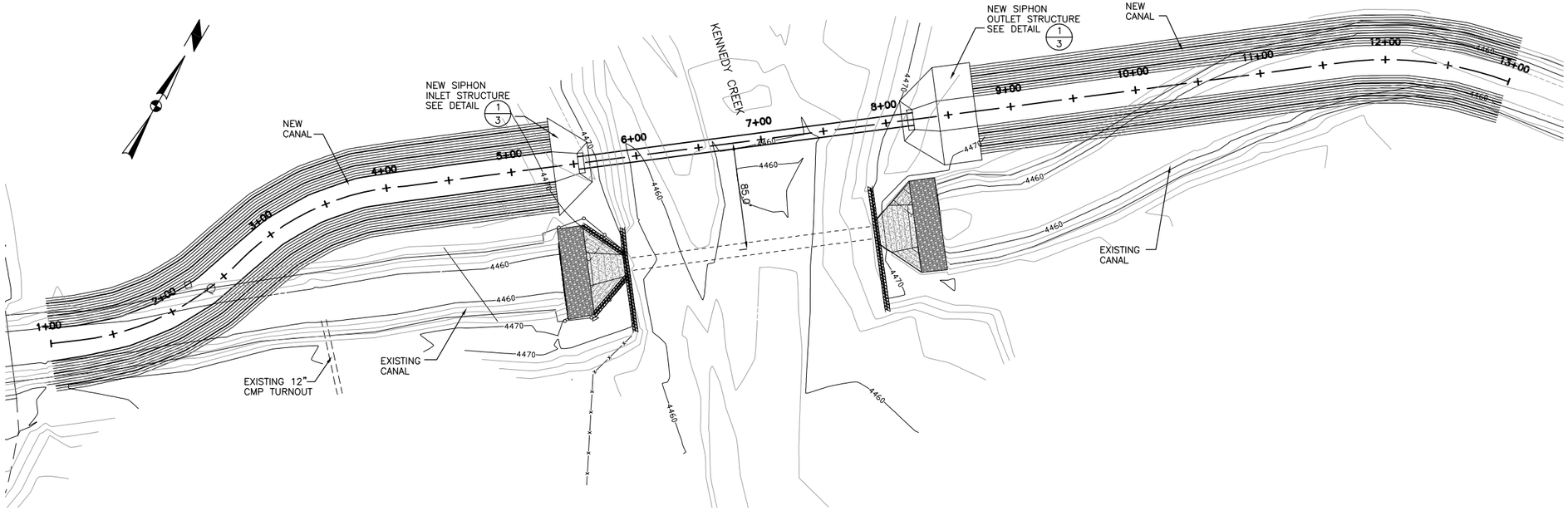
PRELIMINARY NOT FOR DESIGN



NEW 7'x7' DOUBLE BOX CULVERT OPTION

0 50' 100' 150'
SCALE

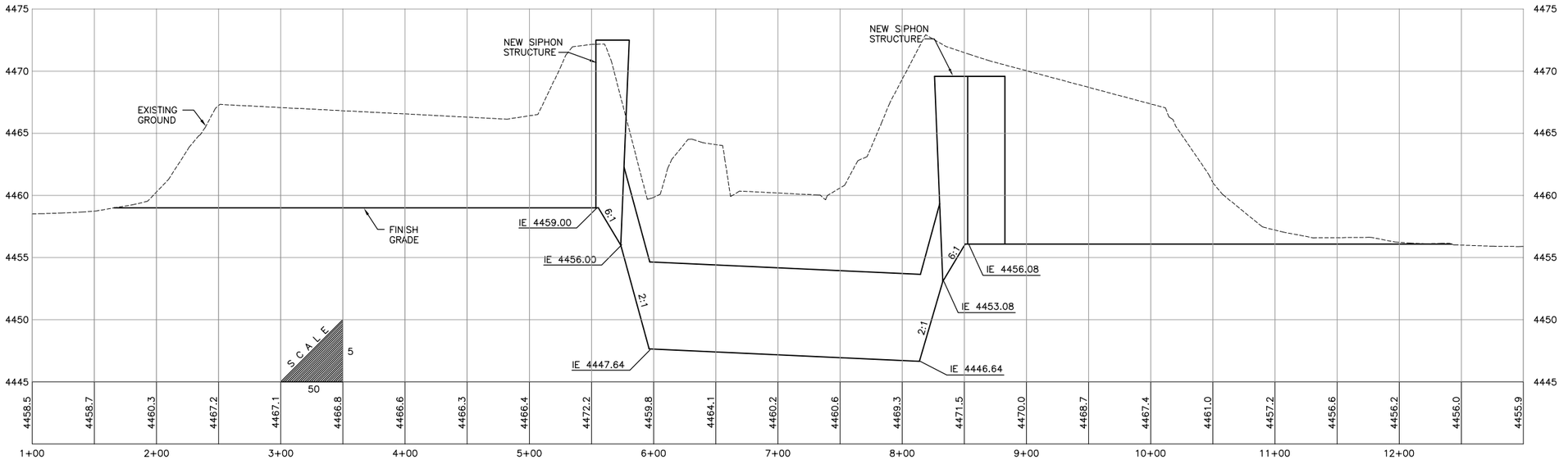


FIGURE 4.13

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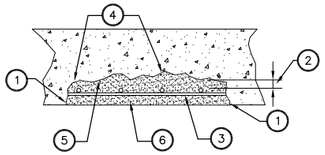
PRELIMINARY ENGINEERING REPORT
KENNEDY CREEK SIPHON CROSSING - REPLACEMENT ALTERNATE PLAN AND PROFILE

CAD NO. SIPHONPROFILE .DWG

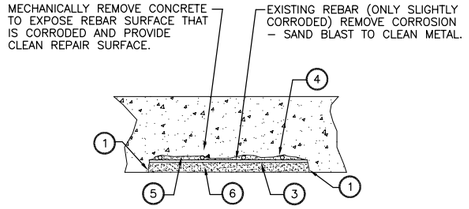
SHEET 2 OF 3

PRELIMINARY NOT FOR CONSTRUCTION



DEEP REPAIR OF CONCRETE DETAIL

NO SCALE



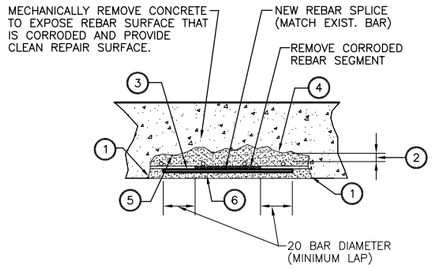
SHALLOW REPAIR OF CONCRETE DETAIL

NO SCALE

CONCRETE REPAIR NOTES

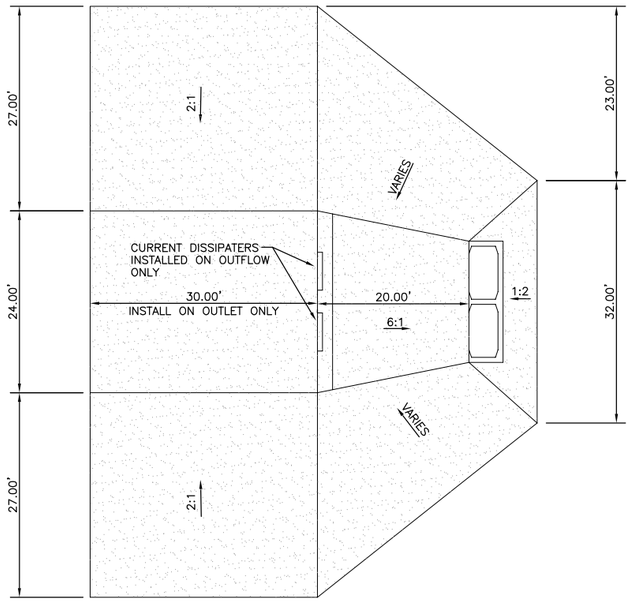
NOTE:
CONCRETE SURFACES TO BE REPAIRED WILL BE IDENTIFIED IN THE FIELD BY THE ENGINEER. REPAIR SURFACES INCLUDE FLAT, VERTICAL AND OVERHEAD SURFACES HAVING BOTH PLANAR AND CURVILINEAR PROFILES.

1. 3/4" DEEP SAWCUT AROUND PERIMETER OF AREA TO BE PATCHED.
2. REPAIR AREA DEPTH SHALL NOT BE LESS THAN 1" IN DEPTH AROUND REBAR. MECHANICALLY REMOVE ALL UNSOUND MATERIAL FOR 1/2" AROUND REBAR AND CLEAN. IF REMOVAL OF UNSOUND CONCRETE EXCEEDS 6" IN DEPTH, STOP AND NOTIFY ENGINEER BEFORE PROCEEDING.
3. INSTALL TWO COATS OF 10 MILS EACH REINFORCEMENT PRIMER TO ALL EXPOSED REBAR SURFACES.
4. SUBSTRATE SHOULD BE SATURATED SURFACE DRY (SSD) DURING APPLICATION
5. APPLY SCRUB COAT TO SUBSTRATE, FILLING ALL PORES AND VOIDS.
6. WHILE SCRUB COAT IS STILL WET APPLY MORTAR.

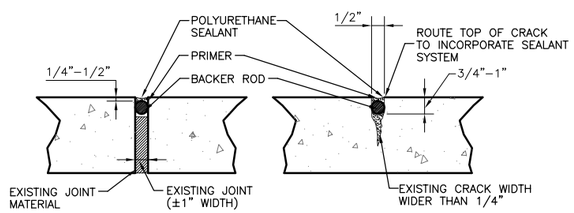


REBAR REPAIR DETAIL

NO SCALE



GENERAL NOTE:
ALL CONCRETE REPAIRS SHALL BE IN ACCORDANCE WITH USBR GUIDELINES, STANDARD SPECIFICATIONS FOR THE REPAIR OF CONCRETE (M-47) & GUIDE TO CONCRETE REPAIR.

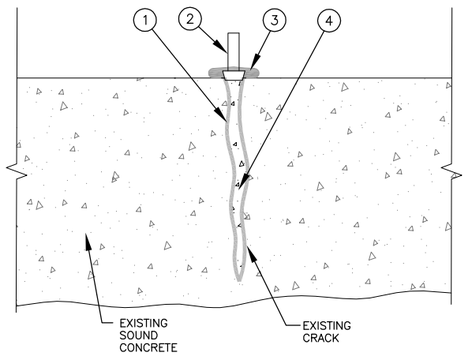


EXISTING JOINT EXISTING CRACK

1. REMOVE EXISTING JOINT MATERIAL AND/OR ROUTE CONCRETE AND CLEAN FOR NEW SEALANT SYSTEM. INSTALL APPROPRIATE BACKER MATERIAL TO PREVENT THREE-SIDED ADHESION AND TO CONTROL SEALANT DEPTH.
2. BRUSH ON PRIMER.
3. SEALANT SHOULD BE GUNNED INTO JOINT AND TOOLED TO FILL JOINTS. (MAX. 1/2" DEPTH)

CRACK/JOINT SEALANT DETAIL

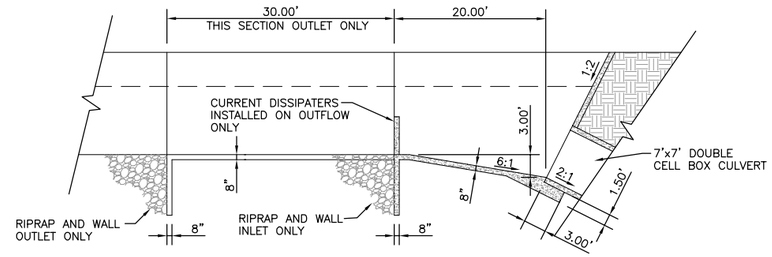
NO SCALE



1. CLEAN CRACK AREA TO BE FILLED
2. SET PORT INJECTION DEVICES OVER CRACK
3. PLACE MIXED SIKADUR 31, HI-MOD GEL EPOXY RESIN ADHESIVE OVER CRACK & AROUND INJECTION PORTS
4. INJECT SIKADUR 35, HI-MOD LV WITH STEADY PRESSURE

TYPICAL EPOXY RESIN CRACK REPAIR DETAIL

NO SCALE



SIPHON STRUCTURE DETAIL 1/3

FIGURE 4.14

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DATE:	1/06
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PRELIMINARY ENGINEERING REPORT
KENNEDY CREEK SIPHON CROSSING - MISCELLANEOUS DETAILS

CAD NO.REPAIR DETAILS .DWG

SHEET 3 OF 3

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4.6 MARY RIVER AND HALL COULEE SIPHONS

4.6.1 Replacement Alternatives

Replacement of the existing inverted siphons at the St. Mary River and Hall Coulee crossings would be offset from and parallel to the current alignments that will maximize summertime construction, minimize construction time and costs, and avoid disruption of service. A potential alignment for each crossing is shown on Figure 4.1. The replacement alternatives investigated for each siphon structure are summarized separately below:

St. Mary River Crossing

Design Flows:	700, 850 and 1,000 cfs
Number of Barrels:	Single and Double
Pipe Material:	Cast-In-Place and Steel
Mode of Construction:	Buried

All alternatives were investigated considering that the siphon barrels are to be buried with a minimum earth cover of five feet. Above ground siphons were not considered for comparison because of the need to account for significant temperature changes, and the related problems of linear expansion/contraction of the siphon barrels. A significant problem related to thermal expansion/contraction of siphon barrels and ground movements are the need for these types of joints. Expansion joints in siphon barrels present problems with water leakage, as has been experienced with the existing siphon. Water introduction to the slopes traversed by the St. Mary River and Hall Coulee siphons exacerbates slope instabilities, ground movements, siphon movements, and joint leakage.

Another problem inherent to expansion/contraction (E/C) joints is that they promote siphon movements. This is desired for internally derived stresses such as thermal expansion. However, for stresses externally imparted such as from unstable or moving ground, the joints invite and facilitate siphon movements. Although a joint is critical to avoid buckling and damage to the siphon barrel, the joint should not readily promote movement. A properly designed joint should

offer resistance to movement up to a prescribed stress level; then allow stress relaxation through a small incremental movement.

The preliminary results of the on-going monitoring of geotechnical instrumentation and investigations at the St. Mary River siphon crossing indicate that slope movements on the north slope (up gradient) are most likely shallow and surficial and directly related to seasonal soil creeping facilitated and exacerbated by elevated soil moisture (solifluction). Sources of additional soil moisture include:

- Leakage from the siphon barrels and E/C joints,
- Leakage from the interface at the inlet or outlet transition structures,
- Leakage from the earthen canal upstream and downstream of siphon, and/or
- Natural groundwater or seepage intercepted by and conveyed in the siphon trench excavation.

Preliminary geotechnical results for the south slope (downstream) suggest similar shallow movements due to the same process and contributing factors. In addition, there is evidence of deep-seated movements at the soil-bedrock contact (± 30-40 feet BGS).

At this time, preliminary geotechnical recommendations for the north slope allow for direct bury of the replacement siphon with provisions for internal drainage to remove detrimental seepage entering the trench backfill zone.

For the south side (downstream), the deep-seated movements may warrant the need to place the replacement siphon on above ground supports in order to enhance long-term performance and minimize future maintenance costs. An elevated siphon concept will resist ground movements and will permit siphon adjustments should the supports move. The final Geotechnical Report is scheduled for December 2006; once sufficient slope monitoring has been obtained. For the purpose of this PER, we have assumed the downstream portion of the St. Mary River siphon will be supported as follows:

- The elevated siphon would consist of two equal-sized steel barrels.
- Approximately 1000 feet of elevated siphon from Station 508+50 to 518+50.

- The elevated siphon would be supported on approximately 22 vertical support members (VSMs) on an assumed 50-foot spacing.
- The VSMs would consist of an H-frame having two piles (HP14X89) driven to bedrock.
- The siphon barrels would be elevated sufficiently as to not be a hinder to migrating elk.

The geotechnical recommendations for this same slope will also most likely include installing horizontal drains into the slope which would reduce hydrostatic forces acting on the slide mass, thereby increasing overall stability. A layout plan and drain projection profiles will be included with the final Geotechnical Report. For the purpose of this PER, we have assumed a horizontal drain program consisting of:

- Five pads from which five separate drains would be installed.
- Drains would consist of approximately 13,750 LF of 1½-inch diameter, slotted, PVC pipe.
- Drain effluent would be combined, conveyed and discharged to the St. Mary River.
- Drain Pads would be fenced to prevent damage from livestock.

The St. Mary River crossing could be accomplished by either a new bridge above the river or by direct bury below the river. It was concluded that the cost of the bridge would be approximately the same as the extra costs of constructing cofferdams and environmental protection works related to burying the siphon barrel below the riverbed. Therefore, this alternative was not investigated to any further extent. The existing bridge will be supplemented with a new vehicle-only bridge to be located approximately ±150 feet upstream. This bridge is being completed as a Montana Department of Transportation project. It will be owned by the State of Montana for public use.

Inland Pipe Limited of Calgary provided a quote for the supply of precast concrete pipe for Halls Coulee siphon replacement. Inland Pipe indicated that the design static pressure head of approximately 200 feet at the St. Mary River Siphon is beyond the scope of precast concrete pipe. Therefore, precast concrete pipe was not considered for the St. Mary River siphon, even for the parts of the siphon where the static head is considerably less than 200 feet.

Siphon inlet and outlet structures were designed in accordance with the criteria provided in

Hydraulic Structures, by C.D. Smith (1985), Professor of Civil Engineering at the University of Saskatchewan. Professor Smith's criteria for the design of these structures were obtained from the results of extensive model studies. The results of the model studies indicated that it was not feasible to make relatively short transitions from the canal to the siphon barrel, and vice versa for the outlet structure, using vertical sidewalls throughout. These types of structures were found to be equally efficient to warped wall transitions, in earlier designs and less costly to construct. Typicals showing various configurations are shown on Figures 4.15 to 4.18.

It is noted that the cost estimates for siphon inlet and outlet structures were prepared using a price of $1,530 per cubic yard of reinforced concrete. This price includes the cost of excavation; construction of the reinforced concrete structure, including rebar; backfill; and riprap. This price per cubic yard of concrete is based on actual bid prices obtained recently for construction of similar structures in Southern Alberta.

Drainage below the siphon barrels was considered for each of the buried alternatives. For single barrel siphons, the drainage system would consist of two lines of 6-inch diameter perforated PVC pipe, extending 750 lineal feet below the siphon inlet structure and 750 lineal feet below the siphon outlet structure. The drainage pipes would be surrounded with drain gravel and the pipes would outlet at ground levels, just above the maximum expected river level. In the case of twin-barreled siphons, three lines of 6-inch diameter perforated drain pipes would be used instead of just two lines. It is recommended to line the main canal with a suitable membrane for an approximate distance of 500 feet upstream of each siphon inlet structure and 500 feet downstream of each siphon outlet structure. The purpose of this is to help prevent seepage from the canal from entering the areas underneath the siphon barrels.

Generally, the cost estimates of the steel pipe alternatives (Figure 4.20) were found to be approximately 6 percent lower that those of the cast-in-place concrete alternatives (Figure 4.19). Also, the cost estimates of the single barrel alternatives were found to be approximately 18 percent lower than those with twin barrels.

Hall Coulee Crossing

Design Flows:	780, 850 and 1,000 cfs
Number of Barrels:	Single and Double
Pipe Material:	Precast, Cast-In-Place, and Steel
Mode of Construction:	Buried

The investigations for replacement of the Hall Coulee siphon were similar to the investigations for the replacement of the St. Mary River siphon. These investigations also included an alternative using precast concrete pipe and a design flow rate of 850 cfs. As discussed previously, the estimated cost of the precast pipe alternative was considerably more than the estimated cost of the same alternative with cast-in-place concrete pipe. As a result, it appears that it is not feasible, financially, to use precast concrete pipe for this application.

Considering that the topographical relief across Hall Coulee is relatively small; maximum of approximately 100 feet versus 200 feet for St. Mary River siphon, it was considered feasible that this siphon could be replaced with an earthen fill (see Figure 4.21). Presently there are three Conoco-Phillips pipelines crossing underneath Hall Coulee siphon. The siphon predates the petroleum pipelines. Copies of the ROW-easement documentation were not available for our review but are being researched by USBR.

From information received from Conoco-Phillips, the estimated cost for relocating each of these pipes is $325 per foot. This is relatively expensive and therefore it was found to be advantageous to relocate the least possible lengths of these lines. This can be accomplished by constructing the fill, for the siphon replacement approximately 400 feet further up the Hall Coulee Valley than the existing siphon location. By moving the fill up the valley, the size of the required fill is also reduced because the valley depth is shallower. However, the cost of this alternative ($24,000,000) was still approximately twice the estimated cost of replacing the siphon with siphon barrels.

Geotechnical recommendations for the Hall Coulee siphon crossing have yet to be developed. It is anticipated that the on-going slope and siphon movements are the result of shallow, surficial seasonal soil creeping exacerbated by elevated soil moistures. This is expected to be similar to the upstream slope (north side) of the St. Mary River siphon crossing. If so, direct bury with integrated backfill drainage will be recommended for siphon installation. A geotechnical investigation program is planned for August 2006. Slope inclinometers will be installed, similar to the St. Mary River siphon crossing, to monitor and characterize the nature of slope movements. A preliminary draft report for the Hall Coulee siphon is scheduled for December 2006.

4.6.2 Design and Cost Estimating Assumptions

The assumptions that were made for the designs are listed as follows:

1. Siphon lengths are the same as the lengths of the existing siphons.
2. Manning's 'n' for concrete and steel siphon barrels is 0.012
3. Siphons are designed to discharge the design flow rates at 90 percent of the available head.
4. Siphons are buried with a minimum earth cover of five feet.
5. The cost estimates for cast-in-place concrete siphons are based on the actual cost of construction of East Arrowwood Siphon, and indexing for inflation.
6. The cost estimates for steel pipe siphons are based on prices from suppliers for material, and actual construction prices for Raymond Hydro Penstock adjusted for inflation.

Steel Pipe Specifications

- AWWA C200 material conforming to ASTM 1018, Grade 36
- Beveled ends for butt-joint welding
- Polyethylene tape coating per AWWA C214, 80 mil thickness
- Epoxy lining per AWWA C-210, 12 to 16 mils in two coats
- Impressed current cathodic protection system

St. Mary River Siphon: Pipe wall thicknesses range from ½-inch for 11 ft. diameter siphon, to ¼-inch for 6.5 ft. diameter siphon.

Hall Coulee Siphon: Pipe wall thicknesses range from 3/8-inch 9.5 ft. diameter siphon, to ¼-inch for 6.5 ft. diameter siphon.

7. For construction of the siphon across the St. Mary River, it was assumed a cofferdam would be constructed across half of the river at a time, to allow for construction of the siphon barrels underneath the riverbed. It was assumed that steel sheet piling be used for construction of the cofferdams.

8. Cost estimates for siphon inlet and outlet structures are based on estimated volumes of reinforced concrete using a construction cost of $1530 per cubic yard of concrete.

9. Cast-in-place reinforced concrete siphon barrels were assumed to have wall thicknesses as follows:

Siphon Diameter (ft.)	Wall Thickness (inches)
9.5 to 11	14
6.5 to 9	12

10. Precast concrete siphon barrel cost estimates were based on a price from a supplier, and actual recent costs for installing large diameter precast conduit type structures. The supplier considered that the use of precast pressure pipe is feasible for Halls Coulee Siphon where the maximum head is 120 feet It is understood that 200 feet of pressure head, as is the situation for St Mary River Siphon, is beyond the scope of precast concrete pipe. The supplier listed the following criteria for precast concrete pipe:
    - ASTM A-361 Pipe Material
    - Polyethylene liner to avoid any leakage at joints

- 8 ft. pipe lengths
- Wall thickness = 17 inches for 9 ft. diameter pipes

11. The earth fill alternative for Hall Coulee Siphon was designed for criteria listed as follows:

- 2.5 H:1 V side slopes of till
- Design includes a check drop structure at the upstream side of the coulee, to account for the drop in head across the existing siphon
- The fill is to be located at the upslope side of the existing siphon, to allow for construction of the fill while the existing siphon is in operation. This will also facilitate the least possible alterations required to the three existing Conoco Oil Lines.

4.6.3 Cost Estimates

It is noted that the current cost estimates are considerably higher than those estimated in 2002 by the USBR or those adjusted and indexed by TD&H in 2004. The cost estimates included in this report were determined as a result of current prices and investigations. Construction cost estimates are based on recent bid prices for similar work in Southern Alberta. Other sources of prices include the following:

- Cost estimates were patterned to some extent from the East Arrowwood Siphon project in Southern Alberta, which was successfully completed in 2001.
- Quotes were received from suppliers for a number of the items, described as follows:
- Northwest Pipe Company, Portland Oregon
- Edmonton Exchange (Group of Companies) Edmonton Alberta
- Inland Pipe Limited, Calgary Alberta
- Cathodic Protection for Steel Pipe
- C.T. Technologies Canada Limited, Calgary Alberta

The cost estimates for each of the alternatives for both the St. Mary River and Hall Coulee siphons are presented in the Tables below. Prices for the above ground support on portions of St. Mary siphon as well as the horizontal drain program are included.

Table 4.8 Cost Estimates for St. Mary River Siphon Replacement Alternatives.

Replacement Alternative	Design Capacity		
	700 cfs	850 cfs	1,000 cfs
Cast-In-Place Concrete			
Single Barrel	$28,000,000	$29,000,000	$31,000,000
Twin Barrels	$34,000,000	$35,000,000	$37,000,000
Steel Pipe			
Single Barrel	$26,000,000	$27,000,000	$29,000,000
Twin Barrels	$31,000,000	$32,000,000	$34,000,000
Above-Ground Portion, Add	$2,000,000		
Horizontal Drain Program, Add	$650,000		

Table 4.9 Cost Estimates for Hall Coulee Siphon Replacement Alternatives.

Replacement Alternative	Design Capacity		
	700 cfs	850 cfs	1,000 cfs
Cast-In-Place Concrete			
Single Barrel	$11,500,000	$12,000,000	$14,000,000
Twin Barrels	$14,500,000	$15,500,000	$16,000,000
Steel Pipe			
Single Barrel	$10,500,000	$12,500,000	$13,000,000
Twin Barrels	$12,500,000	$14,500,000	$15,000,000
Precast Pipe			
Single Barrel	----	$15,500,000	----
Embankment			
Fill Canal	----	$24,000,000	----

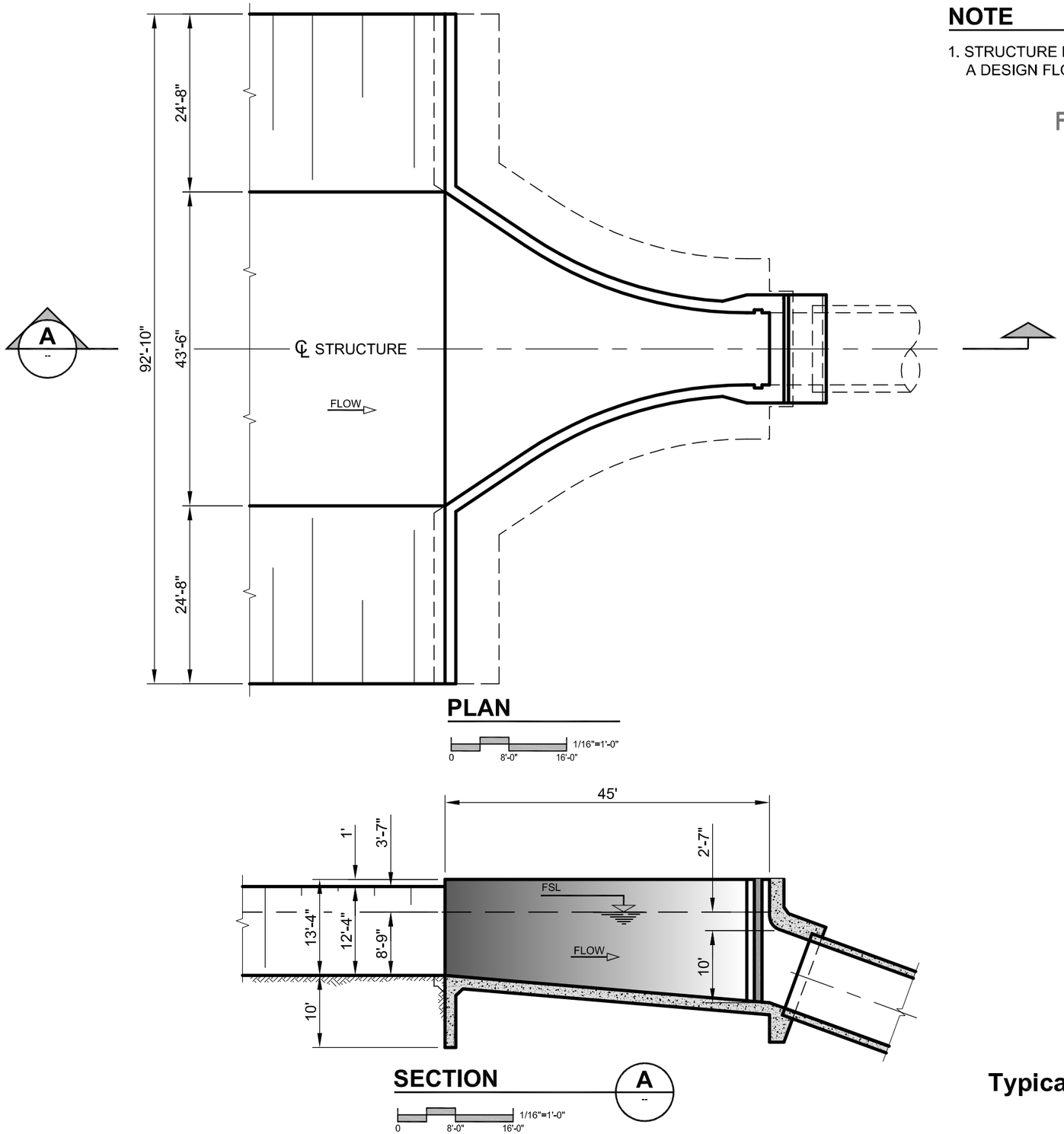
4.6.4 Conclusions

Selection of a preferred alternative for the St. Mary River and Hall Coulee Siphons is not recommended at this time. Since the costs of these structures are heavily dependent on material costs, it may be prudent to update cost estimates during the design phase. Also, results of the geotechnical studies at the St. Mary River and Hall Coulee siphon crossings, which are on-going, have yet to be finalized and may dictate or preclude a particular alternative.

NOTE

1. STRUCTURE DIMENSIONS ARE FOR THE ST MARY RIVER SIPHON, AND A DESIGN FLOW RATE OF 850 cfs.

PRELIMINARY NOT FOR CONSTRUCTION



PLAN

1/16"=1'-0"

0 8'-0" 16'-0"

SECTION A

1/16"=1'-0"

0 8'-0" 16'-0"

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

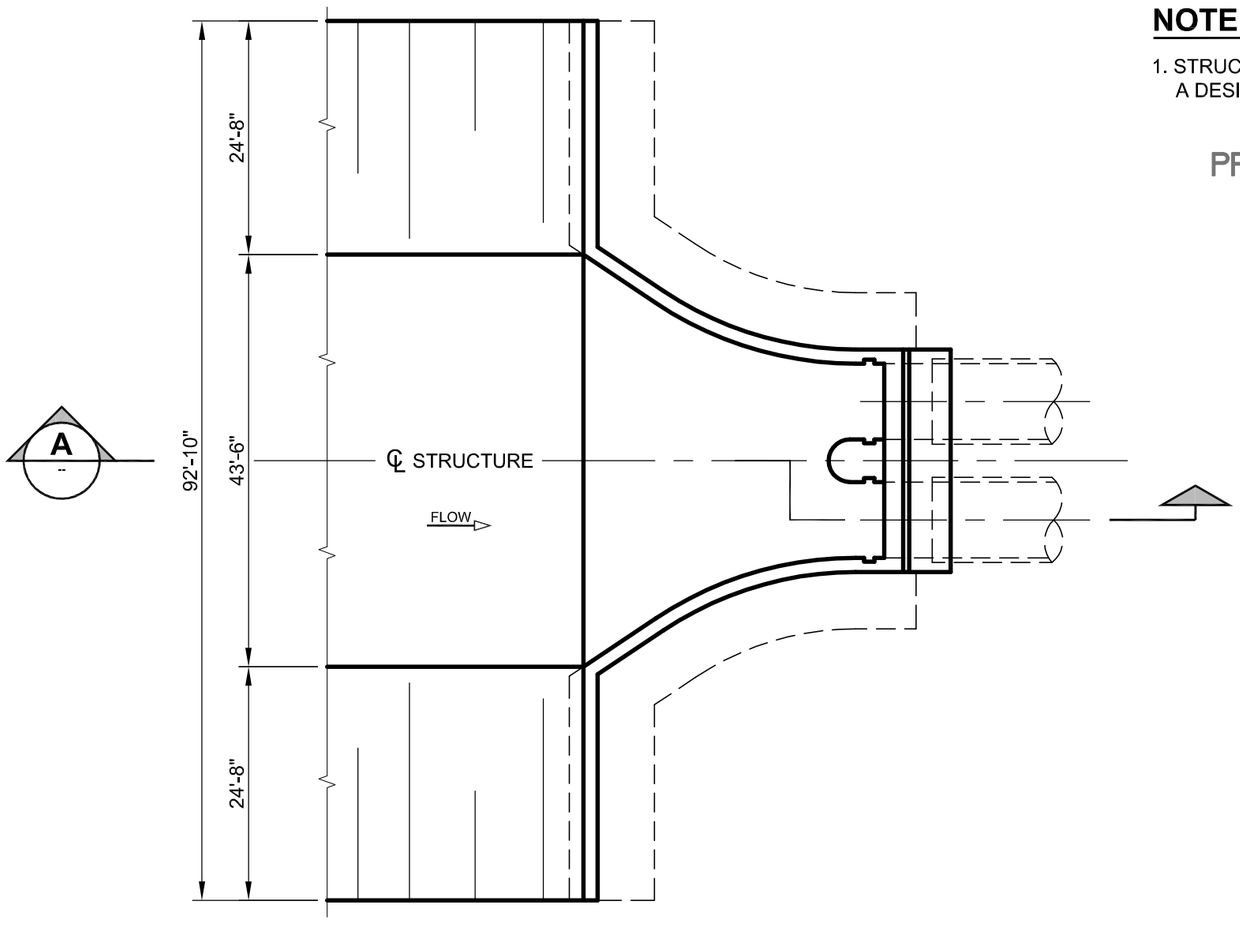
Typical Siphon Inlet Structure - Single Barrel
Plan and Section

Figure - 4.15

NOTE

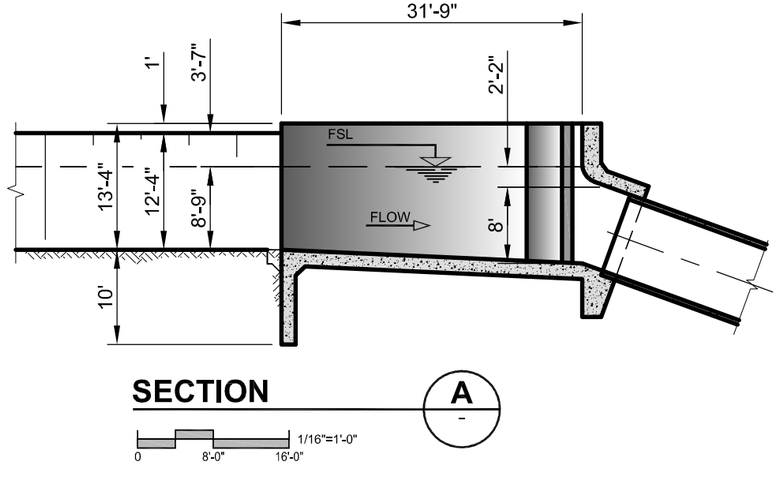
1. STRUCTURE DIMENSIONS ARE FOR THE ST MARY RIVER SIPHON, AND A DESIGN FLOW RATE OF 850 cfs.

PRELIMINARY NOT FOR CONSTRUCTION



PLAN

1/16"=1'-0"
0 8'-0" 16'-0"



SECTION A -

1/16"=1'-0"
0 8'-0" 16'-0"

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Typical Siphon Inlet Structure - Twin Barrels
Plan and Section

Figure - 4.16

UMA | AECOM

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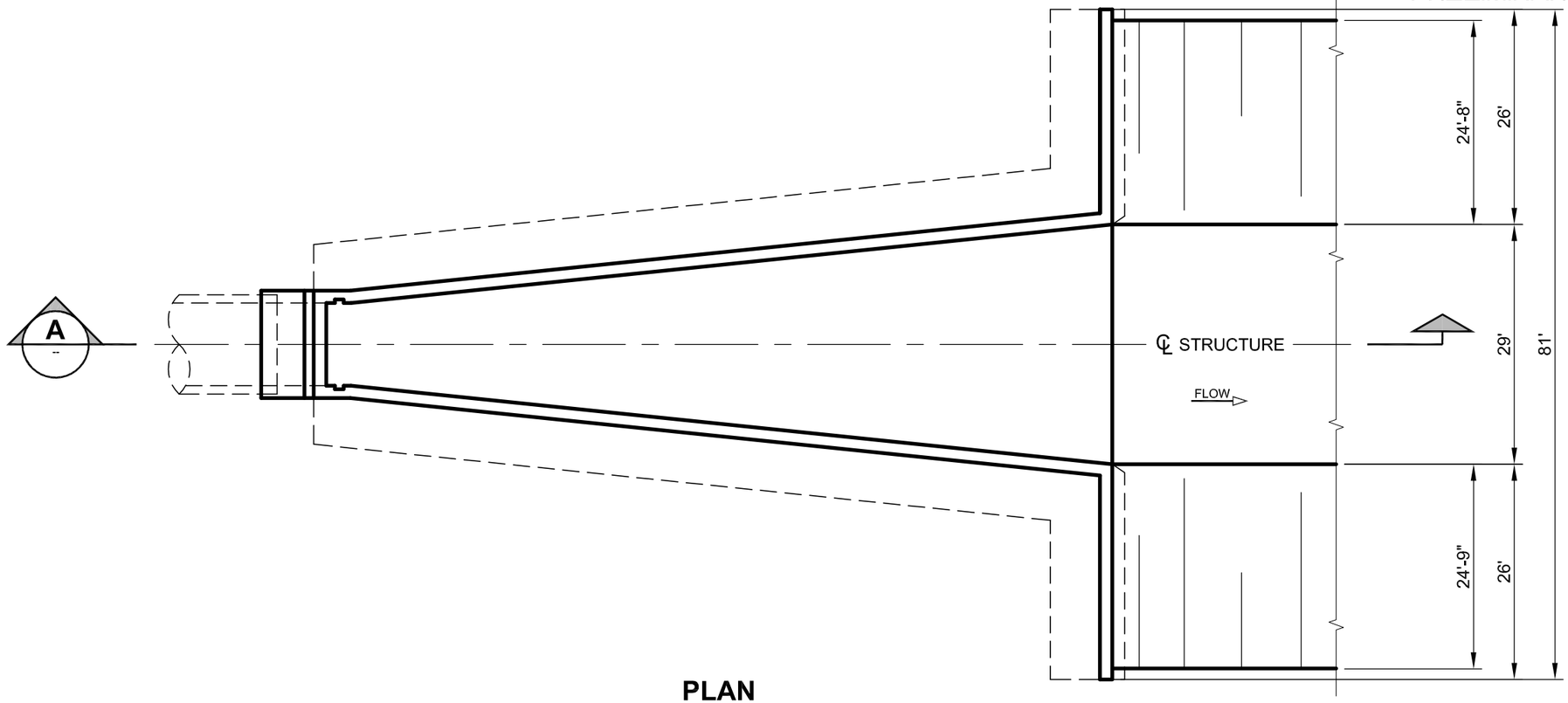
NOTE

1. STRUCTURE DIMENSIONS ARE FOR THE ST MARY RIVER SIPHON, AND A DESIGN FLOW RATE OF 850 cfs.

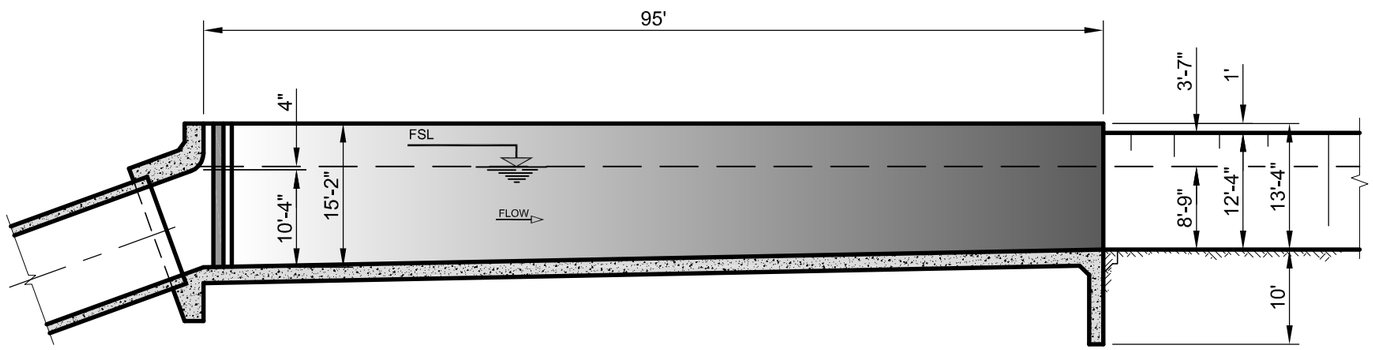
PRELIMINARY NOT FOR CONSTRUCTION



PLAN

1/16"=1'-0"

0 8'-0" 16'-0"



SECTION A--

1/16"=1'-0"

0 8'-0" 16'-0"

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Typical Siphon Outlet Structure - Single Barrel Plan and Section

Figure - 4.17

UMA | AECOM

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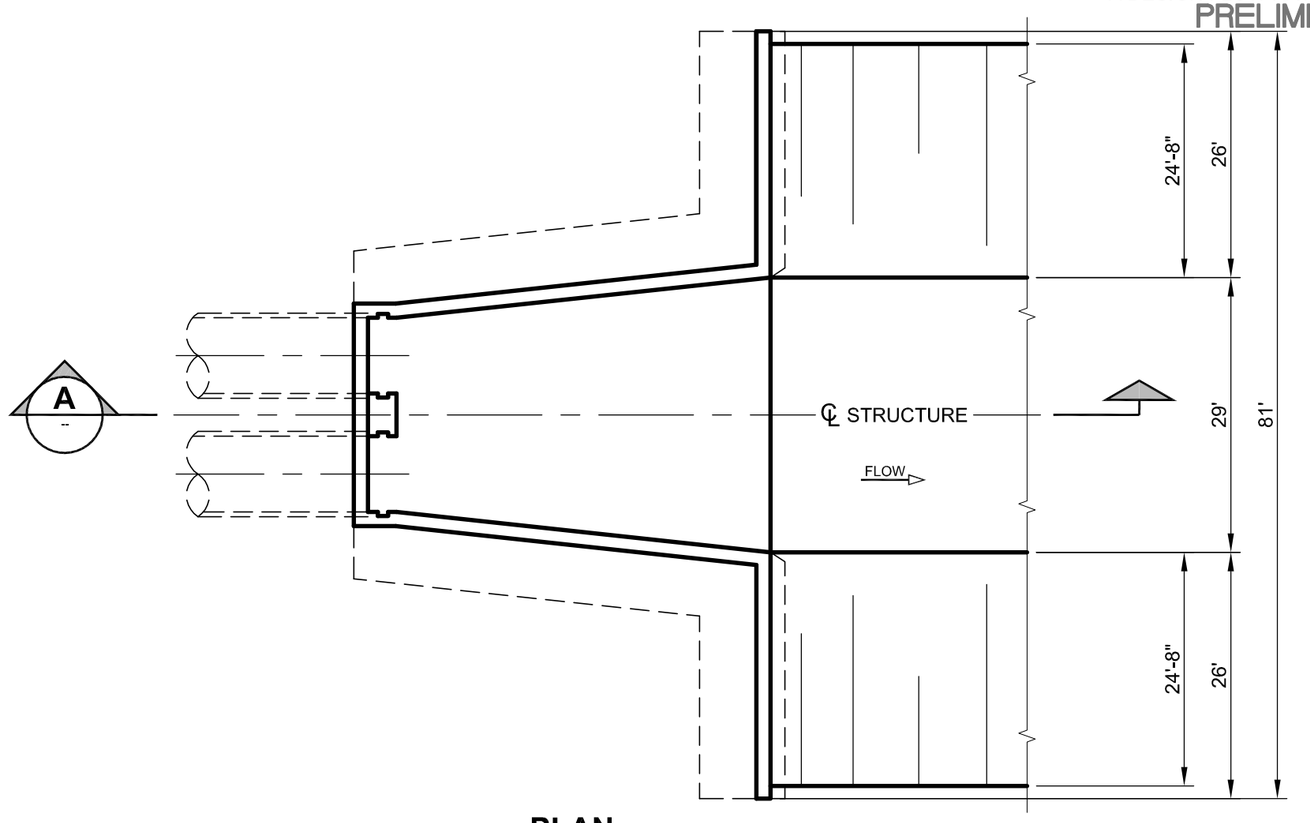
NOTE

1. STRUCTURE DIMENSIONS ARE FOR THE ST MARY RIVER SIPHON, AND A DESIGN FLOW RATE OF 850 cfs.

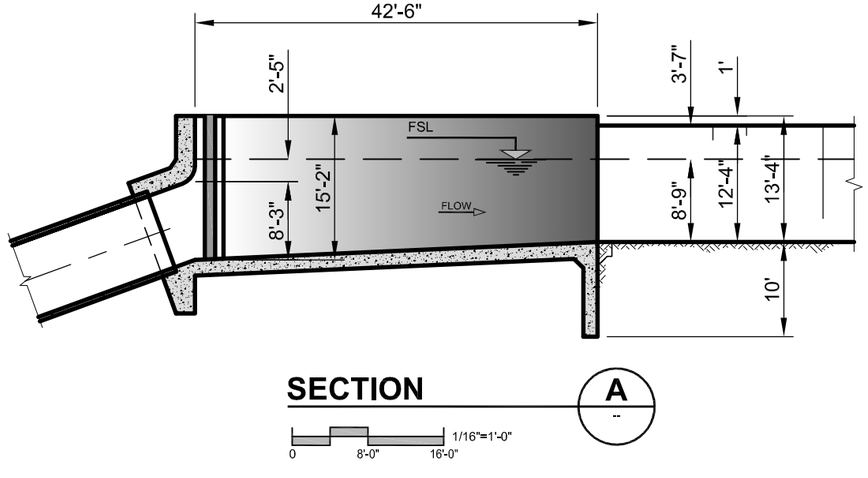
PRELIMINARY NOT FOR CONSTRUCTION



PLAN

1/16"=1'-0"

0 8'-0" 16'-0"



SECTION A --

1/16"=1'-0"

0 8'-0" 16'-0"

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Typical Siphon Outlet Structure - Twin Barrels
Plan and Section

Figure - 4.18

UMA | AECOM

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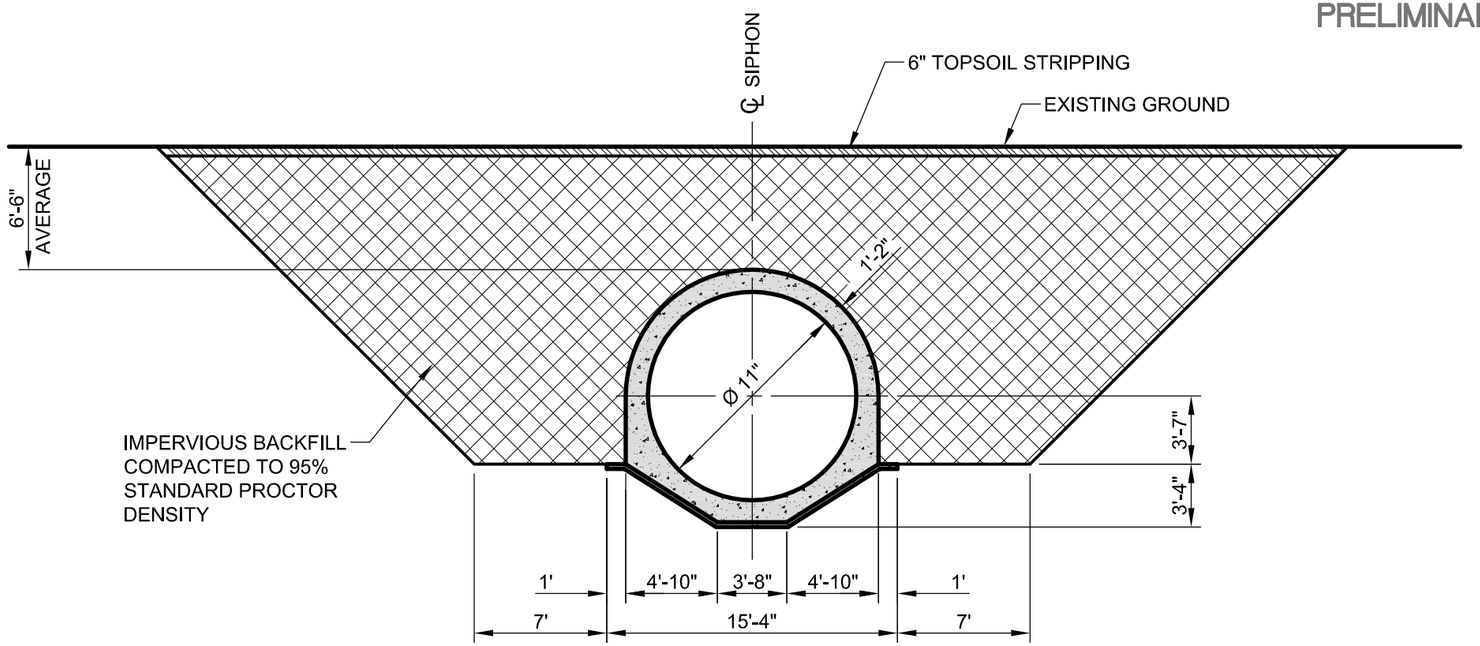
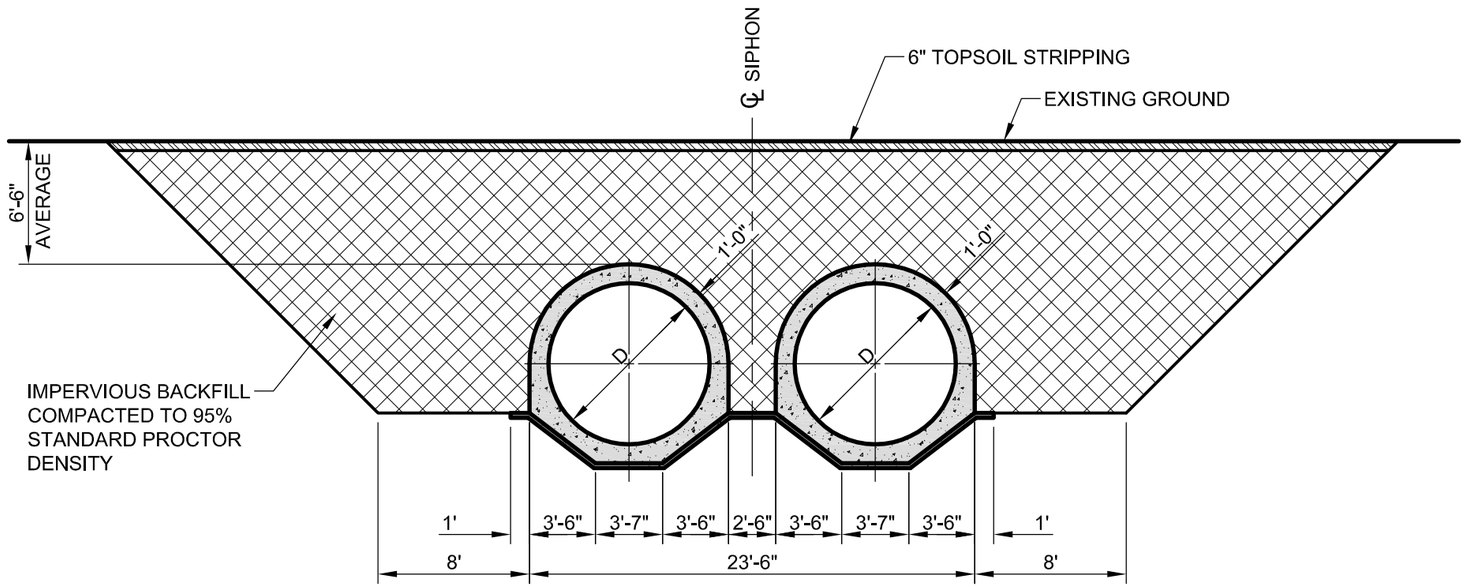


SIPHON CROSS SECTION - SINGLE CONCRETE BARREL

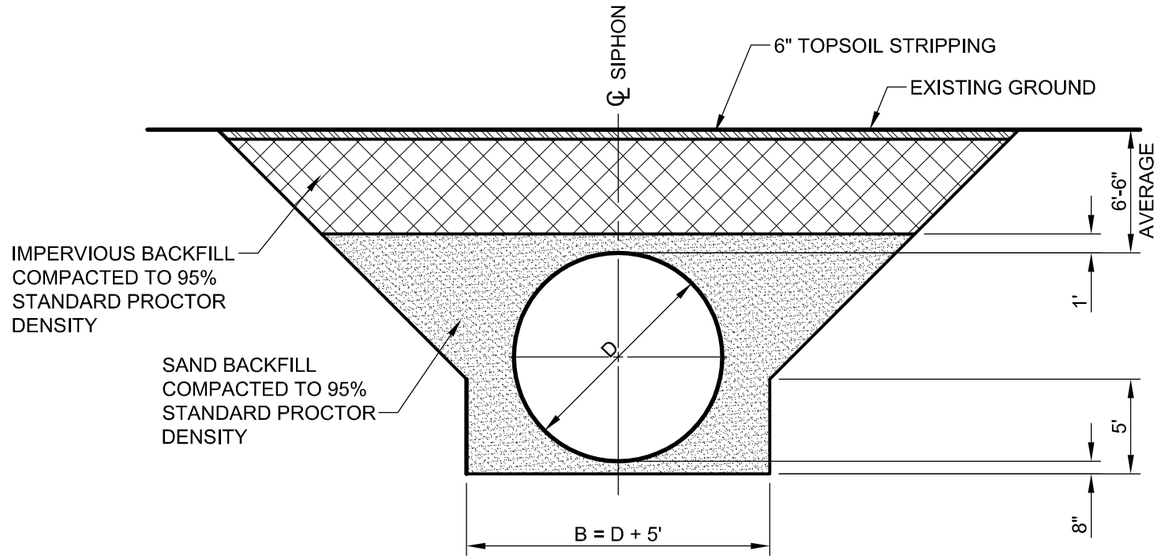


SIPHON CROSS SECTION - TWIN CONCRETE BARRELS

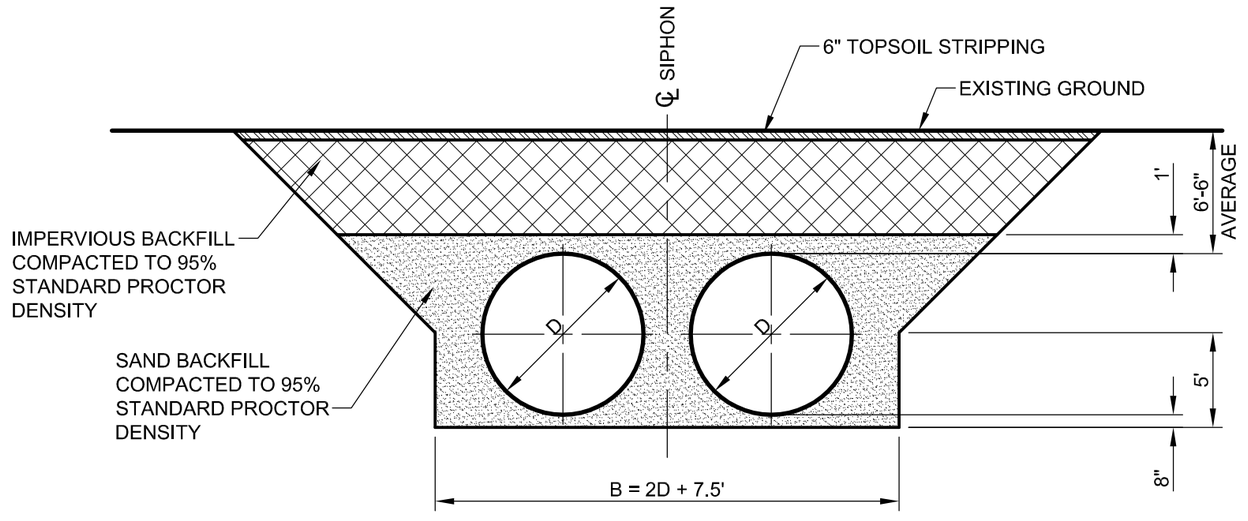
St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Typical Siphon Sections
Concrete Barrels

Figure - 4.19



SIPHON CROSS SECTION - SINGLE STEEL PIPE



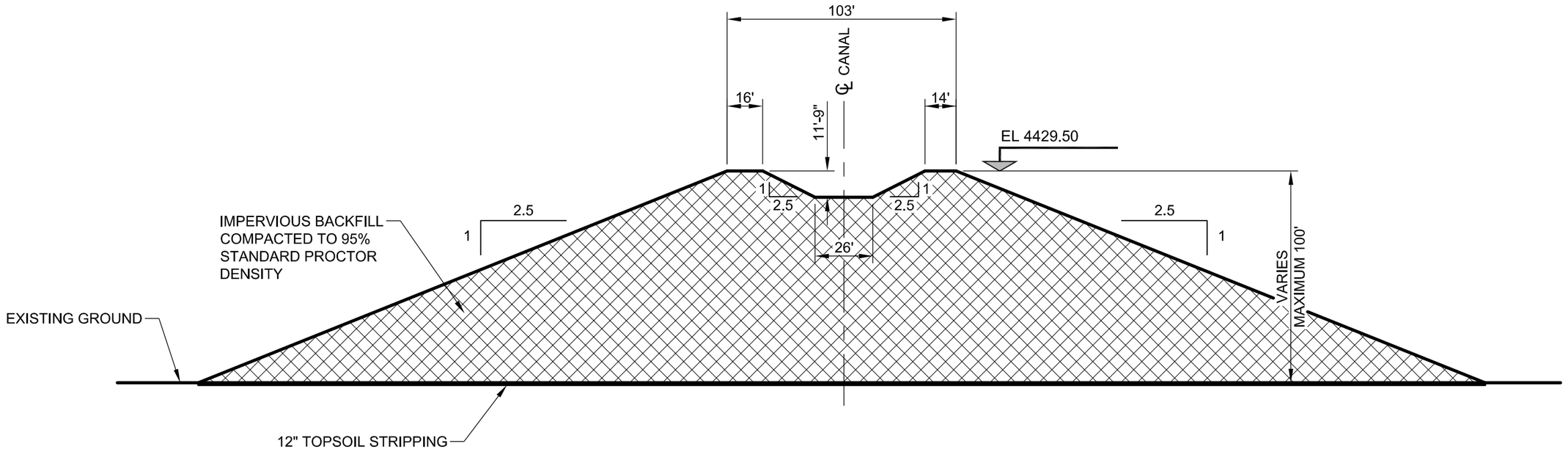
SIPHON CROSS SECTION - TWIN STEEL PIPE

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Typical Siphon Sections
Steel Pipe

Figure - 4.20

PRELIMINARY NOT FOR CONSTRUCTION



FILL CANAL - TYPICAL CROSS SECTION

0 300' 600' 1"=600'

St. Mary Rehabilitation Working Group
Phase II Engineering Services
Siphon Alternative Investigation

Halls Coulee Siphon Fill Canal
Typical Cross Section

Figure - 4.21

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4.7 HYDRAULIC DROPS

4.7.1 Introduction

Five reinforced concrete chute and terminal drop structures and interconnecting canals are used to convey water from the St. Mary canal at the Hudson Bay divide down into the North Fork of the Milk River. These structures were originally constructed in 1915. Over the years, various concrete repairs have been made to the drop structures to maintain them in working order. However, these structures are currently in poor overall condition, near the end of their design life, and in need of replacement.

The structures are numbered one to five, from upstream to downstream. All five structures are similar in plan and profiles but vary in length and overall drop. The total length between drops is less than 2.5 miles and the total elevation drop traversed by these structures is approximately 218 feet.

The current scope of work included feasibility studies and preparation of preliminary designs for rehabilitation and/or replacement of the drop structures. Three alternatives were evaluated and are presented below, including: 1) replace the existing drop structures in-kind with minor variations, 2) replace the existing drop structures with alternative structures, and 3) replace the existing drop structures in a manner that allows for the addition of potential future hydropower (termed “hydropower-ready”). Each of these alternatives was evaluated for flow capacities of 700, 850 and 1,000 cfs. Feasibility level, comparative opinion of probable costs for each alternative was also developed.

4.7.2 Rehabilitation Alternatives

Replacement In-Kind

This alternative consists of replacing the five drop structures in-kind, with minor variations in cross section and overall layout to improve capacity, flow characteristics, and structure durability. A typical plan and profile for this alternative, showing basic dimensions for each of the drop structures, is shown in Figure 4.22 at the end of this section.

Under the existing drop geometry, it was observed that during high flows, the sidewalls of some of the chutes might have overtopped which, in theory, can lead to erosion and continued deterioration of the structure. The cross section of the replacement chute would be rectangular, instead of trapezoidal to better contain the flow and prevent overtopping of the sides. In addition, the sidewalls at the approach to the chute would be vertical, in place of the current, convoluted transition and warping sidewalls.

Severe deterioration within the existing plunge pools has occurred over time as a result of the impact of falling water, improper ventilation, cavitation and freeze-thaw damage. For this alternative, protective measures will be implemented to prolong the life of the concrete, specifically within the plunge pool, including a thicker concrete slab, ventilation, and air-entrained concrete which is more suitable for the harsh freezing conditions normal to this area.

Replacement with Modified Configuration

This alternative consists of two potential configurations. The first option includes replacement of the five drop structures in a similar nature, but consists of modifying the profile and changing the mode of downstream energy dissipation. A typical plan and profile for this alternative, showing general dimensions for each of the drop structures, is shown in Figure 4.23.

In profile, the replacement chute slope will be maintained for the upper two-thirds of the length of the drop with an increase in slope over the lower one-third to tie in to the invert of the existing plunge pool. This arrangement, along with the presence of baffles and an end sill at the base of the chute (USBR Type III stilling basin), will reduce the length of the hydraulic jump and corresponding length of structure, compared with the existing plunge pool. Improved hydraulics within the dissipation section of the drop structure should prolong the life of the concrete and result in a more tranquil transition back into the canal.

The second option includes replacement of the five drop structures with a pipe drop and impact-type energy dissipator. This alternative was originally developed by the USBR as part of the *North Central Montana Feasibility Study*, 2004. No further drawings were developed during this

phase of work as preliminary designs have already been prepared by USBR. This alternative remains a viable option given its cost compared to the other configurations.

Previously discussed advantages with the pipe drop include allowance for access to the other side of the canal, reduction of safety hazards associated with open structures, and elimination of O&M costs associated with snow removal required for early spring use. Previously discussed disadvantages include trash and ice buildup leading to plugging of the entrance to the pipes. An additional disadvantage that should be investigated further is the potential of a hydraulic jump that may occur within the pipe, based on preliminary hydraulic calculations.

Replacement with Hydropower-Ready Configuration

This alternative consists of relocating portions of the canal and bypassing the first four existing drop structures. It includes construction of a single drop structure from the end of the realigned canal to downstream of existing Drop No. 4 in order to maximize the available head for power generation and minimize development costs. The inlet of the new drop would be configured to allow for structural modifications for future hydropower. The total drop would be approximately 160 feet, based on the preliminary layout developed using available USGS topography. The new canal is approximately 9,500 feet long. A plan view of the preliminary canal alignment and drop is shown in Figure 4.24.

Assuming a potential head of 160 feet, a flow rate of 850 cfs and allowing 5¢ per kilowatt hour would produce a gross annual revenue generation over the operational period of six months of approximately $1,650,000. A recently passed energy bill includes incentives for small hydro development. A detailed rate study and review of the recently passed energy bill would be necessary to provide a better estimate of the potential revenue from hydropower.

If this alternative is selected, it would be proposed to first construct the new canal and drop structure (without the inlet modifications) as part of the upcoming drop structure replacement. The layout of the new canal and drop structure would make this stretch of canal “hydropower-ready”. Construction associated with the hydropower facility, including modification to the drop inlet and construction of the penstocks and hydropower structure itself (and associated

equipment), would be performed in the future as the final step towards conversion to hydropower. The inlet to the drop structure would consist of wingwalls used to transition the canal to the chute and a broad crested weir. Provisions for a future control gate should be included in the design of the drop structure. The chute would be rectangular in cross section and end with a USBR Type III stilling basin to dissipate the energy of the falling water. A plan and profile of the drop structure are shown in Figure 4.25.

A potential modification to the inlet of the drop structure as part of the conversion to hydropower is depicted in Figure 4.26. In this arrangement, flow through the canal would normally pass over the broad crested weir and down the chute, with the gate fully open. During hydropower operations, the chute gate would be closed and water would be diverted through the penstocks for power generation. The Figure shows a radial gate deployment, however a drop leaf gate would work equally well. The preferred gate type will be selected during final design.

It is estimated that three 72-inch diameter steel pipes, with associated upstream sluice gates and trash racks, would be required as part of the conversion to hydropower. These items are depicted in Figure 4.26. Each of the three pipes would be approximately 800 feet long, measured from the canal to the hydropower facility. The final number and size of the penstocks will depend upon overall economy, number of turbines to be operated, head losses, and manufacture and handling limitations.

Consideration was given to the potential need of a forebay upstream of the penstocks to address surges during turbine operation. A forebay is essentially a storage reservoir upstream of the penstocks; its purpose is to provide a very small balancing storage for both water rejected due to a stoppage of the turbine and a sufficient amount of water required during startup. For this evaluation, it was assumed that the canal upstream of the penstocks will serve as the forebay and careful synchronization between operation of the units and chute gate will be provided to ensure proper operation of the system. The canal reach from the point of diversion from the existing alignment to the penstock entrance may need to be increased in size slightly to allow for a small rise in the water surface level and still provide adequate freeboard in the event of a sudden shutdown of the turbine. For the opinions of probable cost developed in this report, canal prism

cross sections sized only for flow capacities of 700, 850 and 1000 cfs were used; no allowances were made for fluctuations due to penstock operations.

If it is determined that the required synchronization between operation of the units and the chute gate is not possible, a fixed weir can be used in place of the chute gate. The weir would need to be of considerable length to maintain a minimum required depth upstream of the penstocks and still pass the required flow. This weir could be shaped in the form of a V, or a side channel drop can be constructed, to provide the required crest length and still fit within the limits of available space.

Elimination of the new chute drop structure by use of the penstocks alone and a turbine by-pass value is not recommended. Due to the lack of storage upstream of the penstock inlet and because the canal represents water constantly in motion, here is no margin for error and no safeguard against failure should the turbine by-pass valve fail during a turbine upset episode. Turbine upsets caused by lightning strikes may also impact controls for the by-pass valve. At 850 cfs, 1.2 Ac-Ft of transient canal storage is needed for every minute of turbine downtime.

An additional alternative to possibly consider is to extend the realigned canal along the existing topography as far as possible and construct a drop structure (and future penstocks) from the canal to downstream of existing Drop No. 5 to gain additional head. Based on a review of the topography, the length of the drop structure and penstocks would be considerably greater than the tie-in just downstream of Drop No. 4. At this time, the additional cost of the drop and penstock compared with the additional head and power generation does not appear favorable. However, if hydropower is desired this alternative should be evaluated once additional geotechnical and survey data has been obtained.

4.7.3 Cost Estimates

Feasibility level comparative opinions of probable cost were developed for each of the three alternatives and three flow capacities. Included in the costs were estimates for mobilization, demolition, sitework, structures, contingencies, engineering and administration and interest during construction. The opinions of probable cost for the hydro ready alternative include

construction of the realigned canal and drop structure, modification to the inlet as shown in Figure 4.26, the chute gate and the penstocks with associated gates, valves and trash racks. They do not include the hydroelectric power station itself, associated turbines and generators, electrical equipment, transmission lines, etc.

Unit prices for material and labor were based on a listing of Installed Contractor Prices provided by the USBR (August 2002 indexed to August 2005). At this time, it is assumed that the majority of the construction for the replacement drops and "hydro-ready" structures can be completed during nonwinter months and therefore the unit prices were not marked up for winter construction conditions.

In addition to the costs for the replacement drop structures, the canal prism between the drop structures will require rehabilitation due to degradation, sedimentation, erosion, and sloughing and enlarging for flows exceeding 850 cfs. The length of conveyance between each of the drop structures is approximately 10,550 feet. Excluding the stilling basins and lakes, there is approximately 8,200 feet of actual canal. The cost estimates presented in Table 4.10 below are based on an average price per lineal foot of existing channel rehabilitation and/or new canal construction. These prices are based on cost estimates developed for the six major reaches and three different capacities. This is discussed in further detail in Section 4.8.

Table 4.10 Cost Estimates for Canal Prism Reshaping for the Drops.

Design Capacity (cfs)	Drop No. 1 to Drop No. 2	Drop No. 2 to Drop No. 3	Drop No. 3 to Drop No. 4	Drop No. 4 to Drop No. 5	Total
670	$550,000	$300,000	$810,000	$1,240,000	$2,900,000
850	$640,000	$350,000	$940,000	$1,470,000	$3,400,000
1000	$700,000	$390,000	$1,035,000	$1,575,000	$3,700,000

Replacement In-Kind

The opinion of probable costs to replace the five drop structures in-kind, with minor variations in cross section, are shown below in Table 4.11.

Table 4.11 Cost Estimates to Replace Drop Structures In-Kind.

Design Capacity (cfs)	Drop No. 1	Drop No. 2	Drop No. 3	Drop No. 4	Drop No. 5	Canal Prisms	Rounded Total
700	$900,000	$870,000	$740,000	$1,200,000	$ 990,000	$2,900,000	$7,600,000
850	$930,000	$900,000	$760,000	$1,250,000	$1,050,000	$3,400,000	$8,300,000
1000	$960,000	$930,000	$790,000	$1,250,000	$1,100,000	$3,700,000	$8,800,000

The above costs are based on the assumption that the replacement drop structures will be constructed adjacent to the existing structures so as to allow for uninterrupted service and construction in summer. This assumption is consistent with the previous USBR cost estimates (USBR, 2003).

Replacement with New Configuration

The opinion of probable cost to replace the five drop structures in similar nature, but including modifying the profile and changing the downstream energy dissipation method are shown below in Table 4.12:

Table 4.12 Cost Estimates to Replace Drop Structures with New Configurations.

Canal Capacity (cfs)	Drop No. 1	Drop No. 2	Drop No. 3	Drop No. 4	Drop No. 5	Canal Prisms	Rounded Total
700	$890,000	$850,000	$710,000	$1,200,000	$ 1,000,000	$2,900,000	$7,600,000
850	$930,000	$890,000	$740,000	$1,250,000	$1,050,000	$3,400,000	$8,300,000
1000	$960,000	$920,000	$760,000	$1,300,000	$1,100,000	$3,700,000	$8,800,000

For the pipe drop alternative the same costs as presented in the most recent TD&H report (TD&H 2005) applies as shown below in Table 4.13. The exception is that costs are presented for the previously established flow rate of 670 cfs (estimated current flow capacity of canal) versus the current flow rate of 700 cfs.

Table 4.13 Cost Estimates to Replace Drop Structures with Pipe Drops.

Canal Capacity (cfs)	Drop No. 1	Drop No. 2	Drop No. 3	Drop No. 4	Drop No. 5	Canal Prisms	Total
670	$733,000	$863,000	$780,000	$993,000	$828,000	$1,360,000	$5,557,000
850	$957,100	$1,051,800	$933,600	$1,240,900	$1,051,800	$1,765,000	$7,000,200
1000	$992,700	$1,063,600	$957,200	$1,300,000	$1,099,100	$1,630,000	$7,042,600

Again, the above costs are based on the assumption that the replacement drop structures will be constructed adjacent to the existing structures during the summer.

Replacement with "Hydropower Ready" Configuration

The estimated cost to replace the existing drop structures with a "hydropower ready" configuration as described in Section 2.3 is shown in Table 4.14 below.

Table 4.14 Cost Estimates to Replace Drop Structures with "Hydro-Ready" Configuration.

Design Capacity (cfs)	"Hydro-Ready" w/o Penstocks	"Hydro-Ready" with Penstocks	Net "Hydro-Ready" Costs with Penstocks
700	$9,300,000	$14,000,000	$6,100,000
850	$10,000,000	$14,500,000	$6,000,000
1000	$11,000,000	$15,000,000	$6,000,000

Each of the above cost figures include the replacement cost of Drop No. 5 and canal reshaping between Drop No. 4 and No. 5, assuming the current structure will be replaced with a new drop structure with a USBR Type III stilling basin as discussed above. The net "hydro-ready" costs reflect a cost reduction for Drops No. 1 through No. 4 and the connecting canal prisms that would not require replacement and rehabilitation. The costs do not include any amount for land acquisition. As mentioned earlier, the hydro-ready alternative would require approximately 80 acres. At $1,000/acre, this equates to $80,000.

4.7.4 Feasibility of Hydropower

A cursory economic analysis was performed to assess the potential feasibility of a hydropower installation on the canal. A generating capacity of 7.50 megawatts was used based on an average

daily flow of 850 cfs and the available drop in elevation. It was assumed that power would be generated for six months each year.

The two major variables in this analysis are the cost of the generating facility and the selling price of the power. The analysis was done by first assessing the additional or incremental costs of a hydropower facility in comparison with a project that would not involve hydropower using cost assumptions of 22.0, 27.0 and 32.0 million dollars for the hydropower facilities. Actual cost estimates for a hydropower generating plant were not prepared. Next, the incremental costs were compared with potential revenues at three, five and seven cents per kilowatt-hour to assess economic feasibility.

A commonly used industry rule-of-thumb to determine a reconnaissance level cost for a hydropower facility is $1,500 per kilowatt of capacity. For a 7.5-megawatt facility, the construction cost would therefore be approximately $11,000,000 for the plant itself. It seems reasonable to assume that the additional cost to modify the inlet and add penstocks and transmission lines could be accomplished under an additional $11,000,000 to arrive at the minimum cost assumption of $22,000,000 presented above.

Table 4.15 below shows the results of the comparison of incremental costs with estimated revenues. The nine alternatives in the table are based on the three assumptions for the costs of the generating facilities and the three assumptions for the selling price of power. The costs include both total capital costs as well as an annual cost of $250,000 for O&M associated with hydropower. Incremental costs were derived as the total of capital costs plus O&M less the cost of a project with no hydropower features. The revenues in the table are the present values of 30-year revenue streams from the sale of hydropower discounted at 5.0 percent so as to be comparable to the incremental cost figures.

Table 4.15 Incremental Cost/Revenue Comparison For Given Assumptions(850 cfs)

Assumed Hydropower Plant Costs (millions)	Incremental Cost	Power (Cents per KwHr)	Present Value of Revenue	Revenue Less Incremental Cost
$22	$19,088,000	3	$14,941,584.00	($4,146,416)
	$19,088,000	5	$24,902,640	$5,814,640
	$19,088,000	7	$34,863,696	$15,775,696
$27	$24,088,000	3	$14,941,584	($9,146,416)
	$24,088,000	5	$24,902,640	$814,640
	$24,088,000	7	$34,863,696	$10,775,696
$32	$29,088,000	3	$14,941,584	($14,146,416)
	$29,088,000	5	$24,902,640	($4,185,360)
	$29,088,000	7	$34,863,696	$5,775,696

Note: Numbers In parentheses are negative.

The last column in Table 4.15 shows the difference between revenues and incremental costs. A negative number in this column means the alternative is not economically feasible. The analysis indicates that at 3.0 cents per kilowatt-hour none of the alternatives are likely to be feasible while at 7.0 cents per kilowatt-hour all of the alternatives appear to be viable. There is a sufficient indication of feasibility in the results of the analysis that more detailed investigations appear to be warranted.

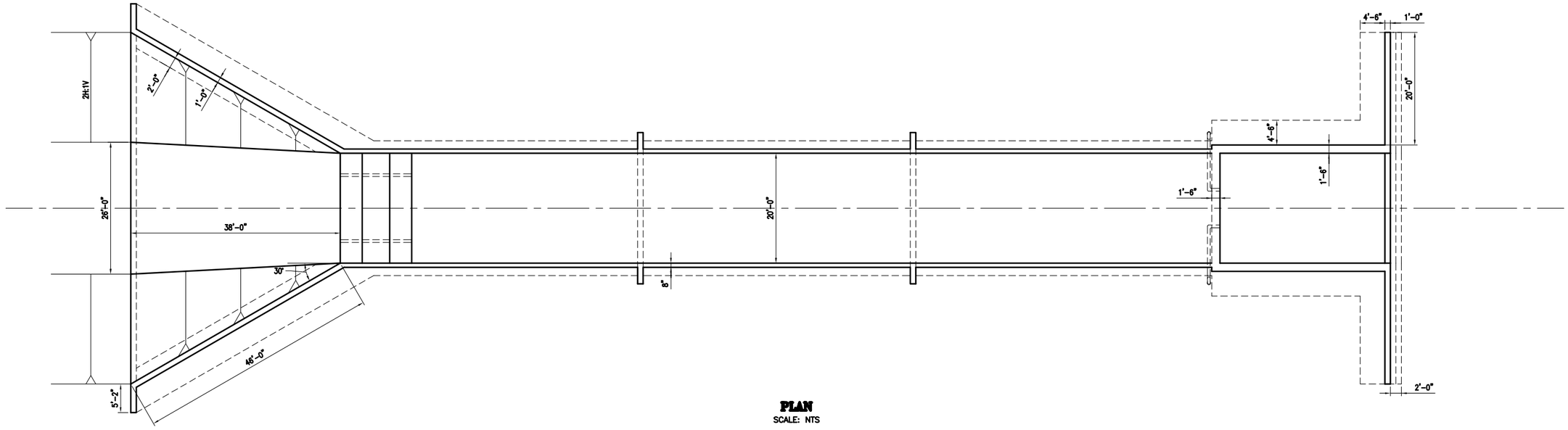
4.7.5 Recommendations

Based upon the advantages previously presented in this report, it is recommended to further consider and refine the design of the revised drop structure with a USBR Type III stilling basin depicted in Figure 4.23 and the pipe drop structure discussed previously. The revised drop structure offers improved flow characteristics within the drop itself as well as downstream and reduces the potential for concrete deterioration that has occurred within the plunge pool of the existing drop structures. One of the main attractions to the pipe drop is access to the opposite side of the canal. It should be noted that if an open chute is selected, access to the opposite side of the canal can also be provided by way of a two-bank canal and/or a small bridge.

Once the final structure type is selected, the location of the replacement structures should also be determined, specifically in place or adjacent to the existing structures. This determination should

be based on items including; geotechnical foundation conditions, construction cost variations between winter and summer, the need to maintain regular discharges, the acceptable duration of construction, and the potential difficult conditions experienced during winter construction.

Addition of hydropower appears to be economically feasible. In order to better determine the feasibility of hydropower, an investigation of potential power sale price and estimated cost for the hydropower facilities needs to be performed.



PLAN
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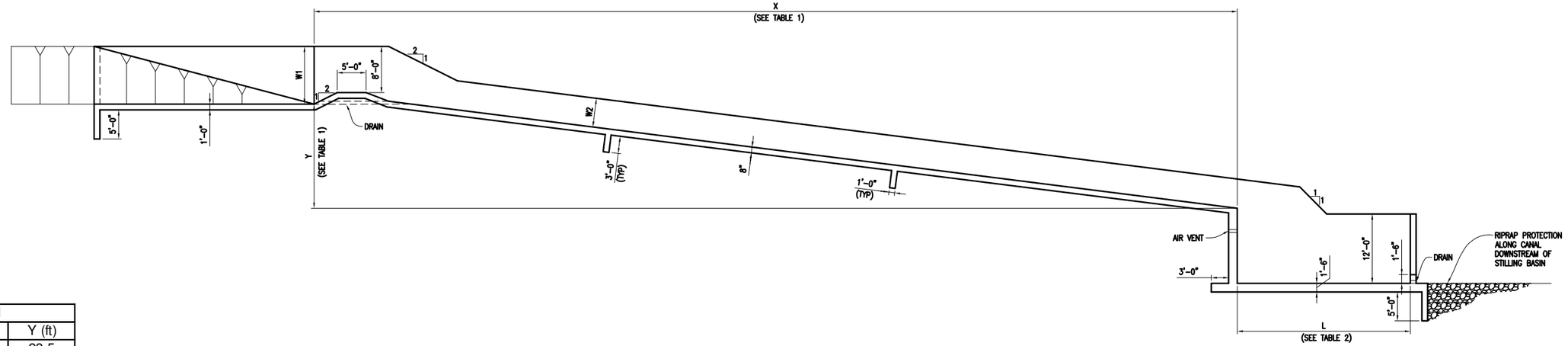


PROFILE
SCALE: NTS

TABLE 1		
No.	X (ft)	Y (ft)
Drop 1	175	23.5
Drop 2	165	16.5
Drop 3	99.5	14.8
Drop 4	300	54
Drop 5	219	44.3

TABLE 2			
Q	L (ft)	W1 (ft)	W2 (ft)
700-cfs	38	9.5	4.5
850-cfs	40	10	5
1000-cfs	42	10.5	5.5

NOTES:

1. THE INLET TO DROP STRUCTURE NO. 1 CAN BE MODIFIED TO PROVIDE FLOW MEASUREMENT CAPABILITY TO MATCH CURRENT CONDITIONS. AS AN ALTERNATE, A SEPARATE FLOW MEASUREMENT STRUCTURE CAN BE INSTALLED UPSTREAM OF THE DROP STRUCTURES.
2. ALL DIMENSIONS ARE APPROXIMATE AND WILL BE CONFIRMED DURING FINAL DESIGN.

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 4.22

REVISIONS			
NO.	APP.	DATE	DESCRIPTION

SCALE VERIFICATION
THIS BAR IS ONE INCH ON ORIGINAL DRAWING.
0 — 1"
IF BAR IS NOT ONE INCH ON THIS SHEET, ADJUST THE SCALE ACCORDINGLY.

TCB | AECOM
TURNER COLLIE & BRADEN
7800 E DORADO PLACE, SUITE 100
GREENWOOD VILLAGE, CO 80111
WWW.TCB.AECOM.COM

	INITIALS	DATE
DESIGN	JCB	11/17/05
CADD LEAD	JCB	11/17/05
CHECK	MLM	
APPROVED	RD	
SCALE: AS SHOWN		
VERSION: AUTOCAD 2004		

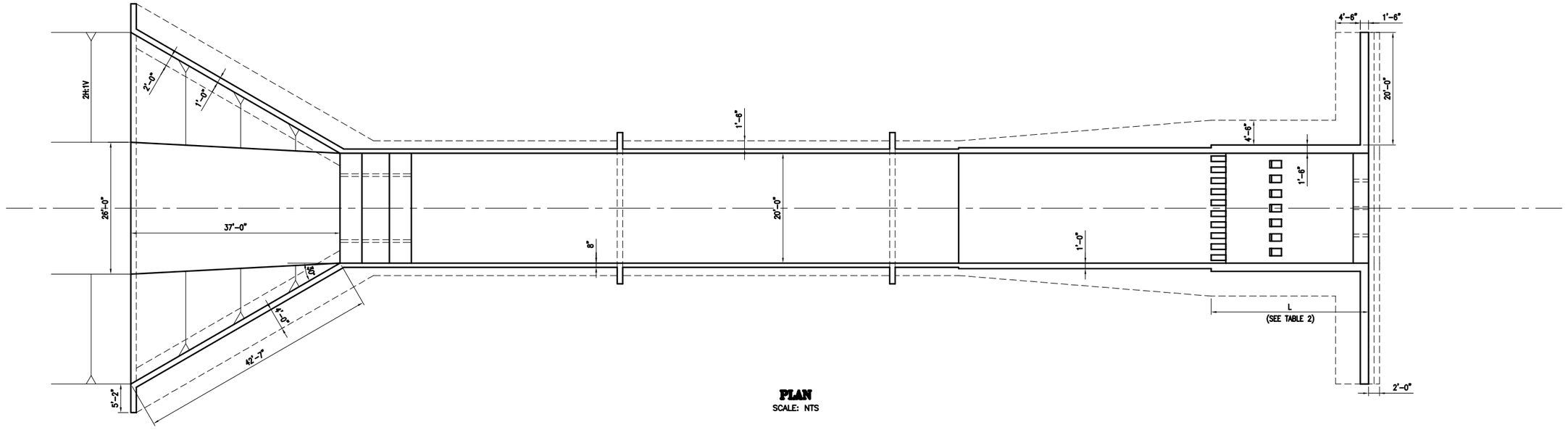
ST. MARY CANAL

DROP STRUCTURE REPLACEMENT
IN-KIND

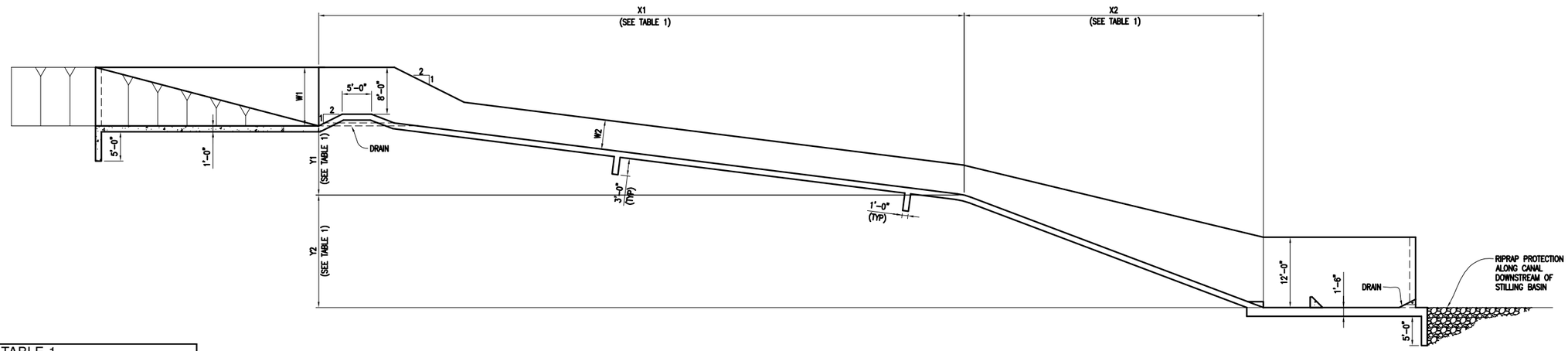
ISSUE DATE | REVISION

ECI PROJECT NO.
52804261.00001

DRAWING NO.



PLAN
SCALE: NTS



PROFILE
SCALE: NTS

TABLE 1				
No.	X1 (ft)	Y1 (ft)	X2 (ft)	Y2 (ft)
Drop 1	116.7	15.7	58.3	20.8
Drop 2	110	11	55	18.5
Drop 3	66.3	9.9	33.2	17.9
Drop 4	200	36	100	31
Drop 5	146	29.5	73	27.8

TABLE 2			
Q	L (ft)	W1 (ft)	W2 (ft)
700-cfs	25	9.5	4.5
850-cfs	28	10	5
1000-cfs	30	10.5	5.5

NOTES:

1. THE INLET TO DROP STRUCTURE NO. 1 CAN BE MODIFIED TO PROVIDE FLOW MEASUREMENT CAPABILITY TO MATCH EXISTING CONDITIONS. AS AN ALTERNATIVE, A SEPARATE FLOW MEASUREMENT STRUCTURE CAN BE INSTALLED UPSTREAM OF THE DROP STRUCTURES.
2. ALL DIMENSIONS ARE APPROXIMATE AND WILL BE CONFIRMED DURING FINAL DESIGN.

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 4.23

REVISIONS			
NO.	APP.	DATE	DESCRIPTION

SCALE VERIFICATION
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	INITIALS	DATE
DESIGN	JCB	11/17/05
CADD LEAD	JCB	11/17/05
CHECK	MLM	
APPROVED	RD	
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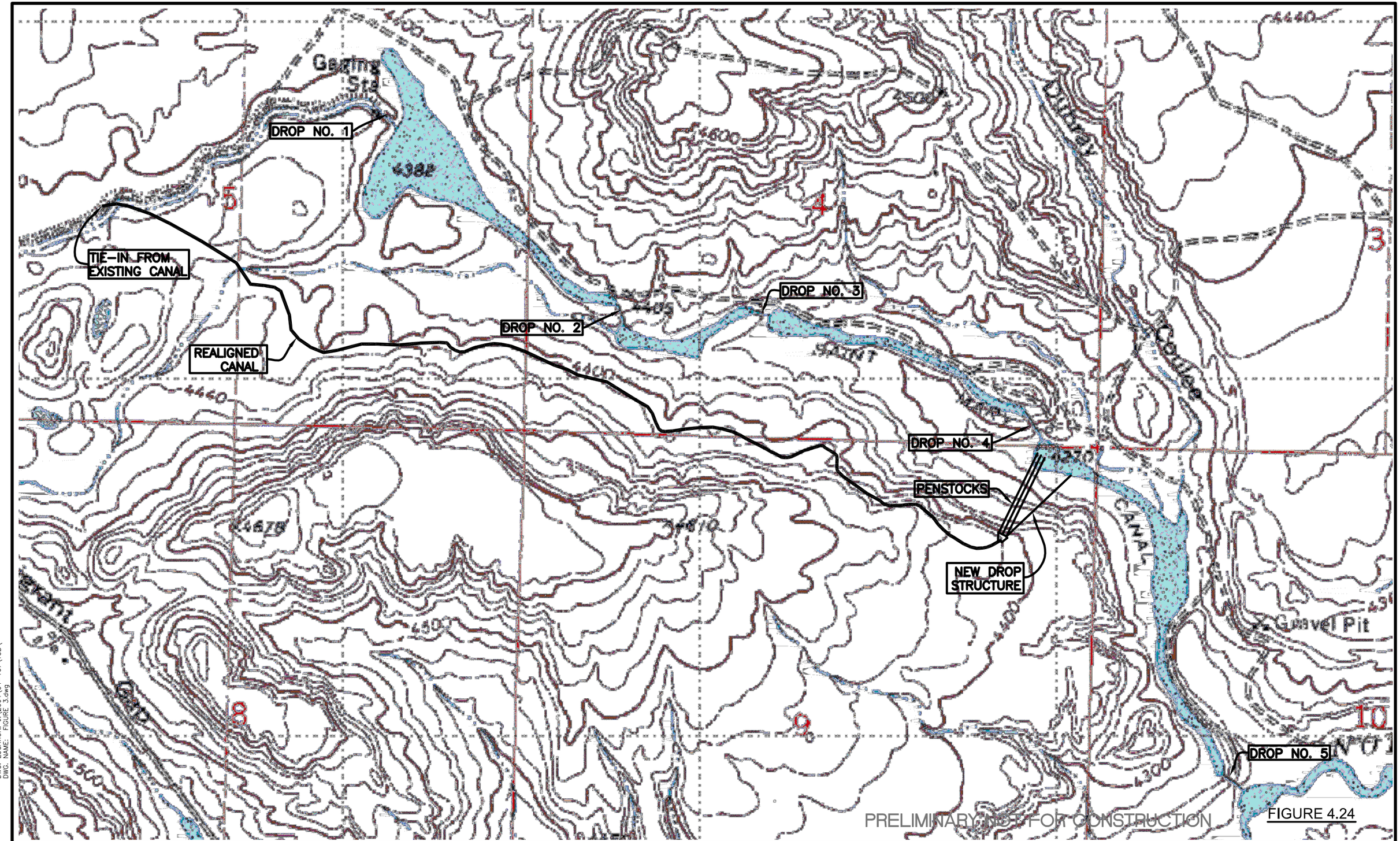
VERSION: AUTOCAD 2004		

ST. MARY CANAL

DROP STRUCTURE REPLACEMENT
CHUTE W/USBR TYPE III BASIN

ISSUE DATE | REVISION
ECI PROJECT NO. 52804261.00001
DRAWING NO.



PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 4.24

REVISIONS			
NO.	APP.	DATE	DESCRIPTION

SCALE VERIFICATION

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ST. MARY CANAL

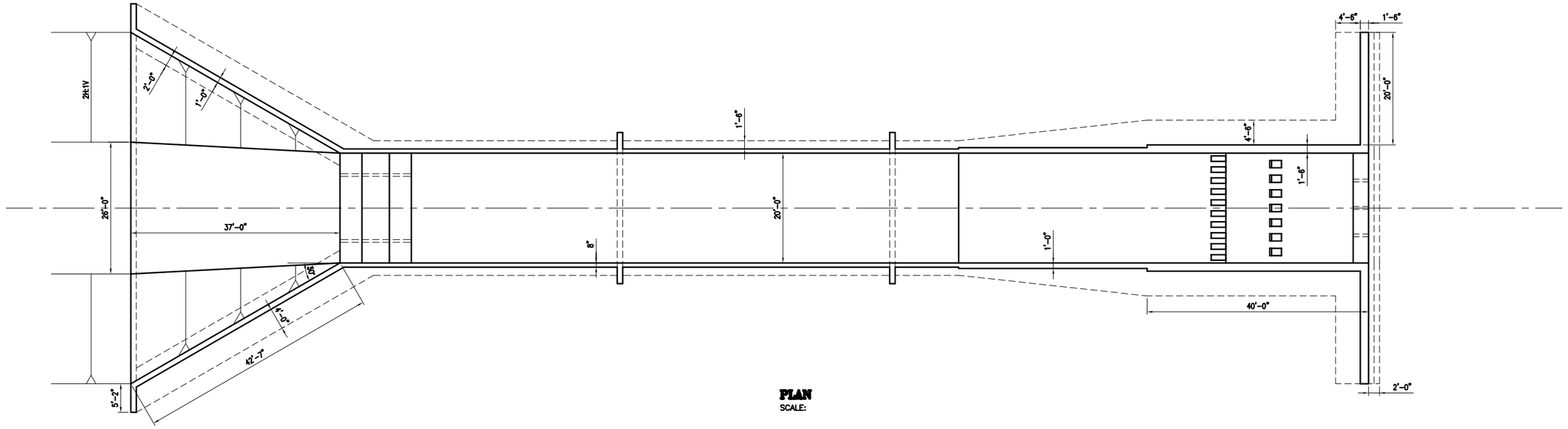
HYDROPOWER READY OPTION
CANAL, PENSTOCKS AND DROP STRUCTURE

ISSUE DATE | REVISION

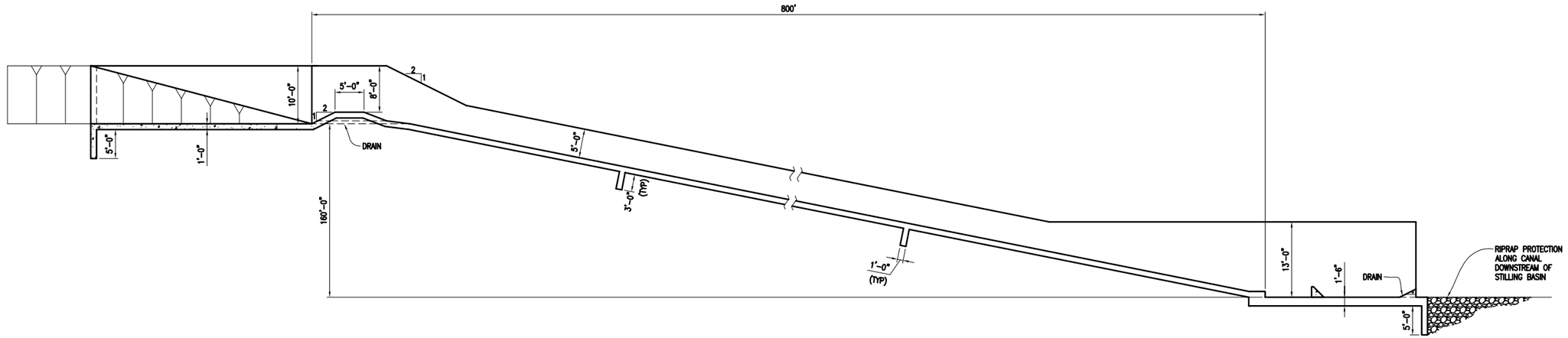
ECI PROJECT NO. 52804261.00001

DRAWING NO.

J:\2004\04-167\TCB\FIGURE 3.dwg, 8/1/2006 8:49:11 AM, TDH Great Falls, MMJ
LAST MODIFIED: Aug 01, 2006 – 8:49am BY USER: MMJ
DWG. LOCATION: J:\2004\04-167\TCB\
DWG. NAME: FIGURE 3.dwg



PLAN
SCALE:



PROFILE
SCALE:

NOTES:

1. A SEPARATE FLOW MEASUREMENT STRUCTURE CAN BE INSTALLED UPSTREAM OF THIS DROP STRUCTURE.
2. ALL DIMENSIONS ARE APPROXIMATE AND WILL BE CONFIRMED DURING FINAL DESIGN.

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 4.25

REVISIONS			
NO.	APP.	DATE	DESCRIPTION

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CADD LEAD	JCB	11/17/05
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APPROVED	RD	
SCALE: AS SHOWN		
VERSION: AUTOCAD 2004		

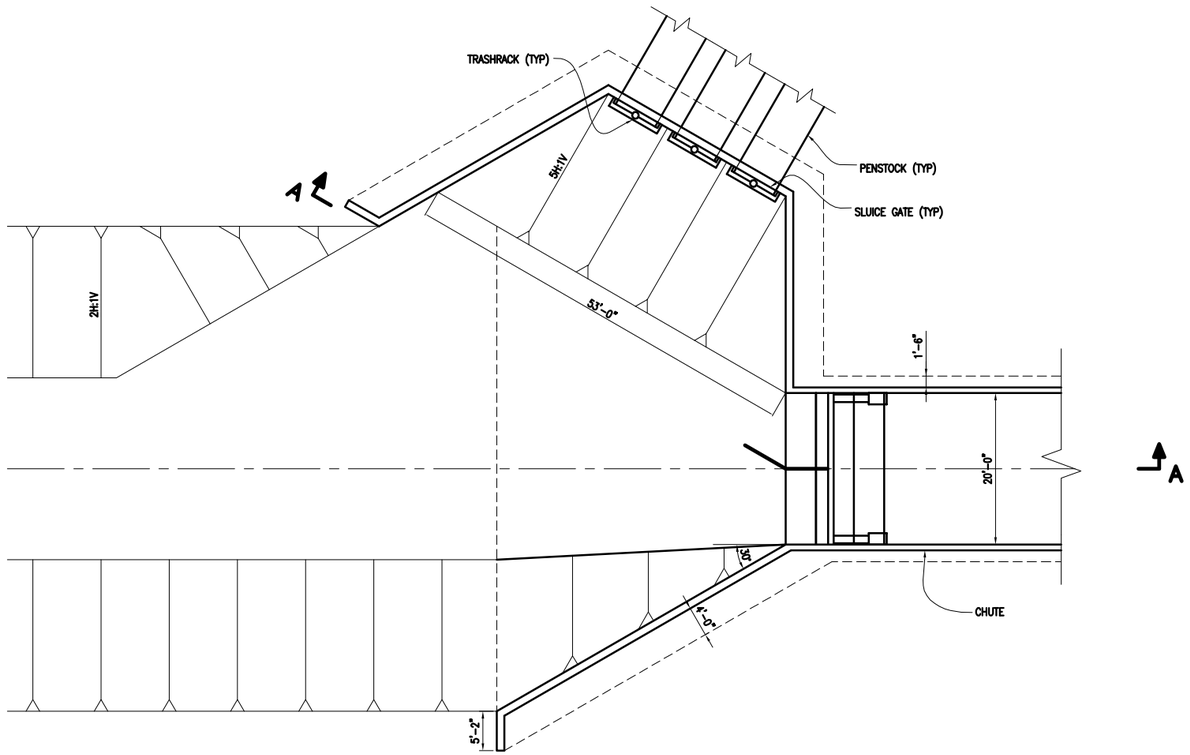
ST. MARY CANAL

HYDROPOWER READY OPTION
CHUTE W/USBR TYPE III BASIN

ISSUE DATE | REVISION

ECI PROJECT NO. 52804261.00001

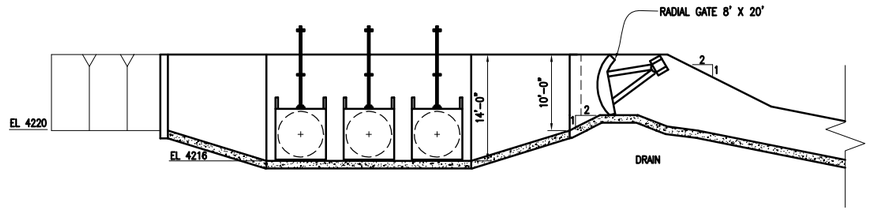
DRAWING NO.



PLAN
SCALE:

NOTES:

1. A SEPARATE FLOW MEASUREMENT STRUCTURE CAN BE INSTALLED UPSTREAM OF THIS DROP STRUCTURE.
2. ALL DIMENSIONS ARE APPROXIMATE AND WILL BE CONFIRMED DURING FINAL DESIGN.



SECTION A-A
SCALE:

FIGURE 4.26

PRELIMINARY NOT FOR CONSTRUCTION

REVISIONS			
NO.	APP.	DATE	DESCRIPTION

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	INITIALS	DATE
DESIGN	JCB	11/17/05
CADD LEAD	JCB	11/17/05
CHECK	MLM	
APPROVED	RD	
SCALE: AS SHOWN		
VERSION: AUTOCAD 2004		

ST. MARY CANAL

HYDROPOWER READY OPTION W/INLET MOD
CHUTE W/USBR TYPE III BASIN

ISSUE DATE | REVISION
ECI PROJECT NO. 52804261.00001
DRAWING NO.

4.8 CANAL PRISMS

4.8.1 Overview

Alternatives considered for rehabilitation of the existing canal prism, excluding the major structures, include either reshaping and rehabilitating the existing canal along its current alignment or realigning the canal to improve hydraulic efficiency, improve maintenance and operational accessibility, reduce overall length, facilitate winter construction and reduce costs. Cost estimates were determined for six individual canal reaches that represent reasonable and practical segments that could be reconstructed in a given off-season. The segments were discussed in Section 4.3.3 and are listed again below.

Table 4.16 Proposed Segments for Reconstruction of the Canal Prism

Canal Reach	Existing Length	Proposed Alignment
No. 1 Diversion Dam to Kennedy Creek Siphon Inlet	25,009	23,680
No. 2 Kennedy Creek Siphon Outlet to St. Mary Siphon Inlet	22,141	20,706
No. 3 St. Mary Siphon Outlet to Station 715+00	20,303	19,547
No. 4 Station 715+00 to Hall Coulee Siphon Inlet	19,851	17,851
No. 5 Hall Coulee Siphon Outlet to Station 1173+50	24,290	21,666
No. 6 Station 1173+50 to Drop No. 1	23,576	22,266
Total	135,170	125,716

The design criteria for the new canal prisms were presented in Section 4.3.4. For each canal reach, 4 alternatives were considered which included:

- 850 cfs, existing alignment, 1-bank canal with reshaping as needed and
- new alignment, 2-bank canal with armoring at design capacities of 700, 850 and 1000 cfs

Lining of the rehabilitated canal is recommended at significant embankment fills such as Powell Creek underdrain and known embankment fill instabilities such as 4th of July and Gravel Road Bridge slides. Also, canal lining is strongly recommended within 500 feet of the transition structures for the St. Mary River and Hall Coulee Siphons. This lining is meant to improve known instabilities. Canal lining to reduce seepage losses alone is not considered cost-effective

from the Diversion Dam to St. Mary River Siphon due to the current IJC method of determining the U.S. apportionment of +100 natural flow. In our opinion, enlarging the canal capacity to account for seepage losses (+100 cfs) is more cost effective than canal lining. Seepage losses downstream from the St. Mary River Siphon are on the order of 30 cfs.

Each proposed canal reach is discussed separately. At this time, the greatest unknowns with respect to the construction cost estimates are as follows:

- ROW constraints, land availability for permanent alignment changes and for temporary construction activities.
- Geotechnical information of the existing backslope instabilities identified by USBR staff.
- Insufficient topographic information that impacts alignment considerations and earthwork quantity determinations.
- The desired diversion rate at the headworks and the desired canal discharge at the top of Drop No. 1.

4.8.2 Canal Reach No. 1

This reach extends from the diversion dam to the inlet of Kennedy Creek Siphon. The current length is approximately 25,009 feet and the proposed realignment is 23,680 feet long. The existing canal grade is on the order 0.095 feet per 1000 feet. Design considerations along this reach include the following:

1) Replacement of two public access bridges; Babb Bridge at Station 94+00 and Reid Bridge (Kennedy Creek) at Station 262+80.
2) Add maintenance access bridge downstream of headgates.
3) Close proximity to U.S. Hwy 89.
4) Scattered residential development from Station 140+00 to 200+00.
5) Several large inflow inundation areas.
6) Significant brush and tree cover on existing fill slope. Scatter trees on cut slope; heavy from Station 200+00 to 254+00.
7) Impact on old Babb domestic wells.
8) Structures to facilitate wildlife migration tendencies as warranted.

Improvements will include the following:

- 2 public bridges, 1 maintenance bridge
- livestock fencing along ROW with access gates and cattle guards
- 3 maintenance drainage turnouts
- 3 livestock turnouts or dugouts
- 3 controlled inlets (2-bank)
- 15 uncontrolled inlets (2-bank)

4.8.3 Canal Reach No. 2

This reach extends from the outlet of Kennedy Creek Siphon to the inlet of St. Mary Siphon. The current length is approximately 22,141 feet and the proposed realignment is 20,706 feet long. The existing canal grade is on the order of 0.077 feet per 1000 feet. Design considerations along this reach include the following:

1) Replacement of existing Kennedy Creek check and wasteway.
2) Replacement of existing Powell Creek underdrain.
3) Provide maintenance access bridge near check and relocate Memorial Bridge (Station 387+00) to new canal crossing.
4) Relocation of approximately 1.5 miles County gravel road (relocation alternatives).
5) Significant brush on fill slope Station 312+00 to 353+00.
6) Reduce canal seepage near inlet structure to St. Mary River Siphon.
7) Structures to facilitate wildlife migration tendencies as warranted.

Improvements will include the following:

- 1 new maintenance bridge,
- relocate Memorial Bridge (realignment alternative)
- replace Powell Creek underdrain including liner section over fill
- fencing with access gates and cattle guards
- 3 maintenance drainage turnouts
- 2 livestock turnouts or dugouts
- 1 controlled inlet (2-bank)
- 13 uncontrolled inlets (2-bank)

- 500 LF of canal liner upstream of St. Mary River Siphon inlet
- 8000 LF of County gravel road relocation/reconstruction
- new drop-leaf check structure and sluice gate wasteway near Kennedy Creek

4.8.4 Canal Reach No. 3

This reach extends from the outlet of St. Mary River Siphon to approximately Station 715+00. The current length is 20,303 feet and the proposed realignment is 19,547 feet. The existing canal grade is approximately 0.142 feet per 1000 feet. Design considerations along this reach include the following:

1) Reduce canal seepage near outlet structure of St. Mary River Siphon.
2) Heavily wooded on backslope Station 542+00 to 580+00.
3) Check structure at mouth of Spider Lake.
4) Replace DeWolfe Bridge (private access).
5) Moderate brush coverage on embankment fill from 668+00 to 715+00.
6) Four existing backslope instabilities; DeWolfe Ranch, DeWolfe Bridge, Mid-Section 22, and East Section 22 slides.
7) Structures to facilitate wildlife migration tendencies as warranted.

Improvements will include the following:

- replacement bridge (DeWolfe Bridge) at Station 668+00
- 500 LF of lined canal downstream of St. Mary River Siphon outlet
- new drop leaf check structure at mouth of Spider Lake
- 9 uncontrolled inlets (2-bank)
- livestock fencing along ROW with access gates and cattle guards
- 3 maintenance turnouts
- 2 livestock turnouts or dugouts
- approximately 4200 LF of back slope mitigation

4.8.5 Canal Reach No. 4

This reach extends from Station 715+00 to the inlet of the Hall Coulee Siphon. The current length is approximately 19,851 feet and the propose realignment is 17,851 feet long. The

existing canal grade is on the order of 0.108 feet per 1000 feet. Design considerations along this reach include the following:

1) Need for new maintenance access bridge in the vicinity of Station 780+00.
2) Several large cuts (realignment alternative).
3) Heavy brush on embankment fill slope Station 715+00 to 757+00 and scattered brush 791+00 to Hall Coulee.
4) Replacement of Hall Coulee Wasteway.
5) Two large inflow inundation areas.
6) Four existing instabilities; Grizzly, Big Cut, 4th of July and Hall Coulee slides.
7) Replace underdrain at Station 794+46.
8) Reduce canal seepage near inlet structure of Hall Coulee Siphon.
9) Structures to facilitate wildlife migration tendencies as warranted.

Improvements will include the following:

- new maintenance access bridge near Station 780+00
- new sluice gate wasteway structure to replace existing
- 2 controlled inlet structures (2-bank)
- 2 livestock turnouts or dugouts
- 3 maintenance drainage outlets
- 9 uncontrolled inlets (2-bank)
- livestock fencing along ROW with access gates and cattle guards
- 500 LF of lined canal upstream of Hall Coulee Siphon inlet structure
- approximately 1100 LF of backslope mitigation (Grizzly, and Hall Coulee slides)
- new cut section at Big Cut Slide
- avoid or reconstruct (with canal lining) 4th of July embankment fill instability

4.8.6 Canal Reach No. 5

This reach extends from Hall Coulee outlet structure to Station 1173+50. The current length is 24,290 feet and the proposed realignment is approximately 21,666 feet. The existing canal grade is on the order of 0.101 feet per 1000 feet. Design considerations along this reach include the following:

1) Reduce canal seepage near outlet structure of Hall Coulee Siphon.
2) Maintain canal alignment and grade at Martin Bridge (Station 987+80) to keep bridge.
3) Replace four underdrain structures.
4) Gas pipeline crossing at Station 1107+60.
5) Need for maintenance access bridge near Station 1170+00.
6) Three existing instabilities; Gravel Road Bridge, Martin and Pipeline Slides.
7) Structures to facilitate wildlife migration tendencies as warranted.

Improvements will include:

- 500 LF of lined canal downstream of Hall Coulee Siphon outlet structure
- livestock fencing along ROW with access gates and cattle guards
- 3 livestock turnouts or dugouts
- 3 maintenance drainage turnouts
- replace four underdrains with RCP conduit
- 1 controlled inlet structure (2-bank)
- 13 uncontrolled inlets (2-bank)
- approximately 400 LF of backslope mitigation for Pipeline Slide
- new cut section at Martin Slide
- avoid or reconstruct (with canal lining) Gravel Road Bridge Slide embankment fill instability
- new maintenance access bridge near Station 1170+00

4.8.7 Canal Reach No. 6

This reach extends from Station 1173+50 to Drop No. 1. The current length is 23,576 feet and the proposed realignment is approximately 22,266 feet. The existing canal grade is on the order of 0.101 feet per 1000 feet. Design considerations along this reach include the following:

1) Replace underdrain at Station 1195+65.
2) Maintain canal alignment and grade at Emigrant Gap Bridge (Station 1363+50) to keep bridge.
3) Structures to facilitate wildlife migration tendencies as warranted

Improvements will include:

- livestock fencing along ROW with access gates and cattle guards
- 3 livestock turnouts or dugouts
- 3 maintenance drainage turnouts
- replace one underdrain with RCP conduit
- 3 controlled inlet structures (2-bank)
- 13 uncontrolled inlets (2-bank)

4.8.8 Summary

The estimated costs are summarized below in the Table and reflect 2005 prices. As stated earlier, the cost estimates were developed making assumptions with respect to ROW costs, geotechnical unknowns of the canal prism instabilities and actual earthwork quantities due to incomplete topographical surveys.

Table 4.17 Cost Estimates to Rehabilitate Six Proposed Canal Reaches

	Reshape Existing	Two-Bank Canal Realignment Alternatives		
Canal Reach	Q=850 CFS	Q=700 CFS	Q=850 CFS	Q=1000 CFS
Canal Reach No. 1	$10,500,000	$ 9,200,000	$ 9,700,000	$10,500,000
Canal Reach No. 2	$12,000,000	$11,500,000	$12,500,000	$13,000,000
Canal Reach No. 3	$13,500,000	$13,000,000	$14,000,000	$14,500,000
Canal Reach No. 4	$11,000,000	$ 9,900,000	$11,000,000	$12,000,000
Canal Reach No. 5	$10,500,000	$ 9,000,000	$10,500,000	$11,500,000
Canal Reach No. 6	$ 7,700,000	$ 7,300,000	$ 8,500,000	$ 9,300,000
TOTAL	$65,200,000	$59,900,000	$66,200,000	$70,800,000

Cost Estimates Do No Include ROW Land Acquisition

As stated earlier, the reshaping (850 cfs) alternative maintains the existing alignment without any proposed hydraulic improvements beyond that originally constructed in the early 1900's. The realignment alternatives include canal straightening and shortening, armoring, two-bank construction and controlled inlets for engineered wetlands.

4.9 SUMMARY

4.9.1 Overview

The majority of the structures comprising the St. Mary Diversion Facilities are in poor to very poor condition and are approximately 90 years old, well beyond their design life. The continued degradation has resulted in a current safe diversion of 725 cfs, well below its original capacity of 850 cfs. Sloughing and deterioration of the earthen canal prisms downstream of the St. Mary River siphon is the primary reason for diminished capacity. In addition, maintenance costs, just to maintain minimal service, are escalating beyond the ability of the prime beneficiaries to pay them. Water shortages in the Milk River Basin have been largely attributed to the gradual deterioration of the St. Mary River Diversion Facilities. This has been echoed in many USBR and DNRC reports, and a representation of quotes is presented below.

- "The current system of canals and storage reservoirs supply irrigators with only one-third to one-half of the water needed for full crop production in a normal year."
- "The deteriorating St. Mary Canal system and decreasing storage in Milk River reservoirs due to sedimentation are major causes of water shortage in the Milk River Basin."
- "The key component of the project is the St. Mary Canal. The 29-mile long canal has outlived its design life, having been completed in 1915. The St. Mary River Siphon in the canal and five large drop structures are in imminent danger of failure. Capacity has diminished from the design capacity of 850 cfs to about 650 cfs today."
- "Based on current trends, catastrophic failure of the St. Mary Canal is likely to occur between now and 2050."
- "The 85-year old St. Mary Canal (now 90 years) is badly in need of rehabilitation; most of the structures have exceeded their design life and thus are in need of major repairs or replacement. Canal capacity has dropped from the original 850 cfs in 1925 to about 650 cfs today. Landslides along the canal route and the dilapidated structures make the canal unreliable as a water source."

The St. Mary River siphon and hydraulic drops represent the greatest potential for catastrophic failure due to their present condition and estimated damage resulting from failure. Catastrophic

failure of either of these two components would result in severe and irreversible environmental damage to the St. Mary River and the North Fork of the Milk River, respectively. Without engineering designs and construction drawings in hand, repairs and structure replacement would most likely take two years for significant failure of one of the two siphon locations and at least one year for a failed drop. This would create an economic disaster for north central Montana directly and indirectly for the remainder of the State.

Catastrophic failure of the canal prism most likely could be repaired in the same season depending on its location. Likewise, the resulting environmental damage would be contained and less severe.

Most of the remaining components of the diversion facilities do not pose a high risk of catastrophic failure, but their overall rehabilitation is warranted to increase diversion capacity, decrease water shortages, improve operational flexibility and efficiency, improve safety, reduce maintenance costs and protect threatened/endangered species.

4.9.2 Rehabilitation Alternatives

With respect to overall rehabilitation of the St. Mary Facilities, numerous alternatives exist which were considered and evaluated. Recommended alternatives were selected based on construction costs, improved O&M efficiency, ease of construction and mitigation of identified environmental and Blackfeet Nation issues. In summary, the recommended alternatives include the following:

- Diversion Dam and Headgates – Adjustable pneumatic crest with enhanced natural stream flow during the off-season. Rock-surfaced, naturalized channel will be utilized to allow fish passage during diversion. Sluice-style headgates with fish deterrent and debris deflection enhancements are proposed. Fish screens with either mechanical or air burst cleaning will be located downstream of the headgates. A by-pass flow will allow fish to return to the river.

- Kennedy Creek Siphon – For canal capacities up to 850 cfs, we recommend rehabilitating the deteriorated concrete of the existing structure. For canal flows above 850 cfs, we recommend replacing the structure with a new siphon consisting of dual RCP's and transition structures.

- Canal Prisms – We recommend realignment of the existing canal to improve hydraulic efficiency, reduce lengths, avoid existing instabilities, and reduce overall costs. It is further recommended to adopt a two-bank canal with armoring to facilitate inspection and maintenance. The ROW should be fenced using wildlife friendly fencing. Additional enhancements include controlled inlets to create upgradient, ponded wetlands, livestock turnouts, additional maintenance turnouts, wildlife crossings, and canal lining in select areas to reduce potential instabilities.

- St. Mary River and Hall Coulee Siphons – We recommend re-evaluating costs for these structures during the design phase since the replacement costs are predominantly material related and have experienced significant volatility in the last two years. Also, the landslide studies for the St. Mary River siphon have yet to be finalized. It is envisioned that a single, buried barrel will be utilized expect for possibly the south side of the St. Mary River crossing where deep-seated movements are suspected. This may warrant an elevated siphon. The river crossing would be below grade installed by direct bury.

- Hydraulic Drops – Costs for replacement structures consisting of either pipe drops, or chutes with Type III stilling basin are comparable. Impacts to O&M activities favor the open chutes. To reconfigure the drops for "hydro-ready" considerations add approximately $6,000,000 excluding costs for the plant, ROW, hydro-machinery, and transmission. In our opinion, hydropower remains economically feasible pending a final study.

4.9.3 Overall Estimated Rehabilitation Costs

The estimated overall rehabilitation costs for canal capacities of 700, 850 and 1000 cfs are summarized in the Table below. These costs are higher than those summarized in the January, 2005 TD&H report and mainly reflect significant increases in construction in the past 12 months. This is seen in the costs for the St. Mary River and Hall Coulee siphons which are predominantly material costs. The costs prepared as part of this study reflect 2005 prices and should be indexed to the appropriate construction start date.

Table 4.18 Estimated Overall Project Costs to Rehabilitate St. Mary Diversion Facilities.

Facility Component	Existing	Realignment Alternatives		
	Q=850 CFS	Q=700 CFS	Q=850 CFS	Q=1000 CFS
Diversion Dam, Fish Ladder, Headworks and Fish Screen	$ 16,740,000	$ 16,302,000	$ 16,740,000	$ 17,500,000
Kennedy Creek Siphon	$ 1,060,000	$ 1,060,000	$ 1,060,000	$ 2,492,000
St. Mary River Siphon –Steel	$ 26,402,000	$ 25,291,000	$ 26,402,000	$ 28,300,000
Hall Coulee Siphon-CIP	$ 11,890,000	$ 11,218,000	$ 11,890,000	$ 12,923,000
Drop 1 - Chute	$ 921,000	$ 882,000	$ 921,000	$ 952,000
Drop 2 - Chute	$ 887,000	$ 850,000	$ 887,000	$ 920,000
Drop 3 - Chute	$ 733,000	$ 701,000	$ 733,000	$ 759,000
Drop 4 - Chute	$ 1,232,000	$ 1,184,000	$ 1,232,000	$ 1,275,000
Drop 5 - Chute	$ 1,038,000	$ 995,000	$ 1,038,000	$ 1,074,000
Drop Canals	$ 3,351,000	$ 2,888,000	$ 3,351,000	$ 3,689,000
Canal Reach 1	$ 10,263,000	$ 9,186,000	$ 9,653,000	$ 10,450,000
Canal Reach 2	$ 11,903,000	$ 11,054,000	$ 12,170,000	$ 12,985,000
Canal Reach 3	$ 13,321,000	$ 12,637,000	$ 13,558,000	$ 14,190,000
Canal Reach 4	$ 10,785,000	$ 9,872,000	$ 10,794,000	$ 11,601,000
Canal Reach 5	$ 10,199,000	$ 8,983,000	$ 10,111,000	$ 11,023,000
Canal Reach 6	$ 7,688,000	$ 7,262,,000	$ 8,424,000	$ 9,274,000
TOTAL	**$128,413,000**	**$120,365,000**	**$128,964,000**	**$139,407,000**
“Hydro-Ready” – Add	$ 5,963,000	$ 6,070,000	$ 5,963,000	$ 5,920,000
“Hydro-Ready” - Total	**$134,483,000**	**$126,435,000**	**$134,927,000**	**$145,327,000**

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FORWARD
TO
COST ESTIMATE

FORWARD TO COST ESTIMATES

The following construction cost estimate sheets reflect the simultaneous and parallel efforts of the 3-firm, St. Mary design team. Attempts were made to interject consistency among the approaches and unit pricing; however, the independent methodologies and philosophies of each firm are evident. Even though the estimating approaches and techniques are slightly different, we are confident that the final cost estimate (i.e., the bottom line) for a given structure is comparable to that if another member of the design team or any outside firm or agency having the same available information had prepared it.

The cost estimates were prepared in general accordance with procedures described in the USBR's *Cost Estimating Handbook* (USBR, 1989). The overall structure of each cost estimate follows the following format:

Actual Line Items,		$
Work Tasks &		$
Pay Items to Construct		$
Canal or Hydraulic Structures		$
	Subtotal w/o Mob Costs	$
8% Mobilization Costs		$
	Subtotal	$
10% Unlisted Items		$
	Contract Costs	$
25% Contingencies		$
	Total Field Cost	$
37% Non-Contract Costs		$
	Construction Cost	$
5% Tribal Fees		$
	Total Project Cost	$$

The USBR's *Cost Estimating Handbook* (USBR, 1989) defines unlisted items, contingencies, and non-contract items as follows:

- Unlisted Items – Percentage allowance for additional items of work, which will appear in the final design, required for a fully finished feature (i.e. design contingency).

- Contingencies – Percentage allowance to cover minor differences between actual and estimated quantities, unforeseeable difficulties at the site, possible minor changes in the plans, and other uncertainties (i.e. construction contingency).

- Non-contract Costs – Non-contract activities are usually based on a percentage of the construction cost. Non-contract costs include: planning, investigations, designs and specifications, contract administration, water rights, environmental permits, and rights-of-ways.

Since 2004, the construction environment has experienced price increases significantly greater than economic inflation alone can account for. Specifically, diesel fuel, steel, concrete, plastics and rubber products all have experienced considerable price increases. Sources for the individual unit prices used in the cost estimates include the following:

- Bid tab results from each member of the design team on recent and similar projects or similar scopes of work having comparable conditions, work scopes, and/or quantities.

- USBR's listing for Contractor's prices including O&P indexed to 2005.

- Calls and contacts to suppliers, venders and Contractors with respect to specific material or equipment costs.

- Montana's Department of Transportation (MDT) Statewide Weighted Average Unit prices for 2005.

- Means Construction Cost Data and Estimating for Heavy Civil Projects – 2005.

The unit prices in these cost estimate worksheets reflect 2005 prices. Future costs can be extrapolated made by cost indexing with an appropriate inflationary factor. Indexing should be only applied to original estimates and never to cost estimates previously indexed. Indexes can vary for different classifications of work and may be significant depending on the number of

years or quantity of work involved. In general, cost indexing should be limited to no more than 5 years from the original cost estimate at which point a new cost estimate should be developed.

Numerical price rounding adopted in the following cost estimate worksheets is similar to that implemented by the USBR and recommended in their *Cost Estimating Handbook.* USBR procedures apply rounding to nearly every subtotal value, which is rounded to the nearest appropriate value. However, for the cost estimates contained in this report only the final line item (Total Cost) was rounded and rounded up to the nearest permissible number as provided below. The numerical price rounding implemented in the following cost estimates is as follows:

If Value is Between	Round Up to Nearest
$ 100,000 - $ 200,000	$ 5,000
$ 200,000 - $ 1,000,000	$ 10,000
$ 1,000,000 - $ 2,000,000	$ 50,000
$ 2,000,000 - $ 10,000,000	$ 100,000
$ 10,000,000 - $ 20,000,000	$ 500,000
$ 20,000,000 - $100,000,000	$ 1,000,000
$100,000,000 - $200,000,000	$ 5,000,000
$200,000,000 - $1 Billion	$10,000,000

During the review phase of this report, there was a great deal of consternation about the variability of individual unit prices such as cubic yard of concrete or excavation. Besides the inherently different cost estimating philosophies between the three experienced design firms, there are also many other factors which would influence the unit price for a given material or work item. Using cast-in-place concrete as an example, the following variables impact the unit price.

- Time of Year – Some structures such as the replacement siphons, new diversion dam and the hydraulic drops are planned to be constructed as parallel structures during the normal diversion season without disruption of water deliveries. This will maximize summer time construction and minimize winter-related costs. Some portions of the St. Mary facilities, however, can only be replaced or repaired during the diversion off-season, i.e. during the

winter. Wintertime placement of concrete is more expensive than during the summer. This would be equally true for all the types of work anticipated.

- Location of Placement – For the same time of year, a cubic yard of concrete placed near Babb (Diversion Dam) will be less expensive than that placed near the hydraulic drops. This simply is due to travel time, distance and ease of access. This variable will have similar impact to any hauled item such as armoring, riprap, road surfacing, aggregates, etc.

- Degree of Reinforcement – Cast-in-place concrete can be unreinforced, normally reinforced or heavily reinforced depending on its intended use. At this time, the price of steel reinforcement is merged into the price of the concrete so the degree of reinforcement can impact the unit cost of concrete.

- Type of Placement – Concrete used in slabs or other flatwork requires less formwork than walls or piers. However, slabs and flat work require more finishing effort. Horizontal placements (slabs) are more expensive to heat and protect from freezing than vertical pours (walls). Some placements will require concrete pumping that adds costs. For earthwork, the analogy might be use of excavators versus scrapers.

As an example, cost estimates prepared by TD&H and TCB-AECOM utilize the 2005 USBR – indexed price for concrete of $753.48/CY. UMA-AECOM used a price of $1,530/CY for structural concrete based on their experience and methods. UMA's price includes all excavation and backfill for each structure as well as other nonspecified items to complete the work. For the cast-in-place concrete siphons, another concrete price of $750/CY was used for "Foundation Concrete". This concrete is unreinforced and does not require elaborate forming or finishing.

The design engineer must consider all these variables when developing cost estimates for the various alternatives. In the absence of detailed construction drawings, contingencies are incorporated, whether planned or subconsciously, into the quantities, unit prices, or "miscellaneous" work items to cover unknowns or various levels of confidence. The varying

confidence reflects the uncertainty that the preliminary drawings will actually reflect the scope of the final structure. Confidence incrementally increases through each investigative study and design phase as design information is systematically acquired and the number of unknowns and uncertainties are reduced. Currently, the major unknowns include, in part, survey data to support the earthwork assumptions, subsurface soil and groundwater conditions, ROW and land ownership issues, final alignment and capacity, and environmental requirements that may be mandated by a NEPA compliance document.

APPENDIX A
ALTERNATIVES

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; All Canadian Route

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	St. Mary River to St. Mary Reservoir		1	L.S.	$0.00	$0.00
	2	St. Mary Reservoir		1	L.S.	$0.00	$0.00
	3	St. Mary - Jensen Canal		1	L.S.	$0.00	$0.00
	4	Jensen Canal		1	L.S.	$0.00	$0.00
	5	Jensen - Milk River Ridge Canal		1	L.S.	$0.00	$0.00
	6	Milk River Ridge Reservoir		1	L.S.	$0.00	$0.00
		Canal - Milk River Ridge Reservoir to Milk River					
	7	Care of Water		1	L.S.	$435,000.00	$435,000.00
	8	Clearing		1	L.S.	$145,000.00	$145,000.00
	9	Stripping and Rehandling		1,812,500	C.Y.	$7.00	$12,687,500.00
	10	Excavation		2,581,000	C.Y.	$4.50	$11,614,500.00
	11	Impervious Backfill		1,725,500	C.Y.	$2.50	$4,313,750.00
	12	Seepage Control		1	L.S.	$5,800,000.00	$5,800,000.00
	13	Gravel Armour Slope Protection		269700	C.Y.	$35.00	$9,439,500.00
		Drop Structures - Milk River Ridge Reservoir to Milk River					
	14	Foundation Concrete		440	C.Y.	$500.00	$220,000.00
	15	Reinforced Concrete		8800	C.Y.	$1,800.00	$15,840,000.00
	16	Miscellaneous Metal		1	L.S.	$110,000.00	$110,000.00
	17	Zone 1 Granular Filter		1320	C.Y.	$24.00	$31,680.00
	18	Zone 2 Granular Filter		330	C.Y.	$24.00	$7,920.00
	19	Zone 5 Granular		10,560	C.Y.	$28.00	$295,680.00
	20	Size I Riprap		11,550	C.Y.	$50.00	$577,500.00
	21	Size II Riprap		14,300	C.Y.	$60.00	$858,000.00
		Miscellaneous - Milk River Ridge Reservoir to Milk River					
	22	Tyrell Diversion Structure		1	L.S.	$100,000.00	$100,000.00
	23	Drain Inlets		60	L.S.	$30,000.00	$1,800,000.00
	24	Wasteways		2	L.S.	$250,000.00	$500,000.00
	25	Controls and SCADA		1	L.S.	$250,000.00	$250,000.00
	26	Railway Crossing		1	L.S.	$850,000.00	$850,000.00
	27	Primary Highway Bridge		1	L.S.	$650,000.00	$650,000.00
	28	Secondary Highway Bridge		3	L.S.	$425,000.00	$1,275,000.00
	29	Road Crossings		10	L.S.	$200,000.00	$2,000,000.00
	30	Miscellaneous Crossings		5	L.S.	$150,000.00	$750,000.00
		Subtotal w/o mobilization					$70,551,030.00
		Mobilization		8%			$5,644,082.00
		Subtotal w/mobilization					$76,195,112.00
		Unlisted Items		15%			$11,429,267.00
		CONTRACT COST					$87,624,379.00
		Contingencies		25%			$21,906,095.00
		TOTAL FIELD COST					$109,530,474.00
		Non-Contract Cost		37%			$40,526,275.00
		CONSTRUCTION COST					$150,056,749.00
		TERO Fees		0%			$0.00
		TOTAL COST					$155,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/3/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

Sheet 1 of 1

FEATURE: August 2, 2006

St. Mary Canal; Duck Lake Tunnel

Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	850 cfs Diversion Dam and Works		1	L.S.	$7,654,188.86	$7,654,188.86
	2	Connecting Canel		300	L.F.	$315.00	$94,500.00
	3	Inlet Portal with Gates		1	L.S.	$350,000.00	$350,000.00
	4	14 ft. Tunnel Bore with Finished 12 ft. I.D. Liner		65,200	L.F.	$2,000.00	$130,400,000.00
	5	Outlet Portal		1	L.S.	$225,000.00	$225,000.00
	6	Stream Modifications to N. Fork of Milk River		14,900	L.F.	$6.25	$93,125.00
	7	Cuttings Disposal		484,000	C.Y.	$3.25	$1,573,000.00
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
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	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$140,389,814.00
		Mobilization		8%			$11,231,185.00
		Subtotal w/mobilization					$151,620,999.00
		Unlisted Items		10%			$15,162,100.00
		CONTRACT COST					$166,783,099.00
		Contingencies		25%			$41,695,775.00
		TOTAL FIELD COST					$208,478,874.00
		Non-Contract Cost		37%			$77,137,183.00
		CONSTRUCTION COST					$285,616,057.00
		TERO Fees		5%			$14,280,803.00
		TOTAL COST					$300,000,000.00

QUANTITIES

BY	JAS with TD&H	**CHECKED**	
DATE PREPARED	1/6/2006	**APPROVED**	

PRICES

BY	EAJ	**CHECKED**	
DATE	1/3/2006	**PRICE LEVEL**	

APPENDIX B
700 cfs

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen					
	1	Excavation		2500	C.Y.	$6.46	$16,150.00
	2	Backfill about Structures		300	C.Y.	$5.92	$1,776.00
	3	Compacted Backfill about Structures		300	C.Y.	$8.34	$2,502.00
	4	Concrete		900	C.Y.	$753.48	$678,132.00
	5	Concrete Canal		450	C.Y.	$753.48	$339,066.00
	6	Miscellaneous Structural Steel		99,000	lbs.	$10.00	$990,000.00
	7	Grating		720	S.F.	$25.00	$18,000.00
	8	Handrail		250	L.F.	$70.00	$17,500.00
	9	Fish Screen		350	L.F.	$2,144.00	$750,400.00
	10	Adjustable Baffles		1	L.S.	$453,600.00	$453,600.00
	11	Transition to By-Pass		1	L.S.	$98,000.00	$98,000.00
	12	Slide Gate		1	L.S.	$35,000.00	$35,000.00
	13	Fish Return Pipe		220	L.F.	$300.00	$66,000.00
	14	Automated Brush Type Screen Cleaning System		1	Each	$345,000.00	$345,000.00
	15	Screen Hoist System		1	Each	$60,000.00	$60,000.00
	16	Electrical & Control System		1	L.S.	$30,000.00	$30,000.00
	17	New Access Road		220	L.F.	$35.00	$7,700.00
	18	Security Fencing		500	L.F.	$50.00	$25,000.00
		Subtotal					$3,933,826.00
		Fish Passage					
	19	Excavation		900	C.Y.	$6.46	$5,814.00
	20	Backfill about Structures		1800	C.Y.	$5.92	$10,656.00
	21	Compacted Backfill about Structures		1800	C.Y.	$8.34	$15,012.00
	22	Concrete		62	C.Y.	$753.48	$46,715.76
	23	Shot Crete		250	C.Y.	$950.00	$237,500.00
	24	Riprap		750	C.Y.	$45.00	$33,750.00
		Subtotal					$349,447.76
		Rubber Dam					
	25	Excavation		2750	C.Y.	$6.46	$17,765.00
	26	Backfill about Structures		900	C.Y.	$5.92	$5,328.00
	27	Compacted Backfill about Structures		900	C.Y.	$8.34	$7,506.00
	28	Concrete		445	C.Y.	$753.48	$335,298.60
	29	Compressor Equipment & Piping		1	L.S.	$40,000.00	$40,000.00
	30	Compressor & Control Building		1	L.S.	$120,000.00	$120,000.00
	31	Electrical Service		1	L.S.	$40,000.00	$40,000.00
	32	Rubber Dam & Controls (114 ft. dam)		1	L.S.	$872,000.00	$872,000.00
		Subtotal					$1,437,897.60

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Flush Gate & Canal Headwall with Gates					
	33	Excavation		3820	C.Y.	$6.46	$24,677.20
	34	Backfill about Structures		1050	C.Y.	$5.92	$6,216.00
	35	Compacted Backfill about Structures		1050	C.Y.	$8.34	$8,757.00
	36	Concrete		240	C.Y.	$753.48	$180,835.20
	37	Slide gate 3x3 with Manual Actuator		1	Each	$15,000.00	$15,000.00
	38	Slide gates 6x6 with Electric Actuators		4	Each	$50,000.00	$200,000.00
	39	Reno Mattress		3400	S.F.	$12.50	$42,500.00
	40	Hand Rail		230	L.F.	$70.00	$16,100.00
	41	Steel Guard Rail		110	L.F.	$80.00	$8,800.00
	42	Security Fencing		200	L.F.	$50.00	$10,000.00
	43	Riprap		70	C.Y.	$45.00	$3,150.00
		Subtotal					$516,035.40
		Canal					
	44	Excavation		6000	C.Y.	$6.46	$38,760.00
	45	Backfill about Structures		200	C.Y.	$5.92	$1,184.00
	46	Compacted Backfill about Structures		200	C.Y.	$8.34	$1,668.00
	47	Riprap		900	C.Y.	$45.00	$40,500.00
	48	Riprap Grout		330	C.Y.	$300.00	$99,000.00
		Subtotal					$181,112.00
		Miscellaneous					
	49	Water Care/Environmental Protection Works / BMPs		1	L.S.	$500,000.00	$500,000.00
	50	Demolition of Existing Structure & Reshape Channel		1	L.S.	$200,000.00	$200,000.00
	51	Site Access Road Improvement		1	L.S.	$60,000.00	$60,000.00
	52	Temporary Access Bridge		1	L.S.	$30,000.00	$30,000.00
	53	Bypass Canal		1	L.S.	$198,000.00	$198,000.00
	54	Construction Coffer Dam		1	L.S.	$100,000.00	$100,000.00
	55	Relocating Gaging Station		1	L.S.	$25,000.00	$25,000.00
	56	SCADA System		1	L.S.	$100,000.00	$100,000.00
		Subtotal					$1,213,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen Subtotal		1	Each	$3,933,826.00	$3,933,826.00
		Fish Passage Subtotal		1	Each	$349,447.76	$349,447.76
		Rubber Dam Subtotal		1	Each	$1,437,897.60	$1,437,897.60
		Flush Gate & Canal Headwall with Gates Subtotal		1	Each	$516,035.40	$516,035.40
		Canal Subtotal		1	Each	$181,112.00	$181,112.00
		Miscellaneous Subtotal		1	Each	$1,213,000.00	$1,213,000.00
		Subtotal w/o mobilization					$7,631,319.00
		Mobilization		8%			$610,506.00
		Subtotal w/mobilization					$8,241,825.00
		Unlisted Items		10%			$824,183.00
		CONTRACT COST					$9,066,008.00
		Contingencies		25%			$2,266,502.00
		TOTAL FIELD COST					$11,332,510.00
		Non-Contract Cost		37%			$4,193,029.00
		CONSTRUCTION COST					$15,525,539.00
		TERO Fees		5%			$776,277.00
		TOTAL COST					$16,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam
USBR Concept 2 Estimate Adjusted by TD&H
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	2	Excavation for Canal	1	4,400	C.Y.	$6.46	$28,424.00
	3,19,32	Excavation for Structures	1	9,350	C.Y.	$6.46	$60,401.00
	23	Canal Concrete	5	280	C.Y.	$753.48	$210,974.40
	4,7,10a,20, 25,28,	Structural Concrete	4	2,960	C.Y.	$753.48	$2,230,300.80
	17,33	Backfill about Structures	2	1,100	C.Y.	$5.92	$6,512.00
	18,34	Compacted Backfill about Structures	3	1,100	C.Y.	$8.34	$9,174.00
		Fish Passage					
	12	Rock		320	C.Y.	$50.40	$16,128.00
	13	Grout		120	C.Y.	$216.00	$25,920.00
	15	Sand/gravel bedding		450	C.Y.	$32.40	$14,580.00
	14	Riprap	24	900	C.Y.	$45.00	$40,500.00
		Fish Screen					
	36	Fish return Pipe	13	200	L.F.	$300.00	$60,000.00
	37	Fish Screens		56,000	lbs.	$13.40	$750,400.00
	38	Adjustable baffles		84,000	lbs.	$5.40	$453,600.00
	39	Hydraulic trash rake		1	L.S.	$288,000.00	$288,000.00
	40	Fish screen guide		100,500	lbs.	$10.00	$1,005,000.00
	41	Steel transition		8,200	lbs.	$12.00	$98,400.00
	42	Slide gate		2,200	lbs.	$18.00	$39,600.00
	43	Water level measuring equipment		1	L.S.	$18,000.00	$18,000.00
		Diversion Dam					
	44,46	Stopping Logs		6,500	lbs.	$10.00	$65,000.00
	45	Trash racks		40,000	lbs.	$10.00	$400,000.00
	47	Radial gates and hoist		5	Each	$72,000.00	$360,000.00
		Miscellaneous					
	19b	Water Care/Environmental Protection Works	49	1	L.S.	$500,000.00	$500,000.00
	16	Demo and Removal of Existing Structure	50	1	L.S.	$200,000.00	$200,000.00
	1	Bypass Canal Excavation	1	31,000	C.Y.	$6.46	$200,260.00
	19a	Construction Coffer Dam	54	1	L.S.	$100,000.00	$100,000.00
	35	Relocating Gaging Station	55	1	L.S.	$25,000.00	$25,000.00
	31	6" water stop		1,000	L.F.	$10.20	$10,200.00
	48,49	Electrical		1	L.S.	$540,000.00	$540,000.00
		Subtotal w/o mobilization					$7,667,549.00
		Mobilization		8%			$613,404.00
		Subtotal w/mobilization					$8,280,953.00
		Unlisted Items		10%			$828,095.00
		CONTRACT COST					$9,109,048.00
		Contingencies		25%			$2,277,262.00
		TOTAL FIELD COST					$11,386,310.00
		Non-Contract Cost		37%			$4,212,935.00
		CONSTRUCTION COST					$15,599,245.00
		TERO Fees		5%			$779,962.00
		TOTAL COST					$16,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 2 Double Cell Box Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		5,350	C.Y.	$6.46	$34,561.00
	3	Backfill about Structures		1,170	C.Y.	$5.92	$6,926.40
	4	Compacted Backfill about Structures		1,170	C.Y.	$8.34	$9,757.80
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Double Cell Box Siphon (7'x6')		264	L.F.	$960.00	$253,440.00
	10	Grout Epoxy and Joint Sealant		2470	L.F.	$16.50	$40,755.00
	11	Concrete		30	C.Y.	$753.48	$22,604.40
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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		Subtotal w/o mobilization					$1,068,023.00
		Mobilization		8%			$85,442.00
		Subtotal w/mobilization					$1,153,465.00
		Unlisted Items		10%			$115,347.00
		CONTRACT COST					$1,268,812.00
		Contingencies		25%			$317,203.00
		TOTAL FIELD COST					$1,586,015.00
		Non-Contract Cost		37%			$586,826.00
		CONSTRUCTION COST					$2,172,841.00
		TERO Fees		5%			$108,642.00
		TOTAL COST					$2,300,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 3 Parallel Pipe Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		6,250	C.Y.	$6.46	$40,375.00
	3	Backfill about Structures		2,270	C.Y.	$5.92	$13,438.40
	4	Compacted Backfill about Structures		2,270	C.Y.	$8.34	$18,931.80
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Parallel Pipe (2-7ft. dia)		264	L.F.	$805.00	$212,520.00
	10	Concrete		30	C.Y.	$753.48	$22,604.40
	11	Flowable Fill		260	C.Y.	$162.00	$42,120.00
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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		Subtotal w/o mobilization					$1,049,968.00
		Mobilization		8%			$83,997.00
		Subtotal w/mobilization					$1,133,965.00
		Unlisted Items		10%			$113,397.00
		CONTRACT COST					$1,247,362.00
		Contingencies		25%			$311,841.00
		TOTAL FIELD COST					$1,559,203.00
		Non-Contract Cost		37%			$576,905.00
		CONSTRUCTION COST					$2,136,108.00
		TERO Fees		5%			$106,805.00
		TOTAL COST					$2,300,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping, Excavation & Rehandling		3565	C.Y.	$4.50	$16,042.50
	4	Excavation		80,940	C.Y.	$4.50	$364,230.00
	5	Impervious Backfill		66,880	C.Y.	$2.50	$167,200.00
	6	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	7	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		250	C.Y.	$1,530.00	$382,500.00
	11	Siphon Outlet Structure		405	C.Y.	$1,530.00	$619,650.00
	12	Siphon Barrel (9.5 ft. dia.)		5090	C.Y.	$1,185.00	$6,031,650.00
	13	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	14	Foundation Concrete		515	C.Y.	$750.00	$386,250.00
	15	Reinforced Concrete Footings		200	C.Y.	$1,530.00	$306,000.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$12,686,523.00
		Mobilization		8%			$1,014,922.00
		Subtotal w/mobilization					$13,701,445.00
		Unlisted Items		10%			$1,370,145.00
		CONTRACT COST					$15,071,590.00
		Contingencies		25%			$3,767,898.00
		TOTAL FIELD COST					$18,839,488.00
		Non-Contract Cost		37%			$6,970,611.00
		CONSTRUCTION COST					$25,810,099.00
		TERO Fees		5%			$1,290,505.00
		TOTAL COST					$28,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site Clearing		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		3940	C.Y.	$4.50	$17,730.00
	4	Excavation		85,750	C.Y.	$4.50	$385,875.00
	5	Impervious Backfill		67,450	C.Y.	$2.50	$168,625.00
	6	Granular Backfill		9,450	C.Y.	$35.00	$330,750.00
	7	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		230	C.Y.	$1,530.00	$351,900.00
	11	Siphon Outlet Structure		260	C.Y.	$1,530.00	$397,800.00
	12	Siphon Barrel (7.5 ft. dia.)		6915	C.Y.	$1,185.00	$8,194,275.00
	13	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	14	Foundation Concrete		800	C.Y.	$750.00	$600,000.00
	15	Reinforced Concrete Footings		315	C.Y.	$1,530.00	$481,950.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$15,462,655.00
		Mobilization		8%			$1,237,012.00
		Subtotal w/mobilization					$16,699,667.00
		Unlisted Items		10%			$1,669,967.00
		CONTRACT COST					$18,369,634.00
		Contingencies		25%			$4,592,409.00
		TOTAL FIELD COST					$22,962,043.00
		Non-Contract Cost		37%			$8,495,956.00
		CONSTRUCTION COST					$31,457,999.00
		TERO Fees		5%			$1,572,900.00
		TOTAL COST					$34,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping Excavation & Rehandling		2270	C.Y.	$4.50	$10,215.00
	4	Excavation		43,060	C.Y.	$4.50	$193,770.00
	5	Sand Backfill		15,490	C.Y.	$30.00	$464,700.00
	6	Impervious Backfill		19,085	C.Y.	$2.50	$47,712.50
	7	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		250	C.Y.	$1,530.00	$382,500.00
	11	Siphon Outlet Structure		405	C.Y.	$1,530.00	$619,650.00
	12	Supply Siphon Barrel (9.5 ft. dia x 1/2" wall thickness, Coated & Lined)		1080	L.Y.	$3,515.00	$3,796,200.00
	13	Cathodic Protection System		1	L.S.	$50,000.00	$50,000.00
	14	Extra for Special Elbows		12	Each	$51,000.00	$612,000.00
	15	Place, Field Well, Coat & Line Joints		1080	L.Y.	$1,620.00	$1,749,600.00
	16	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$11,839,348.00
		Mobilization		8%			$947,148.00
		Subtotal w/mobilization					$12,786,496.00
		Unlisted Items		10%			$1,278,650.00
		CONTRACT COST					$14,065,146.00
		Contingencies		25%			$3,516,287.00
		TOTAL FIELD COST					$17,581,433.00
		Non-Contract Cost		37%			$6,505,130.00
		CONSTRUCTION COST					$24,086,563.00
		TERO Fees		5%			$1,204,328.00
		TOTAL COST					$26,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site Clearing		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		2505	C.Y.	$4.50	$11,272.50
	4	Excavation		48,340	C.Y.	$4.50	$217,530.00
	5	Sand Backfill		16,245	C.Y.	$30.00	$487,350.00
	6	Impervious Backfill		21505	C.Y.	$2.50	$53,762.50
	7	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		231	C.Y.	$1,530.00	$353,430.00
	11	Siphon Outlet Structure		261	C.Y.	$1,530.00	$399,330.00
	12	Supply Siphon Barrel (7.5 ft. dia. x 3/8 " Wall Thickness, Coated & Lined)		2160	L.Y.	$2,300.00	$4,968,000.00
	13	Cathodic Protecting System		1	L.S.	$75,000.00	$75,000.00
	14	Extra for Special Elbows		24	Each	$47,000.00	$1,128,000.00
	15	Place, Field Well, Coat & Line Joints		2160	L.Y.	$1,020.00	$2,203,200.00
	16	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$14,261,375.00
		Mobilization		8%			$1,140,910.00
		Subtotal w/mobilization					$15,402,285.00
		Unlisted Items		10%			$1,540,229.00
		CONTRACT COST					$16,942,514.00
		Contingencies		25%			$4,235,629.00
		TOTAL FIELD COST					$21,178,143.00
		Non-Contract Cost		37%			$7,835,913.00
		CONSTRUCTION COST					$29,014,056.00
		TERO Fees		5%			$1,450,703.00
		TOTAL COST					$31,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		1480	C.Y.	$4.50	$6,660.00
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		31,380	C.Y.	$4.50	$141,210.00
	6	Impervious Backfill		26,455	C.Y.	$2.50	$66,137.50
	7	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		260	C.Y.	$1,530.00	$397,800.00
	12	Siphon Outlet Structure		400	C.Y.	$1,530.00	$612,000.00
	13	Siphon Barrel (8.5 ft. dia.)		1730	C.Y.	$1,185.00	$2,050,050.00
	14	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	15	Foundation Concrete		205	C.Y.	$750.00	$153,750.00
	16	Reinforced Concrete Footings		80	C.Y.	$1,530.00	$122,400.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$5,251,008.00
		Mobilization		8%			$420,081.00
		Subtotal w/mobilization					$5,671,089.00
		Unlisted Items		10%			$567,109.00
		CONTRACT COST					$6,238,198.00
		Contingencies		25%			$1,559,550.00
		TOTAL FIELD COST					$7,797,748.00
		Non-Contract Cost		37%			$2,885,167.00
		CONSTRUCTION COST					$10,682,915.00
		TERO Fees		5%			$534,146.00
		TOTAL COST					$11,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1655	C.Y.	$4.50	$7,447.50
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		33,920	C.Y.	$4.50	$152,640.00
	6	Impervious Backfill		27,380	C.Y.	$2.50	$68,450.00
	7	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		235	C.Y.	$1,530.00	$359,550.00
	12	Siphon Outlet Structure		285	C.Y.	$1,530.00	$436,050.00
	13	Siphon Barrel (6.5 ft. dia.)		2710	C.Y.	$1,185.00	$3,211,350.00
	14	Blow Off Wells		1	L.S.	$310,000.00	$310,000.00
	15	Foundation Concrete		320	C.Y.	$750.00	$240,000.00
	16	Reinforced Concrete Footings		125	C.Y.	$1,530.00	$191,250.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$6,708,238.00
		Mobilization		8%			$536,659.00
		Subtotal w/mobilization					$7,244,897.00
		Unlisted Items		10%			$724,490.00
		CONTRACT COST					$7,969,387.00
		Contingencies		25%			$1,992,347.00
		TOTAL FIELD COST					$9,961,734.00
		Non-Contract Cost		37%			$3,685,842.00
		CONSTRUCTION COST					$13,647,576.00
		TERO Fees		5%			$682,379.00
		TOTAL COST					$14,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		935	C.Y.	$4.50	$4,207.50
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		16,350	C.Y.	$4.50	$73,575.00
	6	Sand Backfill		5,695	C.Y.	$30.00	$170,850.00
	7	Impervious Backfill		7790	C.Y.	$2.50	$19,475.00
	8	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	9	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		260	C.Y.	$1,530.00	$397,800.00
	12	Siphon Outlet Structure		400	C.Y.	$1,530.00	$612,000.00
	13	Supply Siphon Barrel (8.5 ft. dia. x 3/8 " Wall Thickness, Coated & Lined)		478	L.Y.	$2,600.00	$1,242,800.00
	14	Cathodic Protecting System		1	L.S.	$42,000.00	$42,000.00
	15	Extra for Special Elbows		12	Each	$49,000.00	$588,000.00
	16	Place, Field Well, Coat & Line Joints		478	L.Y.	$1,120.00	$535,360.00
	17	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$4,887,068.00
		Mobilization		8%			$390,965.00
		Subtotal w/mobilization					$5,278,033.00
		Unlisted Items		10%			$527,803.00
		CONTRACT COST					$5,805,836.00
		Contingencies		25%			$1,451,459.00
		TOTAL FIELD COST					$7,257,295.00
		Non-Contract Cost		37%			$2,685,199.00
		CONSTRUCTION COST					$9,942,494.00
		TERO Fees		5%			$497,125.00
		TOTAL COST					$10,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1005	C.Y.	$4.50	$4,522.50
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		16,780	C.Y.	$4.50	$75,510.00
	6	Sand Backfill		4,805	C.Y.	$30.00	$144,150.00
	7	Impervious Backfill		8450	C.Y.	$2.50	$21,125.00
	8	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	9	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		235	C.Y.	$1,530.00	$359,550.00
	12	Siphon Outlet Structure		285	C.Y.	$1,530.00	$436,050.00
	13	Supply Siphon Barrel (6.5 ft. dia. x 1/4 " Wall Thickness, Coated & Lined)		956	L.Y.	$1,390.00	$1,328,840.00
	14	Cathodic Protecting System		1	L.S.	$63,000.00	$63,000.00
	15	Extra for Special Elbows		24	Each	$44,000.00	$1,056,000.00
	16	Place, Field Well, Coat & Line Joints		956	L.Y.	$700.00	$669,200.00
	17	Blow Off Well		1	L.S.	$310,000.00	$310,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$5,699,448.00
		Mobilization		8%			$455,956.00
		Subtotal w/mobilization					$6,155,404.00
		Unlisted Items		10%			$615,540.00
		CONTRACT COST					$6,770,944.00
		Contingencies		25%			$1,692,736.00
		TOTAL FIELD COST					$8,463,680.00
		Non-Contract Cost		37%			$3,131,562.00
		CONSTRUCTION COST					$11,595,242.00
		TERO Fees		5%			$579,762.00
		TOTAL COST					$12,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro-Ready" Option w/o Penstock

Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,304	CY	753.48	$982,537.92
	2	Structural Excavation		9,912	CY	6.46	$64,031.52
	3	Compacted Backfill		4,841	CY	8.34	$40,373.94
	4	Channel Excavation		290,490	CY	7.53	$2,187,389.70
	5						
	6	Drop Structure No. 5 (from B24)		1	LS	465,660.00	$465,660.00
	7	Canal Reshaping (Drop No. 4 to No. 5) (from B25)		1	LS	577,010.00	$577,010.00
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		Subtotal w/o mobilization					$4,317,003.00
		Mobilization		8%			$345,360.00
		Subtotal w/mobilization					$4,662,363.00
		Unlisted Items		10%			$466,236.00
		CONTRACT COST					$5,128,599.00
		Contingencies		25%			$1,282,150.00
		TOTAL FIELD COST					$6,410,749.00
		Non-Contract Cost		37%			$2,371,977.00
		CONSTRUCTION COST					$8,782,726.00
		TERO Fees		5%			$439,136.00
		TOTAL COST					$9,300,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro-Ready" Option w/ Penstock

Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,304	CY	753.48	$982,537.92
	2	Structural Excavation		9,912	CY	6.46	$64,031.52
	3	Compacted Backfill		4,841	CY	8.34	$40,373.94
	4	Channel Excavation		290,490	CY	7.53	$2,187,389.70
	5						
	6						
	7	6' x 6' sluice gates		3	EA	61,570.00	$184,710.00
	8	72" steel pipe		2,400	FT	611.14	$1,466,736.00
	9	Pipe Excavation		11,733	CY	7.53	$88,349.49
	10	Pipe Backfill		9,220	CY	8.34	$76,894.80
	11	20' x 8' radial gate		1	EA	100,000.00	$100,000.00
	12	6' x 6' Trashracks		3	EA	5,000.00	$15,000.00
	13	Additional Structural Concrete		116	CY	753.48	$87,403.68
	14	Additional Structural Excavation		1,387	CY	6.46	$8,960.02
	15	Additional Compacted Backfill		799	CY	8.34	$6,663.66
	16						
	17	Drop Structure No. 5 (from B24)		1	LS	465,660.00	$465,660.00
	18	Canal Reshaping (Drop No. 4 to No. 5) (from B25)		1	LS	577,010.00	$577,010.00
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		Subtotal w/o mobilization					$6,351,721.00
		Mobilization		8%			$508,138.00
		Subtotal w/mobilization					$6,859,859.00
		Unlisted Items		10%			$685,986.00
		CONTRACT COST					$7,545,845.00
		Contingencies		25%			$1,886,461.00
		TOTAL FIELD COST					$9,432,306.00
		Non-Contract Cost		37%			$3,489,953.00
		CONSTRUCTION COST					$12,922,259.00
		TERO Fees		5%			$646,113.00
		TOTAL COST					$14,000,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Drop Type Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		505	cy	$753.48	$380,507.40
	2	Structural Excavation		3,489	cy	$6.46	$22,533.36
	3	Compacted Backfill about Structures		1,946	cy	$8.34	$16,233.73
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		Subtotal w/o mobilization					$419,274.00
		Mobilization		8%			$33,542.00
		Subtotal w/mobilization					$452,816.00
		Unlisted Items		10%			$45,282.00
		CONTRACT COST					$498,098.00
		Contingencies		25%			$124,525.00
		TOTAL FIELD COST					$622,623.00
		Non-Contract Cost		37%			$230,371.00
		CONSTRUCTION COST					$852,994.00
		TERO Fees		5%			$42,650.00
		TOTAL COST					$900,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Type III Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		495	cy	$ 753.48	$372,972.60
	2	Structural Excavation		3,579	cy	$ 6.46	$23,114.61
	3	Compacted Backfill about Structures		1,994	cy	$ 8.34	$16,634.15
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		Subtotal w/o mobilization					$412,721.00
		Mobilization		8%			$33,018.00
		Subtotal w/mobilization					$445,739.00
		Unlisted Items		10%			$44,574.00
		CONTRACT COST					$490,313.00
		Contingencies		25%			$122,578.00
		TOTAL FIELD COST					$612,891.00
		Non-Contract Cost		37%			$226,770.00
		CONSTRUCTION COST					$839,661.00
		TERO Fees		5%			$41,983.00
		TOTAL COST					$890,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Drop Type Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		488	cy	$ 753.48	$367,698.24
	2	Structural Excavation		3,396	cy	$ 6.46	$21,932.73
	3	Compacted Backfill about Structures		1,904	cy	$ 8.34	$15,883.36
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		Subtotal w/o mobilization					$405,514.00
		Mobilization		8%			$32,441.00
		Subtotal w/mobilization					$437,955.00
		Unlisted Items		10%			$43,796.00
		CONTRACT COST					$481,751.00
		Contingencies		25%			$120,438.00
		TOTAL FIELD COST					$602,189.00
		Non-Contract Cost		37%			$222,810.00
		CONSTRUCTION COST					$824,999.00
		TERO Fees		5%			$41,250.00
		TOTAL COST					$870,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Type III Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	B	Structural Concrete		477	cy	$ 753.48	$359,409.96
	2	Structural Excavation		3,461	cy	$ 6.46	$22,352.52
	3	Compacted Backfill about Structures		1,931	cy	$ 8.34	$16,108.60
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		Subtotal w/o mobilization					$397,871.00
		Mobilization		8%			$31,830.00
		Subtotal w/mobilization					$429,701.00
		Unlisted Items		10%			$42,970.00
		CONTRACT COST					$472,671.00
		Contingencies		25%			$118,168.00
		TOTAL FIELD COST					$590,839.00
		Non-Contract Cost		37%			$218,610.00
		CONSTRUCTION COST					$809,449.00
		TERO Fees		5%			$40,472.00
		TOTAL COST					$850,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Drop Type Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		412	cy	$ 753.48	$310,433.76
	2	Structural Excavation		2,831	cy	$ 6.46	$18,283.73
	3	Compacted Backfill about Structures		1,647	cy	$ 8.34	$13,739.44
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		Subtotal w/o mobilization					$342,457.00
		Mobilization		8%			$27,397.00
		Subtotal w/mobilization					$369,854.00
		Unlisted Items		10%			$36,985.00
		CONTRACT COST					$406,839.00
		Contingencies		25%			$101,710.00
		TOTAL FIELD COST					$508,549.00
		Non-Contract Cost		37%			$188,163.00
		CONSTRUCTION COST					$696,712.00
		TERO Fees		5%			$34,836.00
		TOTAL COST					$740,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Type III Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		394	cy	$ 753.48	$296,871.12
	2	Structural Excavation		2,792	cy	$ 6.46	$18,031.85
	3	Compacted Backfill about Structures		1,579	cy	$ 8.34	$13,172.18
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		Subtotal w/o mobilization					$328,075.00
		Mobilization		8%			$26,246.00
		Subtotal w/mobilization					$354,321.00
		Unlisted Items		10%			$35,432.00
		CONTRACT COST					$389,753.00
		Contingencies		25%			$97,438.00
		TOTAL FIELD COST					$487,191.00
		Non-Contract Cost		37%			$180,261.00
		CONSTRUCTION COST					$667,452.00
		TERO Fees		5%			$33,373.00
		TOTAL COST					$710,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Drop Type Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		656	cy	$ 753.48	$494,282.88
	2	Structural Excavation		4,601	cy	$ 6.46	$29,715.10
	3	Compacted Backfill about Structures		2,451	cy	$ 8.34	$20,446.49
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		Subtotal w/o mobilization					$544,444.00
		Mobilization		8%			$43,556.00
		Subtotal w/mobilization					$588,000.00
		Unlisted Items		10%			$58,800.00
		CONTRACT COST					$646,800.00
		Contingencies		25%			$161,700.00
		TOTAL FIELD COST					$808,500.00
		Non-Contract Cost		37%			$299,145.00
		CONSTRUCTION COST					$1,107,645.00
		TERO Fees		5%			$55,382.00
		TOTAL COST					$1,200,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Type III Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		663	cy	$ 753.48	$499,557.24
	2	Structural Excavation		4,933	cy	$ 6.46	$31,859.29
	3	Compacted Backfill about Structures		2,711	cy	$ 8.34	$22,615.43
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		Subtotal w/o mobilization					$554,032.00
		Mobilization		8%			$44,323.00
		Subtotal w/mobilization					$598,355.00
		Unlisted Items		10%			$59,836.00
		CONTRACT COST					$658,191.00
		Contingencies		25%			$164,548.00
		TOTAL FIELD COST					$822,739.00
		Non-Contract Cost		37%			$304,413.00
		CONSTRUCTION COST					$1,127,152.00
		TERO Fees		5%			$56,358.00
		TOTAL COST					$1,200,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Drop Type Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		557	cy	$ 753.48	$419,688.36
	2	Structural Excavation		3,896	cy	$ 6.46	$25,161.93
	3	Compacted Backfill about Structures		2,131	cy	$ 8.34	$17,777.02
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		Subtotal w/o mobilization					$462,627.00
		Mobilization		8%			$37,010.00
		Subtotal w/mobilization					$499,637.00
		Unlisted Items		10%			$49,964.00
		CONTRACT COST					$549,601.00
		Contingencies		25%			$137,400.00
		TOTAL FIELD COST					$687,001.00
		Non-Contract Cost		37%			$254,190.00
		CONSTRUCTION COST					$941,191.00
		TERO Fees		5%			$47,060.00
		TOTAL COST					$990,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Type III Stilling Basin
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		558	cy	$ 753.48	$420,441.84
	2	Structural Excavation		4,081	cy	$ 6.46	$26,356.73
	3	Compacted Backfill about Structures		2,261	cy	$ 8.34	$18,861.49
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		Subtotal w/o mobilization					$465,660.00
		Mobilization		8%			$37,253.00
		Subtotal w/mobilization					$502,913.00
		Unlisted Items		10%			$50,291.00
		CONTRACT COST					$553,204.00
		Contingencies		25%			$138,301.00
		TOTAL FIELD COST					$691,505.00
		Non-Contract Cost		37%			$255,857.00
		CONSTRUCTION COST					$947,362.00
		TERO Fees		5%			$47,368.00
		TOTAL COST					$1,000,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drops 1-5
Reshape Existing Canal
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Canal Reshaping Between Drops 1 & 2		1,550	L.F.	$164.86	$255,533.00
	2	Canal Reshaping Between Drops 2 & 3		850	L.F.	$164.86	$140,131.00
	3	Canal Reshaping Between Drops 3 & 4		2,300	L.F.	$164.86	$379,178.00
	4	Canal Reshaping Between Drops 4 & 5		3,500	L.F.	$164.86	$577,010.00
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		Subtotal w/o mobilization					$1,351,852.00
		Mobilization		8%			$108,148.00
		Subtotal w/mobilization					$1,460,000.00
		Unlisted Items		10%			$146,000.00
		CONTRACT COST					$1,606,000.00
		Contingencies		25%			$401,500.00
		TOTAL FIELD COST					$2,007,500.00
		Non-Contract Cost		37%			$742,775.00
		CONSTRUCTION COST					$2,750,275.00
		TERO Fees		5%			$137,514.00
		TOTAL COST					$2,900,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam to Kennedy Creek Siphon
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		214,900	C.Y.	$4.25	$913,325.00
	4	Embankment		71,625	C.Y.	$6.50	$465,562.50
	5	Gravel Prism Armoring		34,520	C.Y.	$18.00	$621,360.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		21,050	C.Y.	$20.15	$424,157.50
	9	Overshot Control Check w/ SCDA - Complete		0	Each		$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each		$0.00
	11	Drain Inlets - Uncontrolled - Complete		15	Each	$6,575.00	$98,625.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each		$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		7,200	S.F.	$158.00	$1,137,600.00
	17	Bridge - Relocation		0	L.S.		$0.00
	18	Demolition of Existing Structures		0	L.S.		$0.00
	19	Fencing		47,360	L.F.	$2.75	$130,240.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		30	Ac.	$225.00	$6,750.00
	22						
	23	RipRap		140	C.Y.	$55.00	$7,700.00
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		Subtotal w/o mobilization					$4,300,195.00
		Mobilization		8%			$344,016.00
		Subtotal w/mobilization					$4,644,211.00
		Unlisted Items		10%			$464,421.00
		CONTRACT COST					$5,108,632.00
		Contingencies		25%			$1,277,158.00
		TOTAL FIELD COST					$6,385,790.00
		Non-Contract Cost		37%			$2,362,742.00
		CONSTRUCTION COST					$8,748,532.00
		TERO Fees		5%			$437,427.00
		TOTAL COST					$9,200,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon to St. Mary Siphon
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		187,900	C.Y.	$4.25	$798,575.00
	4	Embankment		62,250	C.Y.	$6.50	$404,625.00
	5	Gravel Prism Armoring		30,175	C.Y.	$18.00	$543,150.00
	6	20 mil PVC Liner		5,905	S.Y.	$15.75	$93,003.75
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		18,425	C.Y.	$20.15	$371,263.75
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$575,000.00	$575,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$250,500.00	$250,500.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		1	Each	$267,750.00	$267,750.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		1	L.S.	$210,000.00	$210,000.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		44,282	L.F.	$2.75	$121,775.50
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		46	Ac.	$225.00	$10,350.00
	22						
	23	RipRap		130	C.Y.	$65.00	$8,450.00
	24	New 26-ft All Weather Gravel Road with Geotextile		8,000	L.F.	$97.29	$778,328.00
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		Subtotal w/o mobilization					$5,174,421.00
		Mobilization		8%			$413,954.00
		Subtotal w/mobilization					$5,588,375.00
		Unlisted Items		10%			$558,838.00
		CONTRACT COST					$6,147,213.00
		Contingencies		25%			$1,536,803.00
		TOTAL FIELD COST					$7,684,016.00
		Non-Contract Cost		37%			$2,843,086.00
		CONSTRUCTION COST					$10,527,102.00
		TERO Fees		5%			$526,355.00
		TOTAL COST					$11,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary Siphon to Sta. 715+00
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$52,500.00	$52,500.00
	2	Topsoil Striping & Rehandling		450	C.Y.	$6.25	$2,812.50
	3	Excavation		177,400	C.Y.	$4.25	$753,950.00
	4	Embankment		59,150	C.Y.	$6.50	$384,475.00
	5	Gravel Prism Armoring		31,500	C.Y.	$20.00	$630,000.00
	6	20 mil PVC Liner		3,280	S.Y.	$15.75	$51,660.00
	7	Slide Stabilization Buttress		38,250	C.Y.	$59.50	$2,275,875.00
	8	Road Surfacing		17,400	C.Y.	$22.00	$382,800.00
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$575,000.00	$575,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each	$267,750.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		40,000	L.F.	$2.75	$110,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		50	Ac.	$225.00	$11,250.00
	22						
	23	RipRap		1,500	C.Y.	$75.00	$112,500.00
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		Subtotal w/o mobilization					$5,915,798.00
		Mobilization		8%			$473,264.00
		Subtotal w/mobilization					$6,389,062.00
		Unlisted Items		10%			$638,906.00
		CONTRACT COST					$7,027,968.00
		Contingencies		25%			$1,756,992.00
		TOTAL FIELD COST					$8,784,960.00
		Non-Contract Cost		37%			$3,250,435.00
		CONSTRUCTION COST					$12,035,395.00
		TERO Fees		5%			$601,770.00
		TOTAL COST					$13,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 715+00 to Hall Coulee
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$33,000.00	$33,000.00
	2	Topsoil Striping & Rehandling		650	C.Y.	$6.25	$4,062.50
	3	Excavation		162,000	C.Y.	$4.25	$688,500.00
	4	Embankment		54,000	C.Y.	$6.50	$351,000.00
	5	Gravel Prism Armoring		26,020	C.Y.	$22.00	$572,440.00
	6	20 mil PVC Liner		3,300	S.Y.	$15.75	$51,975.00
	7	Slide Stabilization Buttress		9,990	C.Y.	$61.50	$614,385.00
	8	Road Surfacing		15,875	C.Y.	$24.00	$381,000.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$720,000.00	$720,000.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		2	Each	$74,250.00	$148,500.00
	13	Underdrains - Complete		1	Each	$300,000.00	$300,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$30,000.00	$30,000.00
	19	Fencing		36,000	L.F.	$2.75	$99,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,250	C.Y.	$90.00	$112,500.00
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$4,621,213.00
		Mobilization		8%			$369,697.00
		Subtotal w/mobilization					$4,990,910.00
		Unlisted Items		10%			$499,091.00
		CONTRACT COST					$5,490,001.00
		Contingencies		25%			$1,372,500.00
		TOTAL FIELD COST					$6,862,501.00
		Non-Contract Cost		37%			$2,539,125.00
		CONSTRUCTION COST					$9,401,626.00
		TERO Fees		5%			$470,081.00
		TOTAL COST					$9,900,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. Hall Coulee to Sta. 1173+50
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$27,500.00	$27,500.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		196,600	C.Y.	$4.25	$835,550.00
	4	Embankment		65,550	C.Y.	$6.50	$426,075.00
	5	Gravel Prism Armoring		31,600	C.Y.	$24.00	$758,400.00
	6	20 mil PVC Liner		3,280	S.Y.	$15.75	$51,660.00
	7	Slide Stabilization Buttress		4,540	C.Y.	$63.50	$288,290.00
	8	Road Surfacing		19,275	C.Y.	$26.00	$501,150.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		4	Each	$115,000.00	$460,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		43,400	L.F.	$2.75	$119,350.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,000	C.Y.	$100.00	$100,000.00
	24						
	25						
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	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$4,205,125.00
		Mobilization		8%			$336,410.00
		Subtotal w/mobilization					$4,541,535.00
		Unlisted Items		10%			$454,154.00
		CONTRACT COST					$4,995,689.00
		Contingencies		25%			$1,248,922.00
		TOTAL FIELD COST					$6,244,611.00
		Non-Contract Cost		37%			$2,310,506.00
		CONSTRUCTION COST					$8,555,117.00
		TERO Fees		5%			$427,756.00
		TOTAL COST					$9,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 1173+50 to Drop No. 1
Alternative No. 2 New Canal Alignment
Q = 700cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$20,000.00	$20,000.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		202,050	C.Y.	$4.25	$858,712.50
	4	Embankment		67,350	C.Y.	$6.50	$437,775.00
	5	Gravel Prism Armoring		32,450	C.Y.	$26.00	$843,700.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$63.50	$0.00
	8	Road Surfacing		19,800	C.Y.	$28.00	$554,400.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each	$115,000.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		0	S.F.	$158.00	$0.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		44,600	L.F.	$2.75	$122,650.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		60	Ac.	$225.00	$13,500.00
	22						
	23	RipRap		500	C.Y.	$125.00	$62,500.00
	24						
	25						
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	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$3,399,213.00
		Mobilization		8%			$271,937.00
		Subtotal w/mobilization					$3,671,150.00
		Unlisted Items		10%			$367,115.00
		CONTRACT COST					$4,038,265.00
		Contingencies		25%			$1,009,566.00
		TOTAL FIELD COST					$5,047,831.00
		Non-Contract Cost		37%			$1,867,697.00
		CONSTRUCTION COST					$6,915,528.00
		TERO Fees		5%			$345,776.00
		TOTAL COST					$7,300,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

APPENDIX C
850 cfs

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen					
	1	Excavation		2500	C.Y.	$6.46	$16,150.00
	2	Backfill about Structures		300	C.Y.	$5.92	$1,776.00
	3	Compacted Backfill about Structures		300	C.Y.	$8.34	$2,502.00
	4	Concrete		900	C.Y.	$753.48	$678,132.00
	5	Concrete Canal		450	C.Y.	$753.48	$339,066.00
	6	Miscellaneous Structural Steel		104,500	lbs.	$10.00	$1,045,000.00
	7	Grating		720	S.F.	$25.00	$18,000.00
	8	Handrail		250	L.F.	$70.00	$17,500.00
	9	Fish Screen		350	L.F.	$2,297.10	$803,985.00
	10	Adjustable Baffles		1	L.S.	$486,000.00	$486,000.00
	11	Transition to By-Pass		1	L.S.	$98,000.00	$98,000.00
	12	Slide Gate		1	L.S.	$35,000.00	$35,000.00
	13	Fish Return Pipe		220	L.F.	$300.00	$66,000.00
	14	Automated Brush Type Screen Cleaning System		1	Each	$345,000.00	$345,000.00
	15	Screen Hoist System		1	Each	$60,000.00	$60,000.00
	16	Electrical & Control System		1	L.S.	$30,000.00	$30,000.00
	17	New Access Road		220	L.F.	$35.00	$7,700.00
	18	Security Fencing		500	L.F.	$50.00	$25,000.00
		Subtotal					$4,074,811.00
		Fish Passage					
	19	Excavation		900	C.Y.	$6.46	$5,814.00
	20	Backfill about Structures					
	21	Compacted Backfill about Structures		1800	C.Y.	$8.34	$15,012.00
	22	Concrete		62	C.Y.	$753.48	$46,715.76
	23	Shot Crete		250	C.Y.	$950.00	$237,500.00
	24	Riprap		750	C.Y.	$45.00	$33,750.00
		Subtotal					$338,791.76
		Rubber Dam					
	25	Excavation		2750	C.Y.	$6.46	$17,765.00
	26	Backfill about Structures		900	C.Y.	$5.92	$5,328.00
	27	Compacted Backfill about Structures		900	C.Y.	$8.34	$7,506.00
	28	Concrete		445	C.Y.	$753.48	$335,298.60
	29	Compressor Equipment & Piping		1	L.S.	$40,000.00	$40,000.00
	30	Compressor & Control Building		1	L.S.	$120,000.00	$120,000.00
	31	Electrical Service		1	L.S.	$40,000.00	$40,000.00
	32	Rubber Dam & Controls (114 ft. dam)		1	L.S.	$872,000.00	$872,000.00
		Subtotal					$1,437,897.60

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Flush Gate & Canal Headwall with Gates					
	33	Excavation		4035	C.Y.	$6.46	$26,066.10
	34	Backfill about Structures		1050	C.Y.	$5.92	$6,216.00
	35	Compacted Backfill about Structures		1050	C.Y.	$8.34	$8,757.00
	36	Concrete		255	C.Y.	$753.48	$192,137.40
	37	Slide gate 3x3 with Manual Actuator		1	Each	$15,000.00	$15,000.00
	38	Slide gates 6x6 with Electric Actuators		5	Each	$50,000.00	$250,000.00
	39	Reno Mattress		3400	S.F.	$12.50	$42,500.00
	40	Hand Rail		240	L.F.	$70.00	$16,800.00
	41	Steel Guard Rail		115	L.F.	$80.00	$9,200.00
	42	Security Fencing		200	L.F.	$50.00	$10,000.00
	43	Riprap		70	C.Y.	$45.00	$3,150.00
		Subtotal					$579,826.50
		Canal					
	44	Excavation		6000	C.Y.	$6.46	$38,760.00
	45	Backfill about Structures		200	C.Y.	$5.92	$1,184.00
	46	Compacted Backfill about Structures		200	C.Y.	$8.34	$1,668.00
	47	Riprap		900	C.Y.	$45.00	$40,500.00
	48	Riprap Grout		330	C.Y.	$300.00	$99,000.00
		Subtotal					$181,112.00
		Miscellaneous					
	49	Water Care/Environmental Protection Works / BMPs		1	L.S.	$500,000.00	$500,000.00
	50	Demolition of Existing Structure & Reshape Channel		1	L.S.	$200,000.00	$200,000.00
	51	Site Access Road Improvement		1	L.S.	$60,000.00	$60,000.00
	52	Temporary Access Bridge		1	L.S.	$30,000.00	$30,000.00
	53	Bypass Canal		1	L.S.	$209,000.00	$209,000.00
	54	Construction Coffer Dam		1	L.S.	$100,000.00	$100,000.00
	55	Relocating Gaging Station		1	L.S.	$25,000.00	$25,000.00
	56	SCADA System		1	L.S.	$100,000.00	$100,000.00
		Subtotal					$1,224,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: St. Mary Canal; Diversion Dam

Q = 850cfs

August 14, 2006

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION		CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen	Subtotal		1	Each	$4,074,811.00	$4,074,811.00
		Fish Passage	Subtotal		1	Each	$338,791.76	$338,791.76
		Rubber Dam	Subtotal		1	Each	$1,437,897.60	$1,437,897.60
		Flush Gate & Canal Headwall with Gates	Subtotal		1	Each	$579,826.50	$579,826.50
		Canal	Subtotal		1	Each	$181,112.00	$181,112.00
		Miscellaneous	Subtotal		1	Each	$1,224,000.00	$1,224,000.00
		Subtotal w/o mobilization						$7,836,439.00
		Mobilization			8%			$626,915.00
		Subtotal w/mobilization						$8,463,354.00
		Unlisted Items			10%			$846,335.00
		CONTRACT COST						$9,309,689.00
		Contingencies			25%			$2,327,422.00
		TOTAL FIELD COST						$11,637,111.00
		Non-Contract Cost			37%			$4,305,731.00
		CONSTRUCTION COST						$15,942,842.00
		TERO Fees			5%			$797,142.00
		TOTAL COST						$17,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam
USBR Concept 2 Estimate Adjusted by TD&H
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	2	Excavation for Canal	1	5,000	C.Y.	$6.46	$32,300.00
	3,19,32	Excavation for Structures	1	9,350	C.Y.	$6.46	$60,401.00
	23	Canal Concrete	5	360	C.Y.	$753.48	$271,252.80
	4,7,10a,20, 25,28,	Structural Concrete	4	3,020	C.Y.	$753.48	$2,275,509.60
	17,33	Backfill about Structures	2	1,100	C.Y.	$5.92	$6,512.00
		Compacted Backfill about Structures	3				
		Fish Passage					
	12	Rock		320	C.Y.	$50.40	$16,128.00
	13	Grout		120	C.Y.	$216.00	$25,920.00
	15	Sand/gravel bedding		450	C.Y.	$32.40	$14,580.00
	14	Riprap	24	900	C.Y.	$45.00	$40,500.00
		Fish Screen					
	36	Fish return Pipe	13	200	L.F.	$300.00	$60,000.00
	37	Fish Screens		60,000	lbs.	$13.40	$804,000.00
	38	Adjustable baffles		90,000	lbs.	$5.40	$486,000.00
	39	Hydraulic trash rake		1	L.S.	$324,000.00	$324,000.00
	40	Fish screen guide		112,000	lbs.	$10.00	$1,120,000.00
	41	Steel transition		8,200	lbs.	$12.00	$98,400.00
	42	Slide gate		2,200	lbs.	$18.00	$39,600.00
	43	Water level measuring equipment		1	L.S.	$18,000.00	$18,000.00
		Diversion Dam					
	44,46	Stopping Logs		7,800	lbs.	$10.00	$78,000.00
	45	Trash racks		43,750	lbs.	$10.00	$437,500.00
	47	Radial gates and hoist		6	Each	$72,000.00	$432,000.00
		Miscellaneous					
	19b	Water Care/Environmental Protection Works	49	1	L.S.	$500,000.00	$500,000.00
	16	Demo and Removal of Existing Structure	50	1	L.S.	$200,000.00	$200,000.00
	1	Bypass Canal Excavation	1	35,000	C.Y.	$6.46	$226,100.00
	19a	Construction Coffer Dam	54	1	L.S.	$100,000.00	$100,000.00
	35	Relocating Gaging Station	55	1	L.S.	$25,000.00	$25,000.00
	31	6" water stop		1,200	L.F.	$10.20	$12,240.00
	48,49	Electrical		1	L.S.	$540,000.00	$540,000.00
		Subtotal w/o mobilization					$8,151,242.00
		Mobilization		8%			$652,099.00
		Subtotal w/mobilization					$8,803,341.00
		Unlisted Items		10%			$880,334.00
		CONTRACT COST					$9,683,675.00
		Contingencies		25%			$2,420,919.00
		TOTAL FIELD COST					$12,104,594.00
		Non-Contract Cost		37%			$4,478,700.00
		CONSTRUCTION COST					$16,583,294.00
		TERO Fees		5%			$829,165.00
		TOTAL COST					$17,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 1 Repair Existing Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		350	C.Y.	$6.46	$2,261.00
	3	Backfill about Structures		350	C.Y.	$5.92	$2,072.00
	4	Compacted Backfill about Structures		350	C.Y.	$8.34	$2,919.00
	5	Riprap		1,470	C.Y.	$45.00	$66,150.00
	6	Crack Sealing		468	L.F.	$20.00	$9,360.00
	7	Epoxy Resin Crack Repair		234	L.F.	$75.00	$17,550.00
	8	Shallow Concrete Repairs		234	C.F.	$180.00	$42,120.00
	9	Deep Concrete Repairs		351	C.F.	$165.00	$57,915.00
	10	Concrete Replacement		220	C.Y.	$753.48	$165,765.60
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	12						
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	33						
	34						
	35						
		Subtotal w/o mobilization					$496,113.00
		Mobilization		8%			$39,689.00
		Subtotal w/mobilization					$535,802.00
		Unlisted Items		10%			$53,580.00
		CONTRACT COST					$589,382.00
		Contingencies		25%			$147,346.00
		TOTAL FIELD COST					$736,728.00
		Non-Contract Cost		37%			$272,589.00
		CONSTRUCTION COST					$1,009,317.00
		TERO Fees		5%			$50,466.00
		TOTAL COST					$1,100,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 2 Double Cell Box Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		5,550	C.Y.	$6.46	$35,853.00
	3	Backfill about Structures		1,370	C.Y.	$5.92	$8,110.40
	4	Compacted Backfill about Structures		1,370	C.Y.	$8.34	$11,425.80
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Double Cell Box Siphon (7'x7')		264	L.F.	$1,000.00	$264,000.00
	10	Grout Epoxy and Joint Sealant		2470	L.F.	$16.50	$40,755.00
	11	Concrete		30	C.Y.	$753.48	$22,604.40
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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		Subtotal w/o mobilization					$1,082,727.00
		Mobilization		8%			$86,618.00
		Subtotal w/mobilization					$1,169,345.00
		Unlisted Items		10%			$116,935.00
		CONTRACT COST					$1,286,280.00
		Contingencies		25%			$321,570.00
		TOTAL FIELD COST					$1,607,850.00
		Non-Contract Cost		37%			$594,905.00
		CONSTRUCTION COST					$2,202,755.00
		TERO Fees		5%			$110,138.00
		TOTAL COST					$2,400,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 3 Parallel Pipe Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		6,655	C.Y.	$6.46	$42,991.30
	3	Backfill about Structures		2,430	C.Y.	$5.92	$14,385.60
	4	Compacted Backfill about Structures		2,430	C.Y.	$8.34	$20,266.20
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Parallel Pipe (7.5ft. dia & 8ft. dia)		264	L.F.	$985.00	$260,040.00
	10	Concrete		30	C.Y.	$753.48	$22,604.40
	11	Flowable Fill		310	C.Y.	$162.00	$50,220.00
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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		Subtotal w/o mobilization					$1,110,486.00
		Mobilization		8%			$88,839.00
		Subtotal w/mobilization					$1,199,325.00
		Unlisted Items		10%			$119,933.00
		CONTRACT COST					$1,319,258.00
		Contingencies		25%			$329,815.00
		TOTAL FIELD COST					$1,649,073.00
		Non-Contract Cost		37%			$610,157.00
		CONSTRUCTION COST					$2,259,230.00
		TERO Fees		5%			$112,962.00
		TOTAL COST					$2,400,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping, Excavation & Rehandling		3600	C.Y.	$4.50	$16,200.00
	4	Excavation		83,920	C.Y.	$4.50	$377,640.00
	5	Impervious Backfill		68,700	C.Y.	$2.50	$171,750.00
	6	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	7	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		300	C.Y.	$1,530.00	$459,000.00
	11	Siphon Outlet Structure		475	C.Y.	$1,530.00	$726,750.00
	12	Siphon Barrel (10 ft. dia.)		5290	C.Y.	$1,185.00	$6,268,650.00
	13	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	14	Foundation Concrete		515	C.Y.	$750.00	$386,250.00
	15	Reinforced Concrete Footings		200	C.Y.	$1,530.00	$306,000.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$13,125,240.00
		Mobilization		8%			$1,050,019.00
		Subtotal w/mobilization					$14,175,259.00
		Unlisted Items		10%			$1,417,526.00
		CONTRACT COST					$15,592,785.00
		Contingencies		25%			$3,898,196.00
		TOTAL FIELD COST					$19,490,981.00
		Non-Contract Cost		37%			$7,211,663.00
		CONSTRUCTION COST					$26,702,644.00
		TERO Fees		5%			$1,335,132.00
		TOTAL COST					$29,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Case of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site cleaning		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		4050	C.Y.	$4.50	$18,225.00
	4	Excavation		90,720	C.Y.	$4.50	$408,240.00
	5	Impervious Backfill		70,490	C.Y.	$2.50	$176,225.00
	6	Granular Backfill		9,450	C.Y.	$35.00	$330,750.00
	7	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		275	C.Y.	$1,530.00	$420,750.00
	11	Siphon Outlet Structure		325	C.Y.	$1,530.00	$497,250.00
	12	Siphon Barrel (8 ft. dia.)		7350	C.Y.	$1,185.00	$8,709,750.00
	13	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	14	Foundation Concrete		800	C.Y.	$750.00	$600,000.00
	15	Reinforced Concrete Footings		315	C.Y.	$1,530.00	$481,950.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$16,176,890.00
		Mobilization		8%			$1,294,151.00
		Subtotal w/mobilization					$17,471,041.00
		Unlisted Items		10%			$1,747,104.00
		CONTRACT COST					$19,218,145.00
		Contingencies		25%			$4,804,536.00
		TOTAL FIELD COST					$24,022,681.00
		Non-Contract Cost		37%			$8,888,392.00
		CONSTRUCTION COST					$32,911,073.00
		TERO Fees		5%			$1,645,554.00
		TOTAL COST					$35,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping Excavation & Rehandling		2355	C.Y.	$4.50	$10,597.50
	4	Excavation		46,310	C.Y.	$4.50	$208,395.00
	5	Sand Backfill		16,915	C.Y.	$30.00	$507,450.00
	6	Impervious Backfill		19,960	C.Y.	$2.50	$49,900.00
	7	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		300	C.Y.	$1,530.00	$459,000.00
	11	Siphon Outlet Structure		475	C.Y.	$1,530.00	$726,750.00
	12	Supply Siphon Barrel (10 ft. dia x 1/2" wall thickness, Coated & Lined)		1080	L.Y.	$3,700.00	$3,996,000.00
	13	Cathodic Protection System		1	L.S.	$50,000.00	$50,000.00
	14	Extra for Special Elbows		12	Each	$52,000.00	$624,000.00
	15	Place, Field Well, Coat & Line Joints		1080	L.Y.	$1,680.00	$1,814,400.00
	16	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$12,359,493.00
		Mobilization		8%			$988,759.00
		Subtotal w/mobilization					$13,348,252.00
		Unlisted Items		10%			$1,334,825.00
		CONTRACT COST					$14,683,077.00
		Contingencies		25%			$3,670,769.00
		TOTAL FIELD COST					$18,353,846.00
		Non-Contract Cost		37%			$6,790,923.00
		CONSTRUCTION COST					$25,144,769.00
		TERO Fees		5%			$1,257,238.00
		TOTAL COST					$27,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site Clearing		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		2635	C.Y.	$4.50	$11,857.50
	4	Excavation		52,545	C.Y.	$4.50	$236,452.50
	5	Sand Backfill		17,890	C.Y.	$30.00	$536,700.00
	6	Impervious Backfill		22700	C.Y.	$2.50	$56,750.00
	7	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		275	C.Y.	$1,530.00	$420,750.00
	11	Siphon Outlet Structure		325	C.Y.	$1,530.00	$497,250.00
	12	Supply Siphon Barrel (8.0 ft. dia. x 3/8 " Wall Thickness, Coated & Lined)		2160	L.Y.	$2,450.00	$5,292,000.00
	13	Cathodic Protecting System		1	L.S.	$75,000.00	$75,000.00
	14	Extra for Special Elbows		24	Each	$48,000.00	$1,152,000.00
	15	Place, Field Well, Coat & Line Joints		2160	L.Y.	$1,070.00	$2,311,200.00
	16	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$14,954,460.00
		Mobilization		8%			$1,196,357.00
		Subtotal w/mobilization					$16,150,817.00
		Unlisted Items		10%			$1,615,082.00
		CONTRACT COST					$17,765,899.00
		Contingencies		25%			$4,441,475.00
		TOTAL FIELD COST					$22,207,374.00
		Non-Contract Cost		37%			$8,216,728.00
		CONSTRUCTION COST					$30,424,102.00
		TERO Fees		5%			$1,521,205.00
		TOTAL COST					$32,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		1505	C.Y.	$4.50	$6,772.50
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	C.Y.	$195,000.00	$195,000.00
	5	Excavation		32,860	C.Y.	$4.50	$147,870.00
	6	Impervious Backfill		27,455	C.Y.	$2.50	$68,637.50
	7	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		305	C.Y.	$1,530.00	$466,650.00
	12	Siphon Outlet Structure		485	C.Y.	$1,530.00	$742,050.00
	13	Siphon Barrel (9.0 ft. dia.)		1820	C.Y.	$1,185.00	$2,156,700.00
	14	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	15	Foundation Concrete		205	C.Y.	$750.00	$153,750.00
	16	Reinforced Concrete Footings		80	C.Y.	$1,530.00	$122,400.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$5,565,830.00
		Mobilization		8%			$445,266.00
		Subtotal w/mobilization					$6,011,096.00
		Unlisted Items		10%			$601,110.00
		CONTRACT COST					$6,612,206.00
		Contingencies		25%			$1,653,052.00
		TOTAL FIELD COST					$8,265,258.00
		Non-Contract Cost		37%			$3,058,145.00
		CONSTRUCTION COST					$11,323,403.00
		TERO Fees		5%			$566,170.00
		TOTAL COST					$12,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1705	C.Y.	$4.50	$7,672.50
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		36,085	C.Y.	$4.50	$162,382.50
	6	Impervious Backfill		28,745	C.Y.	$2.50	$71,862.50
	7	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		280	C.Y.	$1,530.00	$428,400.00
	12	Siphon Outlet Structure		350	C.Y.	$1,530.00	$535,500.00
	13	Siphon Barrel (7.0 ft. dia.)		2925	C.Y.	$1,185.00	$3,466,125.00
	14	Blow Off Well		1	L.S.	$310,000.00	$310,000.00
	15	Foundation Concrete		320	C.Y.	$750.00	$240,000.00
	16	Reinforced Concrete Footings		125	C.Y.	$1,530.00	$191,250.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$7,144,693.00
		Mobilization		8%			$571,575.00
		Subtotal w/mobilization					$7,716,268.00
		Unlisted Items		10%			$771,627.00
		CONTRACT COST					$8,487,895.00
		Contingencies		25%			$2,121,974.00
		TOTAL FIELD COST					$10,609,869.00
		Non-Contract Cost		37%			$3,925,652.00
		CONSTRUCTION COST					$14,535,521.00
		TERO Fees		5%			$726,776.00
		TOTAL COST					$15,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		960	C.Y.	$4.50	$4,320.00
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		17,680	C.Y.	$4.50	$79,560.00
	6	Sand Backfill		6,270	C.Y.	$30.00	$188,100.00
	7	Impervious Backfill		8120	C.Y.	$2.50	$20,300.00
	8	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	9	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		305	C.Y.	$1,530.00	$466,650.00
	12	Siphon Outlet Structure		485	C.Y.	$1,530.00	$742,050.00
	13	Supply Siphon Barrel (9.0 ft. dia. x 3/8 " Wall Thickness, Coated & Lined)		478	L.Y.	$3,330.00	$1,591,740.00
	14	Cathodic Protecting System		1	L.S.	$42,000.00	$42,000.00
	15	Extra for Special Elbows		12	Each	$50,000.00	$600,000.00
	16	Place, Field Well, Coat & Line Joints		478	L.Y.	$1,560.00	$745,680.00
	17	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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	35						
		Subtotal w/o mobilization					$5,681,400.00
		Mobilization		8%			$454,512.00
		Subtotal w/mobilization					$6,135,912.00
		Unlisted Items		10%			$613,591.00
		CONTRACT COST					$6,749,503.00
		Contingencies		25%			$1,687,376.00
		TOTAL FIELD COST					$8,436,879.00
		Non-Contract Cost		37%			$3,121,645.00
		CONSTRUCTION COST					$11,558,524.00
		TERO Fees		5%			$577,926.00
		TOTAL COST					$12,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1060	C.Y.	$4.50	$4,770.00
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		19,015	C.Y.	$4.50	$85,567.50
	6	Sand Backfill		5,945	C.Y.	$30.00	$178,350.00
	7	Impervious Backfill		8980	C.Y.	$2.50	$22,450.00
	8	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	9	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		280	C.Y.	$1,530.00	$428,400.00
	12	Siphon Outlet Structure		350	C.Y.	$1,530.00	$535,500.00
	13	Supply Siphon Barrel (7.0 ft. dia. x 5/16 " Wall Thickness, Coated & Lined)		956	L.Y.	$1,870.00	$1,787,720.00
	14	Cathodic Protecting System		1	L.S.	$63,000.00	$63,000.00
	15	Extra for Special Elbows		24	Each	$46,000.00	$1,104,000.00
	16	Place, Field Well, Coat & Line Joints		956	L.Y.	$855.00	$817,380.00
	17	Blow Off Well		1	L.S.	$310,000.00	$310,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$6,568,638.00
		Mobilization		8%			$525,491.00
		Subtotal w/mobilization					$7,094,129.00
		Unlisted Items		10%			$709,413.00
		CONTRACT COST					$7,803,542.00
		Contingencies		25%			$1,950,886.00
		TOTAL FIELD COST					$9,754,428.00
		Non-Contract Cost		37%			$3,609,138.00
		CONSTRUCTION COST					$13,363,566.00
		TERO Fees		5%			$668,178.00
		TOTAL COST					$14,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 5 Single Barrel Precast Concrete Siphon
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		1,505	C.Y.	$4.50	$6,772.50
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		32,860	C.Y.	$4.50	$147,870.00
	6	Impervious Backfill		27,455	C.Y.	$2.50	$68,637.50
	7	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3,000	L.F.	$7.50	$22,500.00
	9	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	10	Siphon Inlet Structure		305	C.Y.	$1,530.00	$466,650.00
	11	Siphon Outlet Structure		485	C.Y.	$1,530.00	$742,050.00
	12	Siphon Barrel (9 ft. dia.)		1,435	L.F.	$2,000.00	$2,870,000.00
	13	Siphon Barrel Installation & Testing		1,435	L.F.	$300.00	$430,500.00
	14	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	15	Foundation Concrete Including Cast in Place Concrete Under Siphon Barrel		1,075	C.Y.	$750.00	$806,250.00
	16	Reinforced Concrete Cradles		260	C.Y.	$1,530.00	$397,800.00
	17	25m Longitudinal Rebar		23,030	L.F.	$2.30	$52,969.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$7,190,499.00
		Mobilization		8%			$575,240.00
		Subtotal w/mobilization					$7,765,739.00
		Unlisted Items		10%			$776,574.00
		CONTRACT COST					$8,542,313.00
		Contingencies		25%			$2,135,578.00
		TOTAL FIELD COST					$10,677,891.00
		Non-Contract Cost		37%			$3,950,820.00
		CONSTRUCTION COST					$14,628,711.00
		TERO Fees		5%			$731,436.00
		TOTAL COST					$15,500,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 6 Two Bank Fill

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Topsoil Stripping of Fill Area		21500	C.Y.	$4.50	$96,750.00
	2	Care of Water		1	L.S.	$50,000.00	$50,000.00
	3	Borrow Stripping		200000	C.Y.	$4.50	$900,000.00
	4	Borrow Excavation		1,300,000	C.Y.	$4.50	$5,850,000.00
	5	Compacted Embankment		1,000,000	C.Y.	$2.50	$2,500,000.00
	6	Relocate Three Conoco Oil Lines (distance of 200 feet each)		1	L.S.	$390,000.00	$390,000.00
	7	Power Line Alterations		1	L.S.	$20,000.00	$20,000.00
	8	Cross Drainage Structure		1	L.S.	$190,000.00	$190,000.00
	9	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	10	Check Drop Structure		1	L.S.	$900,000.00	$900,000.00
	11	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$11,146,750.00
		Mobilization		8%			$891,740.00
		Subtotal w/mobilization					$12,038,490.00
		Unlisted Items		10%			$1,203,849.00
		CONTRACT COST					$13,242,339.00
		Contingencies		25%			$3,310,585.00
		TOTAL FIELD COST					$16,552,924.00
		Non-Contract Cost		37%			$6,124,582.00
		CONSTRUCTION COST					$22,677,506.00
		TERO Fees		5%			$1,133,875.00
		TOTAL COST					$24,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro Ready" Option w/o Penstock

Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,344	CY	753.48	$1,012,677.12
	2	Structural Excavation		10,880	CY	6.46	$70,284.80
	3	Compacted Backfill		5,294	CY	8.34	$44,151.96
	4	Chanel Excavation		316,500	CY	7.53	$2,383,245.00
	5						
	6	Drop Structure No. 5 (from C27)		1	LS	485,830.00	$485,830.00
	7	Canal Reshaping (Drop No. 4 to No. 5) (from C28)		1	LS	669,445.00	$669,445.00
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		Subtotal w/o mobilization					$4,665,634.00
		Mobilization		8%			$373,251.00
		Subtotal w/mobilization					$5,038,885.00
		Unlisted Items		10%			$503,889.00
		CONTRACT COST					$5,542,774.00
		Contingencies		25%			$1,385,694.00
		TOTAL FIELD COST					$6,928,468.00
		Non-Contract Cost		37%			$2,563,533.00
		CONSTRUCTION COST					$9,492,001.00
		TERO Fees		5%			$474,600.00
		TOTAL COST					$10,000,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro Ready" Option w/ Penstock

Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,344	CY	753.48	$1,012,677.12
	2	Structural Excavation		10,880	CY	6.46	$70,284.80
	3	Compacted Backfill		5,294	CY	8.34	$44,151.96
	4	Chanel Excavation		316,500	CY	7.53	$2,383,245.00
	5						
	6						
	7	6' x 6' sluice gates		3	EA	61,570.00	$184,710.00
	8	72" steel pipe		2,400	FT	611.14	$1,466,736.00
	9	Pipe Excavation		11,733	CY	7.53	$88,349.49
	10	Pipe Backfill		9,220	CY	8.34	$76,894.80
	11	20' x 8' radial gate		1	EA	100,000.00	$100,000.00
	12	6' x 6' Trashracks		3	EA	5,000.00	$15,000.00
	13	Additional Structural Concrete		120	CY	753.48	$90,417.60
	14	Additional Structural Excavation		1,608	CY	6.46	$10,387.68
	15	Additional Compacted Backfill		942	CY	8.34	$7,856.28
	16						
	17	Drop Structure No. 5 (from C27)		1	LS	485,830.00	$485,830.00
	18	Canal Reshaping (Drop No. 4 to No. 5) (from C28)		1	LS	669,445.00	$669,445.00
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		Subtotal w/o mobilization					$6,705,986.00
		Mobilization		8%			$536,479.00
		Subtotal w/mobilization					$7,242,465.00
		Unlisted Items		10%			$724,247.00
		CONTRACT COST					$7,966,712.00
		Contingencies		25%			$1,991,678.00
		TOTAL FIELD COST					$9,958,390.00
		Non-Contract Cost		37%			$3,684,604.00
		CONSTRUCTION COST					$13,642,994.00
		TERO Fees		5%			$682,150.00
		TOTAL COST					$14,500,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Drop Type Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		519	cy	$753.48	$391,056.12
	2	Structural Excavation		3,828	cy	$6.46	$24,722.76
	3	Compacted Backfill about Structures		2,116	cy	$8.34	$17,651.88
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		Subtotal w/o mobilization					$433,431.00
		Mobilization		8%			$34,674.00
		Subtotal w/mobilization					$468,105.00
		Unlisted Items		10%			$46,811.00
		CONTRACT COST					$514,916.00
		Contingencies		25%			$128,729.00
		TOTAL FIELD COST					$643,645.00
		Non-Contract Cost		37%			$238,149.00
		CONSTRUCTION COST					$881,794.00
		TERO Fees		5%			$44,090.00
		TOTAL COST					$930,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Type III Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		513	cy	$753.48	$386,535.24
	2	Structural Excavation		3,981	cy	$6.46	$25,710.89
	3	Compacted Backfill about Structures		2,220	cy	$8.34	$18,519.46
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		Subtotal w/o mobilization					$430,766.00
		Mobilization		8%			$34,461.00
		Subtotal w/mobilization					$465,227.00
		Unlisted Items		10%			$46,523.00
		CONTRACT COST					$511,750.00
		Contingencies		25%			$127,938.00
		TOTAL FIELD COST					$639,688.00
		Non-Contract Cost		37%			$236,685.00
		CONSTRUCTION COST					$876,373.00
		TERO Fees		5%			$43,819.00
		TOTAL COST					$930,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Drop Type Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		503	cy	$753.48	$379,000.44
	2	Structural Excavation		3,724	cy	$6.46	$24,051.08
	3	Compacted Backfill about Structures		2,069	cy	$8.34	$17,259.80
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		Subtotal w/o mobilization					$420,311.00
		Mobilization		8%			$33,625.00
		Subtotal w/mobilization					$453,936.00
		Unlisted Items		10%			$45,394.00
		CONTRACT COST					$499,330.00
		Contingencies		25%			$124,833.00
		TOTAL FIELD COST					$624,163.00
		Non-Contract Cost		37%			$230,940.00
		CONSTRUCTION COST					$855,103.00
		TERO Fees		5%			$42,755.00
		TOTAL COST					$900,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Type III Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		494	cy	$753.48	$372,219.12
	2	Structural Excavation		3,850	cy	$6.46	$24,864.84
	3	Compacted Backfill about Structures		2,150	cy	$8.34	$17,935.52
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		Subtotal w/o mobilization					$415,019.00
		Mobilization		8%			$33,202.00
		Subtotal w/mobilization					$448,221.00
		Unlisted Items		10%			$44,822.00
		CONTRACT COST					$493,043.00
		Contingencies		25%			$123,261.00
		TOTAL FIELD COST					$616,304.00
		Non-Contract Cost		37%			$228,032.00
		CONSTRUCTION COST					$844,336.00
		TERO Fees		5%			$42,217.00
		TOTAL COST					$890,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Drop Type Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		423	cy	$753.48	$318,722.04
	2	Structural Excavation		3,096	cy	$6.46	$19,995.21
	3	Compacted Backfill about Structures		1,783	cy	$8.34	$14,873.96
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		Subtotal w/o mobilization					$353,591.00
		Mobilization		8%			$28,287.00
		Subtotal w/mobilization					$381,878.00
		Unlisted Items		10%			$38,188.00
		CONTRACT COST					$420,066.00
		Contingencies		25%			$105,017.00
		TOTAL FIELD COST					$525,083.00
		Non-Contract Cost		37%			$194,281.00
		CONSTRUCTION COST					$719,364.00
		TERO Fees		5%			$35,968.00
		TOTAL COST					$760,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Type III Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		409	cy	$753.48	$308,173.32
	2	Structural Excavation		3,107	cy	$6.46	$20,066.25
	3	Compacted Backfill about Structures		1,759	cy	$8.34	$14,673.75
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		Subtotal w/o mobilization					$342,913.00
		Mobilization		8%			$27,433.00
		Subtotal w/mobilization					$370,346.00
		Unlisted Items		10%			$37,035.00
		CONTRACT COST					$407,381.00
		Contingencies		25%			$101,845.00
		TOTAL FIELD COST					$509,226.00
		Non-Contract Cost		37%			$188,414.00
		CONSTRUCTION COST					$697,640.00
		TERO Fees		5%			$34,882.00
		TOTAL COST					$740,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Drop Type Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		675	cy	$753.48	$508,599.00
	2	Structural Excavation		5,063	cy	$6.46	$32,698.88
	3	Compacted Backfill about Structures		2,677	cy	$8.34	$22,331.80
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		Subtotal w/o mobilization					$563,630.00
		Mobilization		8%			$45,090.00
		Subtotal w/mobilization					$608,720.00
		Unlisted Items		10%			$60,872.00
		CONTRACT COST					$669,592.00
		Contingencies		25%			$167,398.00
		TOTAL FIELD COST					$836,990.00
		Non-Contract Cost		37%			$309,686.00
		CONSTRUCTION COST					$1,146,676.00
		TERO Fees		5%			$57,334.00
		TOTAL COST					$1,250,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Type III Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		685	cy	$753.48	$516,133.80
	2	Structural Excavation		5,486	cy	$6.46	$35,430.78
	3	Compacted Backfill about Structures		3,017	cy	$8.34	$25,168.12
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	35						
		Subtotal w/o mobilization					$576,733.00
		Mobilization		8%			$46,139.00
		Subtotal w/mobilization					$622,872.00
		Unlisted Items		10%			$62,287.00
		CONTRACT COST					$685,159.00
		Contingencies		25%			$171,290.00
		TOTAL FIELD COST					$856,449.00
		Non-Contract Cost		37%			$316,886.00
		CONSTRUCTION COST					$1,173,335.00
		TERO Fees		5%			$58,667.00
		TOTAL COST					$1,250,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Drop Type Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		573	cy	$753.48	$431,744.04
	2	Structural Excavation		4,279	cy	$6.46	$27,635.49
	3	Compacted Backfill about Structures		2,321	cy	$8.34	$19,362.01
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	35						
		Subtotal w/o mobilization					$478,742.00
		Mobilization		8%			$38,299.00
		Subtotal w/mobilization					$517,041.00
		Unlisted Items		10%			$51,704.00
		CONTRACT COST					$568,745.00
		Contingencies		25%			$142,186.00
		TOTAL FIELD COST					$710,931.00
		Non-Contract Cost		37%			$263,044.00
		CONSTRUCTION COST					$973,975.00
		TERO Fees		5%			$48,699.00
		TOTAL COST					$1,050,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Type III Stilling Basin
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		578	cy	$753.48	$435,511.44
	2	Structural Excavation		4,540	cy	$6.46	$29,321.14
	3	Compacted Backfill about Structures		2,517	cy	$8.34	$20,997.07
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		Subtotal w/o mobilization					$485,830.00
		Mobilization		8%			$38,866.00
		Subtotal w/mobilization					$524,696.00
		Unlisted Items		10%			$52,470.00
		CONTRACT COST					$577,166.00
		Contingencies		25%			$144,292.00
		TOTAL FIELD COST					$721,458.00
		Non-Contract Cost		37%			$266,939.00
		CONSTRUCTION COST					$988,397.00
		TERO Fees		5%			$49,420.00
		TOTAL COST					$1,050,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drops 1-5
Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Canal Reshaping Between Drops 1 & 2		1,550	L.F.	$191.27	$296,468.50
	2	Canal Reshaping Between Drops 2 & 3		850	L.F.	$191.27	$162,579.50
	3	Canal Reshaping Between Drops 3 & 4		2,300	L.F.	$191.27	$439,921.00
	4	Canal Reshaping Between Drops 4 & 5		3,500	L.F.	$191.27	$669,445.00
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	35						
		Subtotal w/o mobilization					$1,568,414.00
		Mobilization		8%			$125,473.00
		Subtotal w/mobilization					$1,693,887.00
		Unlisted Items		10%			$169,389.00
		CONTRACT COST					$1,863,276.00
		Contingencies		25%			$465,819.00
		TOTAL FIELD COST					$2,329,095.00
		Non-Contract Cost		37%			$861,765.00
		CONSTRUCTION COST					$3,190,860.00
		TERO Fees		5%			$159,543.00
		TOTAL COST					$3,400,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam to Kennedy Creek Siphon
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		98,500	C.Y.	$9.75	$960,375.00
	4	Embankment		236,900	C.Y.	$8.50	$2,013,650.00
	5	Gravel Prism Armoring		0	C.Y.	$18.00	$0.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		14,830	C.Y.	$20.15	$298,824.50
	9	Overshot Control Check w/ SCDA - Complete		0	Each		$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each		$0.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each		$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		7,200	S.F.	$158.00	$1,137,600.00
	17	Bridge - Relocation		0	L.S.		$0.00
	18	Demolition of Existing Structures		0	L.S.		$0.00
	19	Fencing		50,018	L.F.	$2.75	$137,549.50
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		28	Ac.	$225.00	$6,300.00
	22						
	23	RipRap		140	C.Y.	$55.00	$7,700.00
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	34						
	35						
		Subtotal w/o mobilization					$4,804,124.00
		Mobilization		8%			$384,330.00
		Subtotal w/mobilization					$5,188,454.00
		Unlisted Items		10%			$518,845.00
		CONTRACT COST					$5,707,299.00
		Contingencies		25%			$1,426,825.00
		TOTAL FIELD COST					$7,134,124.00
		Non-Contract Cost		37%			$2,639,626.00
		CONSTRUCTION COST					$9,773,750.00
		TERO Fees		5%			$488,688.00
		TOTAL COST					$10,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon to St. Mary Siphon
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		87,200	C.Y.	$9.75	$850,200.00
	4	Embankment		209,700	C.Y.	$8.50	$1,782,450.00
	5	Gravel Prism Armoring		0	C.Y.	$18.00	$0.00
	6	20 mil PVC Liner		6,335	S.Y.	$15.75	$99,776.25
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		13,130	C.Y.	$20.15	$264,569.50
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$598,000.00	$598,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$253,500.00	$253,500.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		1	Each	$267,750.00	$267,750.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		44,282	L.F.	$2.75	$121,775.50
	20	Cattle Guards		3	Each	$5,000.00	$15,000.00
	21	Drill Seeding		46	Ac.	$225.00	$10,350.00
	22						
	23	RipRap		130	C.Y.	$65.00	$8,450.00
	24	New 26-ft All Weather Gravel Road with Geotextile		8,000	L.F.	$97.29	$778,328.00
	25						
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	35						
		Subtotal w/o mobilization					$5,572,074.00
		Mobilization		8%			$445,766.00
		Subtotal w/mobilization					$6,017,840.00
		Unlisted Items		10%			$601,784.00
		CONTRACT COST					$6,619,624.00
		Contingencies		25%			$1,654,906.00
		TOTAL FIELD COST					$8,274,530.00
		Non-Contract Cost		37%			$3,061,576.00
		CONSTRUCTION COST					$11,336,106.00
		TERO Fees		5%			$566,805.00
		TOTAL COST					$12,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary Siphon to Sta. 715+00
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$52,500.00	$52,500.00
	2	Topsoil Striping & Rehandling		450	C.Y.	$6.25	$2,812.50
	3	Excavation		80,000	C.Y.	$9.75	$780,000.00
	4	Embankment		174,800	C.Y.	$8.50	$1,485,800.00
	5	Gravel Prism Armoring		0	C.Y.	$20.00	$0.00
	6	20 mil PVC Liner		3,520	S.Y.	$15.75	$55,440.00
	7	Slide Stabilization Buttress		38,250	C.Y.	$59.50	$2,275,875.00
	8	Road Surfacing		12,050	C.Y.	$22.00	$265,100.00
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$598,000.00	$598,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each	$0.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		41,000	L.F.	$2.75	$112,750.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		50	Ac.	$225.00	$11,250.00
	22						
	23	RipRap		1,500	C.Y.	$75.00	$112,500.00
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	35						
		Subtotal w/o mobilization					$6,235,828.00
		Mobilization		8%			$498,866.00
		Subtotal w/mobilization					$6,734,694.00
		Unlisted Items		10%			$673,469.00
		CONTRACT COST					$7,408,163.00
		Contingencies		25%			$1,852,041.00
		TOTAL FIELD COST					$9,260,204.00
		Non-Contract Cost		37%			$3,426,275.00
		CONSTRUCTION COST					$12,686,479.00
		TERO Fees		5%			$634,324.00
		TOTAL COST					$13,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 715+00 to Hall Coulee
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$33,000.00	$33,000.00
	2	Topsoil Striping & Rehandling		650	C.Y.	$6.25	$4,062.50
	3	Excavation		78,200	C.Y.	$9.75	$762,450.00
	4	Embankment		188,100	C.Y.	$8.50	$1,598,850.00
	5	Gravel Prism Armoring		0	C.Y.	$22.00	$0.00
	6	20 mil PVC Liner		3,525	S.Y.	$15.75	$55,518.75
	7	Slide Stabilization Buttress		9,990	C.Y.	$61.50	$614,385.00
	8	Road Surfacing		11,775	C.Y.	$24.00	$282,600.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$720,000.00	$720,000.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		1	Each	$300,000.00	$300,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$30,000.00	$30,000.00
	19	Fencing		39,800	L.F.	$2.75	$109,450.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,250	C.Y.	$90.00	$112,500.00
	24						
	25						
	26						
	27						
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	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$5,048,491.00
		Mobilization		8%			$403,879.00
		Subtotal w/mobilization					$5,452,370.00
		Unlisted Items		10%			$545,237.00
		CONTRACT COST					$5,997,607.00
		Contingencies		25%			$1,499,402.00
		TOTAL FIELD COST					$7,497,009.00
		Non-Contract Cost		37%			$2,773,893.00
		CONSTRUCTION COST					$10,270,902.00
		TERO Fees		5%			$513,545.00
		TOTAL COST					$11,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. Hall Coulee to Sta. 1173+50
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$27,500.00	$27,500.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		95,700	C.Y.	$9.75	$933,075.00
	4	Embankment		230,050	C.Y.	$8.50	$1,955,425.00
	5	Gravel Prism Armoring		0	C.Y.	$24.00	$0.00
	6	20 mil PVC Liner		3,520	S.Y.	$15.75	$55,440.00
	7	Slide Stabilization Buttress		4,540	C.Y.	$63.50	$288,290.00
	8	Road Surfacing		14,420	C.Y.	$26.00	$374,920.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		4	Each	$115,000.00	$460,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		48,600	L.F.	$2.75	$133,650.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		60	Ac.	$225.00	$13,500.00
	22						
	23	RipRap		1,200	C.Y.	$100.00	$120,000.00
	24						
	25						
	26						
	27						
	28						
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	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$4,774,350.00
		Mobilization		8%			$381,948.00
		Subtotal w/mobilization					$5,156,298.00
		Unlisted Items		10%			$515,630.00
		CONTRACT COST					$5,671,928.00
		Contingencies		25%			$1,417,982.00
		TOTAL FIELD COST					$7,089,910.00
		Non-Contract Cost		37%			$2,623,267.00
		CONSTRUCTION COST					$9,713,177.00
		TERO Fees		5%			$485,659.00
		TOTAL COST					$10,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 1173+50 to Drop No. 1
Alternative No. 1 Reshape Existing Canal
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$20,000.00	$20,000.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		92,850	C.Y.	$9.75	$905,287.50
	4	Embankment		223,280	C.Y.	$8.50	$1,897,880.00
	5	Gravel Prism Armoring		0	C.Y.	$26.00	$0.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$65.50	$0.00
	8	Road Surfacing		14,000	C.Y.	$28.00	$392,000.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		0	Each	$6,575.00	$0.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each	$0.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		0	S.F.	$158.00	$0.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		47,200	L.F.	$2.75	$129,800.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		60	Ac.	$225.00	$13,500.00
	22						
	23	RipRap		500	C.Y.	$125.00	$62,500.00
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$3,598,718.00
		Mobilization		8%			$287,897.00
		Subtotal w/mobilization					$3,886,615.00
		Unlisted Items		10%			$388,662.00
		CONTRACT COST					$4,275,277.00
		Contingencies		25%			$1,068,819.00
		TOTAL FIELD COST					$5,344,096.00
		Non-Contract Cost		37%			$1,977,316.00
		CONSTRUCTION COST					$7,321,412.00
		TERO Fees		5%			$366,071.00
		TOTAL COST					$7,700,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam to Kennedy Creek Siphon
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		214,900	C.Y.	$4.25	$913,325.00
	4	Embankment		98,230	C.Y.	$6.50	$638,495.00
	5	Gravel Prism Armoring		37,050	C.Y.	$18.00	$666,900.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		21,050	C.Y.	$20.15	$424,157.50
	9	Overshot Control Check w/ SCDA - Complete		0	Each		$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each		$0.00
	11	Drain Inlets - Uncontrolled - Complete		15	Each	$6,575.00	$98,625.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each		$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		7,200	S.F.	$158.00	$1,137,600.00
	17	Bridge - Relocation		0	L.S.		$0.00
	18	Demolition of Existing Structures		0	L.S.		$0.00
	19	Fencing		47,360	L.F.	$2.75	$130,240.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		30	Ac.	$225.00	$6,750.00
	22						
	23	RipRap		140	C.Y.	$55.00	$7,700.00
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$4,518,668.00
		Mobilization		8%			$361,493.00
		Subtotal w/mobilization					$4,880,161.00
		Unlisted Items		10%			$488,016.00
		CONTRACT COST					$5,368,177.00
		Contingencies		25%			$1,342,044.00
		TOTAL FIELD COST					$6,710,221.00
		Non-Contract Cost		37%			$2,482,782.00
		CONSTRUCTION COST					$9,193,003.00
		TERO Fees		5%			$459,650.00
		TOTAL COST					$9,700,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon to St. Mary Siphon
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		257,700	C.Y.	$4.25	$1,095,225.00
	4	Embankment		85,900	C.Y.	$6.50	$558,350.00
	5	Gravel Prism Armoring		32,385	C.Y.	$18.00	$582,930.00
	6	20 mil PVC Liner		6,335	S.Y.	$15.75	$99,776.25
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		18,425	C.Y.	$20.15	$371,263.75
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$598,000.00	$598,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$253,000.00	$253,000.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		1	Each	$267,750.00	$267,750.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		1	L.S.	$210,000.00	$210,000.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		44,282	L.F.	$2.75	$121,775.50
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		46	Ac.	$225.00	$10,350.00
	22						
	23	RipRap		130	C.Y.	$65.00	$8,450.00
	24	New 26-ft All Weather Gravel Road with Geotextile		8,000	L.F.	$97.29	$778,328.00
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$5,696,849.00
		Mobilization		8%			$455,748.00
		Subtotal w/mobilization					$6,152,597.00
		Unlisted Items		10%			$615,260.00
		CONTRACT COST					$6,767,857.00
		Contingencies		25%			$1,691,964.00
		TOTAL FIELD COST					$8,459,821.00
		Non-Contract Cost		37%			$3,130,134.00
		CONSTRUCTION COST					$11,589,955.00
		TERO Fees		5%			$579,498.00
		TOTAL COST					$12,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary Siphon to Sta. 715+00
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$52,500.00	$52,500.00
	2	Topsoil Striping & Rehandling		450	C.Y.	$6.25	$2,812.50
	3	Excavation		243,250	C.Y.	$4.25	$1,033,812.50
	4	Embankment		81,100	C.Y.	$6.50	$527,150.00
	5	Gravel Prism Armoring		30,575	C.Y.	$20.00	$611,500.00
	6	20 mil PVC Liner		3,520	S.Y.	$15.75	$55,440.00
	7	Slide Stabilization Buttress		38,250	C.Y.	$59.50	$2,275,875.00
	8	Road Surfacing		17,400	C.Y.	$22.00	$382,800.00
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$598,000.00	$598,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each	$267,750.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		40,000	L.F.	$2.75	$110,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		50	Ac.	$225.00	$11,250.00
	22						
	23	RipRap		1,500	C.Y.	$75.00	$112,500.00
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$6,346,615.00
		Mobilization		8%			$507,729.00
		Subtotal w/mobilization					$6,854,344.00
		Unlisted Items		10%			$685,434.00
		CONTRACT COST					$7,539,778.00
		Contingencies		25%			$1,884,945.00
		TOTAL FIELD COST					$9,424,723.00
		Non-Contract Cost		37%			$3,487,148.00
		CONSTRUCTION COST					$12,911,871.00
		TERO Fees		5%			$645,594.00
		TOTAL COST					$14,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 715+00 to Hall Coulee
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$33,000.00	$33,000.00
	2	Topsoil Striping & Rehandling		650	C.Y.	$6.25	$4,062.50
	3	Excavation		222,200	C.Y.	$4.25	$944,350.00
	4	Embankment		74,050	C.Y.	$6.50	$481,325.00
	5	Gravel Prism Armoring		27,925	C.Y.	$22.00	$614,350.00
	6	20 mil PVC Liner		3,525	S.Y.	$15.75	$55,518.75
	7	Slide Stabilization Buttress		9,990	C.Y.	$61.50	$614,385.00
	8	Road Surfacing		15,875	C.Y.	$24.00	$381,000.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$720,000.00	$720,000.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		2	Each	$74,250.00	$148,500.00
	13	Underdrains - Complete		1	Each	$300,000.00	$300,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$30,000.00	$30,000.00
	19	Fencing		36,000	L.F.	$2.75	$99,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,250	C.Y.	$90.00	$112,500.00
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$5,052,841.00
		Mobilization		8%			$404,227.00
		Subtotal w/mobilization					$5,457,068.00
		Unlisted Items		10%			$545,707.00
		CONTRACT COST					$6,002,775.00
		Contingencies		25%			$1,500,694.00
		TOTAL FIELD COST					$7,503,469.00
		Non-Contract Cost		37%			$2,776,284.00
		CONSTRUCTION COST					$10,279,753.00
		TERO Fees		5%			$513,988.00
		TOTAL COST					$11,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. Hall Coulee to Sta. 1173+50
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$27,500.00	$27,500.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		269,650	C.Y.	$4.25	$1,146,012.50
	4	Embankment		89,900	C.Y.	$6.50	$584,350.00
	5	Gravel Prism Armoring		33,900	C.Y.	$24.00	$813,600.00
	6	20 mil PVC Liner		3,520	S.Y.	$15.75	$55,440.00
	7	Slide Stabilization Buttress		4,540	C.Y.	$63.50	$288,290.00
	8	Road Surfacing		19,275	C.Y.	$26.00	$501,150.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		4	Each	$115,000.00	$460,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		43,400	L.F.	$2.75	$119,350.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,000	C.Y.	$100.00	$100,000.00
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	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$4,732,843.00
		Mobilization		8%			$378,627.00
		Subtotal w/mobilization					$5,111,470.00
		Unlisted Items		10%			$511,147.00
		CONTRACT COST					$5,622,617.00
		Contingencies		25%			$1,405,654.00
		TOTAL FIELD COST					$7,028,271.00
		Non-Contract Cost		37%			$2,600,460.00
		CONSTRUCTION COST					$9,628,731.00
		TERO Fees		5%			$481,437.00
		TOTAL COST					$10,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 1173+50 to Drop No. 1
Alternative No. 2 New Canal Alignment
Q = 850cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$20,000.00	$20,000.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		277,100	C.Y.	$4.25	$1,177,675.00
	4	Embankment		92,400	C.Y.	$6.50	$600,600.00
	5	Gravel Prism Armoring		34,850	C.Y.	$26.00	$906,100.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$65.50	$0.00
	8	Road Surfacing		19,800	C.Y.	$28.00	$554,400.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each	$115,000.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		0	S.F.	$158.00	$0.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		44,600	L.F.	$2.75	$122,650.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		60	Ac.	$225.00	$13,500.00
	22						
	23	RipRap		500	C.Y.	$125.00	$62,500.00
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		Subtotal w/o mobilization					$3,943,400.00
		Mobilization		8%			$315,472.00
		Subtotal w/mobilization					$4,258,872.00
		Unlisted Items		10%			$425,887.00
		CONTRACT COST					$4,684,759.00
		Contingencies		25%			$1,171,190.00
		TOTAL FIELD COST					$5,855,949.00
		Non-Contract Cost		37%			$2,166,701.00
		CONSTRUCTION COST					$8,022,650.00
		TERO Fees		5%			$401,133.00
		TOTAL COST					$8,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

APPENDIX D
1000 cfs

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen					
	1	Excavation		2500	C.Y.	$6.46	$16,150.00
	2	Backfill about Structures		300	C.Y.	$5.92	$1,776.00
	3	Compacted Backfill about Structures		300	C.Y.	$8.34	$2,502.00
	4	Concrete		900	C.Y.	$753.48	$678,132.00
	5	Concrete Canal		450	C.Y.	$753.48	$339,066.00
	6	Miscellaneous Structural Steel		110,000	lbs.	$10.00	$1,100,000.00
	7	Grating		720	S.F.	$25.00	$18,000.00
	8	Handrail		250	L.F.	$70.00	$17,500.00
	9	Fish Screen		350	L.F.	$2,680.00	$938,000.00
	10	Adjustable Baffles		1	L.S.	$567,000.00	$567,000.00
	11	Transition to By-Pass		1	L.S.	$98,000.00	$98,000.00
	12	Slide Gate		1	L.S.	$35,000.00	$35,000.00
	13	Fish Return Pipe		220	L.F.	$300.00	$66,000.00
	14	Automated Brush Type Screen Cleaning System		1	Each	$345,000.00	$345,000.00
	15	Screen Hoist System		1	Each	$60,000.00	$60,000.00
	16	Electrical & Control System		1	L.S.	$30,000.00	$30,000.00
	17	New Access Road		220	L.F.	$35.00	$7,700.00
	18	Security Fencing		500	L.F.	$50.00	$25,000.00
		Subtotal					$4,344,826.00
		Fish Passage					
	19	Excavation		900	C.Y.	$6.46	$5,814.00
	20	Backfill about Structures		1800	C.Y.	$5.92	$10,656.00
	21	Compacted Backfill about Structures		1800	C.Y.	$8.34	$15,012.00
	22	Concrete		62	C.Y.	$753.48	$46,715.76
	23	Shot Crete		250	C.Y.	$950.00	$237,500.00
	24	Riprap		750	C.Y.	$45.00	$33,750.00
		Subtotal					$349,447.76
		Rubber Dam					
	25	Excavation		2750	C.Y.	$6.46	$17,765.00
	26	Backfill about Structures		900	C.Y.	$5.92	$5,328.00
	27	Compacted Backfill about Structures		900	C.Y.	$8.34	$7,506.00
	28	Concrete		445	C.Y.	$753.48	$335,298.60
	29	Compressor Equipment & Piping		1	L.S.	$40,000.00	$40,000.00
	30	Compressor & Control Building		1	L.S.	$120,000.00	$120,000.00
	31	Electrical Service		1	L.S.	$40,000.00	$40,000.00
	32	Rubber Dam & Controls (114 ft. dam)		1	L.S.	$872,000.00	$872,000.00
		Subtotal					$1,437,897.60

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Flush Gate & Canal Headwall with Gates					
	33	Excavation		4250	C.Y.	$6.46	$27,455.00
	34	Backfill about Structures		1050	C.Y.	$5.92	$6,216.00
	35	Compacted Backfill about Structures		1050	C.Y.	$8.34	$8,757.00
	36	Concrete		270	C.Y.	$753.48	$203,439.60
	37	Slide gate 3x3 with Manual Actuator		1	Each	$15,000.00	$15,000.00
	38	Slide gates 6x6 with Electric Actuators		6	Each	$50,000.00	$300,000.00
	39	Reno Mattress		3400	S.F.	$12.50	$42,500.00
	40	Hand Rail		250	L.F.	$70.00	$17,500.00
	41	Steel Guard Rail		120	L.F.	$80.00	$9,600.00
	42	Security Fencing		200	L.F.	$50.00	$10,000.00
	43	Riprap		70	C.Y.	$45.00	$3,150.00
		Subtotal					$643,617.60
		Canal					
	44	Excavation		6000	C.Y.	$6.46	$38,760.00
	45	Backfill about Structures		200	C.Y.	$5.92	$1,184.00
	46	Compacted Backfill about Structures		200	C.Y.	$8.34	$1,668.00
	47	Riprap		900	C.Y.	$45.00	$40,500.00
	48	Riprap Grout		330	C.Y.	$300.00	$99,000.00
		Subtotal					$181,112.00
		Miscellaneous					
	49	Water Care/Environmental Protection Works / BMPs		1	L.S.	$500,000.00	$500,000.00
	50	Demolition of Existing Structure & Reshape Channel		1	L.S.	$200,000.00	$200,000.00
	51	Site Access Road Improvement		1	L.S.	$60,000.00	$60,000.00
	52	Temporary Access Bridge		1	L.S.	$30,000.00	$30,000.00
	53	Bypass Canal		1	L.S.	$220,000.00	$220,000.00
	54	Construction Coffer Dam		1	L.S.	$100,000.00	$100,000.00
	55	Relocating Gaging Station		1	L.S.	$25,000.00	$25,000.00
	56	SCADA System		1	L.S.	$100,000.00	$100,000.00
		Subtotal					$1,235,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 14, 2006

St. Mary Canal; Diversion Dam

Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]SUM

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Fish Screen Subtotal		1	Each	$4,344,826.00	$4,344,826.00
		Fish Passage Subtotal		1	Each	$349,447.76	$349,447.76
		Rubber Dam Subtotal		1	Each	$1,437,897.60	$1,437,897.60
		Flush Gate & Canal Headwall with Gates Subtotal		1	Each	$643,617.60	$643,617.60
		Canal Subtotal		1	Each	$181,112.00	$181,112.00
		Miscellaneous Subtotal		1	Each	$1,235,000.00	$1,235,000.00
		Subtotal w/o mobilization					$8,191,901.00
		Mobilization		8%			$655,352.00
		Subtotal w/mobilization					$8,847,253.00
		Unlisted Items		10%			$884,725.00
		CONTRACT COST					$9,731,978.00
		Contingencies		25%			$2,432,995.00
		TOTAL FIELD COST					$12,164,973.00
		Non-Contract Cost		37%			$4,501,040.00
		CONSTRUCTION COST					$16,666,013.00
		TERO Fees		5%			$833,301.00
		TOTAL COST					$17,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam
USBR Concept 2 Estimate Adjusted by TD&H
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	2	Excavation for Canal	1	5,500	C.Y.	$6.46	$35,530.00
	3,19,32	Excavation for Structures	1	9,350	C.Y.	$6.46	$60,401.00
	23	Canal Concrete	5	440	C.Y.	$753.48	$331,531.20
	4,7,10a,20, 25,28,	Structural Concrete	4	3,070	C.Y.	$753.48	$2,313,183.60
	17,33	Backfill about Structures	2	1,100	C.Y.	$5.92	$6,512.00
		Compacted Backfill about Structures	3	1,101	C.Y.	$8.34	$9,182.34
		Fish Passage					
	12	Rock		320	C.Y.	$50.40	$16,128.00
	13	Grout		120	C.Y.	$216.00	$25,920.00
	15	Sand/gravel bedding		450	C.Y.	$32.40	$14,580.00
	14	Riprap	24	900	C.Y.	$45.00	$40,500.00
		Fish Screen					
	36	Fish return Pipe	13	200	L.F.	$300.00	$60,000.00
	37	Fish Screens		70,000	lbs.	$13.40	$938,000.00
	38	Adjustable baffles		105,000	lbs.	$5.40	$567,000.00
	39	Hydraulic trash rake		1	L.S.	$360,000.00	$360,000.00
	40	Fish screen guide		120,000	lbs.	$10.00	$1,200,000.00
	41	Steel transition		8,200	lbs.	$12.00	$98,400.00
	42	Slide gate		2,200	lbs.	$18.00	$39,600.00
	43	Water level measuring equipment		1	L.S.	$18,000.00	$18,000.00
		Diversion Dam					
	44,46	Stopping Logs		7,800	lbs.	$10.00	$78,000.00
	45	Trash racks		47,250	lbs.	$10.00	$472,500.00
	47	Radial gates and hoist		6	Each	$72,000.00	$432,000.00
		Miscellaneous					
	19b	Water Care/Environmental Protection Works	49	1	L.S.	$500,000.00	$500,000.00
	16	Demo and Removal of Existing Structure	50	1	L.S.	$200,000.00	$200,000.00
	1	Bypass Canal Excavation	1	39,000	C.Y.	$6.46	$251,940.00
	19a	Construction Coffer Dam	54	1	L.S.	$100,000.00	$100,000.00
	35	Relocating Gagging Station	55	1	L.S.	$25,000.00	$25,000.00
	31	6" water stop		1,400	L.F.	$10.20	$14,280.00
	48,49	Electrical		1	L.S.	$540,000.00	$540,000.00
		Subtotal w/o mobilization					$8,652,257.00
		Mobilization		8%			$692,181.00
		Subtotal w/mobilization					$9,344,438.00
		Unlisted Items		10%			$934,444.00
		CONTRACT COST					$10,278,882.00
		Contingencies		25%			$2,569,721.00
		TOTAL FIELD COST					$12,848,603.00
		Non-Contract Cost		37%			$4,753,983.00
		CONSTRUCTION COST					$17,602,586.00
		TERO Fees		5%			$880,129.00
		TOTAL COST					$18,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/13/2006	APPROVED	DATE 1/18/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 1 Repair Existing Siphon & Add Additional Siphon
Q = 1000cfs

PROJECT:
DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Repair Existing Siphon		1	L.S.	$483,712.60	$483,712.60
	2	Dewatering		1	L.S.	$130,000.00	$130,000.00
	3	Excavation		1,550	C.Y.	$6.46	$10,013.00
	4	Backfill about Structures		1,280	C.Y.	$5.92	$7,577.60
	5	Compacted Backfill about Structures		1,280	C.Y.	$8.34	$10,675.20
	6	Granular Backfill		90	C.Y.	$35.00	$3,150.00
	7	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	8	Siphon Inlet Structure Conc.		15	C.Y.	$753.48	$11,302.20
	9	Siphon Outlet Structure Conc.		15	C.Y.	$753.48	$11,302.20
	10	Additional Pipe (6ft. dia)		232	L.F.	$300.00	$69,600.00
	11	Concrete		20	C.Y.	$753.48	$15,069.60
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		Subtotal w/o mobilization					$877,402.00
		Mobilization		8%			$70,192.00
		Subtotal w/mobilization					$947,594.00
		Unlisted Items		10%			$94,759.00
		CONTRACT COST					$1,042,353.00
		Contingencies		25%			$260,588.00
		TOTAL FIELD COST					$1,302,941.00
		Non-Contract Cost		37%			$482,088.00
		CONSTRUCTION COST					$1,785,029.00
		TERO Fees		5%			$89,251.00
		TOTAL COST					$1,900,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 2 Double Cell Box Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		5,735	C.Y.	$6.46	$37,048.10
	3	Backfill about Structures		1,470	C.Y.	$5.92	$8,702.40
	4	Compacted Backfill about Structures		1,470	C.Y.	$8.34	$12,259.80
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Double Cell Box Siphon (8'x7')		264	L.F.	$1,185.00	$312,840.00
	10	Grout Epoxy and Joint Sealant		2470	L.F.	$16.50	$40,755.00
	11	Concrete		30	C.Y.	$753.48	$22,604.40
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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	35						
		Subtotal w/o mobilization					$1,134,188.00
		Mobilization		8%			$90,735.00
		Subtotal w/mobilization					$1,224,923.00
		Unlisted Items		10%			$122,492.00
		CONTRACT COST					$1,347,415.00
		Contingencies		25%			$336,854.00
		TOTAL FIELD COST					$1,684,269.00
		Non-Contract Cost		37%			$623,180.00
		CONSTRUCTION COST					$2,307,449.00
		TERO Fees		5%			$115,372.00
		TOTAL COST					$2,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon
Alternative No. 3 Parallel Pipe Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Dewatering		1	L.S.	$130,000.00	$130,000.00
	2	Excavation		7,090	C.Y.	$6.46	$45,801.40
	3	Backfill about Structures		2,440	C.Y.	$5.92	$14,444.80
	4	Compacted Backfill about Structures		2,440	C.Y.	$8.34	$20,349.60
	5	Riprap		390	C.Y.	$45.00	$17,550.00
	6	Environmental Control		1	L.S.	$125,000.00	$125,000.00
	7	Siphon Inlet Structure Conc.		75	C.Y.	$753.48	$56,511.00
	8	Siphon Outlet Structure Conc.		120	C.Y.	$753.48	$90,417.60
	9	Parallel Pipe (8ft. dia & 9ft. dia)		264	L.F.	$1,148.00	$303,072.00
	10	Concrete		30	C.Y.	$753.48	$22,604.40
	11	Flowable Fill		370	C.Y.	$162.00	$59,940.00
	12	Demo Existing Siphon		1	L.S.	$30,000.00	$30,000.00
	13	Connecting Canal Earthwork		835	L.F.	$300.00	$250,500.00
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		Subtotal w/o mobilization					$1,166,191.00
		Mobilization		8%			$93,295.00
		Subtotal w/mobilization					$1,259,486.00
		Unlisted Items		10%			$125,949.00
		CONTRACT COST					$1,385,435.00
		Contingencies		25%			$346,359.00
		TOTAL FIELD COST					$1,731,794.00
		Non-Contract Cost		37%			$640,764.00
		CONSTRUCTION COST					$2,372,558.00
		TERO Fees		5%			$118,628.00
		TOTAL COST					$2,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping, Excavation & Rehandling		3760	C.Y.	$4.50	$16,920.00
	4	Excavation		92,400	C.Y.	$4.50	$415,800.00
	5	Impervious Backfill		74,630	C.Y.	$2.50	$186,575.00
	6	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	7	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		350	C.Y.	$1,530.00	$535,500.00
	11	Siphon Outlet Structure		560	C.Y.	$1,530.00	$856,800.00
	12	Siphon Barrel (11 ft. dia.)		5860	C.Y.	$1,185.00	$6,944,100.00
	13	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	14	Foundation Concrete		515	C.Y.	$750.00	$386,250.00
	15	Reinforced Concrete Footings		200	C.Y.	$1,530.00	$306,000.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$14,060,945.00
		Mobilization		8%			$1,124,876.00
		Subtotal w/mobilization					$15,185,821.00
		Unlisted Items		10%			$1,518,582.00
		CONTRACT COST					$16,704,403.00
		Contingencies		25%			$4,176,101.00
		TOTAL FIELD COST					$20,880,504.00
		Non-Contract Cost		37%			$7,725,786.00
		CONSTRUCTION COST					$28,606,290.00
		TERO Fees		5%			$1,430,315.00
		TOTAL COST					$31,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site Clearing		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		18570	C.Y.	$4.50	$83,565.00
	4	Excavation		94,165	C.Y.	$4.50	$423,742.50
	5	Impervious Backfill		71,920	C.Y.	$2.50	$179,800.00
	6	Granular Backfill		9,450	C.Y.	$35.00	$330,750.00
	7	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	8	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		310	C.Y.	$1,530.00	$474,300.00
	11	Siphon Outlet Structure		395	C.Y.	$1,530.00	$604,350.00
	12	Siphon Barrel (8.5 ft. dia.)		7785	C.Y.	$1,185.00	$9,225,225.00
	13	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	14	Foundation Concrete		800	C.Y.	$750.00	$600,000.00
	15	Reinforced Concrete Footings		315	C.Y.	$1,530.00	$481,950.00
	16	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	17	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$16,937,433.00
		Mobilization		8%			$1,354,995.00
		Subtotal w/mobilization					$18,292,428.00
		Unlisted Items		10%			$1,829,243.00
		CONTRACT COST					$20,121,671.00
		Contingencies		25%			$5,030,418.00
		TOTAL FIELD COST					$25,152,089.00
		Non-Contract Cost		37%			$9,306,273.00
		CONSTRUCTION COST					$34,458,362.00
		TERO Fees		5%			$1,722,918.00
		TOTAL COST					$37,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,800,000.00	$1,800,000.00
	2	Site Clearing		1	L.S.	$10,000.00	$10,000.00
	3	Stripping Excavation & Rehandling		2550	C.Y.	$4.50	$11,475.00
	4	Excavation		53,140	C.Y.	$4.50	$239,130.00
	5	Sand Backfill		19,990	C.Y.	$30.00	$599,700.00
	6	Impervious Backfill		21,740	C.Y.	$2.50	$54,350.00
	7	Granular Backfill		6,300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		350	C.Y.	$1,530.00	$535,500.00
	11	Siphon Outlet Structure		560	C.Y.	$1,530.00	$856,800.00
	12	Supply Siphon Barrel (11 dia x 1/2" wall thickness, Coated & Lined)		1080	L.Y.	$4,070.00	$4,395,600.00
	13	Cathodic Protection System		1	L.S.	$50,000.00	$50,000.00
	14	Extra for Special Elbows		12	Each	$54,000.00	$648,000.00
	15	Place, Field Well, Coat & Line Joints		1080	L.Y.	$1,800.00	$1,944,000.00
	16	Blow Off Well		1	L.S.	$225,000.00	$225,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$13,247,555.00
		Mobilization		8%			$1,059,804.00
		Subtotal w/mobilization					$14,307,359.00
		Unlisted Items		10%			$1,430,736.00
		CONTRACT COST					$15,738,095.00
		Contingencies		25%			$3,934,524.00
		TOTAL FIELD COST					$19,672,619.00
		Non-Contract Cost		37%			$7,278,869.00
		CONSTRUCTION COST					$26,951,488.00
		TERO Fees		5%			$1,347,574.00
		TOTAL COST					$29,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; St. Mary River Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$1,900,000.00	$1,900,000.00
	2	Site Clearing		1	L.S.	$15,000.00	$15,000.00
	3	Stripping Excavation & Rehandling		2755	C.Y.	$4.50	$12,397.50
	4	Excavation		56,960	C.Y.	$4.50	$256,320.00
	5	Sand Backfill		19,495	C.Y.	$30.00	$584,850.00
	6	Impervious Backfill		23,900	C.Y.	$2.50	$59,750.00
	7	Granular Backfill		9,450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Environmental Protection Works		1	L.S.	$500,000.00	$500,000.00
	10	Siphon Inlet Structure		310	C.Y.	$1,530.00	$474,300.00
	11	Siphon Outlet Structure		395	C.Y.	$1,530.00	$604,350.00
	12	Supply Siphon Barrel (8.5 ft. dia x 3/8" wall thickness, Coated & Lined)		2160	L.Y.	$2,600.00	$5,616,000.00
	13	Cathodic Protection System		1	L.S.	$75,000.00	$75,000.00
	14	Extra for Special Elbows		24	Each	$49,000.00	$1,176,000.00
	15	Place, Field Well, Coat & Line Joints		2160	L.Y.	$1,120.00	$2,419,200.00
	16	Blow Off Well		1	L.S.	$450,000.00	$450,000.00
	17	Remove Existing Siphon		1	L.S.	$1,135,000.00	$1,135,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$15,642,668.00
		Mobilization		8%			$1,251,413.00
		Subtotal w/mobilization					$16,894,081.00
		Unlisted Items		10%			$1,689,408.00
		CONTRACT COST					$18,583,489.00
		Contingencies		25%			$4,645,872.00
		TOTAL FIELD COST					$23,229,361.00
		Non-Contract Cost		37%			$8,594,864.00
		CONSTRUCTION COST					$31,824,225.00
		TERO Fees		5%			$1,591,211.00
		TOTAL COST					$34,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 1 Single Barrel Cast-In-Place Concrete Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		1580	C.Y.	$4.50	$7,110.00
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		35,845	C.Y.	$4.50	$161,302.50
	6	Impervious Backfill		29,615	C.Y.	$2.50	$74,037.50
	7	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	8	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		355	C.Y.	$1,530.00	$543,150.00
	12	Siphon Outlet Structure		575	C.Y.	$1,530.00	$879,750.00
	13	Siphon Barrel (9.5 ft. dia.)		2260	C.Y.	$1,185.00	$2,678,100.00
	14	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	15	Foundation Concrete		205	C.Y.	$750.00	$153,750.00
	16	Reinforced Concrete Footings		80	C.Y.	$1,530.00	$122,400.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$6,320,600.00
		Mobilization		8%			$505,648.00
		Subtotal w/mobilization					$6,826,248.00
		Unlisted Items		10%			$682,625.00
		CONTRACT COST					$7,508,873.00
		Contingencies		25%			$1,877,218.00
		TOTAL FIELD COST					$9,386,091.00
		Non-Contract Cost		37%			$3,472,854.00
		CONSTRUCTION COST					$12,858,945.00
		TERO Fees		5%			$642,947.00
		TOTAL COST					$14,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 2 Twin Barrel Cast-in-Place Concrete Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1745	C.Y.	$4.50	$7,852.50
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		37,980	C.Y.	$4.50	$170,910.00
	6	Impervious Backfill		29,870	C.Y.	$2.50	$74,675.00
	7	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	8	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	9	Slip Form for Siphon		1	L.S.	$500,000.00	$500,000.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		315	C.Y.	$1,530.00	$481,950.00
	12	Siphon Outlet Structure		420	C.Y.	$1,530.00	$642,600.00
	13	Siphon Barrel (7.5 ft. dia.)		3070	C.Y.	$1,185.00	$3,637,950.00
	14	Blow Off Well		1	L.S.	$310,000.00	$310,000.00
	15	Foundation Concrete		320	C.Y.	$750.00	$240,000.00
	16	Reinforced Concrete Footings		125	C.Y.	$1,530.00	$191,250.00
	17	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	18	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$7,488,688.00
		Mobilization		8%			$599,095.00
		Subtotal w/mobilization					$8,087,783.00
		Unlisted Items		10%			$808,778.00
		CONTRACT COST					$8,896,561.00
		Contingencies		25%			$2,224,140.00
		TOTAL FIELD COST					$11,120,701.00
		Non-Contract Cost		37%			$4,114,659.00
		CONSTRUCTION COST					$15,235,360.00
		TERO Fees		5%			$761,768.00
		TOTAL COST					$16,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 3 Single Barrel Steel Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$100,000.00	$100,000.00
	2	Site Clearing		1	L.S.	$8,000.00	$8,000.00
	3	Stripping Excavation & Rehandling		1005	C.Y.	$4.50	$4,522.50
	4	Lower 3 Conoco Oil Lines (distance of 100 ft. each)		1	L.S.	$195,000.00	$195,000.00
	5	Excavation		19,060	C.Y.	$4.50	$85,770.00
	6	Sand Backfill		6,855	C.Y.	$30.00	$205,650.00
	7	Impervious Backfill		8450	C.Y.	$2.50	$21,125.00
	8	Granular Backfill		6300	C.Y.	$35.00	$220,500.00
	9	Drainage Pipes		3000	L.F.	$7.50	$22,500.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		355	C.Y.	$1,530.00	$543,150.00
	12	Siphon Outlet Structure		575	C.Y.	$1,530.00	$879,750.00
	13	Supply Siphon Barrel (9.5 ft. dia. x 1/2 " Wall Thickness, Coated & Lined)		478	L.Y.	$3,515.00	$1,680,170.00
	14	Cathodic Protecting System		1	L.S.	$42,000.00	$42,000.00
	15	Extra for Special Elbows		12	Each	$51,000.00	$612,000.00
	16	Place, Field Well, Coat & Line Joints		478	L.Y.	$1,620.00	$774,360.00
	17	Blow Off Well		1	L.S.	$155,000.00	$155,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$6,049,498.00
		Mobilization		8%			$483,960.00
		Subtotal w/mobilization					$6,533,458.00
		Unlisted Items		10%			$653,346.00
		CONTRACT COST					$7,186,804.00
		Contingencies		25%			$1,796,701.00
		TOTAL FIELD COST					$8,983,505.00
		Non-Contract Cost		37%			$3,323,897.00
		CONSTRUCTION COST					$12,307,402.00
		TERO Fees		5%			$615,370.00
		TOTAL COST					$13,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Hall Coulee Siphon
Alternative No. 4 Twin Barrel Steel Siphon
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Care of Water		1	L.S.	$130,000.00	$130,000.00
	2	Site Clearing		1	L.S.	$12,000.00	$12,000.00
	3	Stripping Excavation & Rehandling		1110	C.Y.	$4.50	$4,995.00
	4	Lower 3 Conoco Oil Lines (distance of 115 ft. each)		1	L.S.	$225,000.00	$225,000.00
	5	Excavation		21,395	C.Y.	$4.50	$96,277.50
	6	Sand Backfill		7,190	C.Y.	$30.00	$215,700.00
	7	Impervious Backfill		9520	C.Y.	$2.50	$23,800.00
	8	Granular Backfill		9450	C.Y.	$35.00	$330,750.00
	9	Drainage Pipes		4500	L.F.	$7.50	$33,750.00
	10	Environmental Protection Works		1	L.S.	$250,000.00	$250,000.00
	11	Siphon Inlet Structure		315	C.Y.	$1,530.00	$481,950.00
	12	Siphon Outlet Structure		420	C.Y.	$1,530.00	$642,600.00
	13	Supply Siphon Barrel (7.5 ft. dia. x 5/16 " Wall Thickness, Coated & Lined)		956	L.Y.	$2,000.00	$1,912,000.00
	14	Cathodic Protecting System		1	L.S.	$63,000.00	$63,000.00
	15	Extra for Special Elbows		24	Each	$47,000.00	$1,128,000.00
	16	Place, Field Well, Coat & Line Joints		956	L.Y.	$900.00	$860,400.00
	17	Blow Off Well		1	L.S.	$310,000.00	$310,000.00
	18	Remove Existing Siphon		1	L.S.	$250,000.00	$250,000.00
	19	Control Building		0	L.S.	$50,000.00	$0.00
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		Subtotal w/o mobilization					$6,970,223.00
		Mobilization		8%			$557,618.00
		Subtotal w/mobilization					$7,527,841.00
		Unlisted Items		10%			$752,784.00
		CONTRACT COST					$8,280,625.00
		Contingencies		25%			$2,070,156.00
		TOTAL FIELD COST					$10,350,781.00
		Non-Contract Cost		37%			$3,829,789.00
		CONSTRUCTION COST					$14,180,570.00
		TERO Fees		5%			$709,029.00
		TOTAL COST					$15,000,000.00

QUANTITIES		PRICES	
BY UMA-AECOM	CHECKED 1/13/2006	BY EAJ	CHECKED
DATE PREPARED 10/24/2005	APPROVED	DATE	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro Ready" Option w/o Penstock

Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,365	CY	753.48	$1,028,500.20
	2	Structural Excavation		11,652	CY	6.46	$75,271.92
	3	Compacted Backfill		5,622	CY	8.34	$46,887.48
	4	Chanel Excavation		342,525	CY	7.53	$2,579,213.25
	5						
	6	Drop Structure No. 5 (from D25)		1	LS	502,662.00	$502,662.00
	7	Canal Reshaping (Drop No. 4 to No. 5) (from D26)		1	LS	736,960.00	$736,960.00
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		Subtotal w/o mobilization					$4,969,495.00
		Mobilization		8%			$397,560.00
		Subtotal w/mobilization					$5,367,055.00
		Unlisted Items		10%			$536,706.00
		CONTRACT COST					$5,903,761.00
		Contingencies		25%			$1,475,940.00
		TOTAL FIELD COST					$7,379,701.00
		Non-Contract Cost		37%			$2,730,489.00
		CONSTRUCTION COST					$10,110,190.00
		TERO Fees		5%			$505,510.00
		TOTAL COST					$11,000,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; "Hydro Ready" Option w/ Penstock

Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		1,365	CY	753.48	$1,028,500.20
	2	Structural Excavation		11,652	CY	6.46	$75,271.92
	3	Compacted Backfill		5,622	CY	8.34	$46,887.48
	4	Chanel Excavation		342,525	CY	7.53	$2,579,213.25
	5						
	6						
	7	6' x 6' sluice gates		3	EA	61,570.00	$184,710.00
	8	72" steel pipe		2,400	FT	611.14	$1,466,736.00
	9	Pipe Excavation		11,733	CY	7.53	$88,349.49
	10	Pipe Backfill		9,220	CY	8.34	$76,894.80
	11	20' x 8' radial gate		1	EA	100,000.00	$100,000.00
	12	6' x 6' Trashracks		3	EA	5,000.00	$15,000.00
	13	Additional Structural Concrete		123	CY	753.48	$92,678.04
	14	Additional Structural Excavation		1,850	CY	6.46	$11,951.00
	15	Additional Compacted Backfill		1,098	CY	8.34	$9,157.32
	16						
	17	Drop Structure No. 5 (from D25)		1	LS	502,662.00	$502,662.00
	18	Canal Reshaping (Drop No. 4 to No. 5) (from D26)		1	LS	736,960.00	$736,960.00
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		Subtotal w/o mobilization					$7,014,972.00
		Mobilization		8%			$561,198.00
		Subtotal w/mobilization					$7,576,170.00
		Unlisted Items		10%			$757,617.00
		CONTRACT COST					$8,333,787.00
		Contingencies		25%			$2,083,447.00
		TOTAL FIELD COST					$10,417,234.00
		Non-Contract Cost		37%			$3,854,377.00
		CONSTRUCTION COST					$14,271,611.00
		TERO Fees		5%			$713,581.00
		TOTAL COST					$15,000,000.00

QUANTITIES		PRICES	
BY JCB with TCB	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Drop Type Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		534	cy	$753.48	$402,358.32
	2	Structural Excavation		4,166	cy	$6.46	$26,905.69
	3	Compacted Backfill about Structures		2,286	cy	$8.34	$19,070.04
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		Subtotal w/o mobilization					$448,334.00
		Mobilization		8%			$35,867.00
		Subtotal w/mobilization					$484,201.00
		Unlisted Items		10%			$48,420.00
		CONTRACT COST					$532,621.00
		Contingencies		25%			$133,155.00
		TOTAL FIELD COST					$665,776.00
		Non-Contract Cost		37%			$246,337.00
		CONSTRUCTION COST					$912,113.00
		TERO Fees		5%			$45,606.00
		TOTAL COST					$960,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #1
Chute w/Type III Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		527	cy	$753.48	$397,083.96
	2	Structural Excavation		4,362	cy	$6.46	$28,171.54
	3	Compacted Backfill about Structures		2,426	cy	$8.34	$20,237.93
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		Subtotal w/o mobilization					$445,493.00
		Mobilization		8%			$35,639.00
		Subtotal w/mobilization					$481,132.00
		Unlisted Items		10%			$48,113.00
		CONTRACT COST					$529,245.00
		Contingencies		25%			$132,311.00
		TOTAL FIELD COST					$661,556.00
		Non-Contract Cost		37%			$244,776.00
		CONSTRUCTION COST					$906,332.00
		TERO Fees		5%			$45,317.00
		TOTAL COST					$960,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Drop Type Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		517	cy	$753.48	$389,549.16
	2	Structural Excavation		4,052	cy	$6.46	$26,169.44
	3	Compacted Backfill about Structures		2,234	cy	$8.34	$18,636.25
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		Subtotal w/o mobilization					$434,355.00
		Mobilization		8%			$34,748.00
		Subtotal w/mobilization					$469,103.00
		Unlisted Items		10%			$46,910.00
		CONTRACT COST					$516,013.00
		Contingencies		25%			$129,003.00
		TOTAL FIELD COST					$645,016.00
		Non-Contract Cost		37%			$238,656.00
		CONSTRUCTION COST					$883,672.00
		TERO Fees		5%			$44,184.00
		TOTAL COST					$930,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #2
Chute w/Type III Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		509	cy	$753.48	$383,521.32
	2	Structural Excavation		4,217	cy	$6.46	$27,235.07
	3	Compacted Backfill about Structures		2,348	cy	$8.34	$19,587.25
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		Subtotal w/o mobilization					$430,344.00
		Mobilization		8%			$34,428.00
		Subtotal w/mobilization					$464,772.00
		Unlisted Items		10%			$46,477.00
		CONTRACT COST					$511,249.00
		Contingencies		25%			$127,812.00
		TOTAL FIELD COST					$639,061.00
		Non-Contract Cost		37%			$236,453.00
		CONSTRUCTION COST					$875,514.00
		TERO Fees		5%			$43,776.00
		TOTAL COST					$920,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Drop Type Stilling Basin
Q = 1000cfs

PROJECT:
DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE:
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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		435	cy	$753.48	$327,763.80
	2	Structural Excavation		3,361	cy	$6.46	$21,706.68
	3	Compacted Backfill about Structures		1,920	cy	$8.34	$16,016.83
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		Subtotal w/o mobilization					$365,487.00
		Mobilization		8%			$29,239.00
		Subtotal w/mobilization					$394,726.00
		Unlisted Items		10%			$39,473.00
		CONTRACT COST					$434,199.00
		Contingencies		25%			$108,550.00
		TOTAL FIELD COST					$542,749.00
		Non-Contract Cost		37%			$200,817.00
		CONSTRUCTION COST					$743,566.00
		TERO Fees		5%			$37,178.00
		TOTAL COST					$790,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #3
Chute w/Type III Stilling Basin
Q = 1000cfs

PROJECT:
DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE:
J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		421	cy	$753.48	$317,215.08
	2	Structural Excavation		3,400	cy	$6.46	$21,958.56
	3	Compacted Backfill about Structures		1,918	cy	$8.34	$16,000.15
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		Subtotal w/o mobilization					$355,174.00
		Mobilization		8%			$28,414.00
		Subtotal w/mobilization					$383,588.00
		Unlisted Items		10%			$38,359.00
		CONTRACT COST					$421,947.00
		Contingencies		25%			$105,487.00
		TOTAL FIELD COST					$527,434.00
		Non-Contract Cost		37%			$195,151.00
		CONSTRUCTION COST					$722,585.00
		TERO Fees		5%			$36,129.00
		TOTAL COST					$760,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Drop Type Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		694	cy	$753.48	$522,915.12
	2	Structural Excavation		5,524	cy	$6.46	$35,676.20
	3	Compacted Backfill about Structures		2,903	cy	$8.34	$24,217.12
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		Subtotal w/o mobilization					$582,808.00
		Mobilization		8%			$46,625.00
		Subtotal w/mobilization					$629,433.00
		Unlisted Items		10%			$62,943.00
		CONTRACT COST					$692,376.00
		Contingencies		25%			$173,094.00
		TOTAL FIELD COST					$865,470.00
		Non-Contract Cost		37%			$320,224.00
		CONSTRUCTION COST					$1,185,694.00
		TERO Fees		5%			$59,285.00
		TOTAL COST					$1,250,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #4
Chute w/Type III Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		704	cy	$753.48	$530,449.92
	2	Structural Excavation		6,017	cy	$6.46	$38,860.19
	3	Compacted Backfill about Structures		3,302	cy	$8.34	$27,545.61
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		Subtotal w/o mobilization					$596,856.00
		Mobilization		8%			$47,748.00
		Subtotal w/mobilization					$644,604.00
		Unlisted Items		10%			$64,460.00
		CONTRACT COST					$709,064.00
		Contingencies		25%			$177,266.00
		TOTAL FIELD COST					$886,330.00
		Non-Contract Cost		37%			$327,942.00
		CONSTRUCTION COST					$1,214,272.00
		TERO Fees		5%			$60,714.00
		TOTAL COST					$1,300,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Drop Type Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		589	cy	$753.48	$443,799.72
	2	Structural Excavation		4,662	cy	$6.46	$30,109.06
	3	Compacted Backfill about Structures		2,511	cy	$8.34	$20,947.01
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		Subtotal w/o mobilization					$494,856.00
		Mobilization		8%			$39,588.00
		Subtotal w/mobilization					$534,444.00
		Unlisted Items		10%			$53,444.00
		CONTRACT COST					$587,888.00
		Contingencies		25%			$146,972.00
		TOTAL FIELD COST					$734,860.00
		Non-Contract Cost		37%			$271,898.00
		CONSTRUCTION COST					$1,006,758.00
		TERO Fees		5%			$50,338.00
		TOTAL COST					$1,100,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drop #5
Chute w/Type III Stilling Basin
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Structural Concrete		594	cy	$753.48	$447,567.12
	2	Structural Excavation		4,976	cy	$6.46	$32,137.00
	3	Compacted Backfill about Structures		2,752	cy	$8.34	$22,957.46
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	35						
		Subtotal w/o mobilization					$502,662.00
		Mobilization		8%			$40,213.00
		Subtotal w/mobilization					$542,875.00
		Unlisted Items		10%			$54,288.00
		CONTRACT COST					$597,163.00
		Contingencies		25%			$149,291.00
		TOTAL FIELD COST					$746,454.00
		Non-Contract Cost		37%			$276,188.00
		CONSTRUCTION COST					$1,022,642.00
		TERO Fees		5%			$51,132.00
		TOTAL COST					$1,100,000.00

QUANTITIES		PRICES	
BY JCB with TBC	CHECKED	BY EAJ	CHECKED
DATE PREPARED 12/27/2005	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Drops 1-5
Reshape Existing Canal
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Canal Reshaping Between Drops 1 & 2		1,550	L.F.	$210.56	$326,368.00
	2	Canal Reshaping Between Drops 2 & 3		850	L.F.	$210.56	$178,976.00
	3	Canal Reshaping Between Drops 3 & 4		2,300	L.F.	$210.56	$484,288.00
	4	Canal Reshaping Between Drops 4 & 5		3,500	L.F.	$210.56	$736,960.00
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	35						
		Subtotal w/o mobilization					$1,726,592.00
		Mobilization		8%			$138,127.00
		Subtotal w/mobilization					$1,864,719.00
		Unlisted Items		10%			$186,472.00
		CONTRACT COST					$2,051,191.00
		Contingencies		25%			$512,798.00
		TOTAL FIELD COST					$2,563,989.00
		Non-Contract Cost		37%			$948,676.00
		CONSTRUCTION COST					$3,512,665.00
		TERO Fees		5%			$175,633.00
		TOTAL COST					$3,700,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Diversion Dam to Kennedy Creek Siphon
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		294,685	C.Y.	$4.25	$1,252,411.25
	4	Embankment		71,625	C.Y.	$6.50	$465,562.50
	5	Gravel Prism Armoring		48,550	C.Y.	$18.00	$873,900.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		21,050	C.Y.	$20.15	$424,157.50
	9	Overshot Control Check w/ SCDA - Complete		0	Each		$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each		$0.00
	11	Drain Inlets - Uncontrolled - Complete		15	Each	$6,575.00	$98,625.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each		$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		7,200	S.F.	$158.00	$1,137,600.00
	17	Bridge - Relocation		0	L.S.		$0.00
	18	Demolition of Existing Structures		0	L.S.		$0.00
	19	Fencing		47,360	L.F.	$2.75	$130,240.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		30	Ac.	$225.00	$6,750.00
	22						
	23	RipRap		140	C.Y.	$55.00	$7,700.00
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		Subtotal w/o mobilization					$4,891,821.00
		Mobilization		8%			$391,346.00
		Subtotal w/mobilization					$5,283,167.00
		Unlisted Items		10%			$528,317.00
		CONTRACT COST					$5,811,484.00
		Contingencies		25%			$1,452,871.00
		TOTAL FIELD COST					$7,264,355.00
		Non-Contract Cost		37%			$2,687,811.00
		CONSTRUCTION COST					$9,952,166.00
		TERO Fees		5%			$497,608.00
		TOTAL COST					$10,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Kennedy Creek Siphon to St. Mary Siphon
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$65,000.00	$65,000.00
	2	Topsoil Striping & Rehandling		500	C.Y.	$6.25	$3,125.00
	3	Excavation		311,600	C.Y.	$4.25	$1,324,300.00
	4	Embankment		103,850	C.Y.	$6.50	$675,025.00
	5	Gravel Prism Armoring		33,350	C.Y.	$18.00	$600,300.00
	6	20 mil PVC Liner		6,525	S.Y.	$15.75	$102,768.75
	7	Slide Stabilization Buttress		0	C.Y.	$57.50	$0.00
	8	Road Surfacing		18,425	C.Y.	$20.15	$371,263.75
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$607,000.00	$607,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$255,000.00	$255,000.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		1	Each	$272,000.00	$272,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		1	L.S.	$210,000.00	$210,000.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		44,282	L.F.	$2.75	$121,775.50
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		46	Ac.	$225.00	$10,350.00
	22						
	23	RipRap		130	C.Y.	$65.00	$8,450.00
	24	New 26-ft All Weather Gravel Road with Geotextile		8,000	L.F.	$97.29	$778,328.00
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	35						
		Subtotal w/o mobilization					$6,078,211.00
		Mobilization		8%			$486,257.00
		Subtotal w/mobilization					$6,564,468.00
		Unlisted Items		10%			$656,447.00
		CONTRACT COST					$7,220,915.00
		Contingencies		25%			$1,805,229.00
		TOTAL FIELD COST					$9,026,144.00
		Non-Contract Cost		37%			$3,339,673.00
		CONSTRUCTION COST					$12,365,817.00
		TERO Fees		5%			$618,291.00
		TOTAL COST					$13,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

Sheet 1 of 1

FEATURE: August 2, 2006

St. Mary Canal; St. Mary Siphon to Sta. 715+00
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$52,500.00	$52,500.00
	2	Topsoil Striping & Rehandling		450	C.Y.	$6.25	$2,812.50
	3	Excavation		294,150	C.Y.	$4.25	$1,250,137.50
	4	Embankment		98,050	C.Y.	$6.50	$637,325.00
	5	Gravel Prism Armoring		28,500	C.Y.	$20.00	$570,000.00
	6	20 mil PVC Liner		3,630	S.Y.	$15.75	$57,172.50
	7	Slide Stabilization Buttress		38,250	C.Y.	$59.50	$2,275,875.00
	8	Road Surfacing		17,400	C.Y.	$22.00	$382,800.00
	9	Overshot Control Check w/ SCDA - Complete		1	Each	$607,000.00	$607,000.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		0	Each	$74,250.00	$0.00
	13	Underdrains - Complete		0	Each	$267,750.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$75,000.00	$75,000.00
	19	Fencing		40,000	L.F.	$2.75	$110,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		50	Ac.	$225.00	$11,250.00
	22						
	23	RipRap		1,500	C.Y.	$75.00	$112,500.00
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		Subtotal w/o mobilization					$6,642,348.00
		Mobilization		8%			$531,388.00
		Subtotal w/mobilization					$7,173,736.00
		Unlisted Items		10%			$717,374.00
		CONTRACT COST					$7,891,110.00
		Contingencies		25%			$1,972,778.00
		TOTAL FIELD COST					$9,863,888.00
		Non-Contract Cost		37%			$3,649,639.00
		CONSTRUCTION COST					$13,513,527.00
		TERO Fees		5%			$675,676.00
		TOTAL COST					$14,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

Sheet 1 of 1

FEATURE: August 2, 2006

St. Mary Canal; Sta. 715+00 to Hall Coulee
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$33,000.00	$33,000.00
	2	Topsoil Striping & Rehandling		650	C.Y.	$6.25	$4,062.50
	3	Excavation		268,600	C.Y.	$4.25	$1,141,550.00
	4	Embankment		89,550	C.Y.	$6.50	$582,075.00
	5	Gravel Prism Armoring		28,750	C.Y.	$22.00	$632,500.00
	6	20 mil PVC Liner		3,625	S.Y.	$15.75	$57,093.75
	7	Slide Stabilization Buttress		9,990	C.Y.	$61.50	$614,385.00
	8	Road Surfacing		15,875	C.Y.	$24.00	$381,000.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		1	Each	$750,000.00	$750,000.00
	11	Drain Inlets - Uncontrolled - Complete		9	Each	$6,575.00	$59,175.00
	12	Drain Inlets - Controlled - Complete		2	Each	$74,250.00	$148,500.00
	13	Underdrains - Complete		1	Each	$330,000.00	$330,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		2	Each	$18,000.00	$36,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		1	L.S.	$30,000.00	$30,000.00
	19	Fencing		36,000	L.F.	$2.75	$99,000.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,250	C.Y.	$90.00	$112,500.00
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	34						
	35						
		Subtotal w/o mobilization					$5,430,516.00
		Mobilization		8%			$434,441.00
		Subtotal w/mobilization					$5,864,957.00
		Unlisted Items		10%			$586,496.00
		CONTRACT COST					$6,451,453.00
		Contingencies		25%			$1,612,863.00
		TOTAL FIELD COST					$8,064,316.00
		Non-Contract Cost		37%			$2,983,797.00
		CONSTRUCTION COST					$11,048,113.00
		TERO Fees		5%			$552,406.00
		TOTAL COST					$12,000,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. Hall Coulee to Sta. 1173+50
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

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PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$27,500.00	$27,500.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		326,000	C.Y.	$4.25	$1,385,500.00
	4	Embankment		108,700	C.Y.	$6.50	$706,550.00
	5	Gravel Prism Armoring		34,900	C.Y.	$24.00	$837,600.00
	6	20 mil PVC Liner		3,625	S.Y.	$15.75	$57,093.75
	7	Slide Stabilization Buttress		4,540	C.Y.	$63.50	$288,290.00
	8	Road Surfacing		19,275	C.Y.	$26.00	$501,150.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		1	Each	$74,250.00	$74,250.00
	13	Underdrains - Complete		4	Each	$125,000.00	$500,000.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		1,600	S.F.	$158.00	$252,800.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		43,400	L.F.	$2.75	$119,350.00
	20	Cattle Guards		12	Each	$5,000.00	$60,000.00
	21	Drill Seeding		75	Ac.	$225.00	$16,875.00
	22						
	23	RipRap		1,000	C.Y.	$100.00	$100,000.00
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	31						
	32						
	33						
	34						
	35						
		Subtotal w/o mobilization					$5,160,184.00
		Mobilization		8%			$412,815.00
		Subtotal w/mobilization					$5,572,999.00
		Unlisted Items		10%			$557,300.00
		CONTRACT COST					$6,130,299.00
		Contingencies		25%			$1,532,575.00
		TOTAL FIELD COST					$7,662,874.00
		Non-Contract Cost		37%			$2,835,263.00
		CONSTRUCTION COST					$10,498,137.00
		TERO Fees		5%			$524,907.00
		TOTAL COST					$11,500,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL

CODE:GP-2200

ESTIMATE WORKSHEET

FEATURE: August 2, 2006

St. Mary Canal; Sta. 1173+50 to Drop No. 1
Alternative No. 2 New Canal Alignment
Q = 1000cfs

PROJECT: DNRC-CARDD St. Mary Canal Rehabilitation

DIVISION:

FILE: J:\2004\04-167\Excel\Cost Estimates\[Master.xls]B14

PLANT ACCT.	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	1	Tree/Brush Removal		1	L.S.	$20,000.00	$20,000.00
	2	Topsoil Striping & Rehandling		600	C.Y.	$6.25	$3,750.00
	3	Excavation		335,050	C.Y.	$4.25	$1,423,962.50
	4	Embankment		111,700	C.Y.	$6.50	$726,050.00
	5	Gravel Prism Armoring		35,850	C.Y.	$26.00	$932,100.00
	6	20 mil PVC Liner		0	S.Y.	$15.75	$0.00
	7	Slide Stabilization Buttress		0	C.Y.	$65.50	$0.00
	8	Road Surfacing		19,800	C.Y.	$28.00	$554,400.00
	9	Overshot Control Check w/ SCDA - Complete		0	Each	$0.00	$0.00
	10	Sluice Gate Wasteway w/ SCDA - Complete		0	Each	$0.00	$0.00
	11	Drain Inlets - Uncontrolled - Complete		13	Each	$6,575.00	$85,475.00
	12	Drain Inlets - Controlled - Complete		3	Each	$74,250.00	$222,750.00
	13	Underdrains - Complete		0	Each	$115,000.00	$0.00
	14	18" Drain Turnouts - Complete		3	Each	$30,000.00	$90,000.00
	15	Livestock Turnouts - Complete		3	Each	$18,000.00	$54,000.00
	16	Bridges - New		0	S.F.	$158.00	$0.00
	17	Bridge - Relocation		0	L.S.	$0.00	$0.00
	18	Demolition of Existing Structures		0	L.S.	$0.00	$0.00
	19	Fencing		44,600	L.F.	$2.75	$122,650.00
	20	Cattle Guards		6	Each	$5,000.00	$30,000.00
	21	Drill Seeding		60	Ac.	$225.00	$13,500.00
	22						
	23	RipRap		500	C.Y.	$125.00	$62,500.00
	24						
	25						
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	33						
	34						
	35						
		Subtotal w/o mobilization					$4,341,138.00
		Mobilization		8%			$347,291.00
		Subtotal w/mobilization					$4,688,429.00
		Unlisted Items		10%			$468,843.00
		CONTRACT COST					$5,157,272.00
		Contingencies		25%			$1,289,318.00
		TOTAL FIELD COST					$6,446,590.00
		Non-Contract Cost		37%			$2,385,238.00
		CONSTRUCTION COST					$8,831,828.00
		TERO Fees		5%			$441,591.00
		TOTAL COST					$9,300,000.00

QUANTITIES		PRICES	
BY JAS with TD&H	CHECKED	BY EAJ	CHECKED
DATE PREPARED 1/6/2006	APPROVED	DATE 1/13/2006	PRICE LEVEL