



TECHNICAL MEMORANDUM 2

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To: Russ Drummond, Wheatland Regional Corporation E-mail: admin@wrc-ab.ca
 cc: Leah Jensen, WRC; Elaine McDonald, Rockyford

From: Dan Modderman, P.Eng. Pages: 9 + Appendices

Subject: Route Options & Preliminary Design – WRC Phase 3 Water Line to Rosebud

Rev. No.	Date	Revision Description	Prepared By	Reviewed By
0	Oct. 23, 2019	For Approval	DM	SF

This Technical Memorandum 2 (TM02) is prepared by MPE Engineering Ltd. (MPE) for the Wheatland Regional Corporation (WRC). The memo includes a summary of the preliminary design for the selected pipe route option of the Phase 3 water pipeline to Rosebud.

1.0 Background Information

The overall WRC regional servicing strategy is to provide potable water to four partnering municipalities: the Villages of Standard, Rockyford and Hussar, and Wheatland County (County), which includes the Hamlets of Gleichen and Rosebud. The regional network is in the third of four phases of implementation. Phase 1 connected the Village of Standard and the Hamlet of Gleichen to the WRC system. Phase 2 connected the Village of Rockyford. The current Phase 3 will connect the Hamlet of Rosebud. The potential to connect to rural residents in the Redland area will be reviewed, as there is a history of groundwater concerns in this area. The future Phase 4 would connect the Village of Hussar.

The main components of each phase are described below:

Phase 1 (completed)

- New raw water reservoir (RWR).
- New raw water pump station.
- New raw water pipeline from the new RWR to the existing Village of Standard Water Treatment Plant (WTP).
- Addition of new transmission pumps to the Village of Standard WTP.
- New treated water line to the Hamlet of Gleichen.

Phase 2 (completed)

- Upgrades and expansion to the Village of Standard WTP (increase capacity).
- New treated water line to the Village of Rockyford.

Phase 3 (proposed)

- Pipeline extension to the Hamlet of Rosebud.

Future Phase 4

- Pipeline extension to the Village of Hussar.

2.0 Summary of Memorandum Contents

This memo includes the following content:

- Design flows
- Summary of the pipeline route options and selected option
- Cost estimate for the selected route option
- Hydraulics
- Pipe Diameter, Material and Velocities
- Method of Pipe Installation
- Chlorine Residual in Pipeline
- Crossings
- Rosebud Tie-in
- Electrical and Controls
- Land/Easements
- Geotechnical Assessment
- Environmental Assessment
- Regulatory Approvals
- Water License
- Schedule

3.0 Design Flow

The following summarizes the original 2016 design flow and 2019 updates based on historical flow data for Rosebud received from the County. The 2016 overall design population and flows for the project are summarized in *TM1 General Design Criteria*, April 22, 2016 (TM1-2016), prepared by MPE for WRC.

The regional pipelines are designed for Maximum Day Demand (MDD) for the *Build-Out Horizon* as described in TM1-2016. Each community is responsible to manage their respective peak hour demands (PHD) and fire flow protection (where applicable). The flow designated for rural supply along each pipeline is 10% of the flow to each downstream community.

The initial pipeline design flow from the tee to Rosebud is summarized in the first column of **Table 3.1**, based on Build-Out MDD from TM1-2016, which assumed an annual growth rate of 1.5% over 25 years from 2013 to 2038. In 2019, the County provided three years of historical flows for the Rosebud water system from 2016 to 2018. A current day MDD of 106 m³/day was estimated from this data. The second column in **Table 3.1** projects an annual growth rate of 1.5% for 25 years from 2019 to 2044. The County issued a Regional Growth Management Study in 2011 with an annual 2.8% growth rate for Rosebud. The third column in **Table 3.1** projects a growth rate of 2.8% for 25 years from 2019 to 2044.

Table 3.1: Pipeline Build-Out Design Flow

	MDD 2016 Design in TM1 2013 to 2038 (m³/day)	MDD 1.5% Growth 2019 to 2044 (m³/day)	MDD 2.8% Growth 2019 to 2044 (m³/day)
Rosebud	110	154	211
Rural (10%)	11	15	21
Total	121	169	232

A 100 mm diameter pipeline was included in the initial conceptual design. Assuming the existing Pressure Reducing Valve (PRV) Station remains within ±5 psi of its current setpoint, the water pipeline would need to be upsized to 150 mm diameter to accommodate the 1.5% and 2.8% growth projections.

The following flows were selected for the design based on 2.8% annual growth projection:

- ADD 116 m³/day
- MDD 232 m³/day

4.0 Pipeline Route Options

Three pipeline route options were selected for comparison in the *TM01 Route Options & Preliminary Design – Phase 3 Water Line to Rosebud*, September 20, 2019 (TM01-2019), prepared by MPE for WRC. A brief description for each option is summarized below:

- Option 1: The pipeline extends east from the tee in the Phase 2 pipeline, north and east across the Serviceberry Creek at two locations, east to Redland and north and east to Rosebud.
- Option 2: The pipeline extends east from the tee, north across the Rosebud River and east to Rosebud.
- Option 2a: This option adds a 100 mm diameter branch west and north to Redland to Option 2.
- Option 3: The pipeline extends east from the tee, north to Redland, north across the Rosebud River and east to Rosebud.

A summary of the comparisons between each option are shown in **Table 4.1**.

Table 4.1: Summary

	Option 1	Option 2	Option 2a	Option 3
Total Length (km)	18.8	16.9	18.9	19.8
Number of Properties Requiring Easements ^[1]	1	3	3	1
Total Residences Interested in Connecting within 1 Mile of Pipeline	7	5	8	8
Overall Environmental Assessment Ranking ^[2]	2	3	4	1
Overall Geotechnical Ranking ^[2]	4	2	3	1
Total Project Cost	\$5.93M	\$5.74M	\$6.01M	\$6.13M
WRC Share Portion	\$0.60M	\$0.60M	\$0.80M	\$0.62M

[1] Assumes railway crossings will not require an easement. To be confirmed during detailed design.

[2] Options are ranked from 1 to 4, with Rank 1 indicating the best routing from an environmental or geotechnical perspective.

The pipeline route options were presented at the September 24, 2019 WRC Board Meeting and the decision was made to proceed with Option 3. Option 3 provides the following benefits:

- Only \$20,000 higher than the lowest cost;
- Least length of pipe on private property (requiring easements);
- Least overall environmental and resource disturbance potential;
- Least probability of geotechnical challenges based on a desktop review;
- Highest number of interested rural residence tie-in potential;
- Lowest number of watercourse crossings;
- Longest length in developed road allowances (best construction access).

See **Appendix A** for a breakdown of the cost estimate for the selected pipe option. The preliminary design drawings for the selected route are attached in **Appendix B**.

5.0 Hydraulics

Figure 5.1 below illustrates the hydraulic grade line (HGL) for the water line from Standard to Rosebud at the build-out design MDD flow. There is an existing PRV Station at SE1-26-23W4, just north of the intersection of Highway 564 and RR 230, which reduces the maximum pressure at the Serviceberry Creek crossing along the pipeline to Rockyford and the Rosebud River crossing along the pipeline to Rosebud. The PRV Station discharge is assumed to be set to 45 psi for the hydraulic analysis, which is the design setpoint established in Phase 2. This

setpoint maintains a minimum pressure of 20 psi along the pipeline, which is the minimum required by Alberta Environment and Parks (AEP). The minimum pressure occurs at a high elevation at Station 7+074 along Township Road 264A.

The pressure along the pipeline at static and design flow is as follows:

- 179 psi Maximum Static Pressure at the Rosebud River crossing
- 154 psi Maximum Dynamic Pressure at the Rosebud River crossing
- 140 psi Static Pressure at Rosebud Reservoir
- 111 psi Dynamic Pressure at Rosebud Reservoir

The maximum dynamic and static pressures occur at the lowest elevation along the route at the Rosebud River crossing at Station 14+835. The HGL for the build-out design flow is shown in **Figure 5.1** below.

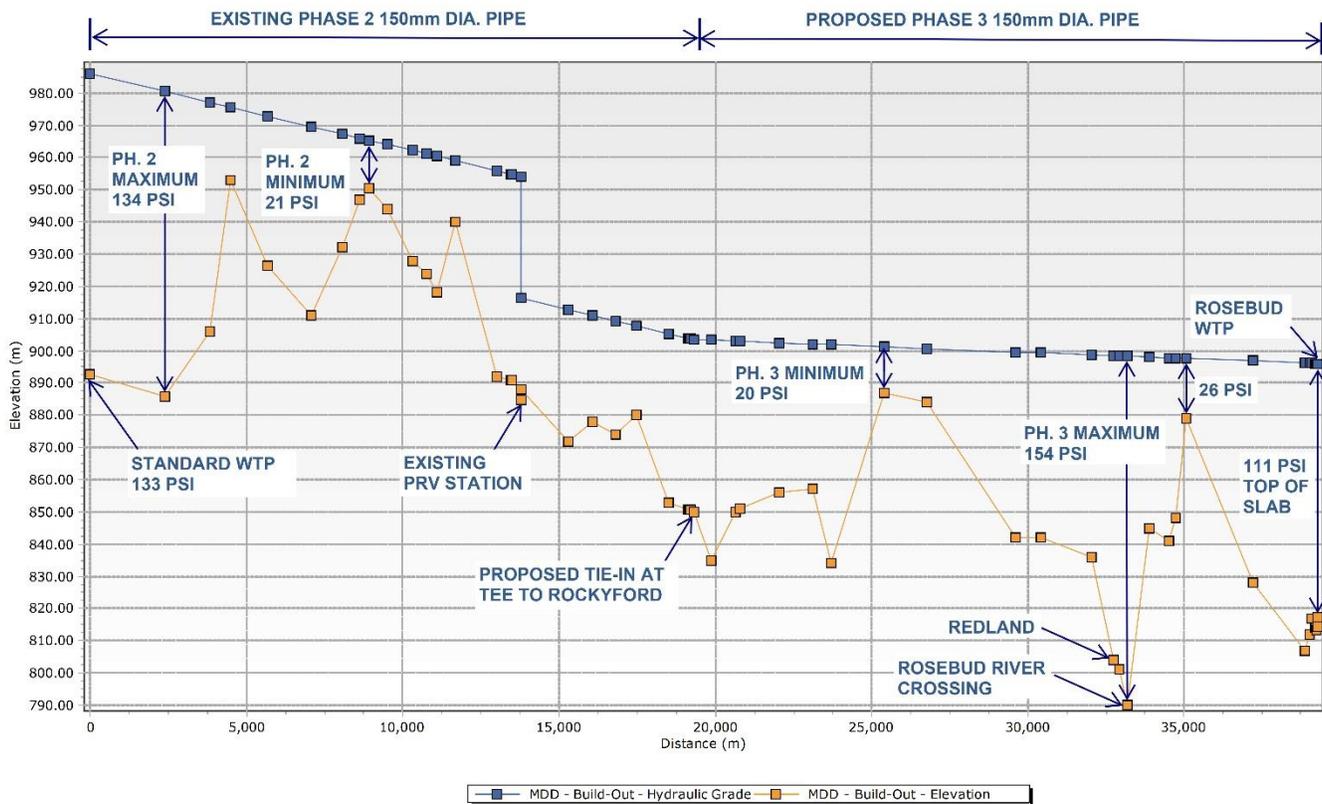


Figure 5.1: Hydraulic Grade Line – Build-Out Flow

6.0 Pipe Diameter, Material and Velocities

The water line is proposed to be 150 mm diameter HDPE DR11 pipe. The HDPE pipe will be specified as PE4710 resin for its working pressure rating of 200 psi. The pipeline will be installed with a minimum cover of 3.0 m within the road allowance and 2.7 m outside of the road allowance.

The water line is proposed to tie-in to an existing 75 mm diameter PVC Series 160 pipe north of the Rosebud Reservoir. This existing pipe feeds well water to the reservoir. The 150 mm diameter pipe has an inside diameter of 136 mm and the 75 mm pipeline has an inside diameter of 82 mm.

The HDPE DR11 pipeline is fused at joints and is corrosion resistant. Due to HDPE flexibility and long pipe lengths, this pipe can potentially be installed using narrow trenches, reducing right-of-way (ROW) and excavation requirements. HDPE is also the prevalent type of pipe used for horizontal directional drilling installations which reduces restoration and roadway reconstruction costs and allows for installation beneath creeks and wetlands with less disruption to the environment.

Table 6.1 summarizes the flow, pipe diameter and velocity of the water and water line during normal operation at design flow rates from the Standard WTP to the Rosebud Reservoir based on Build-Out MDD.

Table 6.1: Pipeline Velocities in m/s (Normal Operation)

Pipeline	Flow Rate (L/s)	Pipe Nominal Diameter (mm)	Pipe Inside Diameter (mm)	Velocity in Pipe (m/s)
Standard to Tee	7.2	150	136	0.49
Tee to Rosebud	2.7	150	136	0.18

7.0 Method of Pipe Installation

The pipeline will be installed by horizontal directional drilling (HDD) with open excavation at drill rig setups, bends and short segments between bends. All private properties, highway crossings, developed County road crossings, creek crossings and wetland crossings will be installed by HDD. The areas where the pipeline is within a County road ROW where the road is developed will also be installed by HDD, to avoid impact to adjacent private property and minimize impact to the County road. There are no undeveloped road allowances along the proposed route.

Because the pipe will be installed by HDD method, the Conservation and Reclamation (C&R) Index calculation will be zero. This is less than the threshold of 2690, that would require a formal EPEA construction and reclamation plan associated with pipeline construction.

8.0 Chlorine Residual in Pipeline

Chlorine (sodium hypochlorite) will be injected into the water at the Standard WTP Clearwell. This water will travel through the pipeline to the Rosebud Reservoir. The static volume in the 19.5 km long 150 mm diameter pipe to the Rockyford-Rosebud tee will be 283 m³ and the volume in the 19.8 km long pipeline to the Rosebud Reservoir will be 288 m³. The following table summarizes the time for the water to flow from the Standard WTP to the Rosebud Reservoir at different flow scenarios.

Table 8.1: Travel Time in Pipeline from Standard to Rockyford

Flow Scenario	Flow Rate Standard WTP to Rockyford Tee (m ³ /day)	Flow Rate Rockyford Tee to Rosebud (m ³ /day)	Travel Time Standard to Rosebud (days)
Existing ADD	191	53	7.0
Existing MDD	381	106	3.5
Build-Out ADD	310	116	3.4
Build-Out MDD	619	232	1.7

The travel times identified in the above table will be modelled during detailed design to estimate the optimum chlorine dose to minimize THM formation while maintaining a minimum of 0.2 mg/L free chlorine to meet AEP standards. The chlorine residual will be monitored on the water tie-in at the Rosebud Reservoir. A chlorine injection system will be installed at the Rosebud Reservoir to inject chlorine if the chlorine residual is low.

9.0 Crossings

The following is a summary of the crossing agreements that will be required for this project:

CN Railway ROW: 1

Wheatland County: 2

Low Pressure Gas:

- Rosebud Gas Co-op Ltd.: 5

High Pressure Oil and Gas:

- Ember Resources Inc.: 1
- Foothills Pipe Lines Ltd.: 1
- Husky Oil Operations Ltd.: 1
- Lynx Energy ULC: 16
- Nova Gas Transmission Ltd.: 1

10.0 Rosebud Tie-in

The existing Rosebud Reservoir is supplied by water wells and a well water pipeline. Chlorine is injected prior to the water flowing into the 726 m³ reservoir. The reservoir supplies water to an underground PRV vault that is in parallel with underground submersible distribution pumps in buried casings adjacent to the reservoir. The pumps supply water for high demand periods. Low demand periods are supplied by gravity through the PRV station.

There is a segment of 75 mm diameter PVC SR160 pipe that was connected to the well pipe when the current reservoir was constructed and an old reservoir was abandoned. The tie-in to the Rosebud facilities will include connection of the 150 mm HDPE regional supply pipeline to the existing 75 mm raw water line outside the reservoir.

The fill line piping inside the water plant will be replaced with new piping, fittings and instruments including new isolation valves, check valve, pressure reducing/sustaining valve, flow meter, flow control valve and pressure indicating transmitter. The flow control valve will be actuated based on level in the treated water reservoir. The existing level indication transmitter will be reused to monitor level in the treated water reservoir. For water quality monitoring, a new chlorine analyser and turbidimeter will be added for monitoring water entering the treated water reservoir. The existing chlorine feed system will be reused to boost chlorine when entering the reservoir when required. The existing chlorine analyser will be reused to monitor water entering the distribution system.

11.0 Electrical and Controls

11.1 Rosebud Electrical

There is no proposed modification to the existing electrical system.

11.2 Rosebud Controls

One PLC will be used for both the regional components and the distribution components, similar to what was implemented at Gleichen and Rockyford. The existing PLC is a Rockwell MicroLogix 1500 with several expansion I/O modules. The MicroLogix 1500 is obsolete, meaning a replacement unit and support is no longer available from the manufacturer. The expansion I/O modules are CompactLogix. Gleichen, Rockyford, and the Raw Water Pump Station (RWPS) are all CompactLogix with an L3 processor, for which a replacement unit and service from the manufacturer is currently available. The existing Rosebud PLC would be upgraded by replacing the existing MicroLogix processor with an L3 CompactLogix processor, reusing the existing CompactLogix I/O modules where possible and adding new I/O modules and associated terminals where required. The upgraded controls will fit within the existing control panel enclosure.

The existing local HMI includes switches and lights on the control panel door as well a Wonderware workstation. A Rockwell PanelView would be installed to replace the existing interfaces. The PanelView requires no software licensing and is similar to what is implemented at Gleichen, Rockyford, and RWPS. The control panel door would be modified to remove the unnecessary components and allow for the PanelView. The screens on the local HMI will be identical to the central HMI at the Standard WTP. The PanelView will also provide local backup data

archiving in the event that communication is lost to central data archiving. The Wonderware workstation and associated UPS would be decommissioned.

The PLC will have HART communications which will allow direct reading of the flowmeter internal totalizers.

Communication between the WTP and the Rosebud Reservoir would be via a secure VPN internet link. The link would utilize the existing internet service at the Rosebud Station. A suitable router would be added.

11.3 WTP Enhancements

WTP enhancements include data handling upgrades. A dedicated historian would be implemented for data archiving. Presently data archiving is done using an ordinary SQL database. A dedicated historian allows more efficient data storage and better retrieval. Storage is more effective because the historian does data compression.

12.0 Land/Easements

The following easements will be required:

- Easement will be required on property owned by Wheatland County at the Rosebud Reservoir.
- Several temporary Work Spaces will be required at road crossings with bends.

Proterra Land Services has been retained to obtain the consent for the geotechnical and environmental surveys and to obtain the agreements for the easements from the landowners. A legal survey will be required after construction to register the easements.

13.0 Geotechnical Assessment

MPE will carry out the geotechnical investigation and compaction testing during construction.

14.0 Environmental Assessment

Ghostpine has been retained to carry out the environmental assessments for the project. They will be doing the following tasks:

- Ghostpine will complete the Phase 1 Environmental Site Assessment
- Environmental Protection Plan (alignment sheets) (EPP)
- Wildlife, wildlife habitat, wetland and vegetation survey (biophysical surveys)
- Fish and fish habitat assessment by a Qualified Aquatic Environmental Specialists (QAES)
- Historical Resources Impact Assessment (HRIA)
- Wetland Assessment and Impact Form (WAIF)
- Provincial and Federal Water Crossing Notifications

15.0 Regulatory Approvals

The following regulatory approvals will be required for this project:

- AEP: *Water Act*: Water Crossings Notification (Rosebud River and wetlands)
- AEP: Notification for water pipeline
- Alberta Culture and Community Spirits: Statement of Justification (and possibly HRIA)

16.0 Water License

Table 16.1 presents a summary of the existing surface water licenses available for the regional system compared with the ADD design flows.

Table 16.1 Existing Surface Water Licenses – Annual Diversion

Unit	Standard	Standard	Wheatland County (Gleichen)	Wheatland County (Rosebud)	Rockyford	Total
	Through WID	Crowfoot Creek	Through WID	None	Through WID	
Approval No.	32524-00-00	39952-00-00	39988-00-00	--	35322-00-01	--
License No.	11057	8984	9221	--	11674	--
File No.	18798	9884	9845	--	15935	--
Effective Date	May 9, 1978	August 29, 1958	July 7, 1958	--	Feb 11, 1982	--
Expiry Date	--	--	--	--	--	--
Acre-Feet/yr	60	40	120	--	105	325
m ³ /yr	74,010	49,340	148,020	--	129,517	401,000^[1]
Equivalent m ³ /d	203	135	406	--	355	1,099

[1] Total m³/yr rounded to the nearest 1,000.

Rosebud currently has a groundwater license only, which cannot be transferred to a surface water license. Rosebud will require at least 116 m³/day. It is recommended that Wheatland County transfer 146 m³/day from the existing Wheatland County (Gleichen) water license to Rosebud.

Table 16.2 Proposed Surface Water License Transfer to Rosebud – Annual Diversion

Unit	Standard	Standard	Wheatland County (Gleichen)	Wheatland County (Rosebud)	Rockyford	Total
	Through WID	Crowfoot Creek	Through WID	Through WID	Through WID	
License ADD m ³ /d	203	135	260 →	146	355	1,099
Design Flows ADD (m ³ /day)	207		230	116	203	756
Volume Remaining in License ^[2] (m ³ /day)	131		30	30	152	343

[1] Total m³/yr rounded to the nearest 1,000.

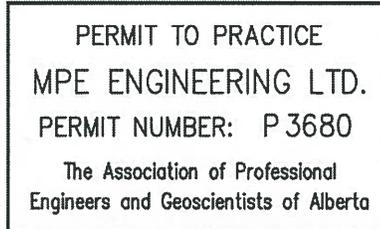
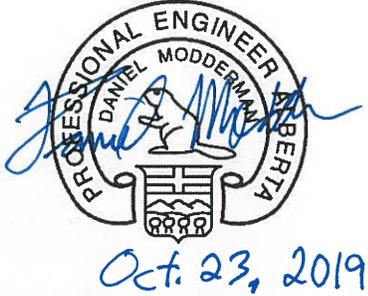
If in the future, one of the municipal partners determines that it requires more raw water supply than its existing diversion license allows, the *Water Act* contains provisions to deal with anticipated shortfall in water diversion. One of those provisions involves a permanent transfer of water allocation from one municipality to another. This process is outlined in Section 81 of the *Water Act*.

Another option involves a temporary assignment of surplus water license from one of the other members of the Wheatland Regional Corporation. This temporary assignment provision is specified in Section 33 of the *Water Act*. This assumes, of course, that one of the other municipal members of WRC has adequate surplus license.

17.0 Schedule

The anticipated schedule for the pipeline contract is as follows:

- Completion of contract documents: February 15, 2020.
- Tender Close: March 12, 2020.
- Construction: March 2020 – October 2020.



APPENDIX A

Cost Estimate for Selected Pipe Route Option



Village of Rockyford c/o Wheatland Regional Corporation
 Regional Water Pipeline - Phase 3 Pipeline to Rosebud
 Selected Pipeline Route Option 3
 PRELIMINARY STAGE

23-Oct-2019

DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization and Demobilization	1	L.S.	\$ 380,000	\$ 380,000
2	Traffic Accommodation	1	L.S.	\$ 30,000	\$ 30,000
3	Erosion and Sediment Control	1	L.S.	\$ 20,000	\$ 20,000
4	Care of Water	1	L.S.	\$ 30,000	\$ 30,000
5	HDPE Water Pipeline				
	(a)150mm HDPE Water Pipeline	19,800	m	\$ 110	\$ 2,178,000
	(b) Class "C" Watercourse, Creek and River Crossings	2	each	\$ 30,000	\$ 60,000
6	D-090 Combination Air Valves	15	each	\$ 18,000	\$ 270,000
7	Flushing Hydrant Assemblies				
	(a) Flushing Hydrant	1	each	\$ 15,000	\$ 15,000
	(b) Flushing Hydrant with Orifice Plate Manhole	5	each	\$ 30,000	\$ 150,000
8	Buried Isolation Valves (150mm)	10	each	\$ 6,500	\$ 65,000
9	Tracer Wire c/w Junction Boxes	19,800	m	\$ 3.00	\$ 59,400
10	Import Screened Topsoil Allowance	100	tonne	\$ 160	\$ 16,000
11	Barbed-Wire Fencing	400	m	\$ 32.00	\$ 12,800
12	Additional Foreign Crossings	6	each	\$ 6,000	\$ 36,000
13	Hydrostatic Testing, Flushing, and Disinfection	1	L.S.	\$ 90,000	\$ 90,000
14	Waterline Warning Signs	75	each	\$ 300	\$ 22,400
15	Road Gravel Surface Reclamation Allowance	120	tonne	\$ 250	\$ 30,000
16	Rock Drilling Allowance (in length)	9,500	m	\$ 80	\$ 760,000
17	Telus Relocation Allowance	1	L.S.	\$ 30,000	\$ 30,000
18	Tie-in to Rosebud Pump Station				
	a Site Work	1	L.S.	\$ 30,000	\$ 30,000
	b Process/Mechanical Work	1	L.S.	\$ 60,000	\$ 60,000
	c Electrical Work	1	L.S.	\$ 145,000	\$ 145,000
	d Prime Cost Allowance – Control System Setup and Programming	1	L.S.	\$ 30,000	\$ 30,000
19	WTP Data Handling Upgrade				
	a Hardware/Software	1	L.S.	\$ 45,000	\$ 45,000
	b Prime Cost Allowance – Configuration	1	L.S.	\$ 10,000	\$ 10,000
SUBTOTAL					\$ 4,575,000
CONSTRUCTION CONTINGENCY (20%)					\$ 915,000
SUB-TOTAL CONSTRUCTION					\$ 5,490,000
PIPELINE ENGINEERING (MPE)					\$ 447,000
ENVIRONMENTAL (Ghostpine)					\$ 67,000
GEOTECHNICAL (MPE)					\$ 60,000
LAND ACQUISITION (Proterra)					\$ 53,000
TEMP AND PERM ROWS - Land Purchase (Excluded from Grant Funding)					\$ 1,500
LEGAL SURVEY (Halma Thompson) (Excluded from Grant Funding)					\$ 3,500
CROP DAMAGES COMPENSATION (Excluded from Grant Funding)					\$ 200
SUB-TOTAL PROJECT					\$ 632,200
TOTAL					\$ 6,130,000
WRC SHARE PORTION					\$ 620,000

APPENDIX B

Preliminary Design Drawings